Honeywell

Honeywell Building Solutions

School District of the Chathams

Energy Savings Plan

Prepared For:
Peter Daquila
Business Administrator

School District of the Chathams
58 Meyersville Road
Chathams, NJ 07928
(973)334-8280

Prepared By:
Joseph J. Coscia
Energy Account Executive

Honeywell Building Solutions
101 Columbia Road
Morristown, NJ 07962
(908)334-1131

January 23, 2015

ENERGY SERVICES GROUP

This Page Intentionally Left Blank

HONEYWELL PROPRIETARY

Non-Disclosure Statement

This proposal or qualification data includes data that shall not be disclosed outside the School District of the Chathams and shall not be duplicated, used or disclosed – in whole or part – for any purposed other than to evaluate this proposal or quotation. If, however, a contract is awarded to this Offer or as a result of -- or in connection with -- the submission of this data, School District of the Chathams shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the School District of the Chathams right to use information contained in this data if it is obtained from another source without restriction. The data subject to this restriction are contained in all sheets.

Budgetary Proposal

This budgetary proposal is provided for information and planning purposes only, to be used for feasibility decisions, planning, and budget development only, and is non-binding and does not constitute an offer for sale. Honeywell will be pleased to provide a firm price proposal upon request which will include all technical and commercial considerations.

General Disclaimer about Pre-Contract Information

HONEYWELL MAKES NO REPRESENTATION OR WARRANTY REGARDING ANY FINANCIAL PROJECTIONS, DATA OR INFORMATION PROVIDED, EXCEPT AS MAY BE EXPRESSLY SET FORTH IN A DEFINITIVE AGREEMENT.

Municipal Advisor Disclaimer

HONEYWELL IS NOT ACTING AS A MUNICIPAL ADVISOR OR FIDUCIARY ON YOUR BEHALF. ANY MUNICIPAL SECURITIES OR FINANCIAL PRODUCTS INFORMATION PROVIDED IS FOR GENERAL INFORMATIONAL AND EDUCATIONAL PURPOSES ONLY AND YOU SHOULD OBTAIN THE ADVICE OF A LICENSED AND QUALIFIED FINANCIAL ADVISOR REGARDING SUCH INFORMATION.

This Page Intentionally Left Blank

TABLE OF CONTENTS

SECTION A EXECUTIVE SUMMARY

Honeywell is pleased to have the opportunity to submit this Energy Savings Plan for the School District of the Chathams. During the development of the Energy Savings Plan, Honeywell has completed a thorough investment grade energy audit of the School District of the Chathams buildings and grounds. Based on the audit findings and Honeywell's extensive experience in working with school districts, we are able to confidently state that we can deliver a financially viable, comprehensive solution to address the District's facility concerns. Our Energy Savings Plan includes projects that achieve energy and operational efficiencies, create a more comfortable and reliable learning environment and are actionable via the New Jersey Energy Savings Improvement Program (NJ ESIP) in accordance with NJ PL2012, c.55.

The Energy Savings Plan is the core of the NJ ESIP process. It describes the energy conservation measures that are planned and the cost calculations that support how the plan will pay for itself through the resulting energy savings. Under the law, the Energy Savings Plan must address the following elements:

- The results of the energy audit;
- A description of the energy conservation measures (ECMs) that will comprise the program;
- An estimate of greenhouse gas reductions resulting from those energy savings;
- Identification of all design and compliance issues and identification of who will provide these services;
- An assessment of risks involved in the successful implementation of the plan;
- Identify the eligibility for, and costs and revenues associated with, the PJM Independent System Operator for demand response and curtail-able service activities;
- Schedules showing calculations of all costs of implementing the proposed energy conservation measures and the projected energy savings;
- Maintenance requirements necessary to ensure continued energy savings, and describe how they will be provided; and
- If developed by an ESCO, a description of, and cost estimates of a proposed energy savings guarantee.

The purpose of this document is to provide all the information required for the School District of the Chathams to determine the best path forward in the implementation of a District-Wide NJ ESIP Project. It is important to note that the Energy Savings Plan provides a comprehensive evaluation of ALL potential ECMs within the School District of the Chathams. This is not meant to infer that all of the ECMs identified must be or, based upon legislative requirements, can be implemented at this time. However, as long as the ECM is part of this plan, it may be implemented at a later date as additional funding becomes available or technology changes in order to provide an improved financial return.

The next step in the NJ ESIP process is for the School District to review the information presented in this Energy Savings Plan, and in consideration with District priorities, select the ECMs which merit further development. The selections may include any combination of ECMs as long as the resulting overall project is self-funding in accordance with NJ PL2012, c.55. A project development agreement may then executed by the School District, which authorizes Honeywell to proceed with development of project design documents and solicitation of bids for the selected ECMs in accordance with New Jersey Public Contracts Law.

Our Energy Savings Plan is structured to clearly demonstrate compliance with the NJ ESIP law, while also presenting the information in an organized manner which allows for informed decisions to be made. The information is divided into the following sections:

A. Executive Summary (This Section)

B. Preliminary Utility Analysis – The Preliminary Utility Analysis (PUA) defines the utility baseline for the school buildings included in the Energy Savings Plan. It provides an overview of the current usage within the District and also a cost per square foot by school of utility expenses. The report also compares the District's utility consumption to that of other similar school districts in the same region on a per square foot basis.

C. Energy Conservation Measures – This section includes a detailed description of the ECMs we have selected and identified for your District. It is specific to your Schools in scope, savings methodology and environmental impact. It is intended to provide a Basis of Design for each measure in narrative form. It is not intended to be a detailed specification for construction. ALL potential ECMs for the District are identified for the purposes of potential inclusion in the program. Final selected ECMs are to be determined by the School District in conjunction with Honeywell during the project development phase of the NJ ESIP process.

D. **Technical and Financial Summary –** This section includes an accounting of all technical and financial outcomes associated with the ECMs as presented on the New Jersey Board of Public Utilities Forms II through IV. Information detailed on the forms includes projected implementation hard costs, projected energy savings, projected operational savings and projected environmental impact. Form IV: Annual Cash Flow Analysis provides a "rolled-up" view of the overall project financials, inclusive of financing costs, on an annual basis as well as over the entire 15 or 20 year term of the agreement.

The following recommended project has been provided for the District's review and consideration:

	Recommended ESIP Project
Value of Project	**$5,323,241**
Term of Repayment	**15 Year**
Projected Savings Over Term	**$6,075,277**
Projected NJ Rebates & Incentives	**$701,194**
Projected Interest Rate	**3.00%**

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
1A	Lighting Upgrades	✓	✓	✓	✓	✓	✓
1B	Lighting Controls	✓	✓	✓	✓	✓	✓
1C	Vending Misers	✓	✓	✓	✓	✓	✓
1D	De-Stratification Fans	✓	✓	✓	✓	✓	✓
1E	Plug Load Management Via WIFI	✓	✓	✓	✓	✓	✓
2A	Boiler Replacements						✓
2B	Boiler Burner Controls					✓	
2G	Kitchen Hood Controllers					✓	✓
2H	Walk-In Compressor Controllers					✓	✓
2I	Steam Trap Replacement		✓		✓		
2J	Piping Insulation						✓
3A	Building Management System Upgrades	✓	✓	✓	✓	✓	✓
3B	Demand Control Ventilation		✓	✓		✓	✓
4A	Building Envelope Improvements	✓	✓	✓	✓	✓	✓
4B	Roof Replacements						
5A	Transformer Replacements	✓		✓	✓	✓	✓
6A	Demand Response/Permanent Load Reduction	✓	✓	✓	✓	✓	✓

E. Measurement & Verification and Maintenance Plan – This section identified the intended methods of verification and measurement for calculating energy savings. These methods are compliant with the International Measurement and Verification Protocols (IMVP), as well as other protocols previously approved by the Board of Public Utilities (BPU) in New Jersey. This section also includes the recommended maintenance requirements for each type of equipment that may be included in this program. Consistent maintenance is essential to achieving the energy savings projected in this plan.

F. Design Approach – This section includes a summary of Honeywell's best practices for the successful implementation of a NJ ESIP project. It includes a project specific Safety Management Plan and provides an overview of our project management procedure, construction management and a sample schedule for the overall completion of the project. Within the schedule, we clearly define the tasks directed towards compliance with architectural, engineering and bidding procedures in accordance with New Jersey Public Contracts Law.

G. Independent Energy Audit – This section includes, for reference, the independent energy audits as previously received by the District through the Local Government Energy Audit (LGEA) program. The audits, provided by Concord Engineering Group, have been included on a compact disk marked as Appendix 1. A comparison can be made of the ECMs outlined in this investment grade energy audit to the additional ECMs described in the overall Energy Savings Plan.

H. Energy Calculations and Greenhouse Gas Reduction Summary – This section titled Appendix 2: ECM Calculations includes all the energy calculations required to ensure compliance with the law and to confirm the energy savings can, and will, be achieved. These calculations are subject to an independent 3rd party engineering firm review for verification.

A summary of all savings based on the Recommended ESIP Project includes a reduction in 1,764,445, kWh (kilowatt hours of electricity), 123,866 Therms (natural gas) and 3,579,840 Pounds of Greenhouse Gas (GHG) emissions. It is the equivalent of removing 309 cars from the road for an entire year and is the same as planting 186.2 acres of forest.

I. Equipment Cut-sheets – This section titled Appendix 3: Equipment Cut-sheets includes specification data for the equipment which shall be utilized as the Basis of Design for plans and specifications during the subsequent project development and NJ public bid phase.

J. Safety Management Plan – This section titled Appendix 4: Safety Management Plan establishes a plan for the implementation of Honeywell's Safe Operations Management (SOM) program. The document includes procedures and requirements specific to the School District of the Chathams necessary to support a safe workplace for all stake holders. The Safety Management Plan is a living document, which will be updated and modified to maintain its relevance throughout the project as site conditions and circumstances change.

In accordance with the NJ ESIP process, the next step in the project development phase is for Honeywell to provide our recommendations and for the School District to select the desired content of the project based upon the District's unique goals and objectives. The selections will consider the projected costs, projected energy and operational savings, available financing options at the time of the agreement, interest rates, length of term and District priorities, which will all play a part in the final selection and cash flow of ECMs. The definitive requirement under NJ PL2012, c.55 is that the project is self funding within the 15 or 20 year term as outlined in the legislation.

Overall, it is evident that the School District of the Chathams is well positioned to implement a program that will upgrading your facilities, while funding itself within the requirements of the law and with zero or minimal impact on your taxpayer base. We welcome this opportunity to partner with the School District of the Chathams in order to improve the comfort and efficiency of your facilities through the successful implementation of this Energy Savings Plan.

Sincerely,

Joseph J Coscia
Energy Account Executive

This Page Intentionally Left Blank

SECTION B PRELIMINARY UTILITY ANALYSIS

This Page Intentionally Left Blank

Americas M&V Services

Preliminary Utility Analysis

School District of the Chathams
Chatham, NJ

Helping customers manage energy resources to improve financial performance

Table of Contents

School District of the Chathams
Chatham, NJ

1.0 Overview

Executive Summary

Honeywell would like to thank you for the opportunity of providing you with this Preliminary Utility Analysis. The facility's EUI (Energy Use Index) was compared to best in class facilities of similar use and location.

Through our PUA offering, Honeywell's goal is to form a long term partnership for the purpose of meeting your current infrastructure needs by focusing to:

- Improve Operational Cost Structures
- Ensure Satisfaction
- Upgrade Infrastructure While Reducing Costs
- Meet Strategic Initiatives
- Leverage Teamwork
- Pursue Mutual Interests
- Provide Financing Options

How does it work?

Under an energy retrofit solution, Honeywell installs new, energy efficient equipment and optimizes your facility, as part of a multi-year service contract. Most of these improvements are cost-justified by energy and operational savings. Some of the energy conservation measures provide for a quick payback, and as such, would help offset other capital intensive energy conservation measures such as, boilers, package rooftop units, domestic hot water heaters, etc. The objective is to provide you with reduced operating costs, increased equipment reliability, optimized equipment use, and improved occupant comfort.

After review of the utility analysis, you can authorize Honeywell to proceed with the development of a d○tailed engineering report. The report development phase allows Honeywell to prepare an acceptable list of proposed energy conservation measures, which are specific to the selected facility. Some examples of typical Energy Conservation Measures include:

- Lighting
- Energy Efficient Motors
- Control Systems
- Boilers
- Chillers
- Variable Speed Drives
- Steam Systems
- Package Rooftop Units
- Domestic Hot Water Heaters
- Power Factor Correction

Why Honeywell?

- Honeywell is one of the world leaders in providing infrastructure improvements
- With Honeywell as your building partner, you gain the advantage of more than 115 years of leadership in building services
- Honeywell has the infrastructure and manpower in place to manage and successfully implement your project
- Honeywell has over 30 years experience in the energy retrofit marketplace with over $3 Billion in customer energy savings
- Honeywell provides you with "Single Source Responsibility" - from Engineering to Implementation, Servicing and Financing (if desired)

2.0 Summary

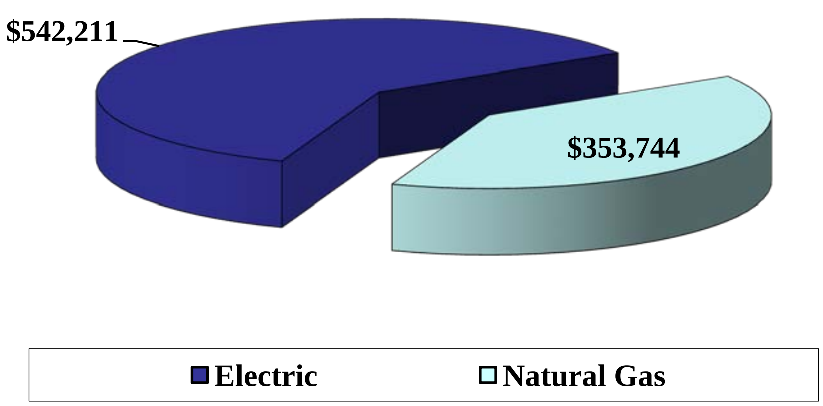
School District of the Chathams

Utility Analysis Period: 10/13-9/14

	Current Year (10/13-9/14)	
	Electric	**Natural Gas**
Utility Costs*	$542,211	$353,744
Utility Usage (kWh, Therms)	4,441,137	385,781
$ Cost/Unit (kWh, Therms)	$0.12209	$0.917
Electric Billed Demand (kW)	16,560	

* Costs include energy and demand components, as well as taxes, surcharges, etc.

Actual Cost by Utility - 10/13-9/14

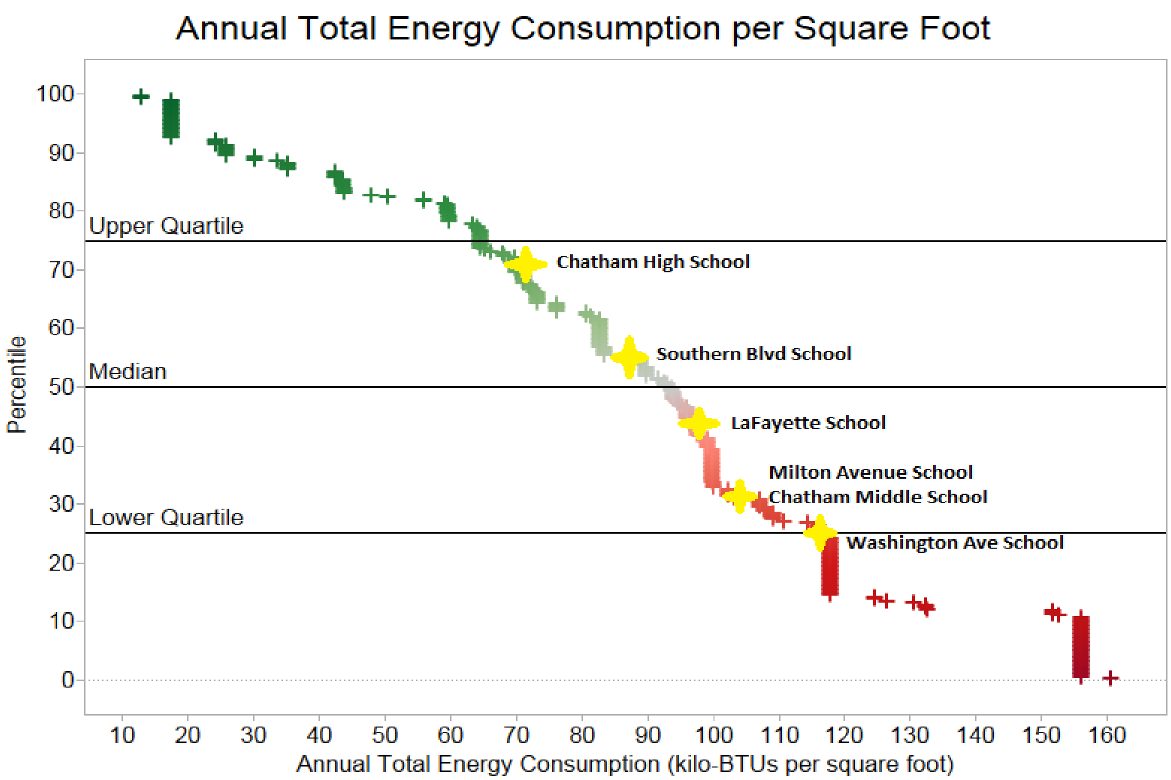


3.0 Review Detail

Benchmark: Energy Use Index

Comparing a building to similar buildings in the same region creates a reference point for how well a building is performing relative to its peers. The following energy benchmarking charts are based on Commercial Building Energy Consumption Survey (CBECS) data from 2003. This is the most recent survey. No additional surveys have been published as of 2012. http://www.eia.gov/emeu/cbecs/

Total Energy Efficiency of the School District of the Chatham's Compared to Other K-12 Schools in the Middle Atlantic Region.



Based on Commercial Building Energy Consumption Survey (CBECS) data from 2003. As of 2012, no additional surveys have been published. http://www.eia.gov/emeu/cbecs/

Results

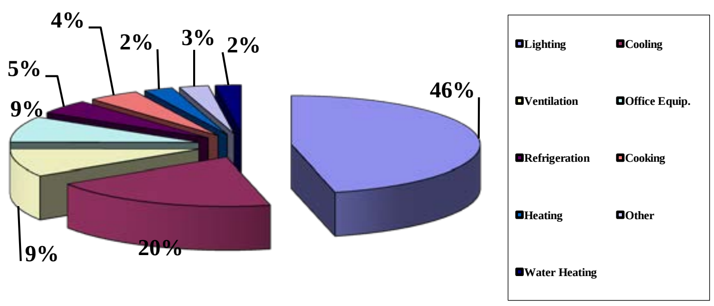
The School District of the Chatham's have schools ranging from the 25th percentile to the 70th percentile, based on their Energy Use Index (EUI), a measure of total energy consumed per square foot. The four (4) schools below the median, LaFayette School, Milton Avenue School, Chatham Middle School, and Washington Avenue School likely have significant energy savings opportunities. Whereas, Chatham High School, ranked in the 70th percentile, is likely to only have moderate efficiency gains.

Sources of Utility Consumption

October 2013- September 2014

Sources of Electric Consumption

Typical End Use Allocation *

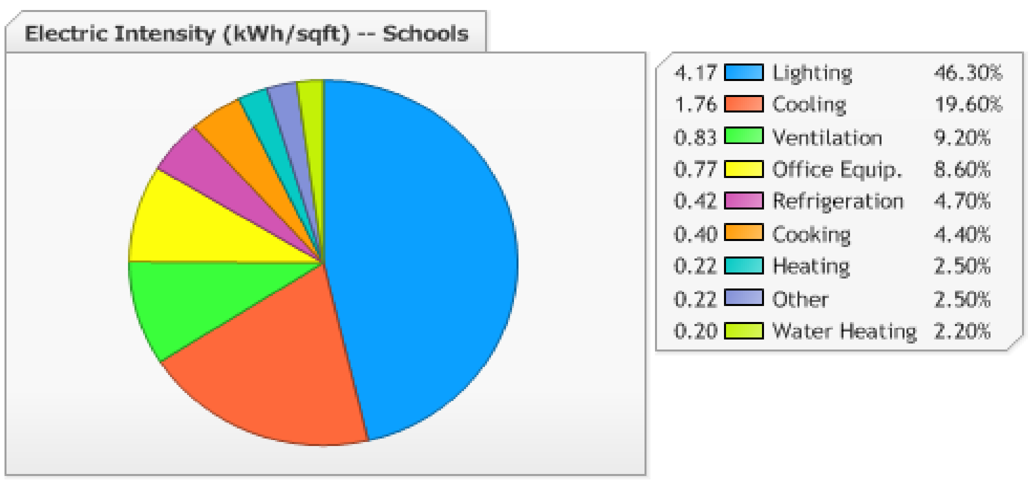


Typical Allocation Applied to Your Electric Cost**

Lighting	$	251,044
Cooling	$	106,273
Ventilation	$	49,883
Office Equip.	$	46,630
Refrigeration	$	25,484
Cooking	$	23,857
Heating	$	13,555
Other	$	13,555
Water Heating	$	11,929
Your Total Cost	**$**	**542,211**

**This allocation is generic and is not a representation of the actual end use in your buildings included in this report.

*Source: Questline Electric Commercial Benchmark Data by Business Segment (Schools) and Climate Zone (Zone 3)



Total Electric Intensity (kWh/sqft, annual basis): 09.00

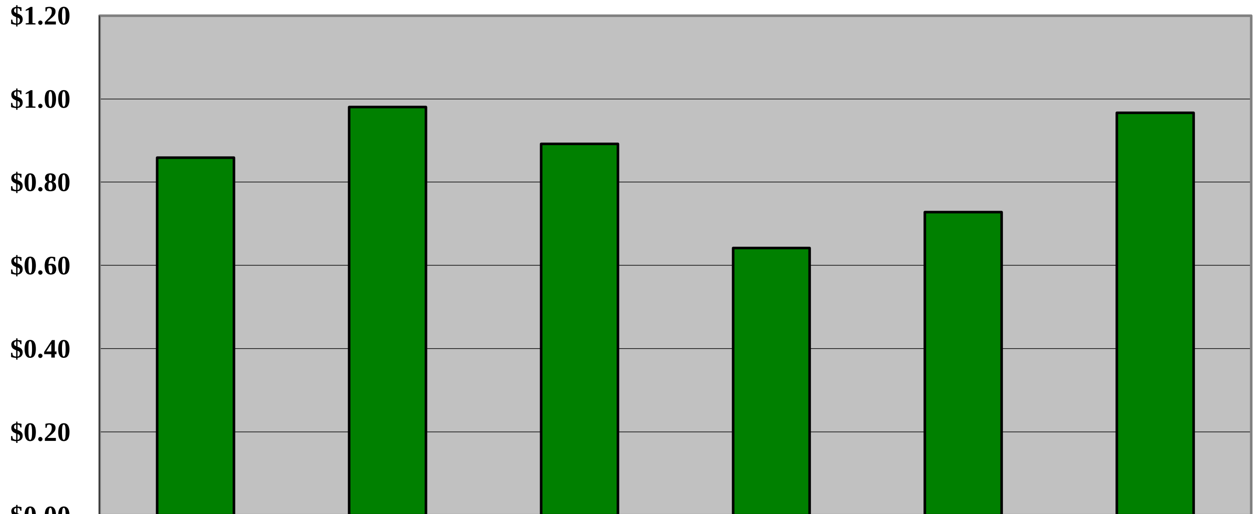
Average Electric Consumption per Establishment (kWh): 414,000

Average Enclosed Floorspace per Establishment (sqft): 46,000

Source: EIA energy intensity data from CBECS and MECS, EPRI, and other third party energy use datasets.

Square Footage Analysis - Electric

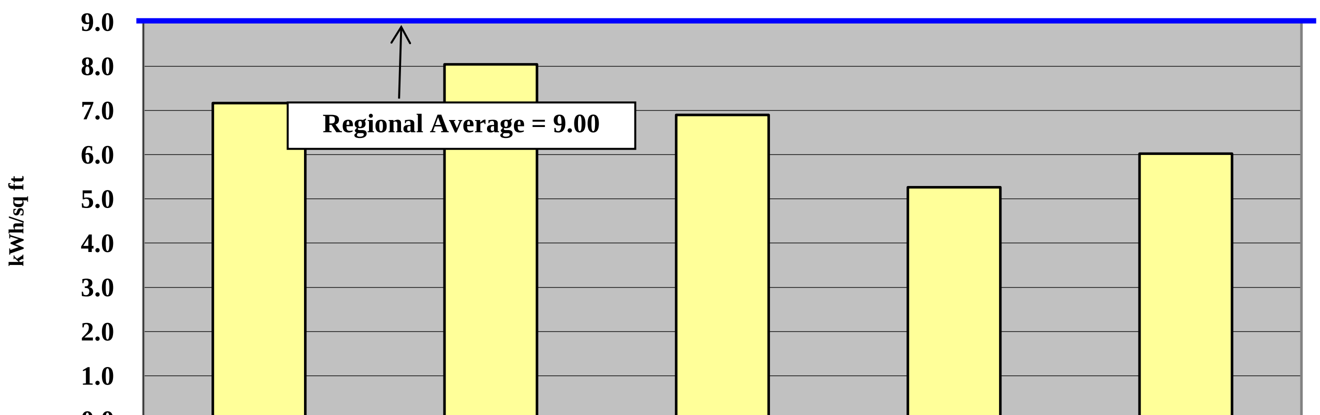
Cost Per Square Foot



	Chatham High School	Chatham Middle School	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School
2013 - 2014	$0.86	$0.98	$0.89	$0.64	$0.73	$0.97

Usage (kWh) per Sq. Ft.

Usage(kWH) Per Square Foot

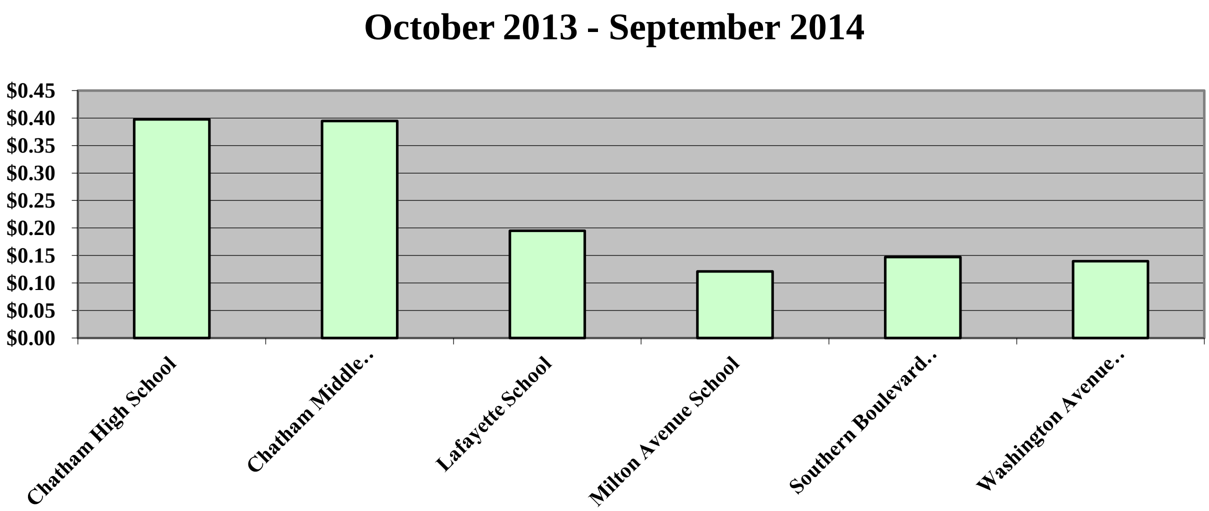


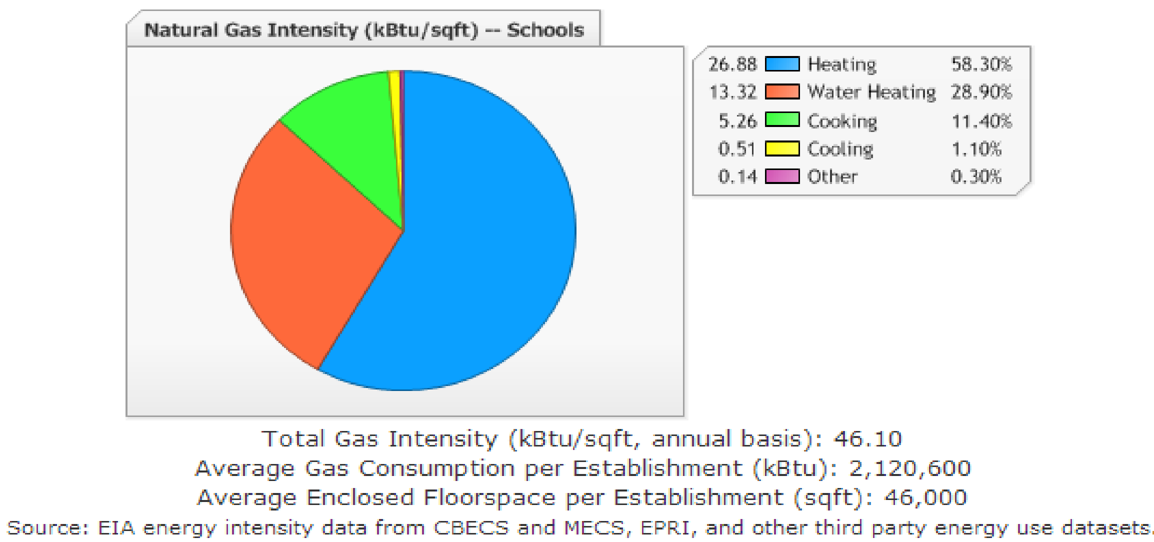
	Chatham High School	Chatham Middle School	Lafayette School	Milton Avenue School	Southern Boulevard School
2013 - 2014	7.16	8.04	6.90	5.26	6.02

*Source: Questline Electric Commercial Benchmark Data by Business Segment (Schools) and Climate Zone (Zone 3)

Square Footage Analysis - Gas

Cost per Sq. Ft.



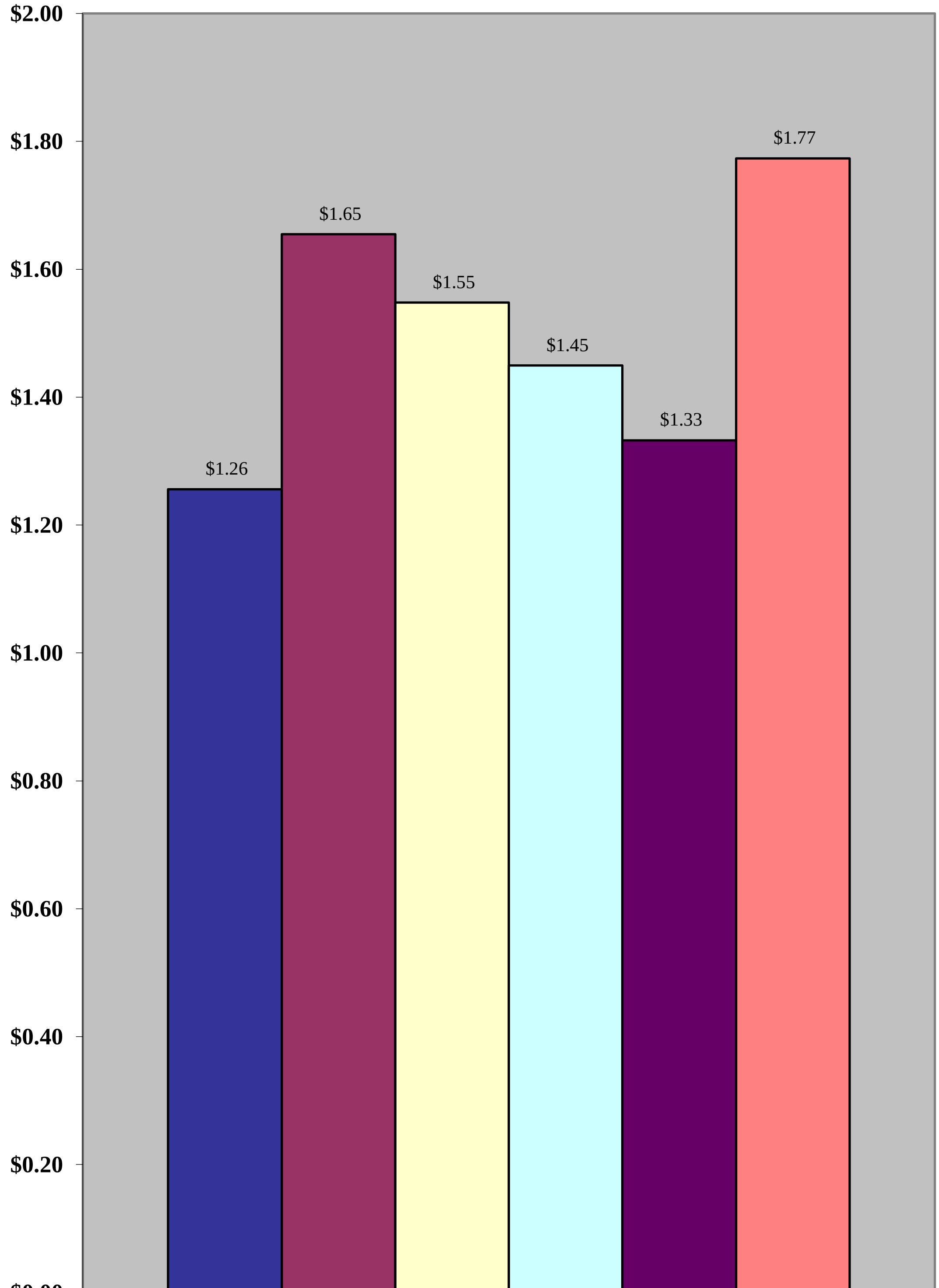


*Source: Questline Natural Gas Commercial Benchmark Data by Business Segment (Schools) and Climate Zone (Zone 3)

Combined Cost

October 2013 - September 2014

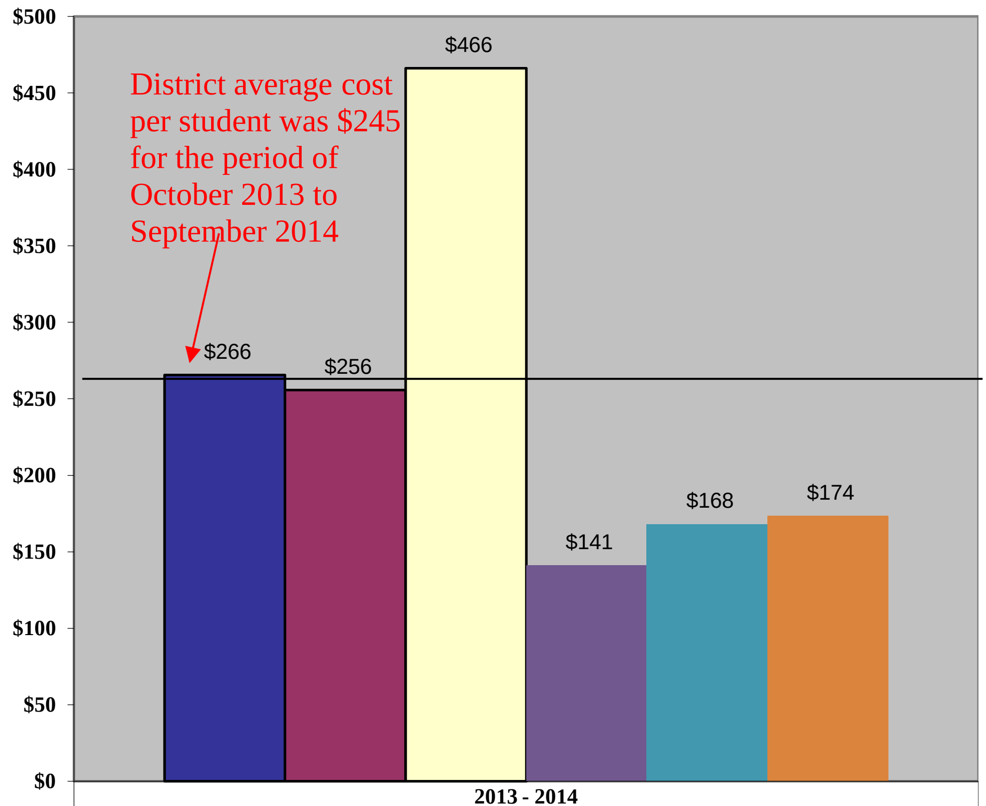
Electic and Gas Costs Combined **(Note: Water/Sewer was excluded in this Cost per SF comparison)**



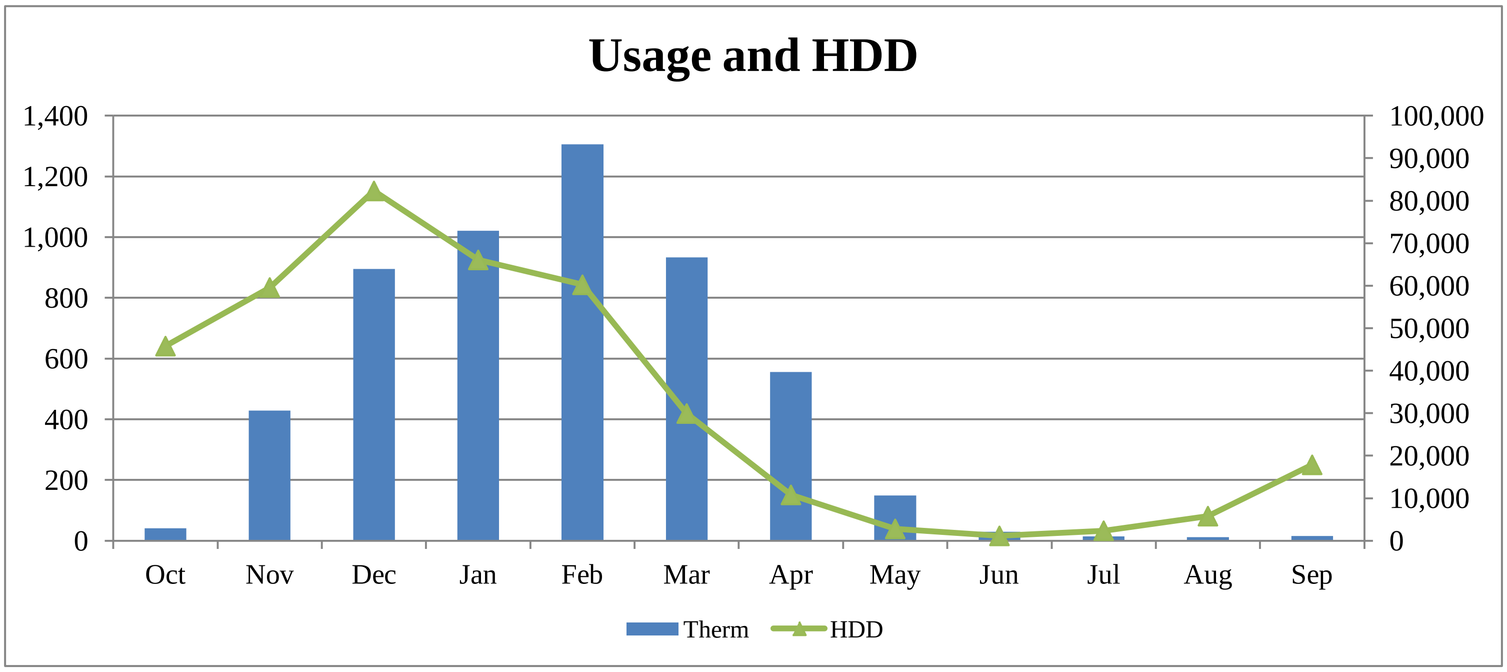
Chatham High School	$1.26
Chatham Middle School	$1.65
Lafayette School	$1.55
Milton Avenue School	$1.45
Southern Boulevard School	$1.33
Washington Avenue School	$1.77

Cost Per Student Comparison

Electric and Natural Gas Combined

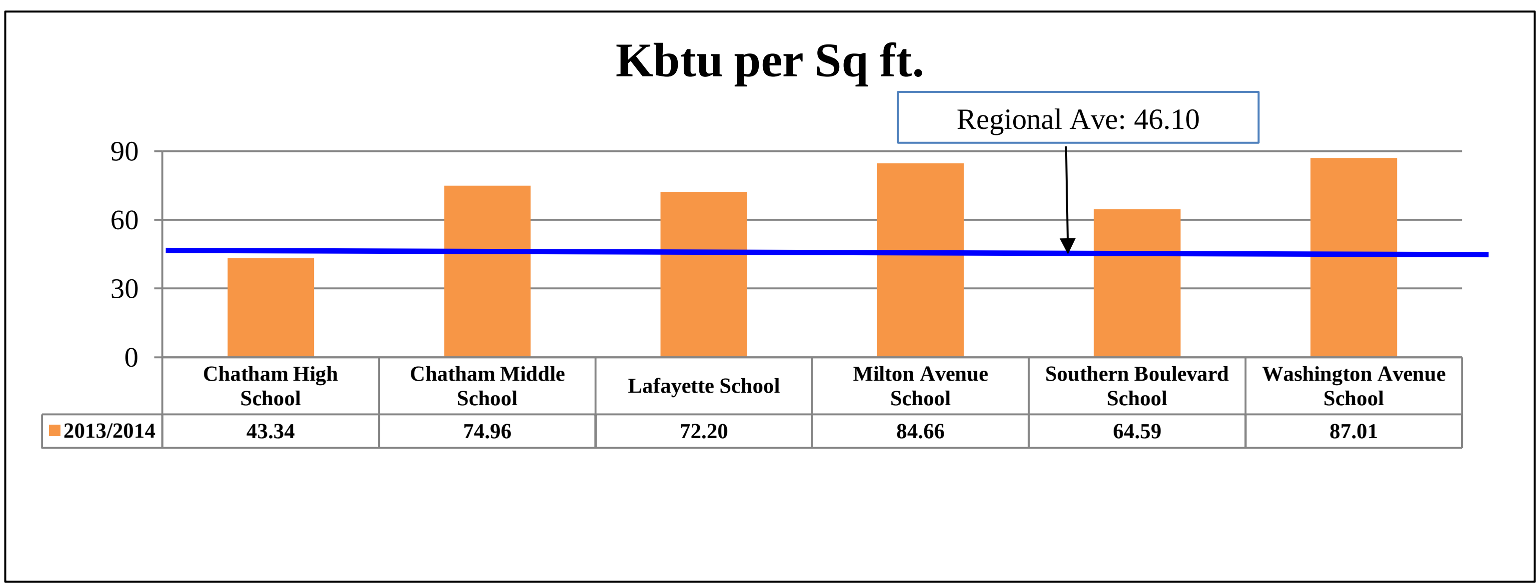


	2013 - 2014
Chatham High School	$266
Chatham Middle School	$256
Lafayette School	$466
Milton Avenue School	$141
Southern Boulevard School	$168
Washington Avenue School	$174



Milleville, NJ (MIV) Weather Station

There is a correlation between the District's gas usage and heating degree days (HDD) indicating that most of its gas usage is for heating in particular the winter months. A more intensive utility analysis is needed to verify and analyze data.



	Chatham High School	Chatham Middle School	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School
2013/2014	43.34	74.96	72.20	84.66	64.59	87.01

Electric Total By Month

School District of the Chathams

TOTAL ELECTRIC DATA BY MONTH

ELECTRIC					
Date	**Months**	**kWh**	**Demand**	**Total Electric Amount**	**Rate**
10/31/13	October	391,193	1,786	50,224	$ 0.1284
11/30/13	November	358,722	1,272	45,395	$ 0.1265
12/31/13	December	300,370	1,376	39,517	$ 0.1316
01/31/14	January	201,543	772	37,868	$ 0.1879
02/28/14	February	446,267	1,204	50,739	$ 0.1137
03/31/14	March	343,178	1,185	40,173	$ 0.1171
04/30/14	April	358,438	1,040	42,063	$ 0.1173
05/31/14	May	379,871	1,228	44,712	$ 0.1177
06/30/14	June	405,498	1,503	50,677	$ 0.1250
07/31/14	July	394,700	1,418	41,784	$ 0.1059
08/31/14	August	347,212	1,636	44,404	$ 0.1279
09/30/14	September	294,037	1,661	39,957	$ 0.1359
AVG		**351,752**	**1,340**	**$ 43,959**	**$ 0.1279**
TOTAL		**4,221,029**	**16,078**	**$ 527,512**	

Natural Gas Total By Month

School District of the Chathams

TOTAL GAS DATA BY MONTH

GAS				
Date	**Months**	**Therm**	**Total Gas Amount**	**Rate**
10/31/13	October	2,972	$ 2,779	$ 0.9351
11/30/13	November	30,594	$ 31,675	$ 1.0354
12/31/13	December	63,935	$ 56,514	$ 0.8839
01/31/14	January	72,891	$ 65,488	$ 0.8984
02/28/14	February	93,214	$ 87,361	$ 0.9372
03/31/14	March	66,693	$ 65,718	$ 0.9854
04/30/14	April	39,729	$ 29,177	$ 0.7344
05/31/14	May	10,615	$ 8,724	$ 0.8218
06/30/14	June	2,116	$ 2,349	$ 1.1104
07/31/14	July	1,066	$ 1,395	$ 1.3087
08/31/14	August	875	$ 1,217	$ 1.3903
09/30/14	September	1,081	$ 1,346	$ 1.2453
AVG		**32,148**	**$ 29,478.67**	**$ 1.0238**
TOTAL		**385,782**	**$ 353,744.05**	

Utility Baseline
School District of the Chathams

		Electric					Gas			Total Energy		
Building	Square Footage	Total Cost	Total kWh	Demand Cost	Total kW Demand	Blended Rate	Total Cost	Total Therms	Unblended Rate	$/Sq ft	kBtu/sq ft	Total Cost
Chatham High School	253,663	$217,825	1,817,200	$ 42,501.70	6,185	$0.120	$100,803	109,927	$ 0.917	$1.26	67.79	$318,628
Chatham Middle School	148,396	$145,463	1,193,421	$28,519	4,465	$0.122	$100,080	111,241	$ 0.900	$1.65	102.41	$245,543
Lafayette School	75,268	$67,113	519,316	$13,221	2,059	$0.129	$49,411	54,342	$ 0.909	$1.55	95.75	$116,524
Milton Avenue School	37,964	$24,364	199,860	$ 5,531.62	881	$0.122	$30,663	32,142	$ 0.954	$1.45	102.63	$55,026
Southern Boulevard School	61,907	$45,089	372,620	$8,173	1,400	$0.121	$37,402	39,986	$ 0.935	$1.33	85.13	$82,491
Washington Avenue School	43,838	$42,357	338,720	$9,155	1,570	$0.125	$35,385	38,143	$ 0.928	$1.77	113.38	$77,742
TOTALS	**621,036**	**$ 542,211**	**4,441,137**	**$ 107,100**	**16,560**	**$ 0.122**	**$ 353,744**	**385,781**		**$ 1.44**	**86.53**	**$ 895,955**

SECTION C ENERGY CONSERVATION MEASURES (ECMS)

Introduction

The information used to develop this Section was obtained through the independent energy audit, building surveys to collect equipment information, interviews with operators and end users, and an understanding of the components to the systems at the sites. The information obtained includes nameplate data, equipment age, condition, the system's design and actual load, operational practices and schedules, and operations and maintenance history.

Honeywell has performed a review of the Energy Conservation Measures (ECMs) which would provide energy and operational cost savings to the School District of the Chathams. This report aims to be an assessment of the feasibility and cost effectiveness of such measures, and an indication of the potential for their implementation. The ECMs listed below have been reviewed throughout your facilities for consideration within a complete Energy Savings Plan. What follows is a general description of the energy auditing process and a detailed description of the Energy Conservation Measures for your facilities.

All Energy Conservation Measures Reviewed and Considered

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
1A	Lighting Upgrades	✓	✓	✓	✓	✓	✓
1B	Lighting Controls	✓	✓	✓	✓	✓	✓
1C	Vending Misers	✓	✓	✓	✓	✓	✓
1D	De-Stratification Fans	✓	✓	✓	✓	✓	✓
1E	Plug Load Management Via WIFI	✓	✓	✓	✓	✓	✓
2A	Boiler Replacements			✓			✓
2B	Boiler Burner Controls					✓	
2C	Premium Efficiency Motors and VFDs			✓		✓	✓
2D	Domestic Hot Water Replacements			✓			
2E	Rooftop Unit Replacement					✓	✓
2F	Window AC Unit Replacements					✓	
2G	Kitchen Hood Controllers					✓	✓
2H	Walk-In Compressor Controllers					✓	✓
2I	Steam Trap Replacement		✓		✓		
2J	Piping Insulation						✓
2K	Window Replacements						✓
2L	AHU Replacement						✓
3A	Building Management System Upgrades	✓	✓	✓	✓	✓	✓
3B	Demand Control Ventilation		✓	✓		✓	✓
4A	Building Envelope Improvements	✓	✓	✓	✓	✓	✓
4B	Roof Replacements						✓
5A	Transformer Replacement	✓		✓	✓	✓	✓
6A	Demand Response/Permanent Load Reduction	✓	✓	✓	✓	✓	✓

Overview

Honeywell has closely evaluated and audited the School District of the Chathams in order to develop the optimum mix of energy saving measures. These selected site-specific measures have been developed using the following process:

- Review Site Audits
- Engineering Team Site Visits
- Develop Measures
- Review Measures with Team

Reject and Accept Measures Based On

- Alignment with Critical Success Factors (CSF)
- Value to the District
- Economic Financial Payback
- Equipment Service Life
- Effect on Current Space Conditions

In developing the proposed measures, the following considerations were critical:

- Reduction of space heating and cooling loads by performing a systems review, with complete consideration of current indoor environmental quality standards.
- Review and redesign lighting systems noting reductions in the internal heat gain in the affected spaces.
- Load reduction measures always precede optimization measures.

Bin weather data was used from a 15-year average reported from Newark, NJ. Ventilation rates, taken from ASHRAE published standard, were predicted by using the building's population multiplied by cfm/person during occupied hours.

Reasonable infiltration rates were assumed based on the building's fenestration conditions and expected values for typical school buildings. A reduced infiltration rate was assumed for the unoccupied hours. Envelope heat loss calculations assumed a reasonable heat transmission rate (U value) based on the construction of the buildings. Wall area and glass area were estimated by supplied drawings and field photographs.

Current efficiencies were derived from assumed and later to be measured boiler efficiencies, and assumed system losses due to thermal losses, distribution losses and loose operational control. The current assumed boiler system efficiencies were then applied to the calculated load and calibrated to last year's actual fuel consumption.

Demand Sensitive Operation

Review existing and proposed thermal loads. For example, the review process will facilitate the application of:

1. Optimized flow rates (steam, water, and air).
2. Optimized operation of equipment, matching current occupancy use profiles and considering both outside and indoor space temperatures.

Benefits of Mechanical Improvements

Listed below are some of the benefits that the School would reap from the mechanical portion of the measures:

1. Avoid costly repairs and replace equipment that would have to be replaced in the next five years.
2. Improved compliance with ASHRAE Ventilation Standards.
3. Ability to trend ventilation rates; thus, insuring compliance through documentation.
4. Operating a more weather sensitive facility.
5. Allowing for a greater capability of central monitoring and troubleshooting via remote access.
6. Greater operating flexibility to reduce costs and optimize staff efficiency.

Indoor Air Quality

Implementation of new energy-related standards and practices has contributed to a degradation of indoor air quality. In fact, the quality of indoor air has been found to exceed the Environmental Protection Agency (EPA) standards for outdoor air in many homes, businesses, and factories.

The American Council of Governmental Industrial Hygienists (ACGIH) in their booklet "Threshold Limit Values," has published air quality standards for the industrial environment. No such standards currently exist for the residential, commercial, and institutional environments, although the ACGIH standards are typically and perhaps inappropriately used. The EPA has been working to develop residential and commercial standards for quite some time.

Recent studies indicate that for even the healthiest students, indoor air pollution can reduce the ability to learn. Honeywell has addressed this issue by focusing on the proper operation and replacement of the unit ventilators and air handler equipment which will assure indoor air quality standards are met.

This Page Intentionally Left Blank

ECM 1A LIGHTING UPGRADES

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
1A	Lighting Upgrades	✓	✓	✓	✓	✓	✓

Existing Conditions

Lighting throughout the schools is comprised mostly of tubular fluorescent recessed fixtures with 32 watt T-8 lamps and electronic ballasts. The fixtures come in different sizes including 1x4, 2x2, and 2x4 wrap-around and recessed models. There are also a number of fixtures with 100 watt incandescent bulbs. A limited quantity of T12 lamps with magnetic ballasts, T5 high output lamps, 28 watt T-8 electronic ballasts, and 250 watt metal halide fixtures were also observed in some locations.

Chatham High School Aux Gymnasium

Lafayette School Gymnasium

Scope of Work

The purpose of the survey was to identify opportunities to improve the efficiency of the lighting system, while maintaining or where necessary, increasing the current light levels to code requirements. The proposed lighting system is based on converting T-12, T-8, T-5, High Intensity Discharge (HID) and High Pressure Sodium (HPS) lights to Light Emitting Diode (LED) technology bulbs and fixtures throughout the district.

Chatham SD will receive many benefits from the lighting system upgrade. They include the following:

- Long Life - LED bulbs and diodes have an outstanding operational life time expectation of up to 100,000 hours. This is 11 years of continuous operation, or 22 years of 50% operation. Operational savings in terms of bulb and ballast replacement are significant based on this technology.

- Energy Efficiency – Today's most efficient way of illumination and lighting has an estimated energy efficiency of 80%-90% when compared to traditional lighting and conventional light bulbs. This means that about 80% of the electrical energy is converted to light, while 20% is lost and converted into other forms of energy such as heat. Traditional incandescent light bulbs operate at 20% energy efficiency only, 80% of the electricity is lost as heat.

- Ecologically Friendly - LED lights are free of toxic chemicals. Most conventional fluorescent lighting bulbs contain a multitude of materials like mercury that are dangerous for the environment. LED lights contain no toxic materials and are 100% recyclable, and will help to reduce carbon footprint by up to a third. The long operational life time span mentioned above means also that one LED light bulb can save material and production of 25 incandescent light bulbs. A big step towards a greener future!

- Durable Quality - LEDs are extremely durable and built with sturdy components that are highly rugged and can withstand even the roughest conditions. Because LED lights are resistant to shock, vibrations and external impacts, they make great outdoor lighting systems for rough conditions and exposure to weather, wind, rain or even external vandalism, traffic related public exposure and athletic areas.

- Zero UV Emissions - LED illumination produces little infrared light and close to no UV emissions. Because of this, LED lighting is highly suitable not only for goods and materials that are sensitive to heat due to the benefit of little radiated heat emission, but also for illumination of UV sensitive objects or materials.

- Design Flexibility - LEDs can be combined in any shape to produce highly efficient illumination. Individual LEDs can be dimmed, resulting in a dynamic control of light, color and distribution. Well-designed LED illumination systems can achieve fantastic lighting effects, not only for the eye but also for the mood and the mind: LED mood illumination is already being used in airplanes, classrooms and many more locations and we can expect to see a lot more LED mood illumination in our daily lives within the next few years.

- Operational in Extremely Cold or Hot Temperatures - LEDs are ideal for operation under cold and low outdoor temperature settings. For fluorescent lamps, low temperatures may affect operation and present a challenge, but LED illumination operates well also in cold settings, such as for outdoor winter settings, freezer rooms etc.

- Light Dispersement – LEDs are designed to focus light and can be directed to a specific location without the use of an external reflector, achieving higher application efficiency than conventional lighting. Well-designed LED illumination systems are able to deliver light more efficiently to the desired location.

- Instant Lighting & Frequent Switching - LED lights brighten up immediately and when powered on, which has great advantages for infrastructure projects such as traffic and signal lights. Also, LED lights can be switched off and on frequently and without affecting the LED's lifetime or light emission. In contrast, traditional lighting may take several seconds to reach full brightness, and frequent on/off switching does drastically reduce operational life expectancy.

- Low-Voltage - A low-voltage power supply is sufficient for LED illumination. This makes it easy to use LED lighting also in outdoor settings, by connecting an external solar-energy source and is a big advantage when it comes to using LED technology in remote or rural areas.

Changes in Infrastructure

New lamps and ballasts will be installed as part of this ECM. Also, new drop ceilings will be installed as part of this ECM.

Customer Support and Coordination with Utilities

Coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use	Energy savings will result from reduced electric energy usage. A slight increase in heating energy is resultant from the reduced heat output of more efficient lamps.
Waste Production	All lamps and ballasts that are removed will be properly disposed.
Environmental Regulations	No environmental impact is expected.

ECM 1B LIGHTING CONTROLS

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
1B	Lighting Controls	✓	✓	✓	✓	✓	✓

Existing Conditions

Honeywell identified areas in which occupancy based lighting controls can be used to conserve lighting energy. The controls noted were local manual switches for interior and analog time clocks for exterior.

Chatham HS- Classroom with Manual Light Switch

Chatham HS- Daylight Harvesting Opportunity

Proposed Solution

Honeywell is proposing to install a comprehensive occupancy sensor control system that will monitor occupancy and turn lights off when spaces are not occupied.

Occupancy sensors will be installed in classrooms, individual offices and storage rooms that do not have them already. The larger spaces will have multiple sensors that will automatically turn lights off when the spaces are unoccupied. Installing new wall switch or ceiling-mount occupancy sensor controls can save approximately 30%(based on historical averages for this type of facility) in energy usage. These new sensors will contain the latest dual-sensor technology (passive infrared & ultrasonic activated). The ultrasonic aspect of the sensor will detect "minor" motion while the passive infrared aspect will detect "major" motion. Based on observation, there were lights on in some unoccupied rooms, further highlighting the need for and potential energy savings from this ECM.

The following are some of the typical room and area types that are part of this proposal and the products that are likely to be used:

- Private Offices – In most cases, sensors will be wall switch type. Sensors will be PIR or dual technology.
- Open Offices – Ceiling mounted sensors and/or corner mounted wide view sensors both with power packs. Sensors will be either Passive Infrared (PIR) or dual technology.
- Copy Rooms / Storage Closets / Kitchenettes / Break Rooms - Sensors also come with vandal resistant option for added durability.
- Restrooms – Restrooms with stalls will have ceiling or other remote mounted sensors with the dual technology option. Smaller private restrooms will usually have wall switch sensors.
- Hallways – Depending on the configuration of the hallways, the sensors will be a combination of ceiling mounted and corner mounted wide view sensors with power packs. Sensors will be either PIR or dual technology as needed.

Honeywell will control the load specified in the proposal and that occupancy sensors installed will control the lighting fixtures to the complete satisfaction of the occupants and the facilities team.

Potential Option For Day Lighting

Daylight harvesting is an effective lighting strategy that is becoming more common in new construction builds and can provide up to a 15% reduction in the buildings overall lighting load. The process involves utilizing ambient light from natural or other sources to supplement general lighting in interior spaces.

After accounting for the possible sunlight available throughout the building, lighting controls can be used that switch or dim the lights either manually or automatically in response to the daylight. Several factors impact the amount of ambient light available to be harvested, including window size, building orientation, latitude and longitude, and weather. Specific software integrates all of the relevant data, both general and site specific, to model buildings for savings potential from daylight harvesting. The systems we evaluate are high efficiency fixed output, high efficiency step dimming (100% to 50%) and high efficiency continuous dimming (100% to 5%).

Changes in Infrastructure

New sensors will be installed as part of this ECM.

Customer Support and Coordination with Utilities

Coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use	Energy savings will result from reduced electric energy usage.
Waste Production	None.
Environmental Regulations	No environmental impact is expected.

ECM 1C VENDING MISERS

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
1C	Vending Misers	✓	✓	✓	✓	✓	✓

The Chatham's School District had different plug loads such as vending machines at multiple school locations. As such, Honeywell has investigated the use of plug controllers for these areas.

Existing Conditions

Vending machines are located throughout your facilities offering soft drinks and snacks to occupants. A typical cold drink machine consumes over 5,000 kWh annually.

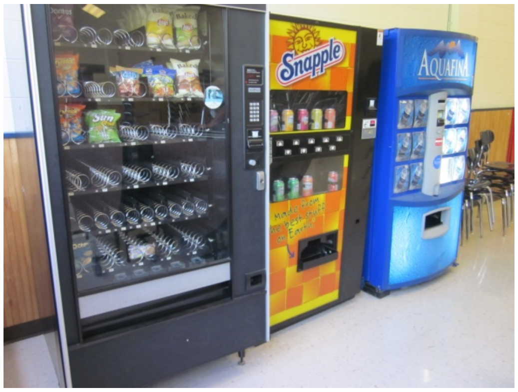
Chatham SD – Vending Machines

Building	Type	Qty	Location
Chatham High School	Cold Beverage	1	Cafeteria
Chatham High School	Snack	1	Cafeteria
Chatham High School	Cold Beverage	1	Cafeteria
Chatham High School	Cold Beverage	1	Hallway
Chatham High School	Cold Beverage	1	Hallway
Chatham High School	Snack	1	Hallway
Chatham High School	Cold Beverage	1	Faculty Room
Chatham High School	Snack	1	Faculty Room
Chatham Middle School	Cold Beverage	1	Cafeteria
Chatham Middle School	Cold Beverage	1	Faculty Room
Chatham Middle School	Snack	1	Faculty Room
Lafayette School	Cold Beverage	1	Faculty Room
Southern Boulevard School	Cold Beverage	1	Hallway
Milton Avenue School	Cold Beverage	1	Faculty Room
Washington Avenue School	Cold Beverage	1	Faculty Room

Table 1C.1 – Existing Vending Machines

Proposed Solution

During the site visit, Honeywell noted vending machines providing an opportunity for energy savings by shutting off non-critical loads during the non-occupied periods. To control the vending machines, Honeywell proposes to install a vending machine occupancy controller (VMOC) to manage the power consumption. Utilizing a Passive Infrared (PIR) Sensor, the VMOC completely powers down a vending machine when the area surrounding it is unoccupied. Once powered down, the VMOC will monitor the room's temperature and use this information to automatically re-power the vending machine at one to three hour intervals, independent of occupancy, to ensure proper vending product temperature control.



Vending Machines in the Cafeteria. Chatham HS

Vending Machine in the Cafeteria. Chatham MS

The VMOC also monitors electrical current used by the vending machine. This ensures that the unit will never power down a vending machine while the compressor is running, so a high head pressure start never occurs. In addition, the current sensor ensures that every time the vending machine is powered up, the cooling cycle is run to completion before again powering down the vending machine. The Coca Cola Company and Pepsi Corporation approve the proposed controller for use on their machines.

Interface with Existing Equipment

All of the plug load control devices are easily installed. The vending machine controllers are installed separately from the machine, and implementation will occur during working hours. A period of three (3) weeks will be required to verify proper calibration of the sensors.

With respect to the vending machines in your facilities, Honeywell has estimated the number and types of vending machines based on our site tour. During the implementation phase, Honeywell will check with the vendor about the type and specification of the vending machines as it relates to any internal time clocks which may exist inside the machine. Should this be the case, the savings and cost will be adjusted accordingly.

Changes in Infrastructure

New vending machine controls will be installed as part of this ECM.

Customer Support and Coordination with Utilities

Minor coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use	Energy savings will result from reduced electric energy usage.
Waste Production	None.
Environmental Regulations	No environmental impact is expected.

ECM 1D INSTALL DE-STRATIFICATION FANS

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
1D	De-Stratification Fans	✓	✓	✓	✓	✓	✓

Existing Conditions

In high ceiling areas such as in a gymnasium and/or cafeteria, warm air stratifies close to the ceiling. Elevated levels of heat transfer through the high walls and roof causes elevated heat loss.

Lafayette School Gym

Milton Avenue School Gym

Proposed Solution

In school gyms with 20+ foot ceiling heights, there is approximately a 15°F+ temperature difference between the floor and the ceiling. With higher ceilings it is even greater. That means to generate the heat necessary to maintain a comfortable 70°F temperature at the floor level, where student activities occur, the ceiling could be 85°F or higher.

De-stratification fans de-stratify the air to a zero to 3°F differential from floor to ceiling and wall to wall. This will allow HVAC systems to run for a shorter duration because of the absence of extreme temperatures to heat or cool, thus allowing the local thermostats to be satisfied for longer periods of time.

Systems Evaluation and Selection

Energy-efficient motor drives a near-silent fan that forces a column of hotter air from the ceiling area to the cooler floor below. As this column of warm air nears the floor, it begins to flare out in a circular pattern and rise again creating a torus. While doing so, it warms the cooler air it mixes with near the floor increasing the temperature of the air and floor where people live and work. Through a natural law of physics, this torus will continue to re-circulate air through the de-stratification fan suspended near the ceiling and continue mixing warmer air from the ceiling with cooler air near the floor until the ceiling and air temperatures are nearly equal.

As this happens, it will require less and less energy to comfortably heat the work area, allowing thermostats to be lowered and energy savings to be realized. Once started, the entire process of "thermal equalization" will take on average less than 24 hours.

Based on preliminary site investigation conducted by our staff, we propose to install the following as indicated in the table below:

School	Location	Qty	Type
Chatham High School	Main Gym	8	Air Pear 25
Chatham High School	Second Gym	6	Air Pear 25
Chatham High School	Weight Room	1	Air Pear 25
Chatham High School	Aux Weight Room	1	Air Pear 25
Chatham Middle School	Upper Gym	6	Air Pear 45
Chatham Middle School	Lower Gym	6	Air Pear 45
Lafayette School	Gym	4	Air Pear 25
Milton Avenue School	Multipurpose Room	2	Air Pear 25
Southern Boulevard School	Gym	4	Air Pear 25
Washington Avenue School	Gym	4	Air Pear 25
Washington Avenue School	Auditorium	4	Air Pear 15

Table 1D.1 – Proposed De-stratification Fans

Scope of Work

Per De-stratification Fan:

- Shut off the main electric power to the area in which the unit(s) will be installed.
- Install new de-stratification fan and wiring.
- Re-energize.
- Inspect unit operation by performing electrical and harmonics testing.

Changes in Infrastructure

New de-stratification fans will be installed as part of this ECM.

Customer Support and Coordination with Utilities

Coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use	Energy savings will result from reduced thermal energy usage. A slight increase in electrical energy is resultant from the increase run time of the fan motors.
Waste Production	None.
Environmental Regulations	No environmental impact is expected.

ECM 1E PLUG LOAD MANAGEMENT VIA WI-FI

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
1E	Plug Load Management Via WIFI	✓	✓	✓	✓	✓	✓

Existing Conditions

A byproduct of the electronic devices such as printers, projectors, SmartBoards, televisions, and window air conditioning units is their phantom load. Phantom load refers to energy that is used when a device is off. This includes energy used by TV's when they're in standby mode (i.e. when they can be turned on with a remote), and energy used by chargers or a laptop's AC adapter. Studies estimate that phantom load now accounts for 6% of all energy use.

With the increasing number of devices, many facilities managers must rely on people to remember to turn out the lights, or unplug their printers when not in use. These phantom loads

Proposed Solution

Home automation and control technologies have been around for years, and have the potential to reduce the energy used by a wide variety of devices. Plug load management via Wi-Fi provides a simple solution to the device control dilemma, by using an existing Wi-Fi network to program BERT® electrical plugs to a set schedule defined by the end user. These plugs are in essence a switch that stops all electrical power to the device, turning off equipment and eliminating phantom loads.

The Enterprise Application Program (EAP) is installed on one computer on the network, and is used to set schedules, group devices, and monitor activity. On/Off requests are sent through the existing network router using Wi-Fi. Each BERT plug contains a microchip and antenna that communicates with the enterprise application program on a periodic basis. The BERT enterprise application program uses SNMP (Simple Network Management Protocol) to monitor the activity of connected devices (plugs). When a BERT plug receives an "off" command, the module turns off all power supplied to the plug.

The benefits are energy savings and extended bulb life for the white board projectors. It is estimated that one (1) less bulb replacement will be required per year for each projector.

Energy Savings Methodology and Results

Installation of the outlet strips will reduce the operating hours of the connected peripheral devices reducing electrical consumption.

Changes in Infrastructure

Computers and peripherals will be connected new BERT plugs permitting peripheral operation to be coordinated with the computer to which they are connected.

Customer Support and Coordination

None.

Environmental Issues

Resource Use	Annual savings for student computers are based wattage difference between the two monitor types.
Waste Production	This measure will result in disposal of existing CRT monitors.
Environmental Regulations	No environmental impact is expected.

ECM 2A BOILER REPLACEMENTS

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
2A	Boiler Replacements			✓			✓

Existing Conditions

In general, the boilers at the Chatham SD have been well maintained which has resulted in additional years of operation.

Chatham High School is heated by two (2) boiler plants. The boiler plant in the original building consist of two (2) Cleaver Brooks model CB-801-150, 6280 MBH natural gas input each water boilers manufactured in 1961. These boilers provide heating hot water to unit heaters, unit ventilators, fin tube radiation, heat & ventilation units and AC units 2 through 6. There is also a separate boiler plant that serves the 2001 addition.

Southern Boulevard School is also heated by two (2) boiler plants. The boiler plant in the original building consists of two (2) H.B. Smith, Mills 450-W-13 water boilers. The 2001 addition added a boiler plant that serves the 1988 addition. It consists of one (1) H.B. Smith model Series 28A-10 cast iron boiler with 3172MBH natural gas input.

Chatham High School – Boiler Plant

Southern Boulevard School – Boiler Plant

School	Manufacturer	Model	Qty	Manuf Year	Input (Each)	Equipment Type	Fuel
Chatham High School	Cleaver Brooks	CB801-150	1	1961	6280 MBH	Hot Water Boiler	Gas
Chatham High School	Cleaver Brooks	CB801-150	1	1961	6280 MBH	Hot Water Boiler	Gas
Southern Boulevard School	H.B. Smith	MS 450-W-13	1	1970	3080 MBH	Hot Water Boiler	Gas
Southern Boulevard School	H.B. Smith	MS 450-W-13	1	1970	3080 MBH	Hot Water Boiler	Gas
Southern Boulevard School	H.B. Smith	Series 28A-10	1	2006	3172 MBH	Hot Water Boiler	Gas

Table 2A.1 – Existing Equipment

Proposed Solution

It is recommended that the boilers listed in Table 2A.1 be replaced with boilers operating at higher efficiency. The existing boilers to be replaced suffer from elevated stack losses as well as jacket losses (radiation losses) due to the age, deterioration of the heat transfer surfaces and obsolete design. New condensing hot water boilers have thermal efficiencies that range from 88% – 95% depending on the return hot water temperature from the heating loop. With proper design, it is typical to see thermal efficiencies of around 92%. Thermal efficiency is only one part of the equation that makes up the seasonal efficiency of a boiler.

Compared to the existing boilers in these schools, the new boilers will provide an increase in boiler efficiency of anywhere between 10% to 15%.

School	Manufacturer	Model	Qty	Input (Each)	Equipment Type	Fuel
Chatham High School	Fulton	EDR-2000	2	2000 MBH	Condensing Hot Water Boiler	Gas
Chatham High School	Fulton	EDR-2000	1	2000 MBH	Condensing Hot Water Boiler	Gas
Southern Boulevard School	Caliber	CAL-850	2	850 MBH	Condensing Hot Water Boiler	Gas
Southern Boulevard School	Caliber	CAL-850	1	850 MBH	Condensing Hot Water Boiler	Gas
Southern Boulevard School	Fulton	EDR-2000	1	2000 MBH	Condensing Hot Water Boiler	Gas

Table 2A.2 – Proposed Boiler Equipment

Scope of Work

The following outlines the boiler replacement:

- Disconnect gas back to shutoff valve and electric back to source panel-board.
- Remove existing boilers
- Connect gas, heating hot water or steam appurtenances to new boilers.
- Terminate and power new boiler electric circuiting.
- Start up, commissioning and operator training.

Energy Savings Methodology and Results

In general, Honeywell uses the following approach to determine savings for this specific measure:

Existing Boiler Efficiency	= Existing Heat Production/ Existing Fuel Input
Proposed Boiler Efficiency	= Proposed Heat Production/ Proposed Fuel Input
Energy Savings $	= Heating Production (Proposed Efficiency – Existing Efficiency)

Equipment Information

Manufacturer and Type	Several quality and cost effective manufacturers are available. Honeywell and the customer will determine final selections.
Equipment Identification	As part of the ECM design and approval process, specific product selection will be provided for your review and approval.

Changes in Infrastructure

New boiler will be installed in itemized locations; in addition, training for maintenance personnel will be required as well as on-going, annual preventive maintenance.

O&M Impact

The new boilers will decrease the O&M cost significantly for maintaining the boilers.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods. Continuity of service must be maintained for the customer.

Environmental Issues

Resource Use	Energy savings will result from greater combustion efficiency, reduced maintenance costs control and setback.
Waste Production	Existing boilers scheduled for removal will be disposed of properly.
Environmental Regulations	No environmental impact is expected; all regulations will be adhered to in accordance with EPA and local code requirements.

This Page Intentionally Left Blank

ECM 2B BOILER BURNER CONTROLS

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
2B	Boiler Burner Controls					✓	

Existing Conditions

Honeywell has surveyed each building's heating and domestic hot water equipment and distribution systems to identify areas for boiler plant optimization. Currently, the existing boilers at Chatham Middle School only have limited or no fuel / air ratio controls in place. Air to fuel ratio is controlled by a mechanical linkage between the fuel valve and the air damper.

Chatham M.S. –Boiler Burners

Proposed Solution

Typically, boilers are sized to accommodate the coldest days (approximately 5% of the year). During these periods of maximum demand, the burner is constantly on and the boiler is operating at maximum capacity. At all other times, the burner cycles on and off in order to maintain temperature or pressure in the boiler. It is during these periods of lesser demand, that the controller will monitor the boiler make up rate, and efficiently manage the firing of the boiler.

The length of the burner's off-cycle is the best measure of total heating demand or load. In other words, the load is directly related to the time it takes for water (or steam) in the boiler to drop from its high-limit temperature (or pressure) to its low-limit or "call" setting. When demand is high, these off-cycles are short and the on-cycles are longer. When demand is lower, off-cycles are longer and on-cycles are reduced.

The device, which is a microprocessor based computer, constantly monitors the demand on the boiler by assimilating all factors affecting a building's heating requirements, including occupancy, climate, wind chill, solar gain, type of building, and many others.

Proposed Systems and Scope of Work

Honeywell will retrofit the existing Burner Management System on boilers with Honeywell ControLinks™ linkages Fuel/Air Ratio Control system.

Honeywell ControLinks™ will integrate to the existing Burner Management Flame Safe Guard Controller (FSG) to monitor and control the burner fuel and air ratios to maintain proper combustion. The single actuator will be replaced with separate Direct Coupled Actuators (DCA) for air and fuel(s) and will be connected to the existing burner control.

This retrofit will provide a combustion curve and light-off points including minimum/maximum firing rate points resulting in a precise firing rate control over the entire firing rate of the burner. Combustion efficiency will be maximized throughout the combustion curve and will provide a fuel curve in order to achieve maximum efficiency.

Scope of Work

Honeywell ControLinks controllers will be installed on the following boiler burners:

School	Boiler Make	Burner Model	Qty	Boiler Output	Fuel
Chatham Middle School	HB Smith	Underwriters Laboratories	2	3217 MBH	Gas

Table 2B.1 – Existing Boilers to be Installed with ControLinks

This retrofit will provide a combustion curve on the burner system and will provide light-off points as well as minimum/maximum firing rate points resulting in a precise firing rate control over the entire firing rate of the burner. Combustion efficiency will be maximized throughout the combustion curve and will provide fuel curves in order to achieve maximum efficiency.

Energy Savings Methodology and Results

The savings approach is based upon reducing the amount of time the boiler is on without reducing the heating response time or system capacity in response to warmer periods of the year and when demand for heating is low or non-existent. The relative savings is based upon the ratio of off time to burn time and the magnitude is between 10% and 15% of fuel used.

Honeywell ControLinks is a patented burner control unit. This unit eliminates mechanical linkages in the traditional burners and replaces the same with electronic equivalents. This eliminates the sluggish operation of the linkages and significantly decreases response time. The air to fuel ratio is therefore maintained accurately, resulting in fuel savings. Case studies have shown that fuel savings range from 4-8% - Honeywell uses 5% savings to be conservative.

Changes in Infrastructure

A new controller for each boiler will be installed and programmed. In addition to the controllers, training for maintenance personnel will be required.

Equipment Information

Manufacturer and Type	Several quality and cost effective manufacturers are available. The following is an example of equipment that may be utilized. Honeywell and the Customer will determine final selections.
Equipment Identification	As part of the measure design and approval process, specific product selection will be provided for your review and approval.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods.

Environmental Issues

Resource Use	Energy savings will result from greater boiler load control.
Waste Production	This ECM will produce no waste by-products.
Environmental Regulations	No environmental impact is expected.

Utility Interruptions

Proper phasing procedures will minimize gas interruptions.

This Page Intentionally Left Blank

ECM 2C PREMIUM EFFICIENCY MOTORS AND VFDS

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
2C	Premium Efficiency Motors and VFDs			✓		✓	✓

Existing Conditions

Honeywell has indentified standard efficiency electric motors on hot water pumps. Energy savings can be obtained by installing Variable Frequency Drives on the standard efficiency motors.

Southern Boulevard School Hot Water Pumps

Chatham High School Hot Water Pump

The motors that were identified in the buildings are listed as follows:

School	Equipment Label	Qty	Motor HP	Replace Motor Y/N	Add VFD Y/N
Chatham High School	CHS-P-1	1	20.0	Y	Y
Chatham High School	CHS-P-2	1	20.0	Y	Y
Chatham High School	CHS-P-3,4	2	5.0	Y	Y
Chatham Middle School	CMS-P-1,2	2	7.5	Y	Y
Chatham Middle School	CMS-P-A,B	2	7.5	Y	Y
Chatham Middle School	CMS-F-1	1	7.5	Y	Y
Chatham Middle School	CMS-F-2	1	7.5	Y	Y
Southern Boulevard School	SBS-P-1,2	2	5.0	Y	Y

Table 2C.1 – Existing Motors and Replacements

Proposed Solution

Honeywell proposes the installing VFDs on all above-mentioned single speed standard efficiency motors.

Scope of Work

1. Install VFDs on the pumps.
2. Install wiring and controls on the new VFDs.
3. Measure and verify the pre and post-retrofit voltage, amperage, and RPM.

Energy Savings Methodology and Results

The energy consumed by electric motors varies inversely to the cube of the motor speed. Variable speed drives reduce motor speed (in response to load) thus reducing energy consumption exponentially.

Equipment Information

Manufacturer and Type	Several quality and cost effective manufacturers are available. The following is an example of equipment being utilized. Honeywell and Chatham SD will determine final selections.
Equipment Identification	Product cut sheets and specifications for generally used are available upon request. As part of the measure design and approval process, specific product selection will be provided for your review and approval.

Changes in Infrastructure

New motors will be installed in place of the old motors. No expansion of the facilities will be necessary.

Customer Support and Coordination with Utilities

Coordination of the electrical tie-in will also be required.

Environmental Issues

Resource Use	Energy savings will result from reducing electrical usage by operating higher efficiency motors for the same horsepower output. The equipment uses no other resources.
Waste Production	This measure will produce waste byproducts. Old motors shall be disposed of in accordance with all federal, state and local codes.
Environmental Regulations	No environmental impact is expected.

ECM 2D DOMESTIC HOT WATER REPLACEMENTS

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
2D	Domestic Hot Water Replacements			✓			

Existing Conditions

Currently Southern Boulevard School has an A.O. Smith model BT-80-112, 74 gallon tank, natural gas, domestic water heater the provides hot water for the original part of the building. There is also a Rheem-Ruud Universal model G75-125, natural gas, domestic water heat that provides hot water for the 1988 addition.

Southern Boulevard School DHW Heater

Southern Boulevard School DHW Heater

School	Location Served	Manufacturer	Model	Qty	Capacity	Fuel
Southern Boulevard School	Original Building	A.O. Smith	BT-80-112	1	60 MBH	Gas
Southern Boulevard School	1988 Addition	Rheem-Ruud	G75-125	1	100 MBH	Gas

Table 2D.1 – Existing Equipment

Proposed Solution

Honeywell proposes replacing the existing DHW heaters at the above schools with highly efficient condensing DHW heaters. New condensing DHW heaters have efficiencies between 92% - 94%. They provide better control with capabilities as night setback, temperature adjustments and demand control hot water.

School	Location Served	Manufacturer	Model	Qty	Input	Fuel
Southern Boulevard School	Original Building	A.O. Smith	BTX-80	1	76 MBH	Gas
Southern Boulevard School	1988 Addition	A.O. Smith	BTX-80	1	76 MBH	Gas

Table 2D.2 – Proposed Equipment

Scope of Work

The following outlines the domestic hot water heater replacement:

- Demolish and remove old water heaters

- Furnish and install 2 x condensing gas fired domestic hot water heaters as specified in the table above
- Install all required piping, controls, and breeching
- Install mixing valve
- Install circulators for building use and kitchen supply
- Disconnect hot water storage tank and abandon in place
- Test and commission

Energy Savings Methodology and Results

The savings are calculated from the domestic hot water heater efficiency differences.

Existing Equipment Efficiency	= Existing Boiler Efficiency + Existing Heat Exchanger Efficiency
Proposed Equipment Efficiency	= Efficiency of the New Domestic Hot Water Heater
Energy Savings	= DHW Load x (Existing Equipment Efficiency – New Equipment Efficiency)

Changes in Infrastructure

A new controller for each boiler will be installed and programmed. In addition to the controllers, training for maintenance personnel will be required.

Equipment Information

Manufacturer and Type	Several quality and cost effective manufacturers are available. The following is an example of equipment that may be utilized. Honeywell and the Customer will determine final selections.
Equipment Identification	As part of the measure design and approval process, specific product selection will be provided for your review and approval.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods.

Environmental Issues

Resource Use	Energy savings will result from improved thermal efficiency.
Waste Production	This ECM will produce no waste by-products.
Environmental Regulations	No environmental impact is expected.

Utility Interruptions

Proper phasing procedures will minimize gas interruptions.

ECM 2E ROOFTOP UNIT REPLACEMENT

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
2E	Rooftop Unit Replacement					✓	✓

Existing Conditions

Some rooftop units serving Chatham High School and Chatham Middle School are inefficient and have exceeded their expected useful service lives. Replacing these units with new, high efficiency units will save energy costs over the long term while reducing repair costs that would otherwise have been necessary to keep the old units in operation.


Chatham High School Rooftop Units

School	Make	Model	Location Served	Qty.	Tons	EER
Chatham HS	York - LUX Air	DB HB-T072AA	Room A110, A110A	1	6.0	8.0
Chatham HS	York - LUX Air	DD HB-T090AA	Room A120	1	7.5	8.0
Chatham HS	Nesbitt	RMA100G2RC24050B01A150100BCZ1	Main Offices	1	23.3	8.9
Chatham MS	York	D1EE036A25EBC	Room 200	1	3.0	11.0
Chatham MS	York	D1EE036A25EBC	Room 100	1	3.0	11.0

Table 2E.1 – Existing Rooftop Units to be Replaced

** EER is estimated.*

Proposed Solution

Honeywell proposes replacing the existing rooftop units in Table 2E.1. The new units will be installed in the same location as the existing units. Existing electrical power supply will be reconnected to the new motors. The new unit will be equipped with factory-installed microprocessor controls that improve unit efficiency. The unit will also communicate with the existing building management system.

School	Make	Model	Location Served	Qty.	Tons	EER
Chatham High School	Daikin	DPS006	Room A110, A110A	1	6.0	19.8
Chatham High School	Daikin	DPS007	Room A120	1	7.5	20.6
Chatham High School	Daikin	MPS020	Main Offices	1	21.7	11.2
Chatham Middle School	Daikin	DPS003	Room 200	1	3.0	16.9
Chatham Middle School	Daikin	DPS003	Room 100	1	3.0	16.9

Table 2E.2 – Proposed Rooftop Units

Scope of Work

The following outlines the scope of work to install the condensing units stated in the above table:

- Disconnect existing RTU electric connections.
- Disconnect piping and air ducts from the unit.
- Remove unit from the base.
- Modify base for new unit if necessary.
- Run new gas line for gas fired heater.
- Rigging and setting new unit at the base.
- Inspect piping and air ducts before reconnecting them to the unit.
- Reconnect piping and air ducts.
- Repair duct and piping insulation.
- Connect electric power.
- Start up and commissioning of new unit.
- Maintenance operator(s) training.

Energy Savings Methodology and Results

The savings approach is based on the energy efficiency between the existing and new units. The savings are generally calculated as:

Electric Energy savings	Existing unit energy consumption (kWh) – replacement unit energy consumption (kWh)

Equipment Information

Manufacturer and Type	Several quality and cost effective manufacturers are available. Honeywell and the School District will determine final selections.
Equipment Identification	Product cut sheets and specifications are available upon request. As part of the measure, design and approval process, specific product selection will be provided for your review and approval.

Customer Support and Coordination with Utilities

Coordination of the electrical tie-in will be required.

Environmental Issues

Resource Use	Energy savings will result from higher efficiency units.
Waste Production	Existing rooftop unit scheduled for removal will be disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 2F WINDOW AC UNIT REPLACEMENTS

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
2F	Window AC Unit Replacements					✓	

Existing Conditions

During walkthroughs, window air conditioning were indentified in the classrooms in some of the schools within the district. The main first floor and second floor classrooms at the Middle School mostly consist of unit ventilators with window AC units. These units typically have 2 to 2.4 tons of capacity each. The existing window air conditioning units range in condition from good to poor, and have an average Estimated Efficiency Ratio of 8. There is also limited temperature/occupancy control of these units, resulting in inefficient operation.

Older Window AC Unit in Classroom
Chatham Middle School

Window AC Unit in Classroom with Unit Ventilator
Chatham Middle School

Existing				
School	Qty.	Location Served	Unit Tonnage	EER
Chatham Middle School	1	Rm 119	2	10.7
Chatham Middle School	1	Rm 120	2	10.7
Chatham Middle School	1	Rm 126	2	10.7
Chatham Middle School	1	Rm 127	2	10.7
Chatham Middle School	1	Rm 128	2	10.7
Chatham Middle School	1	Rm 129	2	10.7
Chatham Middle School	1	Rm 130	2	10.7
Chatham Middle School	1	Rm 131	2	10.7
Chatham Middle School	1	Rm 132	2	10.7
Chatham Middle School	2	Rm 136	2	10.7
Chatham Middle School	2	Rm 141	2	10.7
Chatham Middle School	2	Rm 146	2	10.7
Chatham Middle School	2	Rm 152	2	10.7
Chatham Middle School	2	Rm 153	2	10.7
Chatham Middle School	2	Rm 210	2	10.7
Chatham Middle School	1	Rm 211	2	10.7

Existing				
School	Qty.	Location Served	Unit Tonnage	EER
Chatham Middle School	1	Rm 212	2	10.7
Chatham Middle School	1	Rm 213	2	10.7
Chatham Middle School	1	Rm 214	2	10.7
Chatham Middle School	1	Rm 215	2	10.7
Chatham Middle School	1	Rm 216	2	10.7
Chatham Middle School	1	Rm 217	2	10.7
Chatham Middle School	1	Rm 218	2	10.7
Chatham Middle School	1	Rm 219	2	10.7
Chatham Middle School	1	Rm 221	2	10.7
Chatham Middle School	1	Rm 222	2	10.7
Chatham Middle School	1	Rm 223	2	10.7

Table 2F.1 – Existing Window AC Units to be Replaced

Proposed Solution

Replacement of the existing window air conditioners with multi-split units or new variable Refrigerant Flow System will provide reliable service for many years to come. The new units will have higher efficiencies (EER >= 12), lower maintenance cost and may have an option of being connected to the central BMS. The new units will be sized to provide cooling for the areas that are currently air conditioned, thus eliminating improper sizing and malfunction. The new units will save on operational costs, as well as, reduce energy consumption.

Proposed					
School	Qty.	Make	Location Served	Unit Tonnage	SEER/IEER
Chatham Middle School	1	Daikin	First Floor Classrooms	38.0	19.5
Chatham Middle School	1	Daikin	Second Floor Classrooms	28.0	19.5

Table 2F.2 – Proposed

Energy Savings Methodology and Results

The savings approach is based on the energy efficiency between the existing and new units. The savings are generally calculated as:

Electric Energy Savings	Existing unit energy consumption (kWh) – replacement unit energy consumption (kWh)

Equipment Information

Manufacturer and Type	Several quality and cost effective manufacturers are available. Honeywell and the Customer will determine final selections.
Equipment Identification	Product cut sheets and specifications are available upon request. As part of the measure, design and approval process, specific product selection will be provided for your review and approval.

Customer Support and Coordination with Utilities

None.

Environmental Issues

Resource Use	Energy savings will result from higher efficiency units.
Environmental Regulations	No environmental impact is expected.

This Page Intentionally Left Blank

ECM 2G KITCHEN HOOD CONTROLLERS

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
2G	Kitchen Hood Controllers					✓	✓

Existing Conditions

The kitchens in the Chatham SD currently utilize a constant volume kitchen exhaust hood system. This system operates at full load, even when there is no activity in the kitchen. It also requires operating the exhaust fan at full load. This wastes both fan energy and heating energy. When the hood is not utilized, an opportunity exists to reduce airflow and conserve energy.

Kitchen Hood. Chatham High School

Kitchen Hood. Chatham Middle School

Possible Solution

Honeywell recommends installing a microprocessor based controls system whose sensors automatically regulate fan speed based on cooking load, time of day and hood temperature while minimizing energy usage. The system includes a temperature sensor installed in the hood exhaust collar, IP sensors on the ends of the hood that detect the presence of smoke or cooking effluent and variable frequency drives (VFD) that control the speed of the fans. This will result in energy and cost savings, noise reduction, extension of equipment life and reduction in cleaning costs.

School	Number of Hoods
Chatham Middle School	1
Chatham High School	1

Table 2G.1 – Existing Kitchen Hoods to be installed with Controllers

Scope of Work

1. Install a temperature sensor in the hood to monitor temperature of the exhaust gas
2. Install a set of two photo sensors on the sides to monitor smoke density across the hood
3. Install a control panel with a small point controller and a set of relays in the kitchen close to the hood
4. Provide electric wiring from the new panel to the sensors, exhaust fan motor as well as to the closest electric panel for power supply
5. Provide connection to the BMS system for remote monitoring, control, and alarming. This system could also be stand-alone to save on cost.
6. Commission control components and sequences, and calibrate control loops.

Sequence of operation will enable the exhaust fans when either temperature or smoke density in the range hoods is above a pre-set value. Time delays between start and stop will be programmed to prevent motor short cycling. Schedule programming could be implemented as well.

Energy Savings Methodology and Results

The savings approach is based upon reducing the amount of conditioned air that is being exhausted when there is no cooking taking place.

Changes in Infrastructure

There will be improvements in HVAC equipment and controls for not operating fans continuously.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods.

Environmental Issues

Resource Use	Energy savings will result from reduced energy.
Waste Production	Any removed parts will be disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 2H WALK-IN COMPRESSOR CONTROLLERS

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
2H	Walk-In Compressor Controllers					✓	✓

Existing Conditions

Walk-in refrigerators and freezers were noted during walkthroughs at the High School and Middle School. In many refrigeration walk-in freezers and coolers, the compressor is oversized and cycles on/off frequently. This compressor cycling results in higher energy consumption and may reduce the life of the compressor.

Walk-In Freezer. Chatham HS

Walk-In Refrigerator. Chatham MS

School	Location	Walk-In Refrigerators	Walk-In Freezers
Chatham High School	Kitchen	1	1
Chatham Middle School	Kitchen	-	1

Table 2H.1 – Existing Walk-In Refrig/Freezers to be Installed with Controllers

Proposed Solution

Honeywell will install a controller refrigeration sensor manufactured by Frigitek at the above-mentioned schools to reduce the compressor cycles of the kitchen walk-in coolers and freezers. The installation of this ECM will have no negative impact on system operation or freezing of food products. By reducing the cycling, the sensor will improve operating efficiency and reduce the electric consumption by 10% to 20%.

This control enhancement will save energy through the reduced compressor cycling in the kitchen walk-in coolers and freezers and will extend the operating life of the compressor. Consequently, the compressor will not have to be replaced as often.

Intellidyne Sensor Features

- Automatic restart on power failure
- Surge protection incorporated into circuitry
- Fully compatible with all energy management systems
- UL listed
- Maintenance free

Intellidyne Sensor Benefits

- Patented process reduces air conditioning electric consumption typically 10% to 20%
- Increased savings without replacing or upgrading costly system components
- "State-of-the-art" microcomputer controller – LED indicators show operating modes
- Protects compressor against momentary power outages and short cycling
- Simple 15-minute installation by qualified installer
- No programming or follow-up visits required
- Maximum year-round efficiency
- Reduces maintenance and extends compressor life
- Fail-safe operation
- Guaranteed to save energy
- UL listed, "Energy Management Equipment"

Intellidyne's patented process determines the cooling demand and thermal characteristics of the entire air conditioning system by analyzing the compressor's cycle pattern, and dynamically modifies that cycle pattern to provide the required amount of cooling in the most efficient manner. This is accomplished in real-time by delaying the start of the next compressor "on" cycle, by an amount determined by the cooling demand analysis. These new patterns also result in less frequent and more efficient compressor cycles.

Energy Savings Methodology and Results

The energy savings for this ECM is realized by the reduction in run time of the compressors and fan motors in the freezers/refrigerators.

Changes in Infrastructure

None

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods.

Environmental Issues

Resource Use	Energy savings will result from the reduced electrical consumption of the compressor.
Waste Production	Any removed parts will be disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 2I STEAM TRAP REPAIR/REPLACEMENT

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
2I	Steam Trap Replacement		✓		✓		

Existing Conditions

Milton Avenue and Washington Avenue Schools use steam for space heating within their older sections. A steam-trap audit revealevd that the steam section within Milton Avenue School contains 73 steam traps, while Washington Avenue School has 56 steam traps..

When steam heats the building and transfers it's heat throughout the building it condenses back to water. Therefore, at each of these end uses, the condensate must be trapped and sent back to the boiler. When steam traps fail, the steam does not condense reducing the heat transfer causing unnecessary heat losses. The inspection and correction of the steam traps will reduce unnecessary losses. Traps are designed to drain only the condensate, and prevent live steam from entering the condensate return piping.

As the distribution system ages, the moving parts in the trap tend to get sluggish or fail altogether. This failure results in live steam entering the condensate return piping. The cumulative effect of this is to return the condensate above the flash point, resulting in steam and hence valuable heating energy loss at the boiler. This loss of energy can be minimized by a thorough survey to identify leaking traps by use of infrared temperature sensing instruments.

Washington Ave School – Steam Unit Vent

Milton Ave School – Steam Boilers

Bldg	Location	# of Steam Traps
Milton Avenue School	Original Section of Building	73
Washington Avenue School	Steam Section of Building	56

Table 2I.1 – Existing Steam Traps Estimate

Proposed Solution

This ECM recommends retrofitting the traps per the following scope of work. The steam trap retrofit includes surveying all of the existing steam traps and engineering appropriate replacements. During construction, Honeywell will provide all materials, fittings, labor and supervision for the timely completion of the project. All existing strainers, isolation valves, check valves, and fittings in good repair will be reused.

Thermostatic steam traps will be completely replaced with new thermostatic trap bodies. F&T steam traps will include complete replacement with new steam traps manufactured by Barnes & Jones Inc or equal. Atmospheric vacuum breakers will be installed on the air handling unit coils where thermostatic traps are currently being used as release vacuum.

Energy Savings Methodology and Results

All mechanical steam traps lose some live steam, either through normal cycling, leaking through a closed trap, or failing in the open position. Various sources have stated that the loss through a properly operational trap may exceed ten lbs/hour, while the failed steam trap population ranges between 20-50% at any given time.

We have estimated the steam losses based on a conservative figure of 10% failed, 10% leaking steam trap population. Failure rates are based on what has been found in similar buildings elsewhere in and around New Jersey. In determining steam losses, the trap orifices and steam pressures have been grouped and averaged to create a simpler statistical basis.

Equipment Information

Material and Type	Steam Trap selection will be determined in conjunction with Chatham SD
Material Identification	As part of the measure, design and approval process, a full Investment Grade Audit will be conducted to determine final scope. Specific material selection will be provided for your review and approval.

Customer Support and Coordination with Utilities

Coordination of the trap installation.

Environmental Issues

Resource Use	Energy savings will result the reduction of steam loss from malfunctioning traps resulting in lower fuel consumption. The equipment uses no other resources.
Environmental Regulations	Asbestos abatement may be required

ECM 2J PIPING INSULATION

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
2J	Piping Insulation						✓

An insulation audit was conducted identifying an approximated quantity of heat that is lost from various locations throughout the buildings. The heat losses result from heating hot water converters and hot water and condensate piping giving off heat to the space around it. This measure will insulate these surfaces, resulting in energy savings and improved comfort of those areas in or near occupied spaces.

Existing Conditions

During the site visits, it was noticed that the hot water supply piping in the Chatham High School boiler room was not insulated. The un-insulated piping wastes energy and also poses a danger of getting injured with exposed hot piping. Also, the boiler has to work harder to make up for the wasted energy.

Chatham High School Un-insulated Hot Water Pipes

Proposed Solution

Honeywell proposes insulating these pipes with appropriately thick fiberglass insulation. The following table lists the recommended insulation thickness.

Location	Pipe Diameter	Insulation Type	Recommended Insulation Thickness	Linear Feet of Pipe
Chatham High School	2"	Fiberglass	1.5"	100

Table 2J.1 – Piping Insulation to be Installed

Energy Savings Methodology and Results

Energy savings results from significantly reducing the heat lost to the atmosphere from the piping and tank surfaces. In general, Honeywell uses the following approach to determine savings for this specific measure:

Energy Savings $	= ((Heat Loss Rate per foot of Uninsulated Pipe – Heat Loss Rate per foot of Insulated Pipe) x (Length of Pipe x Hours of Operation) x Cost/btu)/(Boiler Efficiency))

Reference is made to the ASHRAE 1989 Fundamentals text page 22.19, Table 9A "Heat Loss from Bare Steel Pipe to Still Air at 80 degrees F, Btu/hr-ft" for losses from un-insulated lines, and Table 11 "Recommended Thickness for Pipe and Equipment Insulation".

Changes in Infrastructure

The insulation of the steam lines can happen anytime without impact on building operation. In areas were asbestos is present; precautions will be required. Areas that are dangerously hot may require coordination with a normally occurring shutdown of that portion of the system.

Customer Support and Coordination with Utilities

The service to the specific lines may require interruption to allow for the repair or replacement. Coordination with site personnel will be required to minimize interruption to the buildings affected.

Environmental Issues

Resource Use	Energy savings will result the reduction of heat loss from the uninsulated lines resulting in lower fuel consumptions fuel consumption. The equipment uses no other resources.
Waste Production	This measure produces no waste by products.
Environmental Regulations	Asbestos abatement will not be required.

ECM 2K WINDOW REPLACEMENTS

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
2K	Window Replacements						✓

Existing Conditions

The windows in the original 1962 Chatham High School building are single pane acrylic with aluminum frame and insulated opaque panels. Due to age, construction type, and condition, the windows incur excess air infiltration and provide average thermal resistance to heat transfer. An assessment considered installing aluminum frame with double pane glazing to decrease energy losses.


Single Pane Windows – Chatham High School

Proposed System

Honeywell proposes the installation of new energy efficient, double-paned windows to reduce infiltration, infrared and conductive losses. Overall, through the implementation of this measure, Chatham SD will reduce its heating fuel usage and cooling costs each year. The upgrade will result in savings and improved comfort to students and teachers which in turn will foster a better learning environment.

School	Square Footage	U-Factor Existing Window	U-Factor New Window	Type
Chatham High School	14,369	1.13	0.45	Double Pane Low E

Table 2K.1 Window Replacements

Energy Savings Methodology and Results

The energy savings for this ECM are realized at the building's HVAC equipment. The improved windows will limit conditioned air infiltration and exfiltration. Less infiltration and exfiltration means less heating and cooling required.

Following approach is used to determine savings for this specific measure:

Existing Window Efficiency	= 1/Existing R + Existing Infiltration Rate
Proposed Window Efficiency	= 1/Proposed R + Proposed Infiltration Rate

Energy Savings $	= Audit*Hours/boiler efficiency +((Existing Airflow – proposed airflow) x 1.08 (OA Avg. Temp – Inside Avg. Temp)/(boiler efficiency) x (fuel cost)

Changes in Infrastructure

New windows will be installed.

Customer Support and Coordination with Utilities

Minimal coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use	Energy savings will result from reduced HVAC energy usage and better occupant comfort.
Waste Production	Some existing windows will be removed and disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 2L AHU Replacement

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
2L	AHU Replacement						✓

Existing Conditions

Currently the cafeteria at Chatham High School does not have cooling. The district has expressed an interest to add cooling to this area. Additionally, the H+V unit serving the Chatham High School cafeteria is inefficient and has exceeded its expected useful service life. Replacing this unit with a new, high efficiency unit will save energy costs over the long term while reducing repair costs that would otherwise have been necessary to keep the old units in operation.


Chatham High School Cafeteria H+V Unit

School	Make	Model	Location Served	Qty.	Tons	EER
Chatham High School	Buffalo	G-153	Cafeteria	1	13.0	8.0

Table 2L.1 – Existing H+V Unit to be Replaced

** EER is estimated.*

Proposed Solution

Honeywell proposes replacing the existing H+V Unit in Table 2E.1 with a new air handling unit that will be equipped with DX cooling and will be paired with a rooftop condensing unit. The new unit will be installed in the same location as the existing unit. Existing electrical power supply will be reconnected to the new motors. The new unit will be equipped with factory-installed microprocessor controls that improve unit efficiency and will also communicate with the building management system.

School	Make	AHU Model	Location Served	Qty.	Total Tons	SEER
Chatham High School	Daikin	Destiny 010	Cafeteria	1	10.0	19.8
Chatham High School	Daikin	RCS10F	Cafeteria	1	10.0	13.6

Table 2L.2 – Proposed AHU and Condensing Unit

Scope of Work

The following outlines the scope of work to install the condensing units stated in the above table:

- Disconnect existing AHU electric connections.
- Disconnect piping and air ducts from the unit.

- Remove unit from the base.
- Modify base for new unit if necessary.
- Run new gas line for gas fired heater.
- Rigging and setting new unit at the base.
- Inspect piping and air ducts before reconnecting them to the unit.
- Reconnect piping and air ducts.
- Repair duct and piping insulation.
- Connect electric power.
- Start up and commissioning of new unit.
- Maintenance operator(s) training.

Energy Savings Methodology and Results

The savings approach is based on the energy efficiency between the existing and new units. The savings are generally calculated as:

Electric Energy savings	Existing unit energy consumption (kWh) – replacement unit energy consumption (kWh)

Equipment Information

Manufacturer and Type	Several quality and cost effective manufacturers are available. Honeywell and the School District will determine final selections.
Equipment Identification	Product cut sheets and specifications are available upon request. As part of the measure, design and approval process, specific product selection will be provided for your review and approval.

Customer Support and Coordination with Utilities

Coordination of the electrical tie-in will be required.

Environmental Issues

Resource Use	Energy savings will result from higher efficiency units.
Waste Production	Existing rooftop unit scheduled for removal will be disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 3A BUILDING MANAGEMENT SYSTEM UPGRADES

ECM	ECM Description	Chatham High School	Chatham Middle School	Lafayette Elementary School	Milton Elementary School	Washington Elementary School	Southern Elementary School
3a	Building Management System Upgrades / Pneumatic to DDC	✓	✓	✓	✓	✓	✓

Introduction

Honeywell shall provide all equipment, materials, and labor to implement the building management systems upgrades in accordance with the scope outlined below.

Enterprise Building Integrator (EBI) - Scope of Work

Scope of Work

1. Furnish and install one (1) Enterprise Building Integrator (EBI) to be located at the Chatham High School, Chatham, NJ. The new BMS will be web-based and have the ability to be controlled by any PC, laptop, or smart device with a username and password.
2. Chatham School District shall be responsible to ensure all school buildings are connected on school LAN for communication with the Enterprise Building Integrator (EBI).
3. Chatham School District shall be responsible to provide and terminate new LAN connections in each school building which will be used to connect a new controller for integration to the Enterprise Building Integrator (EBI). Network drop locations to be provided by Honeywell.
4. Chatham School District shall provide VPN access to Honeywell for remote access of the school Enterprise Building Integrator (EBI) for M&V and service functions.
5. Honeywell is responsible for providing new DDC valves and DDC actuators as needed. Honeywell is responsible for field verifying all scope of work as outlined below, verifying valve sizes, verifying equipment counts, and site conditions.
6. Honeywell is responsible for exercising all OA/RA dampers and making minor repairs/adjustments as needed to ensure the dampers open and close completely.
7. Honeywell is responsible for setting up individual zone/classroom wing schedules per the school district's request. Each school will have a master occupied/unoccupied schedule that will override the individual zone schedules in the event of a holiday, snow day, or emergency.
8. Honeywell is responsible for providing a deficiency list of failed control and mechanical components that prevent the system from operating correctly. The deficiency list will be presented to the school district by Honeywell and the district will make the necessary repairs as needed prior to the completion of the project.
9. All graphic screens will display at a minimum; OAT, minimum OA damper position and setpoint, operating setpoints (DAT, CO2, DP, space setpoints, boiler lockout, HWS setpoints, etc.).
10. All space setpoints will be adjustable (+/- 2F) and push button overrides will be provided on all space sensors. Blank metal plate type space sensors will be used in gyms and any other area considered vulnerable to damage.
11. Training for the new Building Management System includes 16 hours total of on-site training that will be led by Honeywell and will provide appropriate learning material.
12. There is no new work associated with fire alarm or duct detectors or fan shutdown. Any existing shutdown circuits will remain.
13. UPS backup for controllers is not included.
14. All low voltage wiring to be plenum rated cable (no conduit), including drops to thermostats, except in mechanical rooms, which will be in EMT conduit. Drops to space temperature sensors shall be in wire mold.
15. Cutting, painting and patching is excluded
16. Honeywell is responsible for coordinating valve installations
17. Existing equipment that is to be reused is assumed to be in good working condition, any mechanical repairs required are not included.

Building Scope of Work

Enterprise Building Integrator (EBI) at Chatham High School

A workstation PC and software with flat screen Monitor and printer will be installed at the Chatham High School providing access for monitoring, viewing and servicing of the Chatham High School, Chatham Middle School, Lafayette Elementary, Milton Elementary, Washington Elementary, and Southern Elementary via VPN access provided by the school district.

Chatham High School BMS Integration

Honeywell will integrate the existing Siemens Apogee BMS into a new Enterprise Building Integrator (EBI) System and Operator Workstation for monitoring, viewing and service of existing equipment functions. Honeywell is responsible for all of the necessary integration prep required on the Siemens BMS to allow complete integration into the new EBI system. The following capabilities will be provided:

- Ability to schedule separate zones/classroom wings as needed by the building operator.
- Ability to adjust day/night and heating/cooling space setpoints.
- Provide new graphic screens for each piece of HVAC equipment that is currently controlled by the existing Siemens BMS. All available DDC points will be displayed on the graphic screens, including operating setpoints.

Chatham High School H&V Units

Provide and install new Honeywell DDC controllers for (6) H&V Units with outside air cooling to implement DCV (HV-1, HV-2, and HV-6 only), space temp, and night set back. Provide and install new DDC actuators as needed. Honeywell is responsible for field verifying all scope of work as outlined below, verifying valve sizes, and site conditions.

High School H&V's (Typical of 6) HV-1 thru HV-6	AI	AO	DI	DO
OA/RA Dampers		6		
Mixed Air Temp	6			
Low limit Freezestat			6	
Supply Fan Enable				6
Supply Fan Status			6	
RA CO2 sensor (HV-1, HV-2, and HV-6 only)	2			
DX cooling stage (HV-1 only if its replaced)				1
Hot Water Coil valve (E/P transducer)		6		
Discharge Air Temp	6			
Room Sensor	6			
Room Set point	6			
Exhaust Fan stop/start (Honeywell to field verify locations)				7
Exhaust Fan Status (Honeywell to field verify locations)			7	

<u>Honeywell shall implement:</u>

- Room temperature control with night setback
- Occupied/Unoccupied Schedules
- Implement DCV control
- Integrate all new H&V controllers into Enterprise Building Integrator (EBI).
- Graphics for H&V units showing all points, operating setpoints and associating alarm points with their respected graphic pages.

Chatham High School AHU's

Provide and install new Honeywell DDC controllers for AHU's (AC-2 and AC-3) to implement space temperature control, DCV, and night set back. Provide and install new DDC actuators as needed. Honeywell is responsible for field verifying all scope of work as outlined below, verifying valve sizes, and site conditions.

High School AHUs (Auditorium and Lobby area)	AI	AO	DI	DO
OA/RA Dampers		2		
Mixed Air Temp	2			
Freeze stat alarm			2	
Supply Fan Enable				2
Supply Fan Status			2	
DX Cooling (2-stages)				4
Heating Coil valve (E/P transducer)		2		
RA CO2 sensor (AC-2 and AC-3)	2			
Discharge Air Temp	2			
Room Sensor Temperature	2			
Room Set point	2			

Honeywell shall implement:

- Room temperature control with night setback
- Occupied/Unoccupied Schedules
- Implement DCV control
- Integrate all new AHU controllers into Enterprise Building Integrator (EBI).
- Graphics for AHU showing all points, operating setpoints and associating alarm points with their respected graphic pages.

Chatham High School VFDs

Honeywell to provide new DDC on the VFD's being installed on three hot water heating pumps located in the boiler room.

High School VFD Control – Qty-3	AI	AO	DI	DO
VFD start/stop				3
VFD speed output		3		
VFD speed feedback	3			
VFD alarm			3	
System differential pressure	2			

Honeywell shall implement:

- VFD speed control based on system differential pressure
- Integrate all VFD controllers into Enterprise Building Integrator (EBI).
- Graphics for all VFDs showing all points, operating setpoints and associating alarm points with their respected graphic pages.

Chatham High School Boiler Systems

Provide and install new Honeywell DDC controllers needed to provide full integration with the two new condensing boilers. Honeywell is responsible coordinating with the boiler rep and mechanical contractor to ensure the boiler has the necessary communication cards as required to complete the integration. Provide communication wiring to the boiler as needed. Provide at least 20+ integration points and display them on the boiler graphics screen. Provide hot water pump control as required.

Chatham High School Boiler System	AI	AO	DI	DO
Outside Air Temp	1			
Pump Start/Stop				2
Pump Status			2	

Honeywell shall implement:

- Boiler Enable/Disable based on OAT lockout setpoint

- Boiler Status/Alarm
- Display hot water supply setpoint
- Graphics for Boilers showing proper points and associating alarm points with their respective graphic page(s) in the Enterprise Building Integrator (EBI).

Chatham High School Wireless Cypress Thermostats

Provide and install 25 wireless pneumatic thermostats on the existing pneumatic unit vents and connect them to the new EBI system. Provide all necessary wireless routers and repeaters as required to provide a stable reliable system. Honeywell is responsible for ensuring the existing unit vent pneumatic end-devices work as designed.

Honeywell shall implement:

- Occupied/Unoccupied Schedules
- Room temperature control with night setback

Chatham High School Web-stats

Provide and install 3 web-stats to replace the existing programmable stand-alone thermostats and connect them to the new EBI control system. Provide all necessary communication wiring required to connect the stats to the BMS. The web-stats will be installed on the following:

- AC-4, AC-5, and AC-6

Honeywell shall implement:

- Occupied/Unoccupied Schedules
- Room temperature control with night setback
- Integrate all new web-stats into Enterprise Building Integrator (EBI).
- Graphics for all unit ventilators showing all points, operating setpoints and associating alarm points with their respected graphic pages.
- .

Chatham Middle School BMS Integration

Honeywell will integrate the existing Automated Logic Control (ALC) BMS into a new Enterprise Building Integrator (EBI) System and Operator Workstation for monitoring, viewing and service of existing equipment functions. The following capabilities will be provided:

- Ability to schedule separate zones/classroom wings as needed by the building operator.
- Ability to adjust day/night and heating/cooling space setpoints.
- Provide new graphic screens for each piece of HVAC equipment that is currently controlled by the existing ALC BMS. All available DDC points will be displayed on the graphic screens, including operating setpoints.

Chatham Middle School DCV

Install CO_2 sensors on the two RTU's that serve the lower gym. CO_2 sensors will be installed and programmed. The RTUs have a self-contained factory installed economizer controller that will need to be replaced. Provide and install new OA/RA actuators.

Chatham Middle School H&V Units – Upper Gym & Auditorium

Provide and install new Honeywell DDC controllers for (3) H&V units with outside air cooling to implement DCV, space temp, and night set back. Provide and install DDC actuators as needed. Honeywell is responsible for field verifying all scope of work as outlined below, verifying valve sizes, and site conditions.

Middle School H&V's (Typical of 3)	AI	AO	DI	DO
OA/RA Dampers		3		
Mixed Air Temp	3			
Low limit Freezestat			3	
Supply Fan Enable				3
Supply Fan Status			3	
RA CO2 sensor	3			
Hot Water Coil valve (use E/P transducer) - Auditorium		1		
Face & Bypass damper - Gym		2		
Discharge Air Temp	3			
Room Sensor	3			
Room Set point	3			
Exhaust Fan stop/start (Honeywell to field verify locations)				3
Exhaust Fan Status (Honeywell to field verify locations)			3	

Honeywell shall implement:

- Room temperature control with night setback
- Occupied/Unoccupied Schedules
- Implement DCV control
- Integrate all new H&V controllers into Enterprise Building Integrator (EBI).
- Graphics for H&V units showing all points, operating setpoints and associating alarm points with their respected graphic pages.

Chatham Middle School VFDs

Honeywell to provide new DDC on the VFD's being installed on three hot water heating pumps located in the boiler room.

Middle School VFD Control – Qty-3	AI	AO	DI	DO
VFD start/stop				3
VFD speed output		3		
VFD speed feedback	3			
VFD alarm			3	
System differential pressure	3			

Honeywell shall implement:

- VFD speed control based on system differential pressure
- Integrate all VFD controllers into Enterprise Building Integrator (EBI).
- Graphics for all VFDs showing all points, operating setpoints and associating alarm points with their respected graphic pages

Chatham Middle School Wireless Cypress Thermostats

Provide and install 39 wireless pneumatic thermostats on the existing pneumatic unit vents and connect them to the new EBI system. Provide all necessary wireless routers and repeaters as required to provide a stable reliable system. Honeywell is responsible for ensuring the existing unit vent pneumatic end-devices work as designed.

Honeywell shall implement:

- Occupied/Unoccupied Schedules
- Room temperature control with night setback

Chatham Middle School UV's – 160's and 170's classroom wings (1st flr) & Room 125

Provide and install new Honeywell DDC controllers for the (17) unit ventilators in the 160's and 170's classrooms at Chatham Middle School to implement night set back and accurate temperature control. Nine of the existing UVs (170's & rm 125) have old MicroTech DDC controllers and eight of the existing UVs (160's) have hard-wired electric controls (electric actuators on hot water valve and damper). Reuse the existing valves and actuators as needed. Honeywell is responsible for field verifying all scope of work as outlined below, verifying valve and damper operation, and site conditions.

Chatham Middle School Unit Ventilators w/RA&OAD	AI	AO	DI	DO
Outside & Return Air Damper Signal		17		
Low limit Freezestat			17	
Discharge Air Temperature	17			
Room Sensor Temperature	17			
Room Sensor Setpoint	17			
Fan Enable				17
Fan Status			17	
Hot Water Valve Signal		17		

NOTE: Low limit thermostats will be hardwired to safety circuit.

Honeywell shall implement:

- Occupied/Unoccupied Schedules
- Room temperature control with night setback
- Integrate all new unit ventilator controllers into Enterprise Building Integrator (EBI).
- Graphics for all unit ventilators showing all points, operating setpoints and associating alarm points with their respected graphic pages.

Chatham Middle School Web-stats

Provide and install 3 web-stats to replace the existing programmable stand-alone thermostats and connect them to the new EBI control system. Provide all necessary communication wiring required to connect the stats to the BMS. The web-stats will be installed on the following:

- Band Room
- Room 100 & Room 200

Honeywell shall implement:

- Occupied/Unoccupied Schedules
- Room temperature control with night setback
- Integrate all new web-stats into Enterprise Building Integrator (EBI).
- Graphics for all unit ventilators showing all points, operating setpoints and associating alarm points with their respected graphic pages

Chatham Middle School Exhaust Fans – 170's section

Provide and install new Honeywell DDC controllers for (2) exhaust fans. Honeywell is responsible for field verifying all scope of work as outlined below, and site conditions.

Middle School Exhaust Fans – 170's section	AI	AO	DI	DO
Exhaust Fan stop/start (Honeywell to field verify locations)				2
Exhaust Fan Status (Honeywell to field verify locations)			2	

Honeywell shall implement:

- Occupied/Unoccupied Schedules
- Provide graphic screens for the EFs.

Lafayette Elementary BMS Integration

Honeywell will integrate the existing Automated Logic Control (ALC) BMS into a new Enterprise Building Integrator (EBI) System and Operator Workstation for monitoring, viewing and service of existing equipment functions. The following capabilities will be provided:

- Ability to schedule separate zones/classroom wings as needed by the building operator.
- Ability to adjust day/night and heating/cooling space setpoints.
- Provide new graphic screens for each piece of HVAC equipment that is currently controlled by the existing ALC BMS. All available DDC points will be displayed on the graphic screens, including operating setpoints.

Lafayette Elementary School DCV

Install CO2 sensor on the RTU that serve the Library. CO2 sensors will be installed and programmed. The RTU has a self-contained factory installed economizer controller that will need to be replaced. Provide and install new OA/RA actuators.

Lafayette Elementary School H&V Unit – Gym

Provide and install new Honeywell DDC controllers for (1) H&V unit with outside air cooling to implement DCV, space temp, and night set back. Provide and install new DDC actuators as needed. Honeywell is responsible for field verifying all scope of work as outlined below, verifying valve sizes, and site conditions.

Lafayette Elementary School H&V	AI	AO	DI	DO
OA/RA Dampers		1		
Mixed Air Temp	1			
Low limit Freezestat			1	
Supply Fan Enable				1
Supply Fan Status			1	
Hot Water Coil valve (use E/P transducer)		1		
Freeze protection pump Start/Stop and Status			1	1
Discharge Air Temp	1			
Room Sensor	1			
Room Set point	1			
Exhaust Fan stop/start (Honeywell to field verify locations)				1
Exhaust Fan Status (Honeywell to field verify locations)			1	

<u>Honeywell shall implement:</u>

- Room temperature control with night setback
- Occupied/Unoccupied Schedules
- Integrate all new H&V controllers into Enterprise Building Integrator (EBI).
- Graphics for H&V units showing all points, operating setpoints and associating alarm points with their respected graphic pages.

Lafayette Elementary School Wireless Cypress Thermostats

Provide and install 25 wireless pneumatic thermostats on the existing pneumatic unit vents and finned tube radiation and connect them to the new EBI system. Provide all necessary wireless routers and repeaters as required to provide a stable reliable system. Honeywell is responsible for ensuring the existing unit vent pneumatic end-devices work as designed.

<u>Honeywell shall implement:</u>

- Occupied/Unoccupied Schedules
- Room temperature control with night setback

Lafayette Elementary School Web-stats

Provide and install 16 web-stats to replace the existing programmable stand-alone thermostats and connect them to the new EBI control system. Provide all necessary communication wiring required to connect the stats to the BMS. The web-stats will be installed on the following:

- Classrooms 16 – 23, 28, and 5 small rooms in the same wing.
- Faculty and General Music room

Honeywell shall implement:

- Occupied/Unoccupied Schedules
- Room temperature control with night setback
- Integrate all new web-stats into Enterprise Building Integrator (EBI).

Milton Elementary BMS Integration

Honeywell will integrate the existing Automated Logic Control (ALC) BMS (boiler room only) into a new Enterprise Building Integrator (EBI) System and Operator Workstation for monitoring, viewing and service of existing equipment functions. The following capabilities will be provided:

- Boiler Enable/Disable based on OAT lockout
- Boiler Status/Alarm
- Provide new graphic screens for each boiler that is currently controlled by the existing ALC BMS. All available DDC points will be displayed on the graphic screens, including operating setpoints.

Milton Elementary Main Steam Boilers

Provide and install new Honeywell DDC controller for the existing boilers as designated below. Remove the ALC DDC controller and replace it with a new Honeywell controller. Reuse the existing panel, conduit, wiring, sensors, and end devices to the extent possible. Honeywell is responsible for verifying the operation of the sensors and end-devices. Honeywell is responsible for field verifying all scope of work as outlined below, and site conditions.

Milton Elementary Steam Boiler System	AI	AO	DI	DO
Outside Air Temp	1			
Main Header Steam Pressure	1			
Boiler Enable/Disable				4
Boiler Status			4	
Boiler Alarm			4	
Combustion Air Dampers				1

NOTE: Honeywell shall provide DDC boiler controls which are to be furnished, installed, wired, programmed and checked-out.

Honeywell shall implement:

- Boiler Enable/Disable based on OAT lockout
- Boiler Status/Alarm
- Graphics for Boilers showing proper points and associating alarm points with their respective graphic page(s) in the Enterprise Building Integrator (EBI).

Milton Elementary New Addition Boiler Integration

Honeywell will integrate the existing Honeywell DDC that is currently controlling the new addition hot water boiler into a new Enterprise Building Integrator (EBI) System and Operator Workstation for monitoring, viewing and service of existing equipment functions. Honeywell is responsible for all of the necessary integration prep required on the Honeywell controller to allow complete integration into the new EBI system. The following capabilities will be provided:

- Boiler Enable/Disable based on OAT lockout
- Boiler Status/Alarm

- Provide new graphic screens for each boiler that is currently controlled by the existing Honeywell controller. All available DDC points will be displayed on the graphic screens, including operating setpoints.

Milton Elementary School Unit Heaters – Gym

Provide and install new Honeywell DDC controllers for (2) Unit Heaters to provide space temp control, and night set back. Honeywell is responsible for field verifying all scope of work as outlined below and site conditions.

Milton Elementary School H&V	AI	AO	DI	DO
Unit Heater Enable				2
Unit Heater Status			2	
Room Sensor	2			

<u>Honeywell shall implement:</u>

- Room temperature control with night setback
- Occupied/Unoccupied Schedules
- Integrate all new UH controllers into Enterprise Building Integrator (EBI).
- Graphics for H&V units showing all points, operating setpoints and associating alarm points with their respected graphic pages.

Milton Elementary School Wireless Cypress Thermostats

Provide and install 33 wireless pneumatic thermostats on the existing pneumatic unit vents and finned tube radiation and connect them to the new EBI system. Provide all necessary wireless routers and repeaters as required to provide a stable reliable system. Honeywell is responsible for ensuring the existing unit vent pneumatic end-devices work as designed.

- The DX unit vent in the nurse's room has been bastardized and needs to be repaired. Provide labor and materials to bring the unit back to full operation.

<u>Honeywell shall implement:</u>

- Occupied/Unoccupied Schedules
- Room temperature control with night setback

Milton Elementary School Web-stats

Provide and install 3 web-stats to replace the existing stand-alone thermostats and connect them to the new EBI control system. Provide all necessary communication wiring required to connect the stats to the BMS. The web-stats will be installed on the following:

- AC-1, AC-2, and AC-3 (2^{nd} floor)

<u>Honeywell shall implement:</u>

- Occupied/Unoccupied Schedules
- Room temperature control with night setback
- Integrate all new web-stats into Enterprise Building Integrator (EBI).

Washington Elementary BMS Integration

Honeywell will integrate the existing Automated Logic Control (ALC) BMS into a new Enterprise Building Integrator (EBI) System and Operator Workstation for monitoring, viewing and service of existing equipment functions. The following capabilities will be provided:

- Ability to schedule separate zones/classroom wings as needed by the building operator.
- Ability to adjust day/night and heating/cooling space setpoints.
- Provide new graphic screens for each piece of HVAC equipment that is currently controlled by the existing ALC BMS. All available DDC points will be displayed on the graphic screens, including operating setpoints.

Washington Elementary School DCV

Prove and install (2) 2” 2-way steam valves on the existing steam-to-hot water heat exchangers in the boiler room. Valves will be connected to the existing ALC system.

Washington Elementary School DCV

Install CO2 sensors on the one RTU that serves the gym. CO2 sensors will be installed and programmed. The RTUs have a self-contained factory installed economizer controller that will need to be replaced. Provide and install new OA/RA actuators.

Washington Elementary School H&V Unit – Auditorium

Provide and install new Honeywell DDC for (1) H&V unit to provide on/off space temp control and night set back. Honeywell is responsible for field verifying all scope of work as outlined below and site conditions.

Washington Elementary H&V’s (Typical of 4)	AI	AO	DI	DO
Supply Fan Enable				1
Supply Fan Status			1	
Room Sensor	1			
Room Set point	1			

Honeywell shall implement:

- Cycle unit to provide room temperature control with night setback
- Occupied/Unoccupied Schedules
- Graphics for H&V units showing all points, operating setpoints and associating alarm points with their respected graphic pages.

Washington Elementary School AHU

Provide and install a new Honeywell DDC controller for the library AHU to implement space temperature control and night set back. The AHU is currently controlled by an Andover Infinity controller. Remove the Andover controller and replace it with a new Honeywell controller. Reuse the existing panel, conduit, wiring, sensors, and end devices to the extent possible. Honeywell is responsible for verifying the operation of the sensors and end-devices. Honeywell is responsible for field verifying all scope of work as outlined below, and site conditions.

Washington Elementary AHU (Library)	AI	AO	DI	DO
OA/RA Dampers		1		
Mixed Air Temp	1			
Freeze stat alarm			1	
Supply Fan Enable				1
Supply Fan Status			1	
DX Cooling (2-stages)				2
Heating Coil valve		1		
Discharge Air Temp	1			
Room Sensor Temperature	1			
Room Set point	1			
Exhaust Fan Start/Stop				1
Exhaust Fan Status			1	

Honeywell shall implement:

- Room temperature control with night setback
- Occupied/Unoccupied Schedules
- Integrate all new AHU controllers into Enterprise Building Integrator (EBI).
- Graphics for AHU showing all points, operating setpoints and associating alarm points with their respected graphic pages.

Washington Elementary School Library Heat Exchanger

Provide and install new Honeywell DDC for (1) steam-to-hot water heat exchanger and hot water pumps. Honeywell is responsible for field verifying all scope of work as outlined below and site conditions.

Washington Elementary Heat Exchanger - Library	AI	AO	DI	DO
Steam Valve Control		1		
Hot Water Supply Temp	1			
Pump Start/Stop				1
Pump Status			1	

Honeywell shall implement:

- Hot water reset based on OAT
- Occupied/Unoccupied Schedules
- Graphics for heat exchanger showing all points, operating setpoints and associating alarm points with their respected graphic pages.

Washington Elementary School Wireless Cypress Thermostats

Provide and install 25 wireless pneumatic thermostats on the existing pneumatic unit vents and finned tube radiation and connect them to the new EBI system. Provide all necessary wireless routers and repeaters as required to provide a stable reliable system. Honeywell is responsible for ensuring the existing unit vent pneumatic end-devices work as designed.

Honeywell shall implement:

- Occupied/Unoccupied Schedules
- Room temperature control with night setback

Southern Elementary School H&V Units – Gym

Provide and install new Honeywell DDC controllers for (2) H&V Units with outside air cooling to implement space temp, and night set back. Provide and install new DDC actuators as needed. Honeywell is responsible for field verifying all scope of work as outlined below, verifying valve sizes, and site conditions.

Southern Elementary H&V's (Typical of 2) HV-1 & HV-2	AI	AO	DI	DO
OA/RA Dampers		2		
Mixed Air Temp	2			
Low limit Freezestat			2	
Supply Fan Enable				2
Supply Fan Status			2	
RA CO2 sensor	2			
Hot Water Coil valve (use E/P transducers)		2		
Discharge Air Temp	2			
Room Sensor	2			
Room Set point	2			
Exhaust Fan stop/start (Honeywell to field verify locations)				2
Exhaust Fan Status (Honeywell to field verify locations)			2	

Honeywell shall implement:

- Room temperature control with night setback
- Occupied/Unoccupied Schedules
- Implement DCV control
- Integrate all new H&V controllers into Enterprise Building Integrator (EBI).
- Graphics for H&V units showing all points, operating setpoints and associating alarm points with their respected graphic pages.

Southern Elementary Boiler Systems

Honeywell will integrate the existing Honeywell DDC that is currently controlling the existing hot water boilers into a new Enterprise Building Integrator (EBI) System and Operator Workstation for monitoring, viewing and service of existing equipment functions. Honeywell is responsible for all of the necessary integration prep required on the Honeywell controller to allow complete integration into the new EBI system. The following capabilities will be provided:

- Re-commissioning of the existing Honeywell DDC boiler controllers. Staff claims the controls do not work and the boilers are manually controlled. Provide new end-devices as required to bring the boiler system back to automatic control.
- Boiler Enable/Disable based on OAT lockout
- Boiler Status/Alarm
- Provide new graphic screens for each boiler that is currently controlled by the existing Honeywell controller. All available DDC points will be displayed on the graphic screens, including operating setpoints

Southern Elementary School Wireless Cypress Thermostats

Provide and install 30 wireless pneumatic thermostats on the existing pneumatic unit vents and connect them to the new EBI system. Provide all necessary wireless routers and repeaters as required to provide a stable reliable system. Honeywell is responsible for ensuring the existing unit vent pneumatic end-devices work as designed.

Honeywell shall implement:

- Occupied/Unoccupied Schedules
- Room temperature control with night setback

Southern Elementary School UV's – Retrofit old MicroTech controls

Provide and install new Honeywell DDC controllers for the (7) unit ventilators at Southern Elementary School to implement night set back and space temperature control. The existing unit vents are controlled by old MicroTech controllers. Remove the MicroTech controller and replace it with a new Honeywell controller. Reuse the existing wiring, sensors, and end devices to the extent possible. Honeywell is responsible for verifying the operation of the sensors and end-devices. Honeywell is responsible for field verifying all scope of work as outlined below, verifying valve sizes, and site conditions.

Southern Elementary Unit Ventilators w/RA&OAD	AI	AO	DI	DO
Outside & Return Air Damper Signal		7		
Low limit Freezestat			7	
Discharge Air Temperature	7			
Room Sensor Temperature	7			
Room Sensor Setpoint	7			
Fan Enable				7
Fan Status			7	
DX cooling Signal				7
UV Hot Water Valve Signal		7		

NOTE: Low limit thermostats will be hardwired to safety circuit.

Honeywell shall implement:

- Occupied/Unoccupied Schedules
- Room temperature control with night setback
- Integrate all new unit ventilator controllers into Enterprise Building Integrator (EBI).
- Graphics for all unit ventilators showing all points, operating setpoints and associating alarm points with their respected graphic pages

Southern Elementary School Web-stats

Provide and install 2 web-stats to replace the existing programmable stand-alone thermostats and connect them to the new EBI control system. Provide all necessary communication wiring required to connect the stats to the BMS. The web-stats will be installed on the following:

- Basement - rm 307 and Counselor room

Honeywell shall implement:

- Occupied/Unoccupied Schedules
- Room temperature control with night setback
- Integrate all new web-stats into Enterprise Building Integrator (EBI).
- Graphics for all unit ventilators showing all points, operating setpoints and associating alarm points with their respected graphic pages.

Energy Savings Methodology and Results

The energy savings for this ECM is realized in the buildings' HVAC equipment due to better control of the HVAC system, night set-back and set-up temperatures, start/stop etc.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods.

Environmental Issues

Resource Use	Energy savings will result from reduced electric energy usage and better occupant comfort.
Waste Production	This measure will produce no waste by-products.
Environmental Regulations	No environmental impact is expected.

This Page Intentionally Left Blank

ECM 3B DEMAND CONTROL VENTILATION

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
3B	Demand Control Ventilation		✓	✓		✓	✓

Existing Conditions

The roof top and air handling units serving large one zone spaces such as auditoriums, gymnasiums and cafeterias are often designed for peak occupancy conditions to supply outside air to the space with return air from space being exhausted. Most of the time these spaces are not fully occupied, which increase energy demand for heating and cooling of excessive amount of outside air.

Chatham Middle School Gym DCV Opportunity

Washington Avenue School Gym DCV Opportunity

Proposed Solution

Honeywell will install CO_2 sensors at the below Chatham SD locations. The CO_2 sensors will provide the control signal for the air handlers to optimize the quantity of fresh air required. The installation of CO_2 sensors will read the levels of CO_2 in the space and ensure that only the required outside air is supplied and heated to meet the minimum outdoor air requirements. This control strategy will reduce amount of outside air intake and thus reduce the heating energy used by the air handling units and electric energy used by the motors. Based on this fact, there is a reduced requirement for outside air to this space

School	Area Served	Number of Units	Motor Hp	CFM Total
Chatham High School	1973 Gym addition	1	5.0	8,000
Chatham High School	Cafeteria	1	0.0	5,157
Chatham Middle School	Upper Gymnasium	1	3.0	8,250
Chatham Middle School	Upper Gymnasium	1	3.0	8,250
Chatham Middle School	Auditorium	1	7.5	-
Chatham Middle School	Auditorium	1	7.5	-
Milton Avenue School	Gymnasium	1	5.0	4,000
Milton Avenue School	Gymnasium	1	5.0	4,000
Southern Boulevard School	Gymnasium	2	-	-
Chatham High School	Auditorium	1	25.0	15,416
Chatham High School	Auditorium	1	25.0	15,416
Chatham Middle School	Gymnasium	1	0.0	12,400

School	Area Served	Number of Units	Motor Hp	CFM Total
Chatham Middle School	Gymnasium	1	0.0	12,400

Table 3B.1 – Existing AHUs to be installed with CO_2 sensors

Energy Savings Methodology and Results

The savings approach is based upon reducing the amount of energy that needs to pre-heat or cool the outside air. The savings are generally calculated as:

Existing Heating BTU & Cost per BTU	= Metered Data from Existing meter readings
Cost of Existing Heating	= Average Site Data $/CCF or $/Gallon
Reduction in Heating/Cooling BTU	= Reduction in Outside air cfm x 1.08 x Delta T x Hours the fan is = Existing BTU x Cost per BTU
Cost of Proposed Heating/Cooling	
Energy Savings $	= Existing Heating Costs – Proposed Heating Costs

The baseline adjustment calculations are included with the energy calculations.

Changes in Infrastructure

None.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods.

Environmental Issues

Resource Use	Energy savings will result from reduced energy.
Waste Production	Any removed parts will be disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 4A BUILDING ENVELOPE IMPROVEMENTS

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
4A	Building Envelope Improvements	✓	✓	✓	✓	✓	✓

Existing Conditions

Typically, many schools have problems associated with the design and construction of their buildings. Your buildings avoid some of the inefficiency issues associated with more modern construction buildings. Plus, long-term stewardship of your buildings has helped avoid most of the problems often associated with maintenance issues. But there are several significant building envelope retrofit opportunities, which will provide cost savings and comfort improvements to your building occupants.

Chatham School District buildings surveyed are masonry in construction. So the areas of concern deal with the openings in the "skin" that are mostly "built-in" during the original construction, created during a "retrofit period" and/or have deteriorated. Air leakage is defined as the "uncontrolled migration of conditioned air through the building envelope" caused by pressure differences due to wind, chimney (or stack) effect, and mechanical systems. It has been shown to represent the single largest source of heat loss or gain through the building envelopes of nearly all types of buildings. Our work has found 30% to 50% of heat loss attributable to air leakage in schools.

Chatham Exterior Weather-Stripping

Chatham High School Roof

Beyond representing significant energy savings potential, uncontrolled air leakage can affect occupancy comfort, air quality, the imbalance of mechanical systems, and the potential for compromised structural integrity of the building envelope from moisture migration. Control of air leakage involves the sealing of gaps, cracks and holes, using appropriate materials and systems to help create a continuous plane of "air-tightness" to completely encompass the building envelope. Part of this process also incorporates the need to "decouple" floor-to-floor, and to "compartmentalize" components of the building in order to equalize pressure differences. The buildings were inspected visually to identify both the location and severity of air leakage paths. Air leakage paths are detailed in the scope of work below.

Chatham High School

The building structural elements consist of steel structural columns, flat roof truss design, block walls with masonry façade. There were two types of roofing systems, a built-up and sprayed foam roof system. The windows appeared to be original single glaze metal frame type, with metal exterior doors.

Roof-wall

Seal the roof-wall joint(s) with two-component polyurethane foam. One part of the building has roof-wall joint 26 feet high so a lift may be required.

Doors
The doors in the building are various colors. A brown or stainless color weather-stripping will coordinate. The majority of the doors in the building are leaky and need to be weather-stripped including the overhead doors.

Windows
Some of the windows in the building are leaky and need to be sealed. The leakage was noted at the bottom of the window. The dark fixed frame windows at the auditorium need to be re-glazed from the inside. The majority of windows in the school were original.

Roof
Access roof hatches need to be air sealed, weather stripped and insulated to reduce air leakage and increase thermal boundary to eliminate heat loss and condensation. Roof fans and other penetrations were sealed well no recommendation

Mechanical Electrical Room
There were several wall penetrations needed to be sealed with fire rated caulk and foam.

Chatham Middle School

The Middle School building is one and two story structure supported by structural steel, block wall, and flat steel roof trusses. There were three sky lights sealed and covered over. All roof penetrations appeared to be maintained well and looked to be in good condition.

Roof-wall
Parts of the building have a leaky roof-wall joint. This needs to be sealed with two-component polyurethane foam. Some of the roof-wall joints in the gyms are 20, 25 and 35 feet high and a lift may be required.

Windows
Seal the windows two lines. The two story stairway entrance to the auditorium has a wall of fix windows which need to be re-glazed from the inside.

Doors
The doors in the building are leaky and need to be weather-stripped. Use brown or stainless kits for the doors in this building. One overhead door needs new weather-striping.

Mechanical Electrical Room
There were wall penetrations requiring fire rated caulk and foam to seal utility piping and ductwork from air leakage.

Lafayette School

The Lafayette School is connected to the High School and carries the same structural integrity and façade. There is a newer section called the library and other attached classrooms. Generally, all the doors were tested and showed air leakage. They need new weather-stripping installed, brown color or stainless will complement the existing door colors.

Doors
The doors in the building are leaky and need to be weather-stripped.

Roof-wall
The roof-wall joint in the addition is leaky and needs to be sealed.

Windows
The windows in the building were generally in good shape to new. Smoke tests showed very little air leakage.

Mechanical Electric Room
There were wall penetrations requiring fire rated caulk and foam to seal utility piping and ductwork from air leakage.

Milton Ave School

Milton School is a two story structure with wood frame roof structure and flat steel truss types. The original windows in the building are wooden single pane and leaky and need to be sealed at the sill. All the exterior doors in the building are leaky and need to be weather-stripped.

Roof-wall
The new addition has a leaky roof-wall joint that needs to be sealed with two-component polyurethane foam.

Windows
The wooden windows on the 2nd floor need to be weather-stripped at the sill.

Doors
Many of the doors are weather-stripped with ineffective, brush-style weather-strips. They currently are mill finish and mill finish should be fine for the replacements

Roof
The attic area above the two story section with the cupola has no insulation. We are recommending two part spray foam insulation to the attic floor with R-21. We also recommend attic accesses to be insulated with R-21, air sealed and weather-stripped.

Mechanical Electrical Room
There were wall penetrations requiring fire rated caulk and foam to seal utility piping and ductwork from air leakage.

Southern Boulevard School

The windows in the building are leaky and need to be sealed.
Roof-wall
The roof-wall joint in the newest addition is leaky and needs to be sealed with two-component polyurethane foam. The roof hatch in the new addition also needs to be sealed

Attic
The roof access hatches need to be insulated with R-21, weather-stripped and air sealed.

Doors
Some of the doors are weather-stripped with ineffective brush style weather-strip. Weather-strip the doors.

Mechanical Electrical Room
There were wall penetrations requiring fire rated caulk and foam to seal utility piping and ductwork from air leakage.

Washington Avenue School

Washington School is steel frame construction and needs roof-wall joint sealing. A number of the windows in the building are leaky and need to be sealed. The doors in the building need weather-strip updated. There's a sizable penetration in the boiler room that also needs to be sealed.

Roof-wall
The roof-wall joint needs to be sealed with two-component polyurethane foam.

Doors
Weather-strip the doors.

Roof
The roof access hatches need to be insulated with R-21, weather-stripped and air sealed.

Mechanical Electrical room
There is a sizable penetration adjacent to the chimney in the boiler room. This should be blocked with fireproof materials.

Proposed Solution

Roof-Wall Joint

The buildings were found to require roof-wall joint air sealing. To address these problems we recommend using a high performance sealant. In some buildings, a two-component foam will be used. Any cantilevers off the buildings will be sealed with backer rod and sealant. Finally, the inside vestibule corners should be sealed with backer rod and sealant.

Windows and Doors

Most of your building doors require weather stripping and the installation of door sweeps to prevent air leakage. The operable windows in most of your buildings could present air leakage issues that require weather stripping with fuzz or gasket type materials.

Roof Penetrations

There are a number of roof top exhaust fans that require damper cleaning, lubrication, and inspection for proper operation and to seal the roof deck to prevent penetration. Some units may be deemed to be too oversized for this service. The fan final count by the inspector will indicate how many units could be easily serviced without requiring lifting equipment.

Benefits

The sealing of your school buildings will allow for more efficient operation of the buildings by reducing heating and cooling losses throughout the year. In addition, the draftiness of the buildings, along with hot and cold spots, will be reduced as a result of this measure. A reduction in air infiltration will also minimize potential concerns for dirt infiltration or indoor air quality concerns.

Energy Savings Methodology and Results

The energy savings for this ECM are realized at the buildings' HVAC equipment. The improved building envelope will limit conditioned air infiltration through openings in the building air barrier. Less infiltration means less heating required by the heating system.

Changes in Infrastructure

Building envelopes will be improved with little or no noticeable changes.

Customer Support and Coordination with Utilities

Minimal coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use	Energy savings will result from reduced HVAC energy usage and better occupant comfort.
Waste Production	Some existing caulking and weather-stripping will be removed and disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 4B ROOF REPLACEMENTS

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
4B	Roof Replacements						✓

Existing Conditions

The roofs installed in the Chatham's School District are generally in good shape. However the roof over the Chatham High School cafeteria is recommended to be replaced. The heat loss and heat gains occur due to low R-value of the existing roof insulation will be improved through the replacement with energy efficient roofing materials. Additionally the rate of infiltration that occurs due to the leakage on the roof around perimeters and equipment curbing is also a major cause of energy loss. The upgrade will result in improved savings and comfort for those affected in the building.

Chatham High School Cafeteria Roof

Chatham High School Kitchen Roof

Proposed System

Honeywell proposes the installation of a new energy efficient, Spray Polyethylene Foam (SPF) roofing material over the traditional Ethylene Propylene Diene Monomer (EPDM) single ply roof. The Poly Spray Foam Roof is one monolithic, self flashing system with air barrier – no loss of effective R-value. Overall, through the implementation of this measure the district will reduce its heating fuel usage and air conditioning costs each year.

School	Area	Roof Area
Chatham High School	Kitchen, Cafeteria	13,525

Table 4B.1 Roof Replacements

Energy Efficiency

EPDM Single-ply roof with an initial R-Value of 18 will have a 15%+ loss in thermal resistance due to thermal shorts of steel fasteners. It will also have 10% increase in thermal transmittance when using single layer of insulation board. Finally, R-value and Air permeability of a deck, insulation and membrane has a major impact on System R-value. This will equate to a final overall System R-value equal to approximately 2.42.

An SPF roof has an R Value of approximately 6 per one (1) inch foam (R –Value 6) If three inches of SPF Foam where applied one monolithic, self flashing system with air barrier – no loss of effective R-value would have an overall System R-value: 18

Durability

Single-ply EPDM roof will have a 45 mil water proofing layer, but will also have major fail points such as flashing, seams, fasteners and single-ply punctures. In contrast the SPF roof will not only have a top coat plus SPF insulation which is all water proofing, meaning even damaging top coat will not create leak.

Sustainability

Commercial buildings can have a maximum of 2 roofs in place. In traditional roofing, when a "third" roof is required, a partial or full tear-off is also required. This adds increased cost for tear-off, increased cost for disposal and a negative impact on the environment

With SPF roofing, the top coat is the only part that needs to be re-applied after the warranty period. There is no "tear-off" required or disposal concerns. A quality applied SPF roof should last the life of the building

Energy Savings Methodology and Results

Following approach is used to determine savings for this specific measure:

Existing Roof Efficiency	= Existing U + Existing Infiltration Rate
Proposed Roof Efficiency	= Proposed U + Proposed Infiltration Rate
Energy Savings (Btu) Winter Savings(Therms) Summer Savings (Tons Cooling)	= UAdTproposed – UAdTexisting = Energy Savings/Boiler Eff./100,000 = Energy Savings/12,000 Btu/Ton

Interface with Building:

The new roof will be constructed to match existing, maintaining contours of the existing building.

Energy Savings Methodology and Results

The energy savings for this ECM are realized at the buildings' HVAC equipment. The improved building envelope will limit conditioned air infiltration through openings in the building air barrier. Less infiltration means less heating and cooling required by HVAC systems.

Changes in Infrastructure

Building envelopes will be improved with little or no noticeable changes.

Customer Support and Coordination with Utilities

Minimal coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use	Energy savings will result from reduced HVAC energy usage and better occupant comfort.
Waste Production	Existing roof materials will be removed and disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 5A TRANSFORMER REPLACEMENTS

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
5A	Transformer Replacements	✓		✓	✓	✓	✓

Existing Conditions

The transformers in locations within the electrical distribution systems at in the Chatham School District consist of 480 Volts. Distribution transformers are installed in the boiler rooms and in various electrical and utility closets to step down the voltage to 120-208 Volts. Typically, an electrical distribution system has some losses associated with the electrical system and a considerable portion of these losses are associated with distribution transformers.

Transformer at Chatham High School

Transformer at Washington Avenue School

Systems Evaluation and Selection

Typical transformers are not designed to handle harmonic loads of today's modern facilities, and suffer significant losses as a result, even if the transformer is relatively new. Typically, conventional transformer losses, which are non-linear, increase by 2.7 times when feeding computer loads. The nonlinear load loss multiplier reflects this increase in heat loss, which decreases the net transformer efficiency. Also, unlike most substation transformers that are vented to the exterior, building transformers are ventilated within the building they are located, and their heat losses therefore add to the cooling load.

Based on site investigation conducted by our staff, we identified the following transformers that we propose to replace with energy efficient replacements at a size matching the existing loads as indicated in the table below:

School	Manufacturer	kVA	Qty
Chatham High School	Siemens	15	1
Chatham High School	Siemens	112.5	1
Chatham High School	Siemens	75	1
Chatham High School	Siemens	75	1
Lafayette School	Cutler-Hammer	30	1
Chatham Middle School	Hammond Power	15	1
Chatham Middle School	Hammond Power	30	1
Chatham Middle School	Hammond Power	30	1
Chatham Middle School	Hammond Power	75	1
Chatham Middle School	-	45	1
Chatham Middle School	-	30	1

School	Manufacturer	kVA	Qty
Chatham Middle School	-	500	1
Washington Avenue School	ACME Transformer	30	1
Southern Boulevard School	Cutler-Hammer	30	1

Table 5A.1 – Existing Transformers to be replaced

Proposed Solution

The proposed transformers will be Power Smiths High Efficiency units. They are Energy-Star rated and meet the new TP1 Law requiring replacement of transformers of 600 volts or under.

Scope of Work

Remove and install new E-saver transformers

Per Transformer Unit:

1. Shut off the main electric power to the transformer to be replaced.
2. Disconnect the existing transformer and install replacement unit.
3. Turn power back on.
4. Inspect unit operation by performing electrical and harmonics testing.
5. Dispose of old transformers properly.

Energy Savings Methodology and Results

The energy savings for this ECM is realized by reduction in electric energy lost in the existing transformers as a result of the higher efficiency of the new transformers.

Changes in Infrastructure

New transformers where indicated.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of services for the affected areas.

Environmental Issues

Resource Use	Energy savings will result from increased voltage conversion efficiency.
Waste Production	Any removed parts will be disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 6A DEMAND RESPONSE – PERMANENT LOAD SHED REDUCTION PROGRAM

ECM	ECM Description	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Chatham MS	Chatham HS
6A	Demand Response	✓	✓	✓	✓	✓	✓

Existing Conditions

Chatham's School District does not currently participate in the PJM Demand Response Program.

Proposed Solution

Honeywell proposes to continue to utilize a registered Demand Response Curtailment Service Provider (CSP) to provide energy response services to the Chatham's School District. Through the CSP, the Chatham's School District will participate in the PJM Capacity Market Program and PJM Energy Efficiency Program. These programs are offered through the PJM Regional Transmission Organization (RTO), and Independent System Operator (ISO). The Capacity Market Program allows PJM customers the ability to respond to capacity emergencies when called upon by PJM, and the energy efficiency program pays PJM customers for implementing Energy Conservation measures (ECMs) that result in permanent load reductions during defined hours.

PJM Capacity Market Program

Capacity represents the need to have adequate resources to ensure that the demand for electricity can be met at all times. For PJM, that means that a utility or other electricity supplier, load serving entity, is required to have the resources to meet its consumers' demand plus a reserve amount. Electricity suppliers, load serving entities, can meet that requirement by owning and operating generation capacity, by purchasing capacity from others or by obtaining capacity through PJM's capacity market auctions. PJM operates a capacity market, called the Reliability Pricing Model (RPM). It is designed to ensure that adequate resources are available to meet the demand for electricity at all times. In the RPM, those resources include not only generating stations, but also demand response actions and energy efficiency measures by consumers to reduce their demand for electricity.

PJM must keep the electric grid operating in balance by ensuring there is adequate generation of electricity to satisfy the demand for electricity at every location in the region both now and in the future. PJM's markets for energy and ancillary services help maintain the balance now while the PJM market for capacity aims to keep the system in balance in the future. Resources, even if they operate infrequently, must receive enough revenue to cover their costs. Payments for capacity provide a revenue stream to maintain and keep current resources operating and to develop new resources. Investors need sufficient long-term price signals to encourage the maintenance and development of generation, transmission and demand-side resources. The RPM, based on making capacity commitments in advance of the energy need, creates a long-term price signal to attract needed investments for reliability in the PJM region.

Proposed Solution

Honeywell proposes to work with a PJM Regional Transmission Organization (RTO), CSR to implement a Demand Response energy curtailment program which will generate revenue streams for the Chatham's School District. The PJM programs offer Chatham's School District the ability to respond to capacity emergencies when called upon by PJM, and benefit from permanent kW load reductions associated with implementing Energy Efficiency (EE) improvements. Honeywell's Demand Response agent acting as the CSP will notify the district prior to potential events in order to advise and coordinate load curtailment participation in accordance with RTO program requirements, and will work with Chatham's School District to benefit from energy efficiency improvements.

The PJM Markets are further described below.

The PJM Energy Efficiency Program

Energy efficiency measures consist of installing more efficient devices or implementing more efficient processes/systems that exceed then-current building codes or other relevant standards. An energy efficiency resource must achieve a permanent, continuous reduction in demand for electricity. Energy efficiency measures are fully implemented throughout the delivery year without any requirement of notice, dispatch, or operator intervention. A demand response resource can reduce its demand for electricity when instructed; this means PJM considers it a "dispatchable resource". A demand response resource can participate in the RPM market for as long as its ability to reduce its demand continues. A demand response resource must be willing to reduce demand for electricity up to 10 times each year when called for a reduction. In a year without any reduction calls, the demand response resource is required to demonstrate the ability to reduce demand for electricity during a test of reduction capability. Data will be submitted by the demand response resource to prove compliance with reductions from actual calls or reductions from capability tests. An energy efficiency resource is one that reduced their demand for electricity through an energy efficiency measure that does not require any additional action by the consumer.

Energy Savings Methodology and Results

Revenue is generated through participation in the PJM DR program.

Changes in Infrastructure

None.

Customer Support and Coordination with Utilities

Initiation of demand response curtailment will be required.

Environmental Issues

Resource Use	None.
Waste Production	This measure will produce no waste by-products.
Environmental Regulations	None.

SECTION D TECHNICAL AND FINANCIAL SUMMARY

1. Recommended ESIP Project

	Recommended ESIP Project
Value of Project	**$5,323,241**
Term of Repayment	**15 Year**
Projected Savings Over Term	**$6,075,277**
Projected NJ Rebates & Incentives	**$701,194**
Projected Interest Rate	**3.00%**

Recommended Project Technical and Financial Summary Documents

Form II: Energy Conservation Measures (ECMs) Summary Form
Form III: Projected Annual Energy Savings Data Form
Form IV: Projected Annual Energy Savings Data Form in MMBTUs
Form V: ESCOs Proposed Final Project Cost Form
Form VI: ESCOs Preliminary Annual Cash Flow Analysis Form

Building by Building Simple Payback Summary

A simple payback summary broken down by building by ECM has been provided for School District of the Chathams' use in reviewing available scope combinations and options.

Building By Building Simple Payback Summary (Hard Costs Only)

This Page Intentionally Left Blank

FORM II: RECOMMENDED PROJECT - ENERGY CONSERVATION MEASURES (ECMs) SUMMARY FORM

FORM II -Prospective Project Scenario 3

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ENERGY CONSERVATION MEASUREs (ECMs) SUMMARY FORM
CHATHAMS SCHOOL DISTRICT
ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: Honeywell International

Proposed Preliminary Energy Savings Plan: ECMs (Base Project)	Estimated Installed Hard Costs (1) $	Estimated Annual Savings $	Estimated Simple Payback (years)
1A Lighting Upgrades	$ 1,487,580	$ 174,388	8.53
1B Lighting Controls and Daylight Harvesting	$ 87,073	$ 9,383	9.28
1C Vending Misers	$ 5,310	$ 1,819	2.92
1D Install De-stratification Fans	$ 135,700	$ 11,037	12.29
1E Plug Load Management via WiFi	$ 132,008	$ 16,457	8.02
2A Boiler Replacements	$ 601,800	$ 18,785	32.04
2B Install Honeywell "Controlinks" Boiler Burner Controller	$ 35,400	$ 4,356	8.13
2G Kitchen Hood Controllers	$ 52,000	$ 4,068	12.78
2H Walk-In Freezer/Cooler Controllers	$ 4,129	$ 316	13.06
2I Steam Trap Replacement/Refurbishment	$ 65,619	$ 7,575	8.66
2J Piping Insulation	$ 1,416	$ 277	5.12
3A Building Management Control Systems	$ 1,062,000	$ 130,571	8.13
3B Demand Control Ventilation	$ 38,350	$ 3,233	11.86
4A Building Envelope Improvements	$ 329,770	$ 34,564	9.54
5A Transformer Replacements	$ 123,900	$ 11,298	10.97
6A Demand Response/Permanent Load Reduction	$ -	$ -	-
	$ -	$ -	-
	$ -	$ -	-
	$ -	$ -	-
	$ -	$ -	-
	$ -	$ -	-
	$ -	$ -	-
	$ -	$ -	-
	$ -	$ -	-
	$ -	$ -	
	$ -	$ -	
Add additional lines as needed* **Project Summary:**	$ 4,162,054	$ 428,128	9.72

Optional ECMs Considered, but not included with base project at this time	Estimated Installed Hard Costs (1) $	Estimated Annual Savings $	Estimated Simple Payback (years)
2C Install Premium Efficiency Motors and VFDs	$ 175,313	$ 5,479	32.00
2D Domestic Hot Water Replacement	$ 47,897	$ 344	139.09
2E Rooftop Unit Replacements	$ 263,063	$ 1,380	190.60
2F Window AC Unit Replacements	$ 787,060	$ 1,871	420.73
2K Window Replacements	$ 1,593,000	$ 15,383	103.56

Add additional lines as needed*

(1) The total value of Hard Costs is defined in accordance with standard AIA definitions that include: Labor Costs, Subcontractor Costs, Cost of Materials & Equipment, Temporary Facilities and Related Items, and Miscellaneous Costs such as Permits, Bonds Taxes, Insurance, Mark-ups, Overhead, Profit, etc.

FORM III: RECOMMENDED PROJECT - PROJECTED ANNUAL ENERGY SAVINGS DATA FORM

FORM III - Prospective Project Scenario 3

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP)
PROJECTED ANNUAL ENERGY SAVINGS DATA FORM
CHATHAMS SCHOOL DISTRICT
ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: **Honeywell International**

The projected annual savings for each fuel type MUST be completed using the following format. Data should be given in the form of fuel units that appear in the utility bills.

Energy/Water	ESCO Developed Baseline (Units)	ESCO Developed Baseline (Costs $)	Proposed Annual Savings (Units)	Proposed Annual Savings (Costs $)
Electric Demand (KW)	16,845	$107,315	5,026	$31,994
Electric Energy (KWH)	4,473,358	$546,816	1,764,445	$173,411
Natural Gas (therms)	386,855	$354,452	123,866	$113,562
Fuel Oil (Gal)	0	$0	0	$0
Steam (Pounds)				
Water (gallons)				
Other (Specify Units)				
Other (Specify Units)				
Avoided Emissions (1)	Provide in Pounds (Lbs)			
NOX	16,993			
SO2	24,870			
CO2	3,537,977			

(1) ESCOs are to use the rates provided as part of this RFP to calculate Avoided Emissions. Calculation for all project energy savings and greenhouse gas reductions will be conducted in accordance with adopted NJBPU protocols

(2) “ESCOs Developed Baseline”: Board’s current annual usages and costs as determined by the proposing ESCO; based off Board’s utility information as provided to proposing ESCO.

(3) “Proposed Annual Savings”: ESCOs proposed annual savings resulting from the Board’s implementation of the proposed ESP, as based upon “ESCOs Developed Baseline”.

FORM IV: RECOMMENDED PROJECT - PROJECTED ANNUAL ENERGY SAVINGS DATA FORM IN MMBTUs

FORM IV - Prospective Project Scenario 3

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
PROJECTED ANNUAL ENERGY SAVINGS DATA FORM IN MMBTUs
CHATHAMS SCHOOL DISTRICT
ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: **Honeywell International**

The projected annual energy savings for each fuel type MUST be completed using the following format. Data should be given in equivalent MMBTUs.

ENERGY	ESCO Developed Baseline	ESCO Proposed Savings Annual	Comments
Electric Energy (MMBTUs)	15,263	6,020	
Natural Gas (MMBTUs)	38,686	12,387	
Fuel Oil (MMBTUs)	0	0	
Steam (MMBTUs)			
Other (Specify) (MMBTUs)			
Other (Specify)			

NOTE: MMBTU Defined: A standard unit of measurement used to denote both the amount of heat energy in fuels and the ability of appliances and air conditioning systems to produce heating or cooling.

FORM V: RECOMMENDED PROJECT ESCO'S PROPOSAL PROJECT COST FORM

FORM V - Prospective Project Scenario 3

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCOs PROPOSED FINAL PROJECT COST FORM FOR BASE CASE PROJECT
CHATHAMS SCHOOL DISTRICT
ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: **HONEYWELL INTERNATIONAL**

PROPOSED CONSTRUCTION FEES

Fee Category	Fees [1] Dollar ($) Value	Percentage of Hard Costs
Estimated Value of Hard Costs [2]:	$4,162,054.48	
Project Service Fees		
Investment Grade Energy Audit	$72,835.95	1.75%
Design Engineering Fees	$0.00	0.00%
Construction Management & Project Administration	$208,102.72	5.00%
System Commissioning	$20,810.27	0.50%
Equipment Initial Training Fees	$10,405.14	0.25%
ESCO Overhead	$416,205.45	10.00%
ESCO Profit	$218,507.86	5.25%
Project Service Fees Sub Total	$312,154.09	7.50%
TOTAL FINANCED PROJECT COSTS:	$5,108,921.87	22.75%
ESCO Termination Fee (To be paid only if the Board decides not to proceed beyond the ESP)	$0.00	0.00%

PROPOSED ANNUAL SERVICE FEES

First Year Annual Service Fees	Fees [1] Dollar ($) Value	Percentage of Hard Costs
SAVINGS GUARANTEE (OPTION)	$0.00	0.00%
Measurement and Verification (Associated w/ Savings Guarantee Option)	$18,000.00	Flat Fee
ENERGY STAR™ Services (optional)	Included	0.00%
Post Construction Services (If applicable)	N/A	-
Performance Monitoring	Included	-
On-going Training Services	N/A	-
Verification Reports	Included	-
TOTAL FIRST YEAR ANNUAL SERVICES	$18,000.00	Flat Fee

NOTES:
(1) Fees should include all mark-ups, overhead, and profit. Figures stated as a range will NOT be accepted.
(2) The total value of Hard Costs is defined in accordance with standard AIA definitions that include:

Labor Costs, Subcontractor Costs, Cost of Materials and Equipment, Temporary Facilities and Related Items, and Miscellaneous Costs such as Permits, Bonds Taxes, Insurance, Mark-ups, Overhead and Profit, etc.
ESCO's proposed interest rate at the time of submission: 5% TO BE USED BY ALLRESPONDING ESCOs FOR PROPOSAL PURPOSES

*Annual Service only applies if customer accepts energy guarantee.

FORM VI: RECOMMENDED PROJECT ESCO'S PRELIMINARY ANNUAL CASH FLOW ANALYSIS FORM

FORM VI

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCO's PRELIMINARY ANNUAL CASH FLOW ANALYSIS FORM
CHATHAMS SCHOOL DISTRICT
ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: **Honeywell International**

Note: Proposers must use the following assumptions in all financial calculations:

(a) The cost of all types of energy should be assumed to inflate at: **2.4%** gas, **2.2%** electric per year and

(b) If it is necessary to inflate any other costs, these costs should also be assumed to inflate at: **2.4%** per year (this general inflation factor should NOT include increases in energy costs reflected above in (a), and should be noted if used in any calculation).

1. Term of Agreement: **15** (Years) (Months)
2. Construction Period [(2)] (months): **12**
3. Cash Flow Analysis Format:

Estimated Design and Engineering Fees: $ 214,319
Project Cost Form V: $ 5,108,922
Project Cost [(1)]: **$ 5,323,241** Interest Rate to Be Used for Proposal Purposes: **3.0%**

Year	Annual Energy Savings	Annual Operational Savings	Energy Rebates/Incentives	Total Annual Savings	Annual Project Costs	Board Costs	Annual Service Costs [(3)]	Net Cash-Flow to Client	Cumulative Cash Flow
Installation			$ 34,088	$ 34,088	$ -	$ -	$ -	$ 34,088	$ 34,088
1	$ 318,967	$ 109,161	$ 315,065	$ 743,193	$ (735,077)	$ (753,077)	$ (18,000)	$ 8,116	$ 42,203
2	$ 326,211	$ 111,781	$ 315,065	$ 753,057	$ (744,948)	$ (744,948)	$ -	$ 8,110	$ 50,313
3	$ 333,620	$ 114,464	$ 18,483	$ 466,566	$ (458,458)	$ (458,458)	$ -	$ 8,109	$ 58,422
4	$ 341,198	$ 52,461	$ 18,483	$ 412,142	$ (404,039)	$ (404,039)	$ -	$ 8,103	$ 66,524
5	$ 348,948	$ 54,035	$ -	$ 402,983	$ (394,886)	$ (394,886)	$ -	$ 8,097	$ 74,621
6	$ 356,875		$ -	$ 356,875	$ (348,784)	$ (348,784)	$ -	$ 8,091	$ 82,712
7	$ 364,982		$ -	$ 364,982	$ (356,897)	$ (356,897)	$ -	$ 8,085	$ 90,797
8	$ 373,273		$ -	$ 373,273	$ (365,195)	$ (365,195)	$ -	$ 8,079	$ 98,875
9	$ 381,753		$ -	$ 381,753	$ (373,681)	$ (373,681)	$ -	$ 8,072	$ 106,948
10	$ 390,427		$ -	$ 390,427	$ (382,360)	$ (382,360)	$ -	$ 8,066	$ 115,014
11	$ 399,297		$ -	$ 399,297	$ (391,237)	$ (391,237)	$ -	$ 8,060	$ 123,074
12	$ 408,370		$ -	$ 408,370	$ (400,316)	$ (400,316)	$ -	$ 8,054	$ 131,128
13	$ 417,649		$ -	$ 417,649	$ (409,601)	$ (409,601)	$ -	$ 8,048	$ 139,176
14	$ 427,139		$ -	$ 427,139	$ (419,097)	$ (419,097)	$ -	$ 8,042	$ 147,217
15	$ 436,845		$ -	$ 436,845	$ (428,194)	$ (428,194)	$ -	$ 8,651	$ 155,868
Totals	$ 5,625,553	$ 441,901	$ 701,184	$ 6,768,638	$ (6,612,769)	$ (6,630,769)	$ (18,000)	$ 155,868	$ 155,868

NOTES:
(1) Includes: Hard costs and project service fees defined in ESCO's PROPOSED "FORM V"
(2) No payments are made by CHATHAMS SCHOOL DISTRICT during the construction period.
(3) This figure should equal the value indicated on the ESCO's PROPOSED "FORM V". DO NOT include in the Financed Project Costs.

***Annual Service only applies if customer accepts energy guarantee.**

HONEYWELL IS NOT ACTING AS A MUNICIPAL ADVISOR OR FIDUCIARY ON YOUR BEHALF. ANY MUNICIPAL SECURITIES OR FINANCIAL PRODUCTS INFORMATION PROVIDED IS FOR GENERAL INFORMATIONAL AND EDUCATIONAL PURPOSES ONLY AND YOU SHOULD OBTAIN THE ADVICE OF A LICENSED AND QUALIFIED FINANCIAL ADVISOR REGARDING SUCH INFORMATION.

This Page Intentionally Left Blank

3. Building by Building Simple Payback Summary (Hard Costs Only)

Building & ECM	kW Savings ($)	kWh Savings ($)	Natural Gas Savings ($)	Fuel Oil Savings ($)	Water Savings ($)	Annual Energy Savings ($)	Annual Operational Energy Savings ($)	Simple Payback
Chatham High School	**$ 11,974.3**	**$ 61,217**	**$ 33,698**	**$ -**	**$ -**	**$ 106,889**	**$ 50,607**	**9.1**
1A - Lighting Upgrades	$ 11,974.3	$ 33,353	$ (2,064)	$ -	$ -	$ 43,263	$ 19,757	6.6
1B - Lighting Controls and Daylight Harvesting	$ -	$ 2,741	$ (170)	$ -	$ -	$ 2,571	$ -	8.8
1C - Vending Misers	$ -	$ 636	$ -	$ -	$ -	$ 636	$ -	4.4
1D - Install De-stratification Fans	$ -	$ (214)	$ 4,234	$ -	$ -	$ 4,020	$ -	11.7
1E - Plug Load Management via WiFi	$ -	$ 3,631	$ -	$ -	$ -	$ 3,631	$ -	8.9
2A - Boiler Replacements	$ -	$ -	$ 5,785	$ -	$ -	$ 5,785	$ 13,000	18.9
2B - Install Honeywell "Controlinks" Boiler Burner Controller	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2G - Kitchen Hood Controllers	$ -	$ 510	$ 1,659	$ -	$ -	$ 2,169	$ -	12.2
2H - Walk-In Freezer/Cooler Controllers	$ -	$ 245	$ -	$ -	$ -	$ 245	$ -	12.1
2I - Steam Trap Replacement/Refurbishment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2J - Piping Insulation	$ -	$ -	$ 277	$ -	$ -	$ 277	$ -	5.1
3A - Building Management Control Systems	$ -	$ 12,855	$ 17,147	$ -	$ -	$ 30,002	$ 17,849	6.6
3B - Demand Control Ventilation	$ -	$ -	$ 1,463	$ -	$ -	$ 1,463	$ -	8.1
4A - Building Envelope Improvements	$ -	$ 4,722	$ 5,367	$ -	$ -	$ 10,089	$ -	13.4
5A - Transformer Replacements	$ -	$ 2,738	$ -	$ -	$ -	$ 2,738	$ -	12.9
6A - Demand Response/Permanent Load Reduction	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
Chatham Middle School	**$ 8,338.2**	**$ 49,638**	**$ 31,568**	**$ -**	**$ -**	**$ 89,543**	**$ 22,128**	**6.9**
1A - Lighting Upgrades	$ 8,338.2	$ 24,426	$ (1,351)	$ -	$ -	$ 31,413	$ 11,686	6.4
1B - Lighting Controls and Daylight Harvesting	$ -	$ 3,315	$ (183)	$ -	$ -	$ 3,132	$ -	9.5
1C - Vending Misers	$ -	$ 406	$ -	$ -	$ -	$ 406	$ -	2.6
1D - Install De-stratification Fans	$ -	$ (209)	$ 3,094	$ -	$ -	$ 2,884	$ -	12.3
1E - Plug Load Management via WiFi	$ -	$ 3,380	$ -	$ -	$ -	$ 3,380	$ -	10.4
2A - Boiler Replacements	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2B - Install Honeywell "Controlinks" Boiler Burner Controller	$ -	$ -	$ 4,356	$ -	$ -	$ 4,356	$ -	8.1
2G - Kitchen Hood Controllers	$ -	$ 517	$ 1,382	$ -	$ -	$ 1,899	$ -	13.4
2H - Walk-In Freezer/Cooler Controllers	$ -	$ 71	$ -	$ -	$ -	$ 71	$ -	16.3
2I - Steam Trap Replacement/Refurbishment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2J - Piping Insulation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
3A - Building Management Control Systems	$ -	$ 5,891	$ 17,709	$ -	$ -	$ 23,601	$ 10,442	5.7
3B - Demand Control Ventilation	$ -	$ -	$ 1,403	$ -	$ -	$ 1,403	$ -	10.5
4A - Building Envelope Improvements	$ -	$ 4,670	$ 5,157	$ -	$ -	$ 9,827	$ -	8.0
5A - Transformer Replacements	$ -	$ 7,170	$ -	$ -	$ -	$ 7,170	$ -	8.6
6A - Demand Response/Permanent Load Reduction	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
Lafayette School	**$ 4,180.2**	**$ 21,985**	**$ 13,495**	**$ -**	**$ -**	**$ 39,660**	**$ 12,632**	**6.5**
1A - Lighting Upgrades	$ 4,180.2	$ 13,018	$ (665)	$ -	$ -	$ 16,533	$ 7,336	6.4
1B - Lighting Controls and Daylight Harvesting	$ -	$ 1,577	$ (81)	$ -	$ -	$ 1,497	$ -	9.7
1C - Vending Misers	$ -	$ 204	$ -	$ -	$ -	$ 204	$ -	1.7
1D - Install De-stratification Fans	$ -	$ (57)	$ 874	$ -	$ -	$ 817	$ -	14.4
1E - Plug Load Management via WiFi	$ -	$ 2,949	$ -	$ -	$ -	$ 2,949	$ -	6.9
2A - Boiler Replacements	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2B - Install Honeywell "Controlinks" Boiler Burner Controller	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2G - Kitchen Hood Controllers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2H - Walk-In Freezer/Cooler Controllers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2I - Steam Trap Replacement/Refurbishment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2J - Piping Insulation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
3A - Building Management Control Systems	$ -	$ 1,112	$ 10,546	$ -	$ -	$ 11,658	$ 5,296	5.8
3B - Demand Control Ventilation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
4A - Building Envelope Improvements	$ -	$ 2,673	$ 2,819	$ -	$ -	$ 5,492	$ -	7.3
5A - Transformer Replacements	$ -	$ 509	$ -	$ -	$ -	$ 509	$ -	17.4
6A - Demand Response/Permanent Load Reduction	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-

School District of the Chathams

District Wide Energy Savings Plan

Honeywell

Building & ECM	kW Savings ($)	kWh Savings ($)	Natural Gas Savings ($)	Fuel Oil Savings ($)	Water Savings ($)	Annual Energy Savings ($)	Annual Operational Savings ($)	Simple Payback
Milton Avenue School	**$ 2,100.1**	**$ 10,650**	**$ 11,291**	**$ -**	**$ -**	**$ 24,042**	**$ 6,415**	**7.1**
1A - Lighting Upgrades	$ 2,100.1	$ 6,555	$ (446)	$ -	$ -	$ 8,210	$ 3,744	6.9
1B - Lighting Controls and Daylight Harvesting	$ -	$ 510	$ (35)	$ -	$ -	$ 475	$ -	8.7
1C - Vending Misers	$ -	$ 185	$ -	$ -	$ -	$ 185	$ -	1.9
1D - Install De-stratification Fans	$ -	$ (26)	$ 697	$ -	$ -	$ 671	$ -	8.8
1E - Plug Load Management via WiFi	$ -	$ 2,130	$ -	$ -	$ -	$ 2,130	$ -	6.3
2A - Boiler Replacements	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2B - Install Honeywell "Controlinks" Boiler Burner Controller	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2G - Kitchen Hood Controllers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2H - Walk-In Freezer/Cooler Controllers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2I - Steam Trap Replacement/Refurbishment	$ -	$ -	$ 3,823	$ -	$ -	$ 3,823	$ -	9.7
2J - Piping Insulation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
3A - Building Management Control Systems	$ -	$ 388	$ 5,521	$ -	$ -	$ 5,909	$ 2,671	5.8
3B - Demand Control Ventilation	$ -	$ -	$ 183	$ -	$ -	$ 183	$ -	32.2
4A - Building Envelope Improvements	$ -	$ 908	$ 1,547	$ -	$ -	$ 2,455	$ -	8.2
5A - Transformer Replacements	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
6A - Demand Response/Permanent Load Reduction	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
Southern Boulevard School	**$ 3,203.1**	**$ 17,495**	**$ 10,547**	**$ -**	**$ -**	**$ 31,246**	**$ 9,855**	**7.0**
1A - Lighting Upgrades	$ 3,203.1	$ 10,788	$ (699)	$ -	$ -	$ 13,291	$ 5,499	6.9
1B - Lighting Controls and Daylight Harvesting	$ -	$ 931	$ (60)	$ -	$ -	$ 870	$ -	9.4
1C - Vending Misers	$ -	$ 195	$ -	$ -	$ -	$ 195	$ -	1.8
1D - Install De-stratification Fans	$ -	$ (55)	$ 1,207	$ -	$ -	$ 1,152	$ -	10.2
1E - Plug Load Management via WiFi	$ -	$ 2,446	$ -	$ -	$ -	$ 2,446	$ -	6.9
2A - Boiler Replacements	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2B - Install Honeywell "Controlinks" Boiler Burner Controller	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2G - Kitchen Hood Controllers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2H - Walk-In Freezer/Cooler Controllers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2I - Steam Trap Replacement/Refurbishment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2J - Piping Insulation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
3A - Building Management Control Systems	$ -	$ 1,452	$ 7,856	$ -	$ -	$ 9,308	$ 4,356	5.9
3B - Demand Control Ventilation	$ -	$ -	$ 184	$ -	$ -	$ 184	$ -	32.1
4A - Building Envelope Improvements	$ -	$ 1,297	$ 2,060	$ -	$ -	$ 3,356	$ -	9.8
5A - Transformer Replacements	$ -	$ 443	$ -	$ -	$ -	$ 443	$ -	20.0
6A - Demand Response/Permanent Load Reduction	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
Washington Avenue School	**$ 2,197.7**	**$ 12,426**	**$ 12,963**	**$ -**	**$ -**	**$ 27,588**	**$ 7,523**	**7.1**
1A - Lighting Upgrades	$ 2,197.7	$ 7,496	$ (477)	$ -	$ -	$ 9,217	$ 4,439	6.8
1B - Lighting Controls and Daylight Harvesting	$ -	$ 895	$ (57)	$ -	$ -	$ 838	$ -	9.5
1C - Vending Misers	$ -	$ 193	$ -	$ -	$ -	$ 193	$ -	1.8
1D - Install De-stratification Fans	$ -	$ (81)	$ 1,574	$ -	$ -	$ 1,494	$ -	15.8
1E - Plug Load Management via WiFi	$ -	$ 1,920	$ -	$ -	$ -	$ 1,920	$ -	7.0
2A - Boiler Replacements	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2B - Install Honeywell "Controlinks" Boiler Burner Controller	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2G - Kitchen Hood Controllers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2H - Walk-In Freezer/Cooler Controllers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
2I - Steam Trap Replacement/Refurbishment	$ -	$ -	$ 3,752	$ -	$ -	$ 3,752	$ -	7.6
2J - Piping Insulation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
3A - Building Management Control Systems	$ -	$ -	$ 6,392	$ -	$ -	$ 6,392	$ 3,085	6.0
3B - Demand Control Ventilation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
4A - Building Envelope Improvements	$ -	$ 1,565	$ 1,779	$ -	$ -	$ 3,344	$ -	7.0
5A - Transformer Replacements	$ -	$ 438	$ -	$ -	$ -	$ 438	$ -	20.2
6A - Demand Response/Permanent Load Reduction	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
Project Total	$ 31,993.6	$ 173,411	$ 113,562	$ -	$ -	$ 318,967	$ 109,161	7.7

4. Utility and Other Rebates and Incentives

NJ Pay-for-Performance Program (P4P)

Honeywell has been certified as a Pay for Performance Program Partner to provide technical services under direct contract to you. Acting as your energy expert, Honeywell will develop an Energy Reduction Plan for each project with a whole-building technical component of a traditional energy audit, a financial plan for funding the energy efficient measures and a construction schedule for installation. This supports your ability to take a comprehensive, whole-building approach to saving energy in your existing facilities and earn incentives that are directly linked to your savings.

Eligibility

Existing commercial, industrial and institutional buildings with a peak demand over 100 kW for any of the preceding twelve months are eligible to participate including hotels and casinos, large office buildings, multi-family buildings, supermarkets, manufacturing facilities, schools, shopping malls and restaurants. Buildings that fall into the following five customer classes are not required to meet the 100kW demand in order to participate in the Program: hospitals, public colleges and universities, nonprofits, affordable multifamily housing, and local governmental entities. Your Energy Reduction Plan must define a comprehensive package of measures capable of reducing the existing energy consumption of your building by 15% or more to utilize the Pay Performance Program.

ENERGY STAR Portfolio Manager

Pay for Performance takes advantage of the ENERGY STAR Program with Portfolio Manager, EPA's interactive tool that allows facility managers to track and evaluate energy and water consumption across all of their buildings. The tool provides the opportunity to load in the characteristics and energy usage of your buildings and determine an energy performance benchmark score. You can then assess energy management goals over time, identify strategic opportunities for savings, and receive EPA recognition for superior energy performance.

Incentives

Incentives for the P4P program are based on the annual electric and natural gas savings produced by the Energy Conservation Measures. There are three incentives to the program; details are included in the follow page. The first incentive is distributed after a finalized project is selected and bid. This usually occurs shortly before construction starts or shortly thereafter. The second incentive is distributed a few months after construction is completed, while the third incentive is distributed usually thirteen to fourteen months after the second incentive - once a year of building usage, post-retrofit, is completed.

Incentives, Rebates and Grants Summary

Honeywell has a great deal of experience in applying for, and successfully securing, all available incentives, rebates and grants for our clients. We have been approved for over $5.7M of incentives on behalf of our New Jersey customers alone since the introduction of the Energy Savings Improvement Program legislation in 2009. The New Jersey programs employed included primarily the Office of Clean Energy's Pay for Performance and Cogeneration Incentives. A table of the incentive amounts on a per project basis is provided below.

Building	Rebate Amount
Elizabeth Schools	$934,209
Phillipsburg School District	$496,005
NH-Voorhees Regional HS District	$771,063
Bridgewater-Raritan Regional District	$1,313,470
Hanover Township School District	$343,139

Building	Rebate Amount
Robbinsville Public School District	$529,092
Camden County Technical Schools	$1,210,370
Town of Kearny	$145,002
Frankford School District	$50,657

In regard to the School District of the Chathams Project, Honeywell has determined that the District is eligible for $627,264 in total incentives from the P4P program rebates. Additional Incentives are available through the PJM Demand program and are estimated in the final cash flow form VI.

Please refer to the tables on the following page for a breakdown of the School District of the Chathams incentive levels on a building by building basis for each type of incentive.

Recommended Project

	P4P			
Building	First Incentive	Second Incentive	Third Incentive	Total Incentive
Chatham High School	$ 12,683	$ 99,813	$ 99,813	$ 212,309
Chatham Middle School	$ 7,420	$ 83,164	$ 83,164	$ 173,747
Lafayette School	$ 5,000	$ 35,558	$ 35,558	$ 76,117
Milton Avenue School	$ 5,000	$ 23,105	$ 23,105	$ 51,211
Southern Boulevard School	$ 5,000	$ 28,282	$ 28,282	$ 61,563
Washington Avenue School	$ 5,000	$ 26,666	$ 26,666	$ 58,333
TOTALS	$ 34,088	$ 296,588	$ 296,588	$ 627,264

5. Financing the ESIP

In accordance with P.L.2012, c.55 an ESIP can be financed through energy savings obligations. The term refers to the two primary financing tools, debt and lease-purchase instruments. Each of these options is discussed below.

Energy savings obligations shall not be used to finance maintenance, guarantees, or the required third party verification of energy conservation measures guarantees. Energy saving obligations, however, may include the costs of an energy audit and the cost of verification of energy savings as part of adopting an energy savings plan or upon commissioning. While the audit and verification costs may be financed, they are not to be considered in the energy savings plan as a cost to be offset with savings.

In all cases, maturity schedules of lease-purchase agreements or energy savings obligations shall not exceed the estimated average useful life of the energy conservation measures.

An ESIP can also include installation of renewable energy facilities, such as solar panels. Under an energy savings plan, solar panels can be installed, and the reduced cost of energy reflected as savings.

The law also provides that the cost of energy saving obligations may be treated as an element of the local unit's utility budget, as it replaces energy costs.

Debt Issuance

The law specifically authorizes municipalities, school districts, counties, and fire districts to issue refunding bonds as a general obligation, backed with full faith and credit of the local unit to finance the ESIP. Because an ESIP does not effectively authorize new costs or taxpayer obligations, the refunding bond is appropriate, as it does not affect debt limits, or in the case of a board of education, require voter approval. The routine procedures for refunding bonds found in the Local Bond Law and Public School

Bond Law would be followed for issuance of debt, along with any required Bond Anticipation Notes as authorized pursuant to law.

With regard to bonds for public schools, the Department of Education (DoE) has concluded that debt financed ESIP projects are not covered by State aid for debt service or a "Section 15 EFFCA Grant" as there is no new local debt being authorized.

Tax-Exempt Lease Purchase Financing

The tax-exempt lease is a common form of financing for ESIP projects. Tax-exempt leasing is a tool that meets the basic objectives of debt, spreading the cost of financing over the life of an asset, while avoiding constitutional or statutory limitations on issuing public debt. If structured properly, by including non-appropriation language in the financing documents, the tax-exempt lease will not be considered debt for state law purposes but will be considered debt for federal income tax purposes. Thus for federal purposes, the interest component of the lease payment is tax-exempt.

Under the New Jersey Energy Savings Improvement Program (ESIP), the District may authorize a lease purchase agreement between the District and a financier. Ownership of the equipment or improved facilities will pass to the District when all the lease payments have been made. There are legal expenses and other minimal closing costs associated with this type of structure. The lease purchase agreement may not exceed 15 years (commencing upon completion of the construction work), or 20 years where a combined heat and power or cogeneration plant is included in the project. The primary benefits of a lease are lower rates and the acquisition of essential use property without creating debt.

Under a lease there is typically a single investor. The lease may have non-appropriation language that allows the District to access low tax exempt rates. Some previous customers have chosen to remove the non-appropriation language which has resulted in lower competitive rates.

Repayment of the lease payments is tailored to meet the requirements of the School District of the Chathams. Payments are typically scheduled to commence after the construction is complete and acceptance of the project has been received by the District. Typically, payment terms are structured so there is no up-front capital expense to the District and payments are aligned within your cash flow and fiscal limits.

Certificates of Participation (COP's)

Certificates of Participation are another form of a lease purchase agreement with the differentiating factor being that there are multiple investors participating in the purchase of the lease. COP's require financial disclosure and are typically utilized on higher value projects where one investor doesn't have the capacity to hold a high value lease for a single customer.

Energy Savings Obligations

Energy Savings Obligations can be issued as refunding bonds in accordance with the requirements of N.J.S.A *40A:11-4.6(c)(3)*. These bonds may be funded through appropriation for the utility services in the annual budget of the contract unit and may be issued as refunding bonds pursuant to N.J.S.40A:2-52 et seq., including the issuance of bond anticipation notes as may be necessary, provided that all such bonds and notes mature within the periods authorized for such energy savings obligations. Energy savings obligations may be issued either through the contracting unit or another public agency authorized to undertake financing on behalf of the unit but does not require bond referendum.

This Page Intentionally Left Blank

SECTION E MEASUREMENT & VERIFICATION AND MAINTENANCE PLAN

1. Baseline

The purpose for establishing a baseline for an energy performance project is to accurately predict what the energy consumption and costs would have been as if the energy project was never completed. The baseline can then be used to measure the improvement in efficiency and determine the overall energy savings of the project. Since the energy consumption of all facilities is somewhat effected by variable weather conditions, a baseline for heating and cooling systems is typically dependent on degree-days or outside temperature. A baseline also needs to incorporate changes in facility use, such as a change in hours of operation or increased levels of outside air. Once again, if these changes would have occurred in the absence of the energy project, they should be incorporated into the project's baseline.

Honeywell will calculate the baseline based on the systems and operating conditions as they currently exist. Honeywell finds baseline development most accurate if specific measurements are taken on equipment over a period of time (early in the audit phase) to determine actual kW, kWh, oil and gas consumption, cfm, gpm, hours of use, etc. A summary of some of the methods, which will be used by Honeywell to establish baselines and support, calculated savings are listed below.

1. Spot measurements of electrical loads such as lighting, fan and pump motors, chillers, electric heat, etc.
2. Measurement of equipment operating hours using electric data recorders.
3. Measurement of existing operating conditions using data recorders for space temperature and humidity, air handler temperatures (mixed, return, cooling and heating coil discharges), and space occupancy using lighting loggers.
4. Spot measurement for boiler efficiencies, water use.
5. Running measurements of chiller operation, including simultaneous measurement of input kWh or steam flow, and chilled water supply and return temperatures and flow (gpm).
6. Records of operating conditions from building management systems and utility-grade meters.

The data from the above is used to calculate existing energy use, which is then reconciled with current facility utility bills, and adjusted as required to provide a mutually agreed baseline.

To provide valid savings evaluations, Honeywell's maintains a significant inventory of metering equipment utilized by its auditors and Energy Engineers to ascertain critical data about the operation of the facility.

Typically, Honeywell's auditors use the following equipment for their onsite measurements:

1. Recording and instantaneous power and harmonic analyzers.
2. Data loggers for pressures, temperatures, flow rates, humidity and CO_2.
3. Lighting level and recording profile/run-hour and occupancy meters.
4. Multimeters, hand held kW meters.
5. Combustion analyzers.
6. Ultrasonic flow meters.
7. Infrared thermometers

The ECMs installed in many projects allow for energy savings to be identified by direct metering or a combination of metering and calculations with accepted assumptions. In the case of lighting, for example, it is relatively easy to meter representative samples of unique fixture types, both before and after a retrofit, to determine the power consumption difference in Watts. When multiplied by the quantity of each fixture type, the total connected load reduction can be derived. In combination with run time assumptions, or meters, the electrical reduction can be accurately determined. Where possible, direct measurement of ECMs during construction (before and after the retrofit) coupled with energy savings calculations is a method the Honeywell finds to be very accurate and cost-effective.

Due to the nature of some ECMs, or when a combination of ECMs is installed, individual (discrete) metering may not be either possible or able to fully document a baseline and calculate savings. Many of these situations can be handled by combining results from metering along with either engineering-based calculations or output from nationally recognized building simulation programs such as DOE II, ASEAM, TRACE or HAP. This method would be used for ECMs such as night setback, and where no other ECMs have significant interaction with the setback measure.

Formulas exercised in energy savings calculations follow the laws of physics, and many are included in the ASHRAE Handbook of Fundamentals. However, such calculations (i.e. equipment operation profiles) must be tempered by experience, past retrofit practice, and expectations of future operating conditions to arrive at achievable values in practice. Honeywell always reviews each and every project, in detail, for the anticipated savings and never hesitates to reduce the anticipated energy calculations where experience dictates necessary. The final result is a coupled project where the final savings are equal to or greater than anticipated.

Calculating the units of energy saved is a critical measure of energy efficiency improvements, but it does not indicate the actual dollars saved. To do this, Honeywell and the School District of the Chathams will establish the base rates that will act as "floor" rates in calculating the savings. These are usually the rates that are in effect at the time of the start of the contract or rates used for audit estimated savings.

2. Adjustment to Baseline Methodology[1]

Honeywell's methodology for establishing and adjusting the baseline is determined by the characteristics of the facility, the conservation technology being installed, the technology being replaced, the type of measurement and verification the School District of the Chathams requires and the needs of the District for future changes in facility use.

The purpose of this flexible approach is to make the most accurate possible measurement of the changes in energy uses that are specifically attributable to Honeywell installed ECMs. This creates the ability over the life of the contract to continue measuring only savings achieved by Honeywell and leaves the School District of the Chathams free to make future changes to the building or systems without affecting the savings agreement. It also necessitates fewer provisions for making adjustments to the baseline.

Modifications to the energy baseline or savings will be made for any of the following:

1. Changes in the number of days in the annual review cycle.
2. Changes in the square footage of the facilities.
3. Changes in the operational schedules of the facilities.
4. Changes in facility indoor temperatures.
5. Significant changes in climate.
6. Significant changes in the amount of equipment or lighting utilized in the facility.

Examples of situations where the baseline needs to be adjusted are: i) changes in the amount of space being air conditioned, ii) changes in auxiliary systems (towers, pumps, etc.) and iii) changes in occupancy or schedule. If the baseline conditions for these factors are not well documented it becomes difficult, if not impossible, to properly adjust them when they change and require changes to payment calculations. To compensate for any addition and deletion of buildings and impact on the baseline model, Honeywell will use sound technical methodologies to adjust the baseline. An example would be to add or delete building energy impact via the calculated cooling load in tons as a percentage of the existing campus tonnage baseline or use indices like W/ft^2 and Btu/ft^2 to calculate the energy consumption of the building and then add or subtract the energy usage to or from the baseline energy consumption.

---

[1] The energy baseline modifications shall use commonly accepted energy engineering methods that are mutually agreeable to both Honeywell and customer. Should agreement on these methods, including the climate adjustments, not be reached between Honeywell and customer, both parties could appeal to an independent engineering.

3. Energy Savings Calculations

In calculating energy savings, Honeywell's highly experienced audit staff uses onsite surveys and measurements, National Oceanic and Atmospheric Administration weather data, detailed discussions with the client's operations and maintenance personnel and engineers, utility records, and other sources to ensure accurate energy, water and O&M savings.

Typically, the following data is gathered:

1. Local weather data.
2. Utility bills and sub-metered consumption trends.
3. Utility rate structure.
4. Facility use and occupancy data.
5. Internal equipment loads.
6. Interviews of operations and maintenance staff and management.
7. Building construction, age, use and layout.
8. Schematics of energy and water distribution systems.
9. Identification and inventory of HVAC equipment.
10. Identification and inventory of process equipment.
11. Design, configuration and operating characteristics of HVAC systems.
12. Design, configuration and operating characteristics of process systems.
13. Control strategies and sequences of operation for HVAC and other process equipment.
14. Identification and count of all lighting fixtures and determination of power consumption for each type.
15. Identification and inventory of lighting control methods.
16. Measurement of foot-candle levels at sample locations.
17. Power quality and harmonics, power factor.
18. Indoor air quality issues.

Calculating the units of energy saved is a critical measure of energy efficiency improvements, but it does not indicate the actual dollars saved. To do this, Honeywell and the School District of the Chathams will establish the base rates that will act as "floor" rates in calculating the savings. These are usually the rates that are in effect at the time of the start of the contract or rates used for audit estimated savings.

The equation below will be used to calculate the annual savings in dollars.

$$AnnualSavi\ ngs(\$) = \sum_{m=1}^{12}\{\left(Rate_{kWh,Base} \times kWh_{Saved,m}\right) + (Rate_{fuel\ Oil,Base} \times Fuel\ Oil_{Saved,gal,m}) +$$
$$(Rate_{Steam,Base} \times Steam_{Saved,klbs,m}) + (Rate_{NG} \times NG_{Saved,MCF,m})\} + Agreed(\$)$$

where:

$Rate_{kWh,Base}$= defined base rate for kWh consumption
$kWh_{Saved,m}$= calculated kWh savings for month *m*

$Rate_{Fuel\ Oil,\ Base}$= defined base rate for fuel Oil savings (XX/gal.)
$Fuel\ Oil_{Saved,m}$= calculated chilled water savings in gal. for month *m*

$Rate_{Steam,Base}$= defined base rate for steam consumption ($XX/MMBtu.)
$Steam_{Saved,m}$= calculated Steam savings in MMBtu. for month *m*

$Rate_{NG,Base}$= defined base rate for natural gas consumption ($XX/Therm)
$NG_{Saved,m}$= calculated natural gas savings in Therms for month *m*

Agreed($)= Annual savings in dollars (water, sewer, maintenance, etc.)

Honeywell assigns dollar values to the true incremental value of savings for energy and water. In other words, we do not combine for example, demand and consumptions numbers so that there is an average value to savings. Honeywell looks at each incremental rate to units saved to properly determine the value (dollar) to the School District of the Chathams or "real bill reductions". As noted in the RFP energy escalation rates will be established in accordance with New Jersey Board of Public Utility guidelines.

Based on this, Honeywell will review all utility bills (hourly data), tariffs, special contracts and commodity contracts to develop the incremental value (costs) of each utility.

The O&M savings is typically a function of existing the School District of the Chathams' budgets (labor & direct costs), maintenance contracts and operations (supplier) contracts. Honeywell will analyze the information to provide a conservative savings representation for the School District of the Chathams' review and acceptance. The information will include all calculations and assumptions.

4. Measurement & Verification

The purpose of performing any monitoring and verification is to establish an agreed upon process that provides the customer both a level of satisfaction that the improvements have been delivered and ongoing information as to their operation and performance. Additionally, this effort will be used to assess the actual dollars of savings versus the guarantee level.

It is essential for the success of this program that Honeywell and the School District of the Chathams agree on a mutually acceptable methodology for measuring and verifying energy savings that are attributable to the energy conservation measures (ECMs) Honeywell installs. This M&V plan provides the procedures to document the energy and cost savings of each of the proposed ECMs.

The plan for monitoring and verifying energy savings for the proposed ECMs is based on the methods described in the *International Performance Measurement and Verification Protocol (IPMVP)*[2]. Our approach to M&V is directly consistent with, and in compliance with, the IPMVP. This protocol provides a framework for the most widely accepted and used M&V methods by the industry.

Engineering calculations of energy and cost savings for the project are based on operating parameters (such as weather, temperature settings, run hours, occupancy patterns, and space usage) and equipment performance characteristics. The M&V plan uses the operating parameters established in the baseline for all savings calculations during the term of the project. The intent of the M&V plan is to verify that the ECMs installed by Honeywell will provide the expected energy savings. Therefore, Honeywell will collect data and relative information during the post-retrofit period to demonstrate that the installed equipment is performing at expected levels. It is assumed that the School District of the Chathams will continue to be a dynamic institution adding or renovating buildings and desiring to retain the right to set comfort and operating characteristics. To accommodate this, Honeywell will develop its M&V plan in a way that allows the District to adapt to the demands of future campus growth and changes without the need for the School District of the Chathams and Honeywell to negotiate energy baseline adjustments.

Our typical M&V plan will utilize broadband Internet access to the appropriate School District of the Chathams control interfaces to both confirm operating status and to download trend data to verify proper equipment maintenance.

One year after the commencement date of the ECMs, Honeywell will submit a report verifying and calculating the energy and cost savings for the first year. This report will be submitted for facility review and approval. For the remaining contract term, Honeywell will provide annual reports. These reports will include results of inspections of the installed equipment/systems, energy and cost savings, and recommendations to provide optimum energy performance.

The following table lists the information concerning typical M&V equipment used:

Instrument	Make
Power Multimeter	Fluke 39
Light Meter	Osram or Phillips
Portable Temperature/Humidity Multimeter	TSI
Retractable Insertion Vortex Flow meter	Hydro-Flow Model 3100

[2] www.ipmvp.org.

BTU Meter	Hydro-Flow BTU-121 BTU/Energy Measurement System
KW/KWH Transducers	Veris Industries (H6000 SERIES)

All permanent measurement equipment will be purchased new with a calibration certificate from the manufacturer. The power multi-meter and the TSI multi-meter will be calibrated annually before using them in the annual inspection.

General Approach to M&V

Energy and water savings are determined by comparing the energy and water use associated with a facility or certain systems within a facility before and after the installation of an ECM or other measure. The "before" case is the baseline. The "after" case is the post-installation or performance period. Baseline and post-installation energy use measurements or estimates can be constructed using the methods associated with M&V options A, B, C, and D, as described in the IPMVP. The challenge of M&V is to balance M&V costs, accuracy, and repeatability with the value of the ECM(s) or systems being evaluated, and to increase the potential for greater savings by careful monitoring and reporting.

M&V Options

The IPMVP guidelines classify the M&V procedures into four categories, Options A, B, C and D. As shown in the table below, these options differ in their approach to the level of complexity of the M&V procedures.

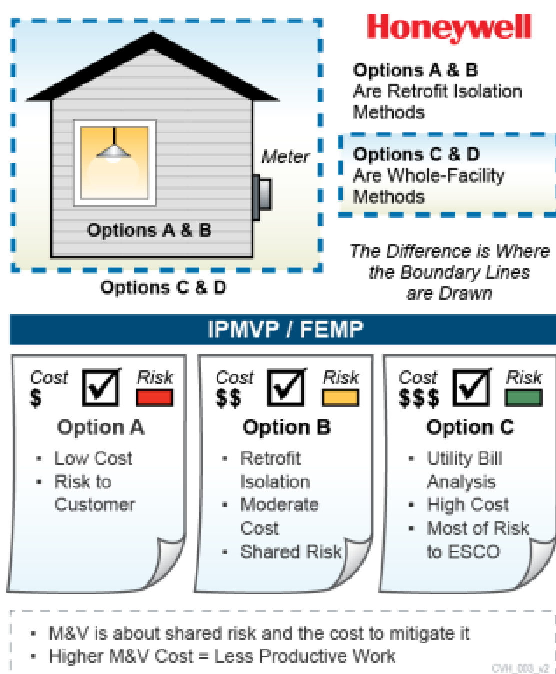
M&V Option	Performance Verification Techniques
Option A Verifying that the measure has the potential to perform and to generate savings.	Engineering calculations before and after installation spot measurements and use of EMS data points with stipulated values.
Option B Verifying that the measure has the potential to perform and verifying actual performance by end use.	Engineering calculations with metering and monitoring strategy throughout term of the contract
Option C Verifying that the measure has the potential to perform and verifying actual performance (whole building analysis.)	Utility meter billing analysis-using techniques from simple comparison to multivariable regression analysis.
Option D Verifying actual performance and savings through simulation of facility components and/or the whole facility	Calibrated energy simulation/modeling; calibrated with hourly or monthly utility billing data and/or end-use metering.

Option A is appropriate for ECMs that have energy use that can be readily quantified, such as the use of high efficiency lighting fixtures, high efficiency constant speed motors, and other standard engineering calculations.

Option B is appropriate for ECMs that require periodic or on-going measurements to quantify energy use; such as the use of variable frequency drives on pump or fan motors.

Option C is used for ECMs for which the energy use or energy savings cannot be measured directly, such as building envelope modifications. Option C is based on the use of utility meters to quantify building energy use.

Option D is used for ECMs for which the energy use or energy savings cannot be measured directly, or savings for individual ECMs are heavily interdependent. Calibrated building simulation is used to separate the energy savings attributable to each ECM.



In general,

ECM Energy Savings = Baseline Energy Use - Post-Installation Energy Use

And

Energy Cost savings ($) = Total Energy Savings x Contractual Energy Rates

Exceptions to this simple equation are as follows:

Projects where an on/off M&V method is used. For example, after a new energy management system is installed, control features are turned off for a set period of time to recreate baseline conditions. Thus, savings are determined after installation by comparing energy use with and without the control features activated.

Since energy use at a facility is rarely, if ever, constant, another way to define M&V is as a comparison of a facility's post-installation energy use with its usage if the ECM or system had not been installed. This takes into account situations in which baseline energy use must be adjusted to account for changing conditions, such as changes in facility operation, occupancy, or use or external factors such as weather.

Post-Retrofit M&V Activities

There are two components associated with M&V of performance contract projects:

1. Verifying the potential of the ECM to generate savings also stated as confirming that the proper equipment/systems were installed, are performing to specification and have the potential to generate the predicted savings.
2. Determining/verify energy savings achieved by the installed ECM(s).

Verifying the Potential to Generate Savings

Verifying baseline and post-installation conditions involves inspections (or observations), spot measurements, and/or commissioning activities. Commissioning includes the following activities:

- Documentation of ECM or system design assumptions
- Documentation of the ECM or system design intent for use by contractors, agencies and operators
- Functional performance testing and documentation necessary for evaluating the ECM or system for acceptance
- Adjusting the ECM or system to meet actual needs within the capability of the system

Post-Installation Verification

Post-installation M&V verification will be conducted by both Honeywell and the Client to ensure that the proper equipment/systems that were installed are operating correctly and have the potential to generate the predicted savings. Verification methods may include surveys, inspections, and/or spot or short-term metering.

Regular Interval Post-Installation Verification

At least annually, Honeywell will verify that the installed equipment/systems have been properly maintained, continue to operate correctly, and continue to have the potential to generate the predicted savings. Savings report for all the installed ECMs will be submitted each year after the acceptance date of the work performed by Honeywell.

Computation of Energy Savings

After the ECMs are installed, energy and cost savings will be determined annually by Honeywell in accordance with an agreed-upon M&V approach, as defined in a project-specific M&V plan.

Construction/Interim Savings

Construction or Interim savings are usually measured by using the same methodology as described in the detail M&V plan for each ECM. The start and the completion time for each ECM must be agreed to between Honeywell and the School District of the Chathams.

Electricity and thermal savings from the ECMs where no detailed long-term data is required to be collected will be stipulated and will be based on the starting and the final completion dates and verification of the operation of the ECMs. For other ECMs where long-term data collection is required by the M&V plan, data will be used to calculate the savings using the same equations as described in the detail plan. For example, to calculate electricity savings for the installation of a VFD, the kW is spot measured at a set speed for selected motors through a sampling plan. The measured kW is subtracted from the baseline kW to calculating the savings. Thermal savings are tied to the electrical savings in the manner described in the detail M&V plan. The results are extrapolated to cover all the VFDs installed by Honeywell.

The savings for each of the monitored VFD is calculated on an interval basis as follows:

$kW_{Saved} = (kW_{Base} – kW_{Spot\ Measured})$

kWh_{Saved} = Estimated operating hours during the interim period * kW_{Saved}

The total kWh savings is the sum of the kWh_{Saved} for all the installed VFDs.

5. Site Specific M&V Plan

ECM # and Name	Summary of ECM	Measurement and Verification Methodology / Recommendation	Description of M&V – Pre and Post Process
ECM 1A - Lighting Upgrades	Upgrade Lighting systems: Re-lamp/Re-ballast T-8 to LED New Fixtures Incandescent to LED Metal Halide and Sodium Vapor to LED High Bays	Option A: Pre and Post measurements Line by Line scope and engineering calculations	Pre M&V: Measurement of KW for 5% sample fixtures in each category Data log usage hours Data Log occupancy schedules Update Line by Line scope with measured KW and usage hours Post M&V: Measurement of KW for 5% sample fixtures in each category Usage Hours to remain same Occupancy schedules to remain same Energy Savings : Update Line by Line scope with measured KW and usage hours and compare to pre retrofit calculated savings
ECM 1B - Lighting Controls	Upgrade Lighting systems Controls, Occupancy sensors	Option A : Pre and Post measurements Line by Line scope and engineering calculations	Pre M&V: Measurement of KW for 5% sample fixtures in each category Data log usage hours Data Log occupancy schedules Update Line by Line scope with measured KW and usage hours Post M&V: Measurement of KW for 5% sample fixtures in each category Usage Hours to remain same Occupancy schedules to remain same Energy Savings : Update Line by Line scope with measured KW and usage hours and compare to pre retrofit calculated savings
ECM 1C – Vending Misers	Install Vending machine energy management devices	Option A: Pre and Post measurements Line by Line scope and engineering calculations	Pre M&V: Measurement of KW for 5% sample machines in each category Data log usage hours Data Log occupancy schedules Update Line by Line scope with measured KW and usage hours Post M&V: Measurement of KW for 5% sample machines in each category Usage Hours to remain same Energy Savings scope with measured KW and usage hours and compare to pre retrofit calculated savings

ECM # and Name	Summary of ECM	Measurement and Verification Methodology / Recommendation	Description of M&V – Pre and Post Process
ECM 1D - De-Stratification Fans	Install De-Stratification fans in Gymnasiums , Cafeterias and Auditoriums to minimize stratification of hot air and maintain hot air flow below the fan level	Option C: Fuel Savings Utility Bill Comparison for all fuel related measures	Pre M&V: Verify parameters used in engineering calculations with equipment name plate data and savings assumptions Post M&V: Fuel: Compare post installation M&V fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days
ECM 1E - Plug Load Management via Wi-Fi	Provide Wi-Fi enabled programmed electrical outlet strips to shut down computer peripherals and various plug loads when building is not occupied	Option A: Engineering calculations based on comparison of existing operations and post installation operation	Pre M&V: Verify parameters used in the calculations based on data provided by Data loggers on selected pieces of equipment Post M&V: Verify that the control equipment is installed and programmed as specified. Data log to verify reduced hours of operation
ECM 2A – Boiler Upgrades	Replace boilers in select locations in kind to handle base load	Option C: Utility Bill Comparison for all fuel related measures	Pre M&V: Baseline annual fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days Perform combustion efficiency test on boilers Post M&V: Compare post installation M&V fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days Perform efficiency test on replaced boilers to insure operating conditions are maintained
ECM 2B - Boiler Burner Controls	Retrofit existing burners with Controllinks	Option C: Utility Bill Comparison for all fuel related measures	Pre M&V: Baseline annual fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days Post M&V: Compare post installation M&V fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days
ECM 2C - Premium Efficiency Motors and VFDs	Install Variable Frequency Drives on hot water and chilled water pumps to operate the pump motors in response to the system load. Replace antiquated motors with new premium efficiency motors	Option A: Engineering calculations for variable frequency drives following pump affinity laws. Engineering calculations based on nameplate and manufacturer supplied data for the existing and replacement motors	Pre M&V: Verify manufacturer provided data for the pump performance data and motor efficiencies. Post M&V: Obtain trend data for VFD operation from the BMS system to verify baseline calculation assumptions on system loads Verify efficiency of new motors Verify manufacturer provided data for new chiller efficiency (kW/ton) – verify the new

ECM # and Name	Summary of ECM	Measurement and Verification Methodology / Recommendation	Description of M&V – Pre and Post Process
			equipment and controls are installed and commissioned as recommended by manufacturer
ECM 2D – Domestic Hot Water Replacement	Replace existing domestic hot water heater with condensing natural gas domestic hot water heater	Option C: Utility Bill Comparison for all fuel related measures	Pre M&V: Baseline annual fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days Perform combustion efficiency test on boilers Post M&V: Compare post installation M&V fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days Perform efficiency test on replaced boilers to insure operating conditions are maintained
ECM 2E - Rooftop Unit Replacement	Replace antiquated Roof Top Units with new high efficiency VFD equipped Rooftop Units	Option A: Engineering calculations based on nameplate and manufacturer supplied data for the existing and replacement RTU	Pre M&V: Verify manufacturer provided data for existing unit efficiency (SEER) Post M&V: Verify manufacturer provided data for new condensing unit (SEER) – verify the new equipment and controls are installed and commissioned as recommended by manufacturer
ECM 2F – Window AC Unit Replacements	Replace antiquated Window AC Units with new high efficiency models	Option A: Engineering calculations based on nameplate and manufacturer supplied data for the existing and replacement Window Unit	Pre M&V: Verify manufacturer provided data for existing unit efficiency (SEER) Post M&V: Verify manufacturer provided data for new window AC unit (SEER) – verify the new equipment and controls are installed and commissioned as recommended by manufacturer
ECM 2G - Kitchen Hood Controls	Install control devices on the Kitchen hoods to control exhaust air in response to the cooking load. Replace fan motors with new premium efficiency motors and VFD drives	Option A: Engineering calculations for variable frequency drives following affinity laws. Engineering calculations based on nameplate, manufacturer supplied data and operating hours for the existing and replacement motors	Pre M&V: Verify manufacturer provided data for the motor performance data and motor efficiencies. Post M&V: Obtain trend data for VFD operation from the BMS system to verify baseline calculation assumptions on system loads Verify efficiency of new motors
ECM 2H – Walk-In Freezer/Cooler Controllers	Install control device on walk-in freezer and refrigerator evaporators to shut down the fan motor when the compressor is off on duty cycle	Option A: Stipulated Engineering calculations based on case studies for the Intellidyne control	Pre M&V: None Post M&V: Savings stipulated based on engineering calculations for the term of contract

ECM # and Name	Summary of ECM	Measurement and Verification Methodology / Recommendation	Description of M&V – Pre and Post Process
ECM 2I – Steam Trap Replacement	Replace failed steam traps throughout steam buildings	Option C: Utility Bill Comparison for all fuel related measures	Pre M&V: Baseline annual fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days Post M&V: Compare post installation M&V fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days
ECM 2J – Piping Insulation	Insulate hot water pipes that are currently un-insulated	Option A Electric energy savings - Engineering calculations based on programmed parameters. Option C: Fuel Savings Utility Bill Comparison for all fuel related measures	Pre M&V: Verify parameters used in engineering calculations with site conditions Post M&V: Fuel: Compare post installation M&V fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days
ECM 2K - Window Replacements	Replace single pane windows with energy efficient low-e windows	Option A Electric energy savings - Engineering calculations based on programmed parameters. Option C: Fuel Savings Utility Bill Comparison for all fuel related measures	Pre M&V: Verify parameters used in engineering calculations with site conditions Post M&V: Fuel: Compare post installation M&V fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days
ECM 2L – AHU Replacement	Replace antiquated AHU with new unit paired with a Condensing Unit	Option A: Engineering calculations based on nameplate and manufacturer supplied data for the existing and replacement AHU	Pre M&V: Verify manufacturer provided data for existing unit efficiency (SEER) Post M&V: Verify manufacturer provided data for new condensing unit (SEER) – verify the new equipment and controls are installed and commissioned as recommended by manufacturer
ECM 3A - Building Management System Upgrades / Pneumatic to DDC Conversion	Upgrade Building Management Systems to DDC and integrate all systems to a central platform such that the systems may be monitored and controlled as programmed to	Option A: Electric energy savings - Engineering calculations based on programmed parameters. Option C: Fuel Savings Utility Bill Comparison for all fuel related measures	Pre M&V: Verify existing operating parameters match the baseline calculation assumptions Post M&V: Verify that systems are installed as specified and controls are programmed to match the savings assumptions Electric Energy: Verify savings based on programmed parameters and engineering calculations Fuel:

ECM # and Name	Summary of ECM	Measurement and Verification Methodology / Recommendation	Description of M&V – Pre and Post Process
	maintain global settings such as night set back , optimum stop-start etc		Compare post installation M&V fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days
ECM 3B - Demand Control Ventilation	Install Demand Control Ventilations System with Carbon Di Oxide sensors installed to modulate the outdoor air intake for air handling system based on space occupancy variations	Option A: Electric energy savings - Engineering calculations based on industry standards Option C: Fuel Savings Utility Bill Comparison for all fuel related measures	Pre M&V: Verify parameters used in engineering calculations with equipment name plate data and savings assumptions Post M&V: Verify that systems are installed as specified and controls are programmed to match the savings assumptions Electric Energy: Verify savings based on verified parameters and engineering calculations Fuel: Compare post installation M&V fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days
ECM 4A - Building Envelope Improvements	Install weather stripping on doors, seal roof wall joints and roof penetrations	Option A: Electric energy savings - Engineering calculations based on programmed parameters. Option C: Fuel Savings Utility Bill Comparison for all fuel related measures	Pre M&V: Verify parameters used in engineering calculations with site conditions Post M&V: Fuel: Compare post installation M&V fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days
ECM 4B – Spray Foam Insulated Roof	Install foam spray roof to increase the R-Value of the existing roof and seal exterior leaks	Option A: Electric energy savings Engineering calculations based on the difference in the R-Values of the old and new windows Option C: Fuel Savings Utility Bill Comparison for all fuel related measures	Pre M&V: Validate of replaced square footage Post M&V: Validate R-values of roof replaced against manufacturer specifications Electric Energy: Post retrofit verification data applied against engineering calculations and contractual utility rates Fuel: Compare post installation M&V fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days
ECM 5A - Transformer Upgrades	Replace various Transformers with High Efficient Units	Engineering calculations based on increase in Transformer Efficiencies	Pre M&V: Baseline annual fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days Post M&V:

ECM # and Name	Summary of ECM	Measurement and Verification Methodology / Recommendation	Description of M&V – Pre and Post Process
			Compare post installation M&V fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days
ECM 6A - Permanent Load Reduction	Participate in utility demand response program	Option A : Stipulated Savings based on incentives offered by Utility (ISO)	Pre M&V: None Post M&V: Savings stipulated based on incentives offered by Utility (ISO)

6. Guarantee of Savings

The approach that Honeywell utilizes in this asset management program includes two key components: a *performance guarantee* and *financial savings*. Honeywell guarantees the District that all installations and work performed are subject to final inspection and the District's acceptance. This procedure ensures all work will be to the level of quality the District expects.

Honeywell also guarantees it will meet the objectives mutually defined with the District. Honeywell takes its commitment to partner with School District of the Chathams for the life of the contract seriously, and looks forward to a successful, long-term partnership.

Honeywell considers the guarantee to be the cornerstone of our service to you. To be considered a *performance contract* an energy guarantee is an optional component under the New Jersey Energy Savings Improvement Program (ESIP) legislation. The basis of an energy performance contract is that the majority of risk is shifted from the District to the ESCO. The strength of the Guarantee is only as good as the Company backing it and their financial solvency. With over $37 Billion in assets, Honeywell has the financial strength and background to support the District for the long term.

Savings Guarantee: With the understanding that School District of the Chathams must maintain fiscal health and accountability, Honeywell can financially guarantee the results of its programs and clearly support this obligation with the commitment to regular review of program results and reconciliation. Honeywell's financial strength and stability give it the ability to extend a FIRST-PARTY GUARANTEE to School District of the Chathams. A first party guarantee eliminates the risk on the District and places it directly onto Honeywell. This differs from some other ESCO's who provide a third-party guarantee, which insulates them from the owner through the use of insurance instruments.

If at the end of any year the program has not met or exceeded the guaranteed savings for that year, Honeywell will refund the difference between the guaranteed amount and what was actually saved.

For all equipment covered by the Energy Savings Guarantee, School District of the Chathams shall be responsible for on-going maintenance and component replacement in accordance with manufacturer's standards. The customer will also be responsible for operating the equipment in accordance with manufacturer's specifications.

Honeywell will develop savings methodologies that follow current industry practice, such as outlined by the New Jersey Board of Public Utilities (BPU) and Federal Energy Management Program's (FEMP) M&V Guidelines: Measurement and Verification for Federal Energy Projects. References to M&V protocols from the International Performance Measurement and Verification Protocol (IPMVP), ASHRAE Guideline 14 and the Air-Conditioning Refrigeration Institute (ARI) are used to further qualify the M&V plan.

As stated above, under the New Jersey ESIP legislation acceptance of a performance guarantee is optional at School District of the Chathams sole discretion. In the same way, the duration of the guarantee is also optional. Many of Honeywell's New Jersey customers have elected to keep the guarantee in force for less than the total performance periods, i.e. three (3) to five (5) years. Others have elected to accept a one (1) year guarantee, while reserving the option to renew for additional years after they have had the opportunity to review the track record of actual savings results. Obviously, this a very customer specific decision based on the risk management culture of each unique organization. The key point is that Honeywell is flexible with regard to the structure and duration of the guarantee. The final terms will be discussed and defined as part of our co-authored ESIP project.

Solely for informational purposes, it is worth noting that if the District does elect to accept a guarantee, New Jersey ESIP law requires that the District contract with a third-party independent firm to verify that the energy savings are realized. In order to preserve the independent status of this contractor these costs are required to be incurred directly by the District.

The RFP requires that the cost of the guarantee be identified during this response phase. Honeywell develops and implements every project with the same high level of detail and confidence and therefore will always provide a Savings Guarantee at no additional cost. However, if the District opts to accept the Savings Guarantee, an annual cost of $15,000 (Fifteen Thousand

Dollars) will be applicable to account for on-going Honeywell service costs incurred during the measurement and verification of the savings.

All guarantees require that the owner maintain the system in accordance with the manufacturer's specifications. Regardless of guarantee acceptance, ongoing maintenance as recommended by the BPU, Honeywell and / or manufacturer specifications is required to achieve the projected energy savings. Maintenance should also include a periodic verification of the system to make sure the maintenance is properly conducted and the system is meeting the original specifications and design.

7. Recommended Preventive Maintenance Services

A Comprehensive Portfolio, a Customized Approach.

Honeywell offers a uniquely comprehensive portfolio of services – one of the most extensive in the industry. As part of the Energy Savings Plan, we recommend the following services for consideration to ensure achievement of the Energy Savings outlined in this plan

According to the NJ ESIP program, all services are required to be bid by the school district for services as desired. Based on Honeywell's vast service organization, we are uniquely qualified to develop design specification for the public bidding according to NJ Law.

Honeywell strongly believes that the long-term success of any conservation program is equally dependent upon the appropriate application of energy savings technologies, as well as solid fundamental maintenance and support. One of the primary contributors to energy waste and premature physical plant deterioration is the lack of operations, personnel training and equipment maintenance.

Honeywell recommends routine maintenance on the following systems throughout the district for the duration of an energy guarantee of savings

Maintenance, Repair and Retrofit Services:

- Mechanical Systems
- Building Automation Systems
- Temperature Control Systems
- Air Filtration

Honeywell will work with the School District to evaluate current maintenance practices and procedures. This information will be the basis of a preventive maintenance and performance management plan designed to maximize building operating efficiencies, extend the useful life of your equipment and support the designed Energy Savings Plan.

At a minimum, we recommend the following tasks be performed on a quarterly basis with the district wide Building Management System.

System Support Services

1. Review recent mechanical system operation and issues with customer primary contact, on a monthly basis.
2. Review online automation system operation and event history logs and provide summary status to the customer primary contact. Identify systemic or commonly re-occurring events.
3. Check with customer primary contact and logbook to verify that all software programs are operating correctly.
4. Identify issues and prioritize maintenance requests as required.
5. Provide technical support services for trouble shooting and problem solving as required during scheduled visits.
6. Provide ongoing system review and operations training support; including two semi-annual lunches and learn sessions.

7. Establish dedicated, site-specific emergency stock of spare parts to ensure prompt replacement of critical components. These will be stored in a secure location with controlled access.

Configuration Management
1. Update documentation and software archives with any minor changes to software made during maintenance work.
2. Verify and record operating systems and databases.
3. Record system software revisions and update levels.
4. Archive software in designated offsite Honeywell storage facility, on an annual basis.
5. Provide offline software imaging for disaster recovery procedures, updated on a regular basis.

Front End / PC Service
1. Verify operation of personal computer and software:
2. Check for PC errors on boot up
3. Check for Windows errors on boot up
4. Check for software operations and performance, responsiveness of system, speed of software
5. Routinely backup system files, on an annual basis:
6. Trend data, alarm information and operator activity data
7. Custom graphics and other information
8. Ensure disaster recovery procedures are updated with current files
9. Clean drives and PC housing, on an annual basis:
10. Open PC and remove dust and dirt from fans and surfaces
11. Open PC interface assemblies and remove dust and dirt
12. Clean and verify operation of monitors.
13. Verify printer operation, check ribbon or ink.
14. Initiate and check log printing functions.
15. Verify modem operation (if applicable).
16. Review IVR schedule for alarms and review (if applicable).

TEMPERATURE CONTROLS

UNIT VENTS

Services Performed
Annual Inspection

1. Inspect motor and lubricate.
2. Lubricate fan bearings.
3. Inspect coil(s) for leaks.
4. Vacuum interior.
5. Test operation of unit controls.

PUMPS

Services Performed
Preseason Inspection

1. Tighten loose nuts and bolts.
2. Check motor mounts and vibration pads.
3. Inspect electrical connections and contactors.

Seasonal Start-up

1. Lubricate pump and motor bearings per manufacturer’s recommendations.

2. Visually check pump alignment and coupling.
3. Check motor operating conditions.
4. Inspect mechanical seals or pump packing.
5. Check hand valves.

Mid-season Inspection

1. Lubricate pump and motor bearings as required.
2. Inspect mechanical seals or pump packing.
3. Ascertain proper functioning.

Seasonal Shut-down

1. Switch off pump.
2. Verify position of hand valves.
3. Note repairs required during shut-down.

PACKAGED AIR-CONDITIONING SYSTEMS

Services Performed
Preseason Inspection

1. Energize crankcase heater.
2. Lubricate fan and motor bearings per manufacturer's recommendations.
3. Check belts and sheaves. Adjust as required.
4. Lubricate and adjust dampers and linkages.
5. Check condensate pan.

Seasonal Start-up

1. Check crankcase heater operation.
2. Check compressor oil level.
3. Inspect electrical connections, contactors, relays, operating and safety controls.
4. Start compressor and check operating conditions. Adjust as required.
5. Check refrigerant charge.
6. Check motor operating conditions.
7. Inspect and calibrate temperature, safety and operational controls, as required.
8. Secure unit panels.
9. Pressure wash all evaporator and condenser coils (if applicable)
10. Log all operating data.

Mid-season Inspection

1. Lubricate fan and motor bearings per manufacturer's recommendations.
2. Check belts and sheaves. Adjust as required.
3. Check condensate pan and drain.
4. Check operating conditions. Adjust as required.
5. Log all operating data.

Seasonal Shut-down *

1. Shut down per manufacturer's recommendations.

* If no Shut-down is required then (2) Mid-season Inspections are performed

BOILERS

Services Performed
Preseason Inspection

1. Inspect fireside of boiler and record condition.
2. Brush and vacuum soot and dirt from flues (not chimneys) and combustion chamber.
3. Inspect firebrick and refractory for defects.
4. Visually inspect boiler pressure vessel for possible leaks and record condition.
5. Disassemble, inspect and clean low-water cutoff.
6. Check hand valves and automatic feed equipment. Repack and adjust as required.
7. Inspect, clean and lubricate the burner and combustion control equipment.
8. Reassemble boiler.
9. Check burner sequence of operation and combustion air equipment.
10. Check fuel piping for leaks and proper support.
11. Review manufacturer's recommendations for boiler and burner start-up.
12. Check fuel supply.
13. Check auxiliary equipment operation.

Seasonal Start-up

1. Inspect burner, boiler and controls prior to start-up.
2. Start burner and check operating controls.
3. Test safety controls and pressure relief valve.
4. Perform combustion analysis.
5. Make required control adjustments.
6. Log all operating conditions.
7. Review operating procedures and owner's log with boiler operator.

Mid-season Inspection

1. Review operator's log.
2. Check system operation.
3. Perform combustion analysis.
4. Make required control adjustments.
5. Log all operating conditions.
6. Review operating procedures and log with boiler operator.

Seasonal Shut-down

1. Review operator's log.
2. Note repairs required.

SECTION F DESIGN APPROACH

In accordance with the ESIP PL 2012, c.55 as part of the implementation process, an agreement between your school district and Honeywell will determine the energy conservation measures (ECM's) to be implemented. The services of a NJ Licensed Engineering firm and / or Architectural firm shall then be secured in order to properly comply with local building codes, compliance issues and NJ Public contracts law. Specifications will be designed and developed to exact standards as recommended by Honeywell in order to achieve all savings outlined in this Energy Savings Plan (ESP). Once specifications are completed, Honeywell will publicly solicit contractors capable of meeting the requirements of the specification for each trade. However, even before the completion of the bidding process, Honeywell project management will be engaged in order to maintain the overall project schedule and ensure the school district's expectations are met. An overview of these activities and functions are detailed below.

1. Safety Management Plan

All of Honeywell's Project Management Plans Begin with Safety. By integrating health, safety and environmental considerations into all aspects of our business, we protect our customers, our people and the environment, achieve sustainable growth and accelerated productivity, drive compliance with all applicable regulations and develop the technologies that expand the sustainable capacity of our world. Our health, safety and environment management systems reflect our values and help us meet our customer's needs and our business objectives.

Honeywell's Safety Management Plan is provided in Appendix 4.

2. Project Management Process

A Honeywell Project Management Plan defines plans and controls the tasks that must be completed for your project. But more than task administration, our project management process oversees the efficient allocation of resources to complete those tasks.

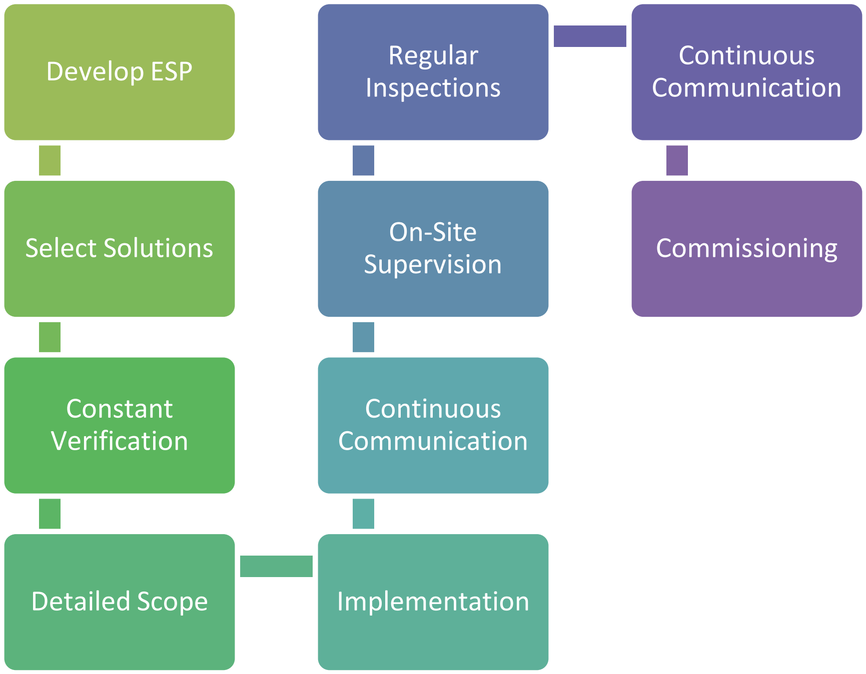
Each project and each customer's requirements are unique. At Honeywell we address customer needs through a formal communication process. This begins by designating one of our project managers to be responsible for keeping the customer abreast of the status of the project.

As the facilities improvements portion of the partnership begins, the Project Manager serves as a single focal point of responsibility for all aspects of the partnership. The Project Manager monitors labor, material, and project modifications related to the School District of the Chathams/Honeywell partnership and makes changes to ensure achievement of performance requirements in the facilities modernization component. The Project Manager regularly reviews the on-going process of the project with the customers.

The Project Manager will develop and maintain effective on-going contact with the School District and all other project participants to resolve issues and update project status.

There are several challenges in this position. The Project Manager must staff the project and create a work force capable of handling the technologies associated with the project (pneumatic or electric/electronic controls, mechanical systems, etc.), and plan for and use these personnel to achieve optimum results focused on occupant comfort and guarantee requirements.

The project management process applies technical knowledge, people and communication skills, and management talent in an on-site, pro-active manner to ensure that our contract commitments are met on time, within budget, and at the quality you expect.



3. Construction Management

Prior to any work in the buildings, our Project Manager will sit down with your administrative and building staff to outline the energy conservation upgrades that we will be installing in their building. We will discuss proper contractor protocol of checking in and out of the buildings on a daily basis, wearing identifiable shirts, identification badges, and checking in with your facilities staff. We will coordinate certain projects for different times of the day so we do not interrupt the building and learning environments. Our staff will work a combination of first and second shifts to accomplish the pre-set implementation schedule.

Communication is the key success factor in any construction management plan, and our project manager will be the key focal point during the installation process.

Our team will prevent schedule slippages by continuously tracking the location of all equipment and components required for the project. We make sure all equipment and components will be delivered on time prior to the scheduled date of delivery. Our thorough survey, evaluation and analysis of existing conditions, performed prior to the commencement of construction, will also prevent schedule slippages.

Honeywell is required to subcontract various portions of our projects to contractors. Within the School District of the Chathams project, all subcontractors will be selected in accordance with New Jersey public contracts law. Typical areas that are subcontracted are as follows:

- Electrical Installation
- Lighting Retrofits
- HVAC Installation (depends upon the project size and scope)
- Associated General Contracting specialty items to support the project etc., (ceilings, windows, concrete, structural steel, roofing, demolition and removal of equipment, painting and rigging)

Where possible under New Jersey public contracts law, Honeywell uses the following guidelines in hiring subcontractors to perform work on our projects.

- Local Presence in the Community (Customer Recommendations)
- Firm's Qualifications and WBE/MBE Status

- Firm's Financial Stability
- Ability to perform the work within the project timeline
- Price
- Ability to provide service on the equipment or materials installed over a long period of time.

Approval of subcontractors that Honeywell proposes to use lies with the School District of the Chathams.

4. Commissioning

Honeywell provides full commissioning of energy conservation measures (ECM's) as part of our responsibility on this project. We will customize this process based on the complexity of ECMs. Specifically, Honeywell will be responsible for start-up and commissioning of the new equipment and systems to be installed during the project. This will include verifying that the installed equipment meets specifications, is installed and started up in accordance with manufacturer's recommendations, and operates as intended. A commissioning plan will be prepared that describes the functional tests to be performed on the equipment and the acceptance criteria.

Prior to customer acceptance of the project, Honeywell submits the final commissioning report containing signed acceptance sheets for each ECM. Signed acceptance sheets are obtained upon demonstrating the functionality of each ECM to a school appointed representative.

Additionally, Honeywell provides training for facility operators and personnel as needed when each ECM is completed and placed into service. All training is documented in the final commissioning report.

Subsequent to the completion of the Honeywell commissioning effort, in accordance with New Jersey ESIP legislation, the School District of the Chathams will be required to secure the services of a 3rd party independent firm in order to verify that the new equipment and systems meet the standards set forth in the Energy Savings Plan. In order to maintain the independence of this review, these costs must be born directly by the District. However, at the option of the District, these services can be financed as a portion of the total project cost.

5. Installation Standards

When Honeywell designs a solution, we take into account current and future operations. For any upgrades we install, we follow building codes/standards, which dictate certain standards for energy or building improvements. Listed in tables following this section are standards for building design. During the life of the agreement, there is a partnership approach to maintaining these standards for reasons of comfort and reliability. For lighting our standard is to meet or exceed Department of Education light levels requirements, achieving the relevant standards wherever possible.

In the case of fluorescent lighting upgrades, we recommend that a group re-lamping of lamps be done approximately five years after the initial installation depending upon run times. Your building facility staff, on an as needed basis, can complete normal routine maintenance of lamps and ballasts. This maintains the quality of the lighting levels, and color rendering qualities of the lamps.

Space temperatures will be set by the energy management system and local building controls, and will be maintained on an annual basis. Flexibility will be maintained to regulate space temperatures as required to accommodate building occupant needs.

Your facility staff and building personnel will operate the energy management system with ongoing training and support from Honeywell. Therefore, both the District and Honeywell will maintain the standards of comfort. The comfort standards will be maintained throughout the life of the agreement through sound maintenance planning and services recommended as part of this ESP.

With regard to ventilation, Honeywell will upgrade ventilation to meet current standards in those areas where our scope of work involves upgrades to or replacement of systems providing building ventilation. We generally will not upgrade ventilation in those areas where our work doesn't involve the upgrade or replacement of systems or equipment providing ventilation to a building or facility.

Heating and Cooling Standards

Heating Temperatures	Cooling Temperatures	Unoccupied Temperatures
70-72° F	72-74° F	58-62° F

Lighting Standards

Recommended Light Levels	
Task Area	Foot-candles
Corridors/Stairways/Restrooms	10-20
Storage Rooms	10-50
Conference Rooms	50-55
General Offices	50-100
Drafting/Accounting	70
Areas with VDTs	75
Classrooms	50-55
Cafeterias	50
Gymnasiums	30-50

Honeywell uses a variety of in-house labor as well as subcontractors to install the energy conservation measures. We have on staff trained professionals in fire, security, energy management systems, all temperature control systems, and HVAC. However, according to the ESIP law, all trades will be publicly bid except for specific controls applications. Listed below is a sampling of some of the disciplines that would apply to the District:

Improvements	Honeywell	Subcontractor
Engineering Design/Analysis	X	
Technical Audit	X	
Construction Administration/Management	X	
On-Site Construction Supervision	X	
Installation of Energy Management System	X	X
Manufacturer of Energy Management Equipment	X	X
Installation of HVAC/Mechanical Equipment		X
Installation of Renewable Technology		X
Installation of Building Envelope		X
Energy Supply Management Analysis/Implementation	X	
Installation of Boilers		X
Maintenance of Energy Management Equipment	X	X
Manufacturer/Installation of Temperature Controls	X	X
Monitoring/Verification Guarantee	X	
Training of Owner Staff	X	
Financial Responsibility for Energy Guarantees	X	

Hazardous Waste Disposal or Recycling

Honeywell disposes of all PCB ballasts or mercury containing materials removed as part of the project per EPA guidelines. Honeywell will complete all of the required paperwork on behalf of the District. Honeywell will work with the School District to review your hazardous material reports, and will identify the areas where work will be completed so that the District can contract to have any necessary material abatement completed.

Honeywell can help schedule or coordinate waste removal, but does not contract for, or assume responsibility for, the abatement work. Honeywell also has the capabilities to assist the District in working with the EPA under compliance management issues. We also develop and manufacture automated systems to track and report a wide variety of environmental factors.

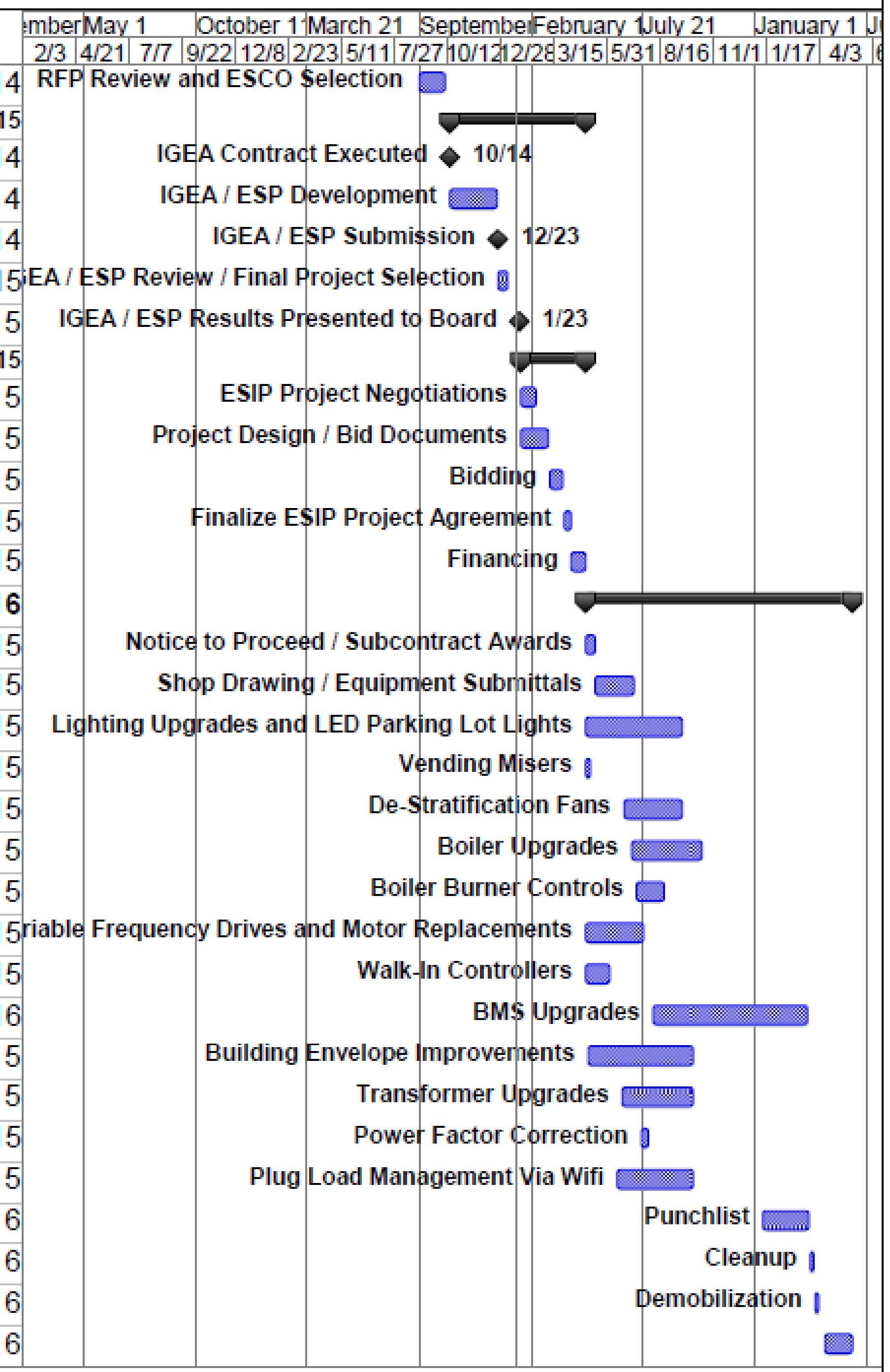
6. Implementation Schedule

Attached please find a sample schedule for construction and completion

This Page Intentionally Left Blank

Chatham School District
Honeywell Energy Project
Energy Savings Plan Schedule

ID	Task Name	Start	Finish
1	RFP Review and ESCO Selection	Mon 9/1/14	Tue 10/7/14
2	**IGEA**	**Tue 10/14/14**	**Wed 4/29/15**
3	IGEA Contract Executed	Tue 10/14/14	Tue 10/14/14
4	IGEA / ESP Development	Wed 10/15/14	Mon 12/22/14
5	IGEA / ESP Submission	Tue 12/23/14	Tue 12/23/14
6	IGEA / ESP Review / Final Project Selection	Wed 12/24/14	Tue 1/6/15
7	IGEA / ESP Results Presented to Board	Fri 1/23/15	Fri 1/23/15
8	**ESIP**	**Mon 1/26/15**	**Wed 4/29/15**
9	ESIP Project Negotiations	Mon 1/26/15	Mon 2/16/15
10	Project Design / Bid Documents	Mon 1/26/15	Fri 3/6/15
11	Bidding	Mon 3/9/15	Fri 3/27/15
12	Finalize ESIP Project Agreement	Mon 3/30/15	Wed 4/8/15
13	Financing	Thu 4/9/15	Wed 4/29/15
14	**Construction Period**	**Thu 4/30/15**	**Fri 5/20/16**
15	Notice to Proceed / Subcontract Awards	Thu 4/30/15	Wed 5/13/15
16	Shop Drawing / Equipment Submittals	Thu 5/14/15	Wed 7/8/15
17	Lighting Upgrades and LED Parking Lot Lights	Thu 4/30/15	Wed 9/16/15
18	Vending Misers	Thu 4/30/15	Wed 5/6/15
19	De-Stratification Fans	Thu 6/25/15	Wed 9/16/15
20	Boiler Upgrades	Mon 7/6/15	Thu 10/15/15
21	Boiler Burner Controls	Mon 7/13/15	Fri 8/21/15
22	Variable Frequency Drives and Motor Replacements	Thu 4/30/15	Wed 7/22/15
23	Walk-In Controllers	Thu 4/30/15	Wed 6/3/15
24	BMS Upgrades	Thu 8/6/15	Wed 3/16/16
25	Building Envelope Improvements	Mon 5/4/15	Fri 10/2/15
26	Transformer Upgrades	Mon 6/22/15	Fri 10/2/15
27	Power Factor Correction	Mon 7/20/15	Wed 7/29/15
28	Plug Load Management Via Wifi	Mon 6/15/15	Fri 10/2/15
29	Punchlist	Tue 1/12/16	Fri 3/18/16
30	Cleanup	Mon 3/21/16	Fri 3/25/16
31	Demobilization	Mon 3/28/16	Fri 4/1/16
32	Delivery and Acceptance	Mon 4/11/16	Fri 5/20/16



Page 1 Chatham ESP Schedule 10-07-2015-14

This Page Intentionally Left Blank

APPENDIX 1 INDEPENDENT ENERGY AUDITS

This Page Intentionally Left Blank

ENERGY AUDIT – FINAL REPORT

SCHOOL DISTRICT OF THE CHATHAMS
CHATHAM HIGH SCHOOL

255 LAFAYETTE AVENUE
CHATHAM, NJ 07928
ATTN: RALPH GOODWIN
SCHOOL BUSINESS ADMINISTRATOR BOARD SECRETARY

CEG PROJECT NO. 9C09078

CONCORD ENGINEERING GROUP

520 SOUTH BURNT MILL ROAD
VOORHEES, NJ 08043
TELEPHONE: (856) 427-0200
FACSIMILE: (856) 427-6529
WWW.CEG-INC.NET

CONTACT: MICHAEL FISCHETTE, PRESIDENT
EMAIL: mfischette@ceg-inc.net

Table of Contents

REPORT DISCLAIMER

The information contained within this report, including any attachment(s), is intended solely for use by the named addressee(s). If you are not the intended recipient, or a person designated as responsible for delivering such messages to the intended recipient, you are not authorized to disclose, copy, distribute or retain this report, in whole or in part, without written authorization from Concord Engineering Group, Inc., 520 S. Burnt Mill Road, Voorhees, NJ 08043.

This report may contain proprietary, confidential or privileged information. If you have received this report in error, please notify the sender immediately. Thank you for your anticipated cooperation.

I. EXECUTIVE SUMMARY

This report presents the findings of an energy audit conducted for:

Chatham High School
255 Lafayette Avenue
Chatham, NJ 07928

Facility Contact Person: John Cataldo
Municipal Contact Person: Ralph Goodwin

This audit was performed in connection with the New Jersey Clean Energy Local Government Energy Audit Program. These energy audits are conducted to promote the office of Clean Energy's mission, which is to use innovation and technology to solve energy and environmental problems in a way that improves the State's economy. This can be achieved through the wiser and more efficient use of energy.

The annual energy costs at this facility are as follows:

Electricity	$310,997
Natural Gas	$133,194
Total	$444,191

The potential annual energy cost savings for each energy conservation measure (ECM) and renewable energy measure (REM) are shown below in Table 1. Be aware that the ECM's are not additive because of the interrelation of some of the measures. This audit is consistent with an ASHRAE level 2 audit. The cost and savings for each measure is ± 20%. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

Table 1
Financial Summary Table

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Lighting Upgrade - General	$6,712	$10,498	0.6	3810.2%
ECM #2	Install Lighting Controls	$22,120	$4,699	4.7	218.6%
ECM #3	Install LED Exit Signs	$3,082	$3,471	0.9	2715.5%
ECM #4	T-5 Lighting System in Gym	$6,200	$1,022	6.1	312.1%
ECM #5	Boiler Replacement – High Efficiency Upgrade	$370,500	$6,181	59.9	-41.6%
ECM #6	Install NEMA Premium Efficient Pump Motor	$1,160	$123	9.4	112.1%
ECM #7	Indoor Air handling Unit Replacement	$72,100	$1,358	53.1	-62.3%
ECM #8	DDC System – High School	$1,014,650	$36,807	27.6	-45.6%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	Solar Energy System	$3,055,320	$202,420	15.1	65.6%

Notes: A. Cost takes into consideration applicable NJ Smart StartTM incentives.

The estimated demand and energy savings for each ECM and REM is shown below in Table 2. The information in this table corresponds to the ECM's and REM's in Table 1.

Table 2
Estimated Energy Savings Summary Table

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION			
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	Lighting Upgrade - General	28.1	62,693.5	-
ECM #2	Install Lighting Controls	-	28,307.0	-
ECM #3	Install LED Exit Signs	1.7	15,260.0	-
ECM #4	T-5 Lighting System in Gym	2.6	5,491.0	-
ECM #5	Boiler Replacement – High Efficiency Upgrade	-	-	5,848
ECM #6	Install NEMA Premium Efficient Pump Motor	0.2	722.9	-
ECM #7	Indoor Air handling Unit Replacement	2.1	8,181.0	-
ECM #8	DDC System – High School	-	70,450.0	17,330

RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	Solar Energy System	339.5	392286.0	-

Recommendation:

Concord Engineering Group (CEG) strongly recommends the implementation of all ECM's that provide a calculated simple payback at or under ten (10) years. The following Energy Conservation Measures are recommended for Chatham High School:

- **ECM #1:** Lighting Upgrade
- **ECM #2:** Install Lighting Controls
- **ECM #3:** Install LED Exit Signs
- **ECM #4:** Install T-5 Lighting in Gym
- **ECM#6:** Install NEMA Premium Efficient Pump Motor

Systems that have past their useful service life should be replaced such as the systems described in ECM#5, 7 and 8. Although these ECMs will not have a payback, they are systems that should be replaced and will save a substantial amount of energy as summarized in Table 2 on page 5.

CEG recommends the owner pursue the **REM#1** PV Solar Energy System. The system can have a simple payback of 15.1 years and reduce the annual power requirement (kWh/yr) from the power grid as much as 20.9%. Two financing options are discussed in the **Renewable / Distributed Energy Measures** section of the report.

In addition to the ECMs, there are maintenance and operational measures that can provide significant energy savings and provide immediate benefit. The ECMs listed above represent investments that can be made to the facility which are justified by the savings seen overtime. However, the maintenance items and small operational improvements below are typically achievable with on site staff or maintenance contractors and in turn have the potential to provide substantial operational savings compared to the costs associated. The following are recommendations which should be considered a priority in achieving an energy efficient building:

1. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.
2. Maintain all weather stripping on entrance doors.
3. Clean all light light fixtures to maximize light output.
4. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.
5. Confirm that outside air economizers on the rooftop units are functioning properly to take advantage of free cooling and avoid excess outside air during occupied periods.

Efficient HVAC equipment replacements are difficult to justify with the energy savings alone. The replacement of HVAC equipment such as the heating and ventilation units at Chatham High School is typically initiated when the equipment stops working, surpasses the life expectancy, or maintenance requirements grow beyond the ability to continue to support it. When replacing the equipment becomes necessary, the additional cost to install high efficiency systems becomes a great value for the investment.

Incentives provide financial motivation and much needed support for the implementation of energy conservation measures. Along with the NJ Smart Start program, the Pay for Performance Program incentives, sponsored by NJ Clean Energy Program, are suited favorably for this facility and its energy saving opportunities. It is expected through the implementation of multiple recommended ECMs, that this facility could reduce its overall energy consumption by more than 15%. The existing average operating demand above 200 KW and high energy consumption suggests the potential to qualify for the pay for performance program through the implementation of multiple ECMs. The incentive based on a 15% energy reduction for this facility would qualify for an additional $75,840 in the pay for performance program. This option is one to consider for a whole-building approach to energy reduction. CEG recommends the Owner review this option in more detail with a Pay for Performance Partner.

II. INTRODUCTION

The High School is a 253,663 square foot facility that includes classrooms, offices, media center, gymnasiums, cafeteria, auditorium, kitchen, auto shop and boiler rooms.

Electrical and natural gas utility information is collected and analyzed for one full year's energy use of the building. The utility information allows for analysis of the building's operational characteristics; calculate energy benchmarks for comparison to industry averages, estimated savings potential, and baseline usage/cost to monitor the effectiveness of implemented measures. A computer spreadsheet is used to calculate benchmarks and to graph utility information (see the utility profiles below).

The Energy Use Index (EUI) is established for the building. Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year (BTU/ft^2/yr), which is used to compare energy consumption to similar building types or to track consumption from year to year in the same building. The EUI is calculated by converting the annual consumption of all energy sources to BTU's and dividing by the area (gross square footage) of the building. Blueprints (where available) are utilized to verify the gross area of the facility. The EUI is a good indicator of the relative potential for energy savings. A low EUI indicates less potential for energy savings, while a high EUI indicates poor building performance therefore a high potential for energy savings.

Existing building architectural and engineering drawings (where available) are utilized for additional background information. The building envelope, lighting systems, HVAC equipment, and controls information gathered from building drawings allow for a more accurate and detailed review of the building. The information is compared to the energy usage profiles developed from utility data. Through the review of the architectural and engineering drawings a building profile can be defined that documents building age, type, usage, major energy consuming equipment or systems, etc.

The preliminary audit information is gathered in preparation for the site survey. The site survey provides critical information in deciphering where energy is spent and opportunities exist within a facility. The entire site is surveyed to inventory the following to gain an understanding of how each facility operates:

- Building envelope (roof, windows, etc.)
- Heating, ventilation, and air conditioning equipment (HVAC)
- Lighting systems and controls
- Facility-specific equipment

The building site visit is performed to survey all major building components and systems. The site visit includes detailed inspection of energy consuming components. Summary of building occupancy schedules, operating and maintenance practices, and energy management programs provided by the building manager are collected along with the system and components to determine a more accurate impact on energy consumption.

.

III. METHOD OF ANALYSIS

Post site visit work includes evaluation of the information gathered, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on HVAC, lighting and building envelope improvements. Data collected is processed using energy engineering calculations to anticipate energy usage for each of the proposed energy conservation measures (ECMs). The actual building's energy usage is entered directly from the utility bills provided by the owner. The anticipated energy usage is compared to the historical data to determine energy savings for the proposed ECMs.

It is pertinent to note, that the savings noted in this report are not additive. The savings for each recommendation is calculated as standalone energy conservation measures. Implementation of more than one ECM may in some cases affect the savings of each ECM. The savings may in some cases be relatively higher if an individual ECM is implemented in lieu of multiple recommended ECMs. For example implementing reduced operating schedules for inefficient lighting will result in a greater relative savings. Implementing reduced operating schedules for newly installed efficient lighting will result in a lower relative savings, because there is less energy to be saved. If multiple ECM's are recommended to be implemented, the combined savings is calculated and identified appropriately.

ECMs are determined by identifying the building's unique properties and deciphering the most beneficial energy saving measures available that meet the specific needs of the facility. The building construction type, function, operational schedule, existing conditions, and foreseen future plans are critical in the evaluation and final recommendations. Energy savings are calculated base on industry standard methods and engineering estimations. Energy consumption is calculated based on manufacturer's cataloged information when new equipment is proposed.

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers. The NJ SmartStart Building® program incentives savings (where applicable) are included for the appropriate ECM's and subtracted from the installed cost. Maintenance savings are calculated where applicable and added to the energy savings for each ECM. The costs and savings are applied and a simple payback and simple return on investment (ROI) is calculated. The simple payback is based on the years that it takes for the savings to pay back the net installation cost (Net Installation divided by Net Savings.) A simple return on investment is calculated as the percentage of the net installation cost that is saved in one year (Net Savings divided by Net Installation.)

A simple life-time calculation is shown for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The energy savings is extrapolated throughout the life-time of the ECM and the total energy savings is calculated as the total life-time savings.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

The energy usage for the facility has been tabulated and plotted in graph form as depicted within this section. Each energy source has been identified and monthly consumption and cost noted per the information provided by the Owner.

There are two electric services for the facility. The primary service is located at the original boiler room. The secondary service is located at the boiler room in the 2001 addition. The electric usage profile represents the combined total actual electrical usage for the facility. Jersey Central Power and Light (JCP&L) provides electricity to the facility under their General Service Primary and Secondary Three-Phase rate structures. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile shows the actual natural gas energy usage for the facility. Public Service Electric and Gas (PSE&G) provides natural gas to the facility under the Basic General Supply Service- Large Volume Gas (LVG) rate structure. Hess Corporation is a third party supplier. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

The overall cost for utilities is calculated by dividing the total cost by the total usage. Based on the utility history provide, the average cost for utilities at this facility is as follows:

Description	Average
Electricity	16.6¢ / kWh
Natural Gas	$1.449 / Therm

Table 3
Electricity Billing Data

Electric Usage Summary			
Utility Provider: JCP&L, General Service Secondary 3 phase			
Meter: G28742750		Customer Number: 0801577897 0000554655	
Meter: G21248931		Customer Number: 0801577897 0005941011	
MONTH OF USE	**CONSUMPTION**	**DEMAND**	**TOTAL BILL**
Aug-08	202,480	657.6	$36,431
Sep-08	147,480	753.6	$24,993
Oct-08	159,880	520.7	$25,285
Nov-08	147,160	470.4	$23,855
Dec-08	145,120	450.1	$23,978
Jan-09	169,720	469.0	$27,746
Feb-09	154,240	470.5	$25,129
Mar-09	134,880	470.4	$22,173
Apr-09	174,680	600.5	$27,745
May-09	148,440	660.7	$24,861
Jun-09	125,040	747.5	$22,293
Jul-09	163,760	520.9	$26,508
Totals	**1,872,880**	**753.6 Max**	**$310,997**

AVERAGE DEMAND 566.0 KW average
AVERAGE RATE $0.166 $/kWh

Figure 1
Electricity Usage Profile

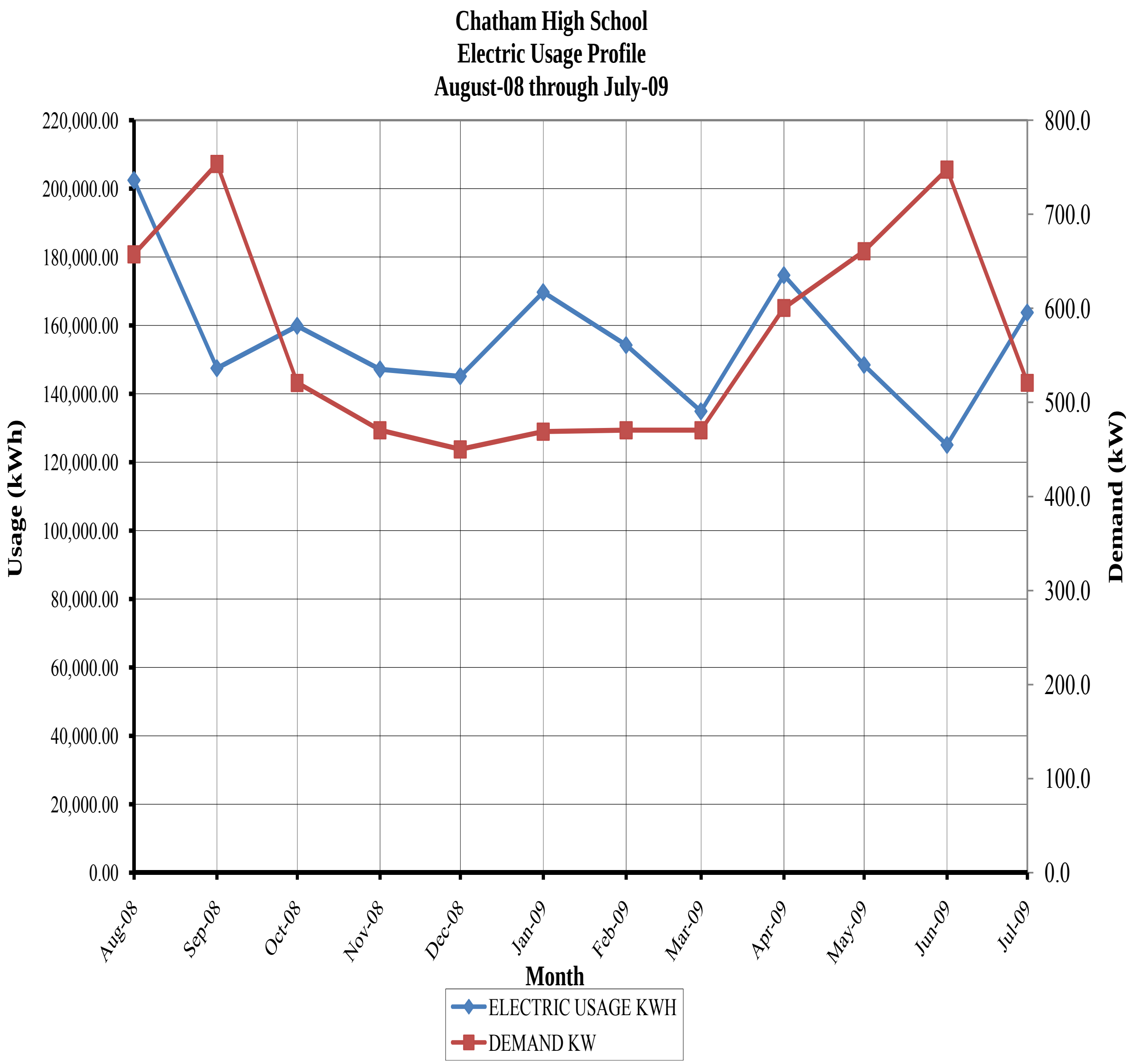


Table 4
Natural Gas Billing Data

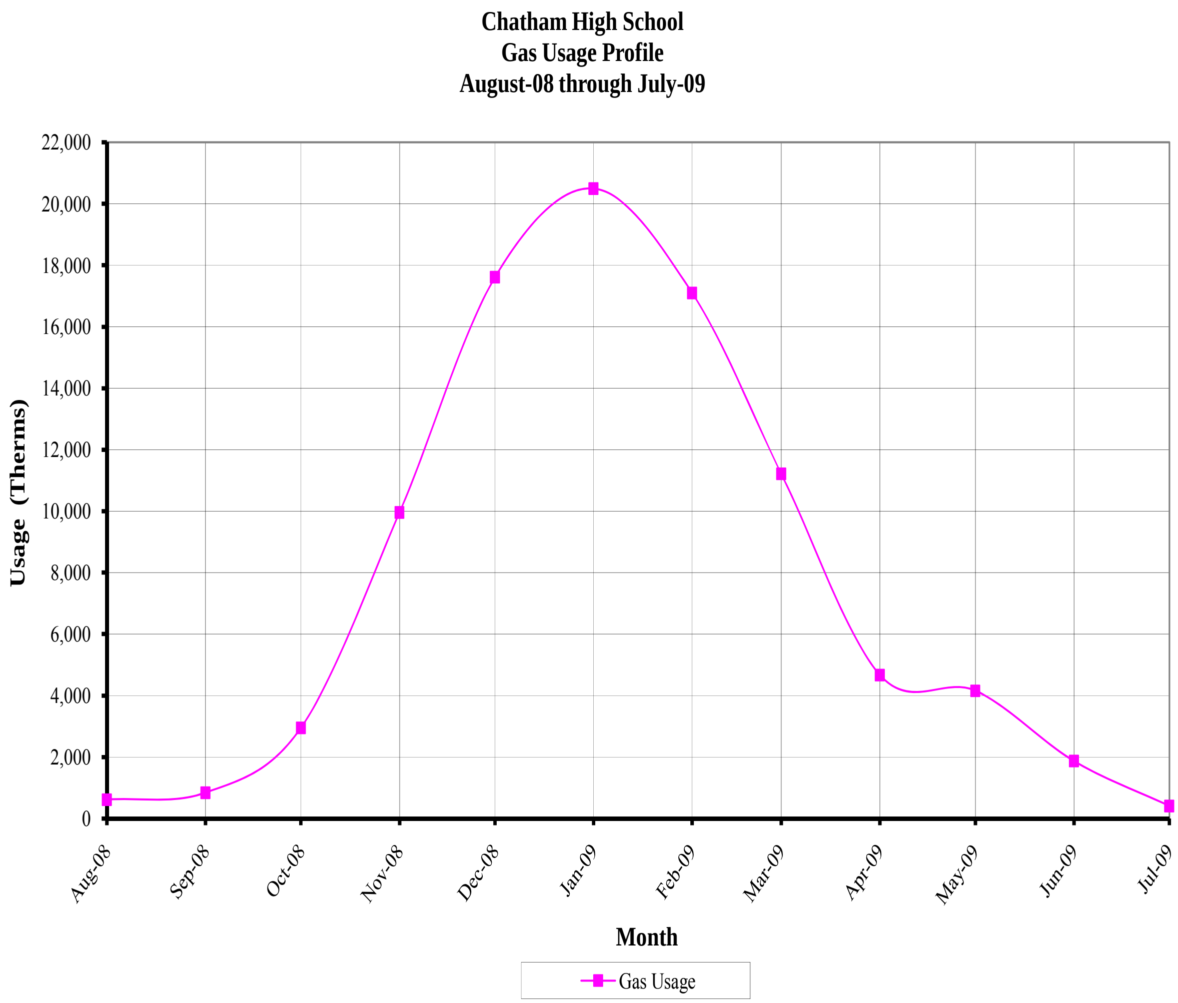
Natural Gas Usage Summary

Utility Provider: PSE&G Rate
LVG Meter: 2917466 Combined (2209062, 2352818)
PoD ID: PG000008242842604649 PG000008242839204541
Third Party Utility Provider: HESS
HESS Meters: 394872/404581, 394872/394901, 394872/446430

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
Aug-08	613.14	$1,031.81
Sep-08	841.01	$1,307.65
Oct-08	2,949.30	$4,966.25
Nov-08	9,963.09	$14,871.76
Dec-08	17,618.38	$26,657.66
Jan-09	20,502.47	$30,929.74
Feb-09	17,100.95	$26,244.94
Mar-09	11,221.82	$14,714.38
Apr-09	4,667.44	$6,256.02
May-09	4,157.48	$5,586.79
Jun-09	1,868.46	$391.06
Jul-09	406.69	$235.96
TOTALS	**91,910.22**	**$133,194.02**

AVERAGE RATE: $1.449 $/THERM

Figure 2
Natural Gas Usage Profile



B. Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's annual energy utilization per square foot of building. This calculation is completed by converting all utility usage consumed by a building for one year, to British Thermal Units (BTU) and dividing this number by the building square footage. EUI is a good measure of a building's energy use and is utilized regularly for comparison of energy performance for similar building types. The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of Energy maintains a Benchmarking Building Energy Performance Program. The ORNL website determines how a building's energy use compares with similar facilities throughout the U.S. and in a specific region or state.

Source use differs from site usage when comparing a building's energy consumption with the national average. Site energy use is the energy consumed by the building at the building site only. Source energy use includes the site energy use as well as all of the losses to create and distribute the energy to the building. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses, which allows for a complete assessment of energy efficiency in a building. The type of utility purchased has a substantial impact on the source energy use of a building. The EPA has determined that source energy is the most comparable unit for evaluation purposes and overall global impact. Both the site and source EUI ratings for the building are provided to understand and compare the differences in energy use.

The site and source EUI for this facility is calculated as follows. (See Table 5 for details):

$$Building\ Site\ EUI = \frac{(Electric\ Usage\ in\ kBtu + Gas\ Usage\ in\ kBtu)}{Building\ Square\ Footage}$$

$$Building\ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ x\ SS\ Ratio + Gas\ Usage\ in\ kBtu\ x\ SS\ Ratio)}{Building\ Square\ Footage}$$

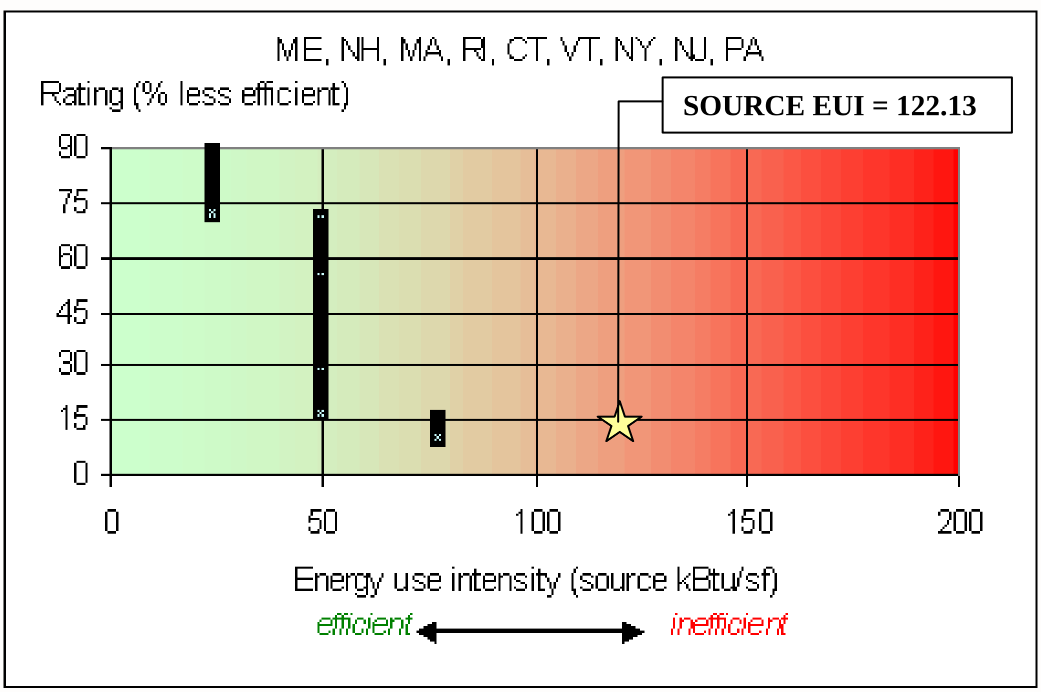
Table 5
Chatham High School EUI Calculations

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE RATIO	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu		kBtu
ELECTRIC	1,872,880.0			6,394,012	3.340	21,356,001
NATURAL GAS		91,910.2		9,191,022	1.047	9,623,000
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				15,585,035		30,979,001

*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.

BUILDING AREA	253,663	SQUARE FEET
BUILDING SITE EUI	*61.44*	kBtu/SF/YR
BUILDING SOURCE EUI	*122.13*	kBtu/SF/YR

Figure 3
Source Energy Use Intensity Distributions: High Schools



C. EPA Energy Benchmarking System

The United States Environmental Protection Agency (EPA) in an effort to promote energy management has created a system for benchmarking energy use amongst various end users. The benchmarking tool utilized for this analysis is entitled Portfolio Manager. The Portfolio Manager tool allows tracking and assessment of energy consumption via the template forms located on the ENERGY STAR website (www.energystar.gov). The importance of benchmarking for local government municipalities is becoming more important as utility costs continue to increase and emphasis is being placed on carbon reduction, greenhouse gas emissions and other environmental impacts.

Based on information gathered from the ENERGY STAR website, Government agencies spend more than $10 billion a year on energy to provide public services and meet constituent needs. Furthermore, energy use in commercial buildings and industrial facilities is responsible for more than 50 percent of U.S. carbon dioxide emissions. It is vital that local government municipalities assess facility energy usage, benchmark energy usage utilizing Portfolio Manager, set priorities and goals to lessen energy usage and move forward with priorities and goals.

In accordance with the Local Government Energy Audit Program, CEG has created an ENERGY STAR account for the municipality to access and monitoring the facility's yearly energy usage as it compares to facilities of similar type. The following is the user name and password for this account:

https://www.energystar.gov/istar/pmpam/index.cfm?fuseaction=login.login

Username: chathamsd
Password: lgeaceg2009

Security Question: What city were you born in?
Security Answer: "chatham"

The utility bills and other information gathered during the energy audit process are entered into the Portfolio Manager. The following is a summary of the results for the facility:

Table 6
ENERGY STAR Performance Rating

FACILITY DESCRIPTION	ENERGY PERFORMANCE RATING	NATIONAL AVERAGE
Chatham High School	62	50

Refer to the Statement of Energy Performance appendix for the detailed energy summary.

V. FACILITY DESCRIPTION

The Chatham High School is a two-story, block with brick faced building. The first floor of the facility houses the boiler rooms, kitchen, cafeteria, offices, classrooms, gymnasium, locker rooms, restrooms, library, auto shop, auditorium, band and choral rooms. The second floor areas consist of class rooms and the upper areas of the auditorium. The original building was approximately 120,440 square feet and was built in 1962. There were additions in 1973 that added approximately 60,081 square feet and an addition in 2001 added approximately 73,142 square feet bringing the building total to 253,663 square feet. The building operates for 40 hours during a typical week. There are different roof types in the building. There is cement fiber roof deck on steel joist, concrete plank with rigid insulation on steel joist, concrete on metal deck on steel joist as depicted in the 1973 addition architectural drawings. The 2001 additions have rigid insulation on steel deck on steel beams. There was a roofing project in progress during our survey. The windows in the additions are double pane with aluminum frame. The windows in the original 1962 building are single pane acrylic with aluminum frame and insulated opaque panels.

Heating System

Heat for this facility is provided by two (2) boiler plants and thirty (30) gas fired roof top air handling units. The boiler plant in the original building consists of two (2) Cleaver Brooks model CB801-150, 6280 MBH Natural Gas input each, dual fuel burner (natural gas / oil) water boilers, are 82% efficient and were manufactured in July-1961 and are in poor condition. These boilers provide heating hot water to unit heaters, unit ventilators, fin tube radiation, heat & ventilation units and AC units 2 through 6. There are two (2) 20 hp system pumps piped in parallel located in the original boiler room and operating in a lead/lag configuration. The pumps are eight years old and in good condition. AC unit 1 has been replaced by several packaged roof top units with natural gas furnaces. The packaged roof top units with natural gas heat have inputs ranging from 40,000 BTUH up to 469,000 BTUH. The packaged roof top units range from good to poor condition.

The 2001 addition added a boiler plant that serves the 2001 addition. The boiler is a Buderus model G615/13 cast iron boiler, 3753 maximum MBH natural gas input and is 82.9% efficient and is in good to fair condition. There are two (2) 5 hp in-line system pumps piped in parallel and operating in a lead/lag configuration. The pumps are eight (8) years old and are in fair condition.

Domestic Hot Water

A Lochinvar model CWN500PM, natural gas, domestic water boiler provides hot water for the facility. This unit has an input of 500,000 Btu/h and a recovery rate of 498 gallons per hour. The boiler is 5 years old and is in good condition.

Cooling System

The facility is cooled via twenty-six (26) split system air conditioning systems, eight (8) ductless split system air conditioning systems, fifteen (15) window air conditioners and thirty (30) roof top units. All cooling units are air cooled, direct expansion cooling. These units vary in sizes ranging from 0.75 nominal tons to 60 nominal tons and range from good to poor condition.

Controls System

There are Johnson Controls pneumatic controls serving the original boiler room and original school building. A 2 year old Quincy air compressor with (2) 3hp motors provides air to the controls system. There are five control zones. Zone 1 is the cafeteria, zone 2 is Gym A and Gym B, zone 3 is rooms 55-79, 136, 137 and 138, zone 4 is room 82-135, 139 and zone 5 is rooms 140-159. The system operates on a hot water reset schedule as follows: 0°F Outside air temperature (OA): 200°F Leaving Water Temperature (LWT), 15°F Outside air temperature (OA): 175°F Leaving Water Temperature (LWT), 30°F Outside air temperature (OA): 150°F Leaving Water Temperature (LWT), 45°F Outside air temperature (OA): 125°F Leaving Water Temperature (LWT), 60°F Outside air temperature (OA): 100°F Leaving Water Temperature (LWT). The system appears to be operational but is antiquated.

Exhaust System

There are many roof top centrifugal fans exhausting the bathroom, kitchen, gym and locker room areas. They are fractional horse power fan motors and range from good to poor condition. The two (2) largest exhaust fans noted are Penn Ventilator Fumex upblast centrifugal fans with 1 horsepower motors. These fans are exhausting air via the kitchen hood.

Lighting

The building is lit by varying types and sizes of light bulb types. The types used include the use of T-12 fluorescent, T-8 fluorescent, incandescent, mercury start and compact fluorescent. Most of the wattages for the fluorescent light fixtures are 32 Watts and wattage for the incandescent lamps range from 60 watts to 200 watts. There are two types of exit signs. The older units have (2) 15 watt incandescent lamps whereas the newer units use LED technology. Approximately 1/3 of the exit signs are the newer LED type.

VI. MAJOR EQUIPMENT LIST

The equipment list is considered major energy consuming equipment and through energy conservation measures could yield substantial energy savings. The list shows the major equipment in the facility and all pertinent information utilized in energy savings calculations. An approximate age was assigned to the equipment in some cases if a manufactures date was not shown on the equipment's nameplate. The ASHRAE service life for the equipment along with the remaining useful life is also shown in the Appendix.

Refer to the **Major Equipment List Appendix** for this facility.

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade - General

Description: General

The lighting in the High School is primarily made up of fluorescent fixtures with T-12 lamps and magnetic ballasts, T-8 lamps with electronic ballasts. There are a few storage rooms, original boiler room and closets with incandescent lighting and compact fluorescent fixtures.

This ECM includes replacement of the existing fixtures containing T12 lamps and magnetic ballasts with fixtures containing T8 lamps and electronic ballasts. The new energy efficient, T8 fixtures will provide adequate lighting and will save the owner on electrical costs due to the better performance of the lamp and ballasts. This ECM will also provide maintenance savings through the reduced number of lamps replaced per year. The expected lamp life of a T8 lamp is approximately 30,000 burn-hours, in comparison to the existing T12 lamps which is approximately 20,000 burn-hours. The facility will need 33% less lamps replaced per year.

This ECM also includes replacement of all incandescent lamps to compact fluorescent lamps. The energy usage of an incandescent compared to a compact fluorescent approximately 3 to 4 times greater. In addition to the energy savings, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours.

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix – ECM#1** outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, the replacement of a T-12 fixture to a T-5 or T-8 fixture warrants the following incentive: T-5 or T-8 (1-2 lamp) = $25 per fixture; T-5 or T-8 (3-4 lamp) = $30 per fixture.

$$\text{Smart Start® } Incentive = (\#\ of\ 1-2\ lamp\ fixtures \times \$\,25) + (\#\ of\ 3-4\ lamp\ fixtures \times \$\,30)$$
$$\text{Smart Start® } Incentive = (7 \times \$\,25) = \underline{\$}175$$

Replacement and Maintenance Savings are calculated as follows:

$$Savings = (reduction\ in\ lamps\ replaced\ per\ year) \times (repacment\ \$\ per\ lamp + Labor\ \$\ per\ lamp)$$
$$Savings = (13\ lamps\ per\ year) \times (\$2.00 + \$5.00) = \$91$$

From the Smart Start Incentive appendix, there is no incentive for replacing incandescent lamps with compact fluorescent lamps. The incentive is only available if the entire light fixture is replaced. In most cases, the existing fixtures can be re-lamped by the facility's staff to obtain the energy savings without the expense of a new fixture and the involvement of an electrician to install a new fixture.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$6,887
NJ Smart Start Equipment Incentive ($):	$175
Net Installation Cost ($):	$6,712
Maintenance Savings ($/Yr):	$91
Energy Savings ($/Yr):	$10,407
Total Yearly Savings ($/Yr):	$10,498
Estimated ECM Lifetime (Yr):	25
Simple Payback	0.6
Simple Lifetime ROI	3810.2%
Simple Lifetime Maintenance Savings	$2,275
Simple Lifetime Savings	$262,450
Internal Rate of Return (IRR)	156%
Net Present Value (NPV)	$176,091.22

* ECM#1 Calculations DO NOT include lighting control changes implemented in ECM#2. If ECM#1 and #2 are implemented together the savings will be relatively lower than shown above.

ECM #2: Install Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. There has been a belief that it is better to keep the lights on rather than to continuously switch them on and off. This on/off dilemma was studied, and it was determined that the best option is to turn the lights off whenever possible. Although this practice reduces the lamp life, the energy savings far outweigh the lamp replacement costs.

Lighting controls are available in many forms. Lighting controls can be as simplistic as an additional switch. Timeclocks are often used which allow the user to set an on/off schedule. Timeclocks range from a dial clock with on/off indicators to a small box the size of a thermostat with user programs for on/off schedule in digital format. Occupancy sensors detect motion and will switch the lights on when the room is occupied. They can either be mounted in place of the current wall switch, or they can be mounted on the ceiling to cover large areas. Lastly, photocells are a lighting control that sense light levels and will turn the lights off when there is adequate daylight. These are mostly used outside, but they are becoming much more popular in energy-efficient office designs as well.

To determine an estimated savings for lighting controls, we used ASHRAE 90.1-2004 (NJ Energy Code). Appendix G states that occupancy sensors have a 10% power adjustment factor for daytime occupancies for buildings over 5,000 SF. CEG recommends the installation of dual technology occupancy sensors in all private offices, conference rooms, restrooms, lunch rooms, storage rooms, lounges, file rooms, etc.

Energy Savings Calculations:

From **Investment Grade Lighting Audit Appendix – ECM#2** of this report, we calculated the lighting power density (Watts/ft^2) of the existing High School to be 220,840 Watts / 253,663 SF = 0.87 Watts/SF. The hallways of the building is a 24/7 facility while the majority of the building is only occupied 40 hours a week and other areas are only a few hours a day. Ten percent of this value is the resultant energy savings due to installation of occupancy sensors:

High School:

10% x 0.87 Watts/SF x 156,426 SF x 2,080 hrs/yr. x 1kW/1000W = 28,307 kWh

Savings = 28,307 kWh x $0.166Wh = $4,699 / yr

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is $160/unit including material and labor. The SmartStart Buildings® incentive is $20 per control which equates to an installed cost of $140/unit. Total number of rooms to be retrofitted is 158. Total cost to install sensors is $140/ceiling unit x 158 units = $22,120.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$25,280
NJ Smart Start Equipment Incentive ($):	$3,160
Net Installation Cost ($):	$22,120
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$4,699
Total Yearly Savings ($/Yr):	$4,699
Estimated ECM Lifetime (Yr):	15
Simple Payback	4.7
Simple Lifetime ROI	218.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$70,485
Internal Rate of Return (IRR)	20%
Net Present Value (NPV)	$33,976.36

ECM #3: Install LED Exit Signs

Description:

LED is an acronym for light-emitting-diode. LED's are small light sources that are readily associated with electronic equipment. LED exit signs have been manufactured in a variety of shapes and sizes. There are also retrofit kits that allow for simply modification of existing exit signs to accommodate LED technology. The benefits of LED technology are substantial. LED exit signs will last for 20-30 years without maintenance. This results in tremendous maintenance savings considering that incandescent or fluorescent lamps need to be replaced at a rate of 1-5 times per year. Lamp costs ($2-$7 each) and labor costs ($4-$10 per lamp) add up rapidly. Additionally, LED exit lights only uses 4 Watts. In comparison, conventional exit signs use 10-40 Watts. It is recommended that samples of the products be installed to confirm that they are compatible with the existing electrical system.

This EM replaces all exit signs with incandescent lamps with new exit signs containing LED technology.

Energy Savings Calculations:

A detailed Investment Grade Lighting Audit can be found in **Investment Grade Lighting Audit Appendix – ECM#3** that outlines the proposed retrofits, costs, savings, and payback periods.

(30 watts-4 watts) x 1 kW/1000 watts x 8760 hrs/yr x 67 fixtures = 15,259.92 kWh/yr. saved

15,259.92 kWh/yr x $0.166/kWh = $2,533 / yr. saved

Maintenance savings = 67 fixtures x 2 bulbs/fixture x ($3/bulb + $4/bulb installation) = $938/yr

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, $20/LED Exit sign (≤75kW facility connected load) and $10/LED Exit sign (≥75kW facility connected load).

67 LED Exit signs x $10/ LED Exit sign = $670

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$3,752
NJ Smart Start Equipment Incentive ($):	$670
Net Installation Cost ($):	$3,082
Maintenance Savings ($/Yr):	$938
Energy Savings ($/Yr):	$2,533
Total Yearly Savings ($/Yr):	$3,471
Estimated ECM Lifetime (Yr):	25
Simple Payback	0.9
Simple Lifetime ROI	2715.5%
Simple Lifetime Maintenance Savings	$23,450
Simple Lifetime Savings	$86,775
Internal Rate of Return (IRR)	113%
Net Present Value (NPV)	$57,359.04

ECM #4: Install T-5 Lighting System in Gym

Description:

The Gym is currently lit via twenty (24) HID, 250 W Metal Halide fixtures that are mounted approximately 20'-0" above the finished floor. The lighting system is antiquated and the space would be better served with a more efficient, fluorescent lighting system. Studies have shown that metal halide lighting systems have a steep lumen depreciation rate (rate at which light is produced from fixture) which equates to approximately a 26% to 35% reduction in lighting output at 40% of the rated lamp life. In addition, the new fluorescent system will provide a better quality of light and save the Owner many dollars on replacement of the highly expensive metal halide lamps.

CEG recommends upgrading the lighting within the Gym to an energy-efficient T-5 lighting system that includes new lighting fixtures with high efficiency, electronic ballasts and T-5 high output (HO) lamps. The T-5 HO lamps are rated for 20,000 hours versus the 10,000 hours for the 250W Metal Halide lamps so there would be a savings in replacement cost and labor. In addition to the standard lighting features of the T-5 fixtures; a day-lighting option could be selected for the outside rows of light to take advantage of the natural daylight that provides light to the room during the day via the clerestory.

This measure replaces all the HID, 250 W Metal Halide fixtures in the Gym with a well-designed T-5 lighting system. Approximately twenty (24), 3-lamp T5HO high bay fixtures with reflectors and high-efficiency, electronic ballasts will be required in order to meet the mandated 50 foot-candle average within the Gym.

Energy Savings Calculations:

A detailed Investment Grade Lighting Audit can be found in **Investment Grade Lighting Audit Appendix – ECM#4** that outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, the replacement of a 250 W HID fixture to a T-5 or T-8 fixture warrants the following incentive: $50 per fixture.

$$\text{Smart Start® } Incentive = (\#\ of\ \ fixtures \times\ \$50) = (24 \times \$50) = \underline{\$1{,}200}$$

Maintenance savings are calculated based on the facility operational hours as indicated by the Owner. For the Gym, the estimated operational hours are 2,080 hours per year. Based on the lamp life comparison, there will be two (5) complete lamp replacements required for the metal halide system at the time when one (2) complete lamp replacement would be required for the fluorescent lighting system. Based on industry pricing, the lamp cost for a 250W metal halide lamp is approximately ±$25 per lamp and a T-5 54HO fluorescent lamp is approximately ±$5 per lamp. Therefore, the maintenance savings are calculated as follows:

$$Ma\text{int}eance\ Savings = (\#\ of\ \ MH\ \ lamps \times\ \ \$25\ \ per\ lamp) - (\#\ of\ \ T5HO\ lamps \times \$5\ \ per\ lamp)$$

$$Maint\,eance\ Savings = (120\ lamps \times\ \$25\ per\ lamp) - (48\ lamps \times \$5\ per\ lamp) = \underline{\$2{,}760}$$

= $2,760 / 25 years = $110/year average maintenance savings

It is pertinent to note, that installation labor was not included in the maintenance savings.

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$7,200
NJ Smart Start Equipment Incentive ($):	$1,000
Net Installation Cost ($):	$6,200
Maintenance Savings ($/Yr):	$110
Energy Savings ($/Yr):	$912
Total Yearly Savings ($/Yr):	$1,022
Estimated ECM Lifetime (Yr):	25
Simple Payback	6.1
Simple Lifetime ROI	312.1%
Simple Lifetime Maintenance Savings	$2,750
Simple Lifetime Savings	$25,550
Internal Rate of Return (IRR)	16%
Net Present Value (NPV)	$11,596.24

ECM #5: Boiler Replacement – High Efficiency Upgrade

Description:

Heating is provided to the facility by two heating plants. The original heating plant, built in 1962 is outdated and can be more efficient. The newer heating plant, built in 2001 is adequately efficient and should remain in service.

In regards to the original plant, there are two (2) Clever Brooks model CB801-150, 6280 MBH Natural Gas input each, dual fuel burner (natural gas / oil) water boilers, which have a combustion efficiency of 82% when new. These boilers are 24 years past its ASHRAE useful service life.

This energy conservation measure will replace the gas fired boilers serving the original facility. Calculation is based on the following equipment: Aerco, Benchmark BMK-3.0LN-4 condensing boiler or equivalent. The existing units will be replaced with high energy efficient units with capacities typical of the existing units.

Energy Savings Calculations:

<u>Existing 6280 MBh Gas Fired Boiler:</u>

Rated Capacity = 12,560 MBh Input, 10,042 MBh Output (Natural Gas)

Combustion Efficiency = 82%
Age & Radiation Losses = 5%
Thermal Efficiency = 78%

<u>Replacement Gas Fired Boiler:</u>

High-Efficiency Gas Fired Boiler

Rated Capacity = 12,000 MBh Input, 11,124 MBh Output (Natural Gas)

Combustion Efficiency = 87.5%
Radiation Losses = 0.5%
Thermal Efficiency = 87%

Natural Gas Equipment List - Estimated Annual Usage per unit

Concord Engineering Group

Chatham High School

Manufacturer	Qty.	Model #	Serial #	Input (MBh)	% of Total Input	Estimated Annual Therms
Cleaver Brooks	**1**	**CB801-150**	**L-25716**	**6280**	**31.81%**	**20,617.62**
Cleaver Brooks	**1**	**CB801-150**	**L-25715**	**6280**	**31.81%**	**20,617.62**
Buderus	1	G615-13	1529.9C	3753	19.01%	12,321.32
Carrier Weathermaster	1	48HJE004-M-641HE	4201G23115	72	0.36%	236.38
Carrier Weathermaster	1	48HJD005---641HE	4001G23503	72	0.36%	236.38
Nesbitt	1	RSA35053N05CLM0BDG00DD1201	N0202008	469	2.38%	1,539.76
Carrier	7	48GX-024040301	4201G11258	40	0.20%	131.32
York - LUX Air	1	DB HB-T072AA	NCHM043966	72	0.36%	236.38
York - LUX Air	1	DD HB - T090AA	(S)NDHM055881	90	0.46%	295.48
Carrier Weathermaster Series	1	48HJD007---641HE	4001G23508	72	0.36%	236.38
Nesbitt	1	RSA25053N05GMM08DG00DD1201	N0202007	469	2.38%	1,539.76
Carrier Weathermaster Series	1	48HJF007---641HE	4001G23512	150	0.76%	492.46
Carrier	1	48HJF007---641HE	4001G23513	150	0.76%	492.46
Carrier Weathermaster Series	1	48HJF007---641HE	4001G23511	150	0.76%	492.46
Carrier Weathermaster Series	1	48HJE004-M-541HE	4201G23106	72	0.36%	236.38
Carrier	1	48HJD005-M-541HE	4201G23089	72	0.36%	236.38
Carrier	1	48HJD006---541HE	4301G22096	72	0.36%	236.38
Carrier	1	48HJE004---641HE	4001G23480	72	0.36%	236.38
Carrier	1	48GX-024040301--	4201611256	40	0.20%	131.32
Carrier	1	48HJF007---641HE	4001G23516	150	0.76%	492.46
Carrier	1	48HJF007---641HE	4001G23514	150	0.76%	492.46
Carrier	1	48HJF007---641HE	4001G23515	150	0.76%	492.46
Carrier	1	48HJD006---541HE	4301G22097	72	0.36%	236.38
Carrier	1	48HJD006---541HE	4001G23543	72	0.36%	236.38
Lochanvar	1	CWN500PM	L04H00171813	500	2.53%	1,641.53
State	1	Sandblaster SBF100199NET	G02415536	199.99	1.01%	656.58
			Total Input MBH	**19,741**	**1.00**	**64,810.85**
			Total Input Therms	197.4		
			Total Gas Consumption Therms / yr.	64810.85		

Operating Data:

Heating Season Fuel Consumption = 2 x 20,617.62 = 41,235 Therms/yr

$$\text{Heating Energy Savings} = \text{Fuel Consumption} \times (\text{New Boiler Efficiency} - \text{Old Boiler Efficiency})$$

Heating Energy Savings = 41,235 Therms x ((87% - 78%) / (87%)) = 4,266 Therms

Total Heating Cost savings

Heating Energy Cost Savings = Annual Energy Savings x $/Therm

Heating Energy Cost Savings = (4,266 Therms) x $1.449/Therm = $6,181/ yr.

Installed cost of (4) four new BMK3.0 LN 460/4, IRI 3000MBH input gas fired boilers with one (1) BMS II sequencing panel, sensor kit and installation is $391,500.

Equipment Incentives:

Heating Smart Start Equipment Incentive = ($1.75/MBh) = (12,000 MBh) x $1.75 = $21,000

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$391,500
NJ Smart Start Equipment Incentive ($):	$21,000
Net Installation Cost ($):	$370,500
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$6,181
Total Yearly Savings ($/Yr):	$6,181
Estimated ECM Lifetime (Yr):	35
Simple Payback	59.9
Simple Lifetime ROI	-41.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$216,335
Internal Rate of Return (IRR)	-3%
Net Present Value (NPV)	($237,687.49)

ECM #6: Install NEMA Premium Efficient Pump Motor

Description:

Replacing the old system booster pump motor with new efficient motor is a simple change that can provide substantial savings.

Existing electric motors equal to or greater than one horsepower ranged from 78 to 93% efficient. The improved efficiency of the NEMA premium efficient motors is primarily due to better designs with use of better materials to reduce losses. Surprisingly, the electricity used to power a motor represents 95 % of its total lifetime operating cost. Because many motors operate 40-80 hours per week, even small increases in efficiency can yield substantial energy and dollar savings.

This energy conservation measure would replace all motors equal to or greater than 1 HP with NEMA Premium® Efficient Motors. NEMA Premium® is the most efficient motor designation in the marketplace today. Using MotorMaster+, Version 4, the energy & cost savings were calculated for the fan/pump motors in this facility that are greater than or equal to 1 HP.

Energy Savings Calculations:

Existing: A 2 HP system circulation pump Motor with the following characteristics:
Existing Motor Efficiency = 78%
Annual Hours of Operations = 4500 (Average)
1 HP = 0.746 Watt
Load Factor = 75%
Cost of electricity = $0.166 / kWh

Existing 2HP Motor Operating Cost =
{0.746 Watt/HP x Motor HP x Load Factor x Hours of Operation x Cost of Electricity] ÷ Motor Efficiency
= [0.746 x 2 x 0.75 x 4,500 x 0.166] ÷ 0.78 = $1072 / Year

New NEMA Premium Motor Efficiency = 88%

New NEMA Premium Efficiency Motor Operating Cost =
{0.746 x 2 x 0.75 x 4,500 x 0.166} ÷ 0.88 = $949 / Year

Savings = $1072 - $949 = $123 / Year

Installed Cost of a 2 HP NEMA Premium® Efficiency Motor = $1,280 minus the SmartStart Building® incentive of 2hp x $60/hp is $1,160.

Simple Payback = $1,160 / $123 = 9.4 Years

kWh saved = $120 / $0.166/kWh = 722.9 kWh
kW saved = 722.9 kWh / 4,500 hrs./yr. =0.16 kW

The following table outlines the motor replacement plan for this facility:

MOTOR REPLACEMENT PLAN

MOTOR HP	QTY	ENCLOSURE TYPE	NUMBER OF POLES	INSTALLED COST **	TOTAL COST	TOTAL SAVINGS	SIMPLE PAYBACK	SIMPLE RETURN ON INVESTMENT
2	1	TEFC	4-Pole	$1,280	$1,160	$123	9.4	10.6 %
				Totals:	*$3,587*	*$617*	*5.81*	*17.2 %*

**** Net Cost after the SmartStart Buildings® incentive is applied.**

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,280
NJ Smart Start Equipment Incentive ($):	$120
Net Installation Cost ($):	$1,160
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$123
Total Yearly Savings ($/Yr):	$123
Estimated ECM Lifetime (Yr):	20
Simple Payback	9.4
Simple Lifetime ROI	112.1%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$2,460
Internal Rate of Return (IRR)	9%
Net Present Value (NPV)	$669.93

ECM #7: Indoor Air handling Unit Replacement

Description:

Three (3) indoor air handling units with hot water heating coils have surpassed there expected service life of fifteen (15) years as outlined in Chapter 36 of the 2007 ASHRAE Applications Handbook. These units appear to be 1975 vintage, and are excellent candidates for replacement. Due to escalating owning and maintenance costs, these units should be replaced. Each of these units contains a hot water heating section and savings can we yielded from year round operation. The units range from 2320 CFM (cubic feet per minute) to 13,000 cfm capacity.

This energy conservation measure would replace air handling units with fan motors equal to or greater than 1 HP with new air handling units having NEMA Premium® Efficient Motors. NEMA Premium® is the most efficient motor designation in the marketplace today. The Trane M-series or equivalents were utilized as a basis of design. Because many units operate 40-80 hours per week, even small increases in efficiency can yield substantial energy and dollar savings.

Energy Savings Calculations:

Existing: HV-5 serving the Gym locker rooms, has a fan motor with the following characteristics:
Existing Motor Efficiency = 78%
Existing motor HP = 2 HP
Annual Hours of Operations = 4500 (Average)
1 HP = 0.746 Watt
Load Factor = 75%
Cost of electricity = $0.166 / kWh

Existing AHU Motor Operating Cost =
{0.746 Watt/HP x Motor HP x Load Factor x Hours of Operation x Cost of Electricity] ÷ Motor Efficiency
= [0.746 x 2 x 0.75 x 4,500 x 0.166] ÷ 0.78 = $1,072 / Year

New AHU with NEMA Premium Motor Efficiency = 86.5%

New AHU with NEMA Premium Efficiency Motor Operating Cost =
{0.746 x 2 x 0.75 x 4,500 x 0.166} ÷ 0.865 = $966 / Year

Savings = $1,072 - $966 = $106 / Year

Installed Cost of a 2320 CFM AHU with a 2 HP NEMA Premium® Efficiency Motor = $9,300
The SmartStart Building® incentive of 2hp x $60/hp is $120
Net installed Cost = $9,300 - $120 = $9,180.

Simple Payback = $9,180 / $106 = 87 Years

kWh saved = $106 / $0.166/kWh = 639 kWh
kW saved = 639 kWh / 4,500 hrs./yr. =0.14 kW

Existing: HV-6 serving the Gym, has a fan motor with the following characteristics:
Existing Motor Efficiency = 78%
Existing motor HP = 15 HP
Annual Hours of Operations = 4,500 (Average)
1 HP = 0.746 Watt
Load Factor = 75%
Cost of electricity = $0.166 / kWh

Existing AHU Motor Operating Cost =
{0.746 Watt/HP x Motor HP x Load Factor x Hours of Operation x Cost of Electricity] ÷ Motor Efficiency
= [0.746 x 15 x 0.75 x 4,500 x 0.166] ÷ 0.78 = $8,037 / Year

New AHU with NEMA Premium Motor Efficiency = 92.4%

New AHU with NEMA Premium Efficiency Motor Operating Cost =
{0.746 x 15 x 0.75 x 4,500 x 0.166} ÷ 0.924 = $6,785 / Year

Savings = $8,037 - $6,785 = $1,252 / Year

Installed Cost of a 13,000 CFM AHU with a 15 HP NEMA Premium® Efficiency Motor = $52,000
The SmartStart Building® incentive of 2hp x $60/hp is $900
Net installed Cost = $52,000 - $900 = $51,100.

Simple Payback = $51,100 / $1,252 = 40 Years

kWh saved = $1,252 / $0.166/kWh = 7,542 kWh
kW saved = 7,542 kWh / 4,500 hrs./yr. =1.68 kW

Existing: HV-7 serving the Auto Shop, has a fan motor with the following characteristics:
Existing Motor Efficiency = 78%
Existing motor HP = 3 HP
Annual Hours of Operations = 4500 (Average)
1 HP = 0.746 Watt
Load Factor = 75%
Cost of electricity = $0.166 / kWh

Existing AHU Motor Operating Cost =
{0.746 Watt/HP x Motor HP x Load Factor x Hours of Operation x Cost of Electricity] ÷ Motor Efficiency
= [0.746 x 3 x 0.75 x 4,500 x 0.166] ÷ 0.78 = $1,607 / Year

New AHU with NEMA Premium Motor Efficiency = 89.5%

New AHU with NEMA Premium Efficiency Motor Operating Cost =
{0.746 x 3 x 0.75 x 4,500 x 0.166} ÷ 0.895 = $1,401 / Year

Savings = \$1,607 - \$1,401 = \$206 / Year

Installed Cost of a 3000 CFM AHU with a 3 HP NEMA Premium® Efficiency Motor = \$12,000
The SmartStart Building® incentive of 3hp x \$60/hp is \$180
Net installed Cost = \$12,000 - \$180 = \$11,820.

Simple Payback = \$11,820 / \$206 = 57 Years

kWh saved = \$206 / \$0.166/kWh = 1,241 kWh
kW saved = 1,241 kWh / 4,500 hrs./yr. =0.28 kW

Unit	CFM	Energy Savings	Energy Saved	Energy Demand Saved
HV-5	2,320	\$106	639 kWh	0.14 kW
HV-6	13,000	\$1,252	7,542 kWh	1.68 kW
HV-7	3,000	\$206	1,241 kWh	0.28 kW
ECM TOTAL		\$1,358	8,181 kWh	2.10 kW

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$73,300
NJ Smart Start Equipment Incentive (\$):	\$1,200
Net Installation Cost (\$):	\$72,100
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$1,358
Total Yearly Savings (\$/Yr):	\$1,358
Estimated ECM Lifetime (Yr):	20
Simple Payback	53.1
Simple Lifetime ROI	-62.3%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$27,160
Internal Rate of Return (IRR)	-8%
Net Present Value (NPV)	(\$51,896.39)

ECM #8: DDC System – High School

Description:

The current HVAC systems within the High School are controlled via pneumatic thermostats in the original building and the 1975 addition. There is a Siemens Direct Digital Control (DDC) system serving the 2001 addition and is not a web based system. Thermostats are 2-stage for a day/night (occupied/unoccupied) function by means if a mechanical time clock. The roof top units in the 1975 addition can be monitored by a computer workstation using a Honeywell system. During initial discussions with the Owner it was noted that the hours of operation of the facility are generally 40 hours per week. Occasionally, there are additional after-hours usage during weeknights and weekends and thermostat adjustments are made by the person currently occupying the space instead on one general setpoint. This is a means for a cycling amongst different HVAC systems attempting to meet various setpoints throughout the year, independent of heating or cooling season. Therefore, a DDC system providing the Owner with full control over the HVAC equipment within the building appears to be an energy saving opportunity.

This ECM includes installing a Building Automation system with Direct Digital Controls (DDC) wired through an Ethernet backbone and front end controller within the High School only. The system will include new thermostat controllers for all indoor air-handling systems and the rooftop units, in addition to each piece of equipment being wired back to a front end controller and computer interface. With the communication between the devices and the front end computer interface, the Owner will be able to take advantage of equipment scheduling for occupied and unoccupied periods based on the actual occupancy of the facility. Due to the fact that the High School has diverse hours of occupancy, including evening and weekend hours, having supervisory control over all of the equipment makes sense. The DDC system will also aid in the response time to service / maintenance issues when the facility is not under normal maintenance supervision, i.e. after-hours.

The new DDC system has the potential to provide substantial savings by controlling the HVAC systems as a whole and provide operating schedules and features such as space averaging, night set-back, temperature override control, etc. The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings is based on the “Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways,” document posted for public use April 2005. The study has found that commercial buildings have the potential to achieve significant energy savings through the use of building controls. The average energy savings are as follows based on the referenced report:

- Energy Management and Control System Savings: 5%-15%.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be <u>10%</u> of the total energy cost for the facility.

The cost of a full DDC system with new field devices, controllers, computer, software, programming, etc. is approximately $4.00 per SF in accordance with recent Contractor pricing for systems of this magnitude. Savings from the implementation of this ECM will be from the reduced energy consumption currently used by the HVAC system by proper control of schedule and temperatures via the DDC system.

Cost of complete DDC System = ($4.00/SF x 253,663 SF) = $1,014,650

Heating Season Heating Degree Days = 4,996 HDD
Average Cost of Gas = $1.449 / Therm

Cooling Season Full Load Cooling Hrs. = 1,129 hrs / yr
Average Cost of Electricity = $0.166 / kWh

Note: Degree Days and Full Load Hours referenced from ASHRAE Weather Data for Newark, NJ.

Energy Savings Calculations:

10% Savings on Heating Calculations

$$Heat\ Load = \frac{Heat\ Loss\left(\frac{Btu}{Hr\ SF}\right)\times Area\ (SF)}{1000\left(\frac{Btu}{kBtu}\right)}$$

$$Heat\ Load = \frac{50\left(\frac{Btu}{Hr\ SF}\right)\times 253{,}663\ (SF)}{1000\left(\frac{Btu}{kBtu}\right)} = 12{,}683\left(\frac{kBtu}{Hr}\right)$$

$$Est\ Heat\ Cons. = \frac{Heat\ Load\left(\frac{kBtu}{Hr}\right)\times Heat\ Deg\ Days\times 24\ Hrs\times Correction\ Factor}{Design\ Temp\ Difference\ (^\circ F)\times Efficiency\ (\%)\times Fuel\ Heat\ Value\left(\frac{kBtu}{Therm}\right)}$$

$$Est\ Heat\ Cons. = \frac{12{,}683\left(\frac{kBtu}{Hr}\right)\times 4{,}996\ (HDD)\times 24\ Hrs\times 0.6}{65\ (^\circ F)\times 81\%\times 100\left(\frac{kBtu}{Therm}\right)} = 173{,}304\,(Therms)$$

$$Savings. = Heat\ Cons.(Therms)\times 10\%\ Savings\times Ave\ Gas\ Cost\left(\frac{\$}{Therm}\right)$$

$$Savings. = 173{,}304\ (Therms)\times 10\%\times 1.449\left(\frac{\$}{Therm}\right) = \underline{\$25{,}112}$$

10% Savings on Cooling Calculations:

$$Est\ Cool\ Cons. = \frac{Cool\ Load\ (Tons) \times 12{,}000 \left(\frac{Btu}{Ton\ Hr}\right) \times Full\ Load\ Cooling\ Hrs.}{Ave\ Energy\ Efficiency\ Ratio \left(\frac{Btu}{Wh}\right) \times 1000 \left(\frac{Wh}{kWh}\right)}$$

$$Est\ Cool\ Cons. = \frac{520\ (Tons) \times 12{,}000 \left(\frac{Btu}{Ton\ Hr}\right) \times 1{,}129\ Hrs.}{10.0 \left(\frac{Btu}{Wh}\right) \times 1000 \left(\frac{Wh}{kWh}\right)} = 704{,}496 (kWh)$$

$$Savings. = Cool\ Cons.(kWh) \times 10\%\ Savings \times Ave\ Elec\ Cost \left(\frac{\$}{kWh}\right)$$

$$Savings. = 704{,}496\ (kWh) \times 10\% \times 0.166 \left(\frac{\$}{kWh}\right) = \underline{\$11{,}695}$$

Total Annual Energy Savings = \$25,112 + \$11,695 = \$36,807 per year

It is pertinent to note that electric demand savings were unable to be estimated. Also, incentives for the installation of the DDC system are not currently available and maintenance savings could not be adequately calculated because information was not available to baseline the savings.

Energy Savings Summary:

ECM #8 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$1,014,650
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$1,014,650
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$36,807
Total Yearly Savings (\$/Yr):	\$36,807
Estimated ECM Lifetime (Yr):	15
Simple Payback	27.6
Simple Lifetime ROI	-45.6%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$552,105
Internal Rate of Return (IRR)	-7%
Net Present Value (NPV)	(\$575,250.42)

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

Globally, renewable energy has become a priority affecting international and domestic energy policy. The State of New Jersey has taken a proactive approach, and has recently adopted in its Energy Master Plan a goal of 30% renewable energy by 2020. To help reach this goal New Jersey created the Office of Clean Energy under the direction of the Board of Public Utilities and instituted a Renewable Energy Incentive Program to provide additional funding to private and public entities for installing qualified renewable technologies. A renewable energy source can greatly reduce a building's operating expenses while producing clean environmentally friendly energy. CEG has assessed the feasibility of installing renewable energy technologies for Chatham High School, and concluded that there is potential for solar energy generation.

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which will be mounted on all south and southwestern facades of the building. Flat roof, as well as sloped areas can be utilized; flat areas will have the panels turned to an optimum solar absorbing angle. (A structural survey of the roof would be necessary before the installation of PV panels is considered). The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit is around $350, this value was used in our financial calculations. This equates to $0.35 per kWh generated.

CEG has reviewed the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 21,700 S.F. can be utilized for a PV system. A depiction of the area utilized is shown in Renewable / Distributed Energy Measures Calculation appendix. Using this square footage it was determined that a system size of 339.48 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 392,286 KWh annually, reducing the overall utility bill by approximately 20.9% percent. A detailed financial analysis can be found in the Renewable / Distributed Energy Measures Calculation appendix. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

The proposed photovoltaic array layout is designed based on the specifications for the Sun Power SPR-230 panel. This panel has a "DC" rated full load output of 230 watts, and has a total panel conversion efficiency of 18%. Although panels rated at higher wattages are available through Sun Power and other various manufacturers, in general most manufacturers who produce commercially available solar panels produce a similar panel in the 200 to 250 watt range. This provides more manufacturer options to the public entity if they wish to pursue the proposed solar recommendation without losing significant system capacity.

The array system capacity was sized on available roof space on the existing facility. Estimated solar array generation was then calculated based on the National Renewable Energy Laboratory PVWatts Version 1.0 Calculator. In order to calculate the array generation an appropriate location with solar data on file must be selected. In addition the system DC rated kilowatt (kW) capacity must be inputted, a DC to AC de-rate factor, panel tilt angle, and array azimuth angle. The DC to AC de-rate factor is based on the panel nameplate DC rating, inverter and transformer efficiencies (95%), mismatch factor (98%), diodes and connections (100%), dc and ac wiring(98%, 99%), soiling, (95%), system availability (95%), shading (if applicable), and age(new/100%). The overall DC to AC de-rate factor has been calculated at an overall rating of 81%. The PVWatts Calculator program then calculates estimated system generation based on average monthly solar irradiance and user provided inputs. The monthly energy generation and offset electric costs from the PVWatts calculator is shown in the **Renewable/Distributed Energy Measures Calculation Appendix**.

The proposed solar array is qualified by the New Jersey Board of Public Utilities Net Metering Guidelines as a Class I Renewable Energy Source. These guidelines allow onsite customer generation using renewable energy sources such as solar and wind with a capacity of 2 megawatts (MW) or less. This limits a customer system design capacity to being a net user and not a net generator of electricity on an annual basis. Although these guidelines state that if a customer does net generate (produce more electricity than they use), the customer will be credited those kilowatt-hours generated to be carried over for future usage on a month to month basis. Then, on an annual basis if the customer is a net generator the customer will then be compensated by the utility the average annual PJM Grid LMP price per kilowatt-hour for the over generation. Due to the aforementioned legislation, the customer is at limited risk if they generate more than they use at times throughout the year. With the inefficiency of today's energy storage systems, such as batteries, the added cost of storage systems is not warranted and was not considered in the proposed design.

CEG has reviewed financing options for the owner. Two options were studied and they are as follows: Self-financed and direct purchase without finance. Self-finance was calculated with 95% of the total project cost financed at a 7% interest rate over 25 years. Direct purchase involves the local government paying for 100% of the total project cost upfront via one of the methods noted in the Installation Funding Options section below. Both of these calculations include a utility inflation rate as well as the degradation of the solar panels over time. Based on our calculations the following are the payback periods for the respective method of payment:

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM			
PAYMENT TYPE	**SIMPLE PAYBACK**	**SIMPLE ROI**	**INTERNAL RATE OF RETURN**
Self-Finance	15.1 Years	65.6%	0.3%
Direct Purchase	15.1 Years	65.6%	5.0%

*The solar energy measure is shown for reference in the executive summary REM table

The resultant Internal Rate of Return indicates that if the Owner was able to "Direct Purchase" the solar project, the project would be slightly more beneficial to the Owner.

In addition to the Solar Analysis, CEG also conducted a review of the applicability of wind energy for the facility. Wind energy production is another option available through the Renewable Energy Incentive Program. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. Based on CEG's review of the applicability of wind energy for the facility, it was determined that the average wind speed is not adequate for purchase of a commercial wind turbine. Therefore, wind energy is not a viable option to implement.

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

Load Profile analysis was performed to determine the seasonal energy usage of the facility. Irregularities in the load profile will indicate potential problems within the facility. Consequently based on the profile a recommendation will be made to remedy the irregularity in energy usage. For this report, the facility's energy consumption data was gathered in table format and plotted in graph form to create the load profile. Refer to the Electric and Natural Gas Usage Profiles included within this report to reference the respective electricity and natural gas usage load profiles.

<u>Electricity:</u>

The Electric Usage Profile demonstrates a very flat load shape throughout the year. This is a bit unusual for a school, because typically schools are closed in the summer. However the steady load profile (especially the summer) is supported by summer school, weekend activities, gymnasium, auditorium and some ongoing projects. The auditorium is in use throughout the year. There is an increase a slight peak in consumption in August as is typical with summer cooling (air conditioning) loads. The cooling in this facility is provided by (26) twenty six, split system air conditioning units, (8) eight, ductless split system air conditioning units, (15) window units and (30), thirty roof-top units. The units vary from .75 to 60 nominal ton capacity. A flatter load profile of this type, will allow for more competitive energy prices when shopping for alternative energy suppliers.

<u>Natural Gas:</u>

The Natural Gas Usage Profile demonstrates a very typical heating load profile. An increase in consumption is observed October through March during the standard heating season. Heating for this facility is supplied by (2) two, boiler plants and (30) thirty gas-fired roof-top air-handling units. The boilers provide hot-water throughout the facility and to AC units 2-6 (adding to the base-load load profile). The 2001 addition also added a boiler for the addition. Domestic hot-water is supplied by a natural gas fired hot water boiler. Natural gas delivery-service is provided by Public Service Electric and Gas Company (PSE&G) on an LVG rate schedule. Commodity service is supplied by the Hess Corporation, the Third Party Supplier. This consistent load profile is beneficial when looking at supply options with a Third Party Supplier.

Tariff:

<u>Electricity:</u>

This facility receives electrical service through Jersey Central Power & Light (JCP&L) on a GSS (General Service Secondary – 3 Phase) rate. Service classification GS is available for general service purposes on secondary voltages not included under Service Classifications RS, RT, RGT or GST. This facility's rate is a three phase service at secondary voltages. For electric supply (generation), the customer uses the service of a JCP&L. This facility uses the Delivery Service of the utility (JCP&L). The Delivery Service includes the following charges: Customer Charge, Supplemental Customer Charge, Distribution Charge (kW Demand), kWh Charge, Non-utility Generation Charge, TEFA, SBC, SCC, Standby Fee and RGGI. The Generation Service is provided by JCP&L under BGS (Basic Generation Service). BGS Energy and Reconciliation Charges are provided in Rider BGS-FP (fixed pricing) or BGS-CIEP (Commercial Industrial Energy Pricing). BGS also has a Transmission component to its charge.

Natural Gas:

This facility receives utility service through Public Service Electric and Gas Company (PSE&G). This facility utilizes the Delivery Service from PSE&G while receiving Commodity service from a Third Party Supplier (TPS), Hess Corporation.

LVG Rate: This utility tariff is for "firm" delivery service for general purposes. This rate schedule has a Delivery Charge, Balancing Charge, Societal Benefits Charge, Realignment Adjustment Charge, Margin Adjustment Charge, RGGI Charge and Customer Account Service Charge. The customer can elect to have the Commodity Charge serviced through the utility or by a Third Party Supplier (TPS). Note: Should the TPS not deliver, the customer may receive service from PSE&G under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service.

"Firm" delivery service defines the reliability of the transportation segment of the pricing. Much like the telecom industry, natural gas pipelines were un-bundled in the late 1990's and the space was divided up and marketed into reliability of service. Firm Service is said to be the most reliable and last in the pecking order for interruption. This service should not be interrupted.

Commodity Charges: Customer may choose to receive gas supply from either: A TPS or PSE&G through its Basic Gas Supply Service default service. PSE&G may also supply Emergency Sales Service in certain instances. This is at a much higher than normal rate. It should be perceived as a penalty.

This facility utilizes the services of a Third Party Supplier, The Hess Corporation. The contract is administered by The Alliance for Competitive Service (ACES). ACES is the energy aggregation program of the New Jersey School Boards Association of School Administrator's. The process was reviewed and approved by the New Jersey Department of Community Affairs.

Please see CEG recommendations below.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities. Good potential savings can be seen equally in the electric costs and the natural gas costs. The average price per kWh (kilowatt hour) for the High School based on a historical 1-year weighted average fixed price from the utility JCP&L is $.1415 / kWh (this is the fixed "price to compare" when shopping for energy procurement alternatives). The fixed weighted average price per decatherm for natural gas service in the High School, provided by the Hess Corporation (TPS) is $ 12.08 / dth (dth, is the common unit of measure). The natural gas prices are also the "prices to compare".

The "price to compare" is the netted cost of the energy (including other costs), that the customer will use to compare to Third Party Supply sources when shopping for alternative suppliers. For electricity this cost would not include the utility transmission and distribution chargers. For natural gas the cost would not include the utility distribution charges and is said to be delivered to the utilities city-gate.

Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. Chatham School District could see improvement in its energy costs if it were to take advantage of these current market prices quickly, before energy prices increase. Based on electric supply from JCP&L and utilizing the historical consumption data provided (August 2008 through July 2009) and current electric rates, the school(s) could see an improvement in its electric costs of up to 25 % annually. (Note: Savings were calculated using Average Annual Consumption and a variance to a Fixed Average One-Year commodity contract). CEG recommends aggregating the entire electric load to gain the most optimal energy costs. CEG recommends advisement for alternative sourcing and supply of energy on a "managed approach".

CEG's second recommendation coincides with the natural gas costs. Based on the current alternative market pricing supplied by the Hess Corporation (ACES Agreement), CEG feels that School District could see an improvement of up to 33 % in its natural gas costs. CEG has experience with the mechanism for schools to buy energy in New Jersey. It is through the ACES Agreement (The Alliance for Competitive Energy Services) which is an energy aggregation program. From our experience, the basis price is the reason that the overall average price per dekatherm is ($12.08/dth). Therefore the average pricing formula supplied by Hess is 25 % above today's competitive market pricing. CEG recommends the school receive further advisement on these prices through an energy advisor. They should also consider procuring energy (natural gas) through an alternative supply source.

CEG also recommends scheduling a meeting with the current utility providers to review their utility charges and current tariff structures for electricity and natural gas. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), the municipality can learn more about the competitive supply process. The county can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu. They should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the information for ongoing demand-side management projects. Furthermore, special attention should be given to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with the utility representative. The School District should ask the utility representative about alternative billing options, such as consolidated billing when utilizing the service of a Third Party Supplier. Finally, if the supplier for energy (natural gas) is changed, closely monitor balancing, particularly when the contract is close to termination. This could be performed with the aid of an "energy advisor".

X. INSTALLATION FUNDING OPTIONS

CEG has reviewed various funding options for the Owner to utilize in subsidizing the costs for installing the energy conservation measures noted within this report. Below are a few alternative funding methods:

i. *Energy Savings Improvement Program (ESIP)* – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and par for the costs using the value of energy savings that result from the improvements. The “Energy Savings Improvement Program (ESIP)” law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources.

ii. *Municipal Bonds* – Municipal bonds are a bond issued by a city or other local government, or their agencies. Potential issuers of municipal bonds include cities, counties, redevelopment agencies, school districts, publicly owned airports and seaports, and any other governmental entity (or group of governments) below the state level. Municipal bonds may be general obligations of the issuer or secured by specified revenues. Interest income received by holders of municipal bonds is often exempt from the federal income tax and from the income tax of the state in which they are issued, although municipal bonds issued for certain purposes may not be tax exempt.

iii. *Power Purchase Agreement* – Public Law 2008, Chapter 3 authorizes contractor of up to fifteen (15) years for contracts commonly known as “power purchase agreements.” These are programs where the contracting unit (Owner) procures a contract for, in most cases, a third party to install, maintain, and own a renewable energy system. These renewable energy systems are typically solar panels, windmills or other systems that create renewable energy. In exchange for the third party’s work of installing, maintaining and owning the renewable energy system, the contracting unit (Owner) agrees to purchase the power generated by the renewable energy system from the third party at agreed upon energy rates.

iv. *Pay For Performance* – The New Jersey Smart Start Pay for Performance program includes incentives based on savings resulted from implemented ECMs. The program is available for all buildings with average demand loads above 200 KW. The facility’s participation in the program is assisted by an approved program partner. An “Energy Reduction Plan” is created with the facility and approved partner to shown at least 15% reduction in the building’s current energy use. Multiple energy conservation measures implemented together are applicable toward the total savings of at least 15%. No more than 50% of the total energy savings can result from lighting upgrades / changes.

Total incentive is capped at 50% of the project cost. The program savings is broken down into three benchmarks; Energy Reduction Plan, Project Implementation, and

Measurement and Verification. Each step provides additional incentives as the energy reduction project continues. The benchmark incentives are as follows:

1. Energy Reduction Plan – Upon completion of an energy reduction plan by an approved program partner, the incentive will grant $0.10 per square foot between $5,000 and $50,000, and not to exceed 50% of the facility's annual energy expense. (Benchmark #1 is not provided in addition to the local government energy audit program incentive.)

2. Project Implementation – Upon installation of the recommended measures along with the "Substantial Completion Construction Report," the incentive will grant savings per KWH or Therm based on the program's rates. Minimum saving must be 15%. (Example $0.11 / kWh for 15% savings, $0.12/ kWh for 17% savings, … and $1.10 / Therm for 15% savings, $1.20 / Therm for 17% saving, …) Increased incentives result from projected savings above 15%.

3. Measurement and Verification – Upon verification 12 months after implementation of all recommended measures, that actual savings have been achieved, based on a completed verification report, the incentive will grant additional savings per kWh or Therm based on the program's rates. Minimum savings must be 15%. (Example $0.07 / kWh for 15% savings, $0.08/ kWh for 17% savings, … and $0.70 / Therm for 15% savings, $0.80 / Therm for 17% saving, …) Increased incentives result from verified savings above 15%.

CEG recommends the Owner review the use of the above-listed funding options in addition to utilizing their standard method of financing for facilities upgrades in order to fund the proposed energy conservation measures.

XI. ADDITIONAL RECOMMENDATIONS

The following recommendations include no cost/low cost measures, Operation & Maintenance (O&M) items, and water conservation measures with attractive paybacks. These measures are not eligible for the Smart Start Buildings incentives from the office of Clean Energy but save energy none the less.

A. Chemically clean the condenser and evaporator coils in the window AC units periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%. The 3-step process includes cleaning of the coils, rinsing and a micro biocide treatment. Thoroughly cleaned coils are not as susceptible to re-fouling so they stay clean longer, reducing the cleaning cycle frequency

B. Maintain all weather stripping on windows and doors.

C. Repair/replace damaged or missing ductwork insulation in the ceiling spaces.

D. Provide more frequent air filter changes to decrease overall fan horsepower requirements and maintain better IAQ.

E. Recalibrate existing zone thermostats.

F. Clean all fixtures to maximize light output.

G. Feel for air drafts around electrical outlets. Inexpensive pads are available, as are plugs for unused sockets.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Chatham High School

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT.	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	Lighting Upgrade - General	$6,887	$0	$175	$6,712	$10,407	$91	$10,498	25	$262,450	$2,275	3810.2%	0.6	156.41%	$176,091.22
ECM #2	Install Lighting Controls	$25,280	$0	$3,160	$22,120	$4,699	$0	$4,699	15	$70,485	$0	218.6%	4.7	19.84%	$33,976.36
ECM #3	Install LED Exit Signs	$3,752	$0	$670	$3,082	$2,533	$938	$3,471	25	$86,775	$23,450	2715.5%	0.9	112.62%	$57,359.04
ECM #4	T-5 Lighting System in Gym	$7,200	$0	$1,000	$6,200	$912	$110	$1,022	25	$25,550	$2,750	312.1%	6.1	16.09%	$11,596.24
ECM #5	Boiler Replacement – High Efficiency Upgrade	$391,500	$0	$21,000	$370,500	$6,181	$0	$6,181	35	$216,335	$0	-41.6%	59.9	-2.73%	($237,687.49)
ECM #6	Install NEMA Premium Efficient Pump Motor	$1,280	$0	$120	$1,160	$123	$0	$123	20	$2,460	$0	112.1%	9.4	8.55%	$669.93
ECM #7	Indoor Air handling Unit Replacement	$73,300	$0	$1,200	$72,100	$1,358	$0	$1,358	20	$27,160	$0	-62.3%	53.1	-7.91%	($51,896.39)
ECM #8	DDC System – High School	$1,014,650	$0	$0	$1,014,650	$36,807	$0	$36,807	15	$552,105	$0	-45.6%	27.6	-6.79%	($575,250.42)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	Solar Energy System	$3,055,320	$0	$0	$3,055,320	$202,420	$0	$202,420	25	$5,060,500	$0	65.6%	15.1	4.33%	$469,449.36

Notes: 1) The variable Cn in the formulas for Internal Rate of Return and Net Present Value stands for the cash flow during each period.
2) The variable DR in the NPV equation stands for Discount Rate
3) For NPV and IRR calculations: From n=0 to N periods where N is the *lifetime of ECM* and Cn is the *cash flow during each period* .

Concord Engineering Group, Inc.

520 BURNT MILL ROAD
VOORHEES, NEW JERSEY 08043
PHONE: (856) 427-0200
FAX: (856) 427-6508

SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of January, 2009:

Electric Chillers

Water-Cooled Chillers	$12 - $170 per ton
Air-Cooled Chillers	$8 - $52 per ton

Gas Cooling

Gas Absorption Chillers	$185 - $400 per ton
Gas Engine-Driven Chillers	Calculated through custom measure path)

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	$73 - $93 per ton
Air-to-Air Heat Pumps	$73 - $92 per ton
Water-Source Heat Pumps	$81 per ton
Packaged Terminal AC & HP	$65 per ton
Central DX AC Systems	$40- $72 per ton
Dual Enthalpy Economizer Controls	$250

Ground Source Heat Pumps

Closed Loop & Open Loop	$370 per ton

Gas Heating

Gas Fired Boilers < 300 MBH	$300 per unit
Gas Fired Boilers ≥ 300 - 1500 MBH	$1.75 per MBH
Gas Fired Boilers ≥1500 - ≤ 4000 MBH	$1.00 per MBH
Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	$300 - $400 per unit

Variable Frequency Drives

Variable Air Volume	$65 - $155 per hp
Chilled-Water Pumps	$60 per hp
Compressors	$5,250 to $12,500 per drive

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons	$50 per unit
Gas-Fired Water Heaters >50 gallons	$1.00 - $2.00 per MBH
Gas-Fired Booster Water Heaters	$17 - $35 per MBH

Premium Motors

Three-Phase Motors	$45 - $700 per motor

Prescriptive Lighting

T-5 and T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 - $30 per fixture, (depending on quantity)
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start	$25 per fixture
LED Exit Signs	$10 - $20 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $284 per fixture

Lighting Controls – Occupancy Sensors

Wall Mounted	$20 per control
Remote Mounted	$35 per control
Daylight Dimmers	$25 per fixture
Occupancy Controlled hi-low Fluorescent Controls	$25 per fixture controlled

Lighting Controls – HID or Fluorescent Hi-Bay Controls

Occupancy hi-low	$75 per fixture controlled
Daylight Dimming	$75 per fixture controlled

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2004 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive

MAJOR EQUIPMENT LIST

Concord Engineering Group

Chatham High School

Boiler

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Orig Boiler Room		Cleaver Brooks	1	CB801-150	L-25716	6280	5150	82	Natural Gas	7/16/1961	24	(-24)	
Orig Boiler Room		Cleaver Brooks	1	CB801-150	L-25715	6280	5150	82	Natural Gas	7/13/1961	24	(-24)	
New Boiler Rm	2001 Addition	Buderus	1	G615-13	1529.9C	3753	3112	82.9	Natural Gas	1/8/2001	25	17	83.9% Comb. Eff.

Boiler - Burner

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Orig Boiler Room			1		H923213			Natural Gas	47	21	(-26)	Nat Gas/Oil burner (no oil), 7.5hp burner
Orig Boiler Room			1		H923212			Natural Gas	47	21	(-26)	Nat Gas/Oil burner (no oil), 7.5hp burner
New Boiler Rm	2001 Addition	Industrial Combustion	1	HG-42-S-2	40972-1	3890	80	Natural Gas	8	21	13	Natural Gas, 1.5 hp blower

Boiler - Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	RPM	GPM	Ft. Hd	Frame Size	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Orig Boiler Room	Boiler Pump		1	185011	1533208	20	1750				200/400		8	20	12	91% NEMA Eff.
Orig Boiler Room	Boiler Pump		1	185011		20	1750				230/460		3	20	17	
Orig Boiler Room	HX Pump	Bell & Gosset	1	HD3 AB	102228	1/3	1725				115/230	1	34	10	(-24)	Server MoHawk heat exchanger M/N F1059
New Boiler Rm	2001 Addition	Armstrong	2	3x3x10	452686 and452686	5	1800	110	65				8	10	2	
New Boiler Rm	2001 Addition		1			fractional							8	10	2	In-line circ pump above boiler
Mechanical room	1973 Addition	Aurora Pump	1	1 1/2x3A, 344 BF	74-14881	2		75	50	145T			34	20	(-14)	Motor replaced: Dayton m/n 3KW97G NEMA 84% Eff.
Mechanical room	1973 Addition		1	5K184BC206	98-07592	5							11	20	9	3A4A-8F, 1.5x2x7A
Gym Storage	HV-6 1973 Gym	Bell & Gosset	1					50	15				8	10	2	

Domestic Hot Water Heater

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Input (MBh)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Orig. Boiler Room		Lochanvar	1	CWN500PM	L04H00171813	500	498	(2) TANKS - SEE BELOW	82	Natural Gas	5	25	20	Copper-Fin
	DOMESTIC BOILER	Lochanvar	2	RJS120	AM5644324 / AM5644344	-	-	(2) x 119 Gal. = 238 Gallon			5	15	10	
New Boiler Rm	2001 Addition	State	1	Sandblaster SBF100199NET	G02415536	199.99	189.1	100		Natural Gas	8	10	2	
L-wing		American Proline	1	E62-30N-045DV	522100057	4500kW		30		Electric	2	10	8	820503

DHW - Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	Volts	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Orig Boiler Room	Recirc	Bell & Gosset	1	BP451	189034 M58	1/3			24	10	(-14)	
Orig Boiler Room	Recirc	Bell & Gosset	1	P06441 AB	189034 K48	1/3			25	10	(-15)	
Orig Boiler Room	DW Loop Pump	Bell & Gosset	1	PL458	1BL004 D50				4	10	6	
New Boiler Rm	2001 Addition		1	SA55JXFSN-3748		1/8			8	10	2	cat no. 110-178

Air Handling Units

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Cooling Coil	Cooling Eff. (EER)	Cooling Capacity BTUH	Heating Type	Input (MBh)	Output (MBh)	Heating Eff. (%)	Fuel	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Rooftop		Carrier Weathermaster	1	48HJE004-M-641HE	4201G23115	R-22	11.8	36,200	HTX	72	58	82%	NG	460	3		8	15	7	
Rooftop		Carrier Weathermaster	1	48HJD005---641HE	4001G23503	R-22	11.7	46,000	HTX	72	58	82%	NG	460	3		8	15	7	
Rooftop	Area D	Nesbitt	1	RSA35053N05CLM0BDG00DD1201	N0202008	R-22		420,000	HTX	469	375	80%	NG	460	3		7	15	8	
Rooftop		Carrier	7	48GX-024040301	4201G11258	R-22	12	24,000	HTX	40	32.8	82%	NG	208/230	1		8	15	7	
Gym Storage (HV-5)	Locker Rooms	American Air Filter				n/a	n/a	n/a	HW	240							35	15	(-20)	200-160 F Water, 0-85 F Air, 12 GPM, 10 Ft Hd.
Gym Storage (HV-6)	1973 Gym addition	American Air Filter	1	G size 45-70	RM745907	n/a	n/a	n/a	HW		1198.925						35	15	(-20)	200-160 F Water, 0-85 F Air, 50 GPM, 10 Ft Hd.
Admin rooftop (AC-4)	Administration	Nesbitt	1	RMA100G2RC24050B01A150100BCZ1	9507-61450	R-22	8.9	280,000	HW	300			-	208	3		14	15	1	
Rooftop (AC-6)	Area D	York - LUX Air	1	DB HB-T072AA	NCHM043966	R-22		72,000						208	3		10	15	5	Rusty REV B 073-19202-207
Rooftop (AC-5)	Area D	York - LUX Air	1	DD HB - T090AA	(S)NDHM055881	R-22		90,000						208	3		10	15	5	
Rooftop	Area D	Nesbitt	1	RMA100G2RC24050B01A150100BCZ1	9507-61450		8.9	280,000	HW	300			-	200	3		14	15	1	1/6 HP GB
Rooftop	Area D	Carrier Weathermaster Series	1	48HJD007---641HE	4001G23508			72,000		50/72	41/59	82%	NG	460	3		8	15	7	
Rooftop	Area D Library	Nesbitt	1	RSA25053N05GMM08DG00DD1201	N0202007	R-22		300,000	HTX	469	375		NG	460	3		7	15	8	M.O. 200012
Rooftop	Partial 2nd Floor	Carrier Weathermaster Series	1	48HJF007---641HE	4001G23512			72,000		120/150	96/120	80%	NG	460	3		8	15	7	
Rooftop	Partial 2nd Floor	Carrier	1	48HJF007---641HE	4001G23513			72,000		120/150	96/120	80%	NG	460	3		8	15	7	
Rooftop	Partial 2nd Floor	Carrier Weathermaster Series	1	48HJF007---641HE	4001G23511			72,000		120/150	96/120	80%	NG	460	3		8	15	7	
Rooftop	Area E	Carrier Weathermaster Series	1	48HJE004-M-541HE	4201G23106		11.8	36,200		50/72	41/59	82%	NG	208	3		8	15	7	
Rooftop	Area E	Carrier	1	48HJD005-M-541HE	4201G23089		11.7	46,000		50/72	41/59	82%	NG	208	3		8	15	7	
Rooftop	Area D	Carrier	1	48HJD006---541HE	4301G22096		11.9	59,000		50/72	41/59	82%	NG				8	15	7	
Rooftop	Area D	Carrier	1	48HJE004---641HE	4001G23480		11.8	36,200		72	58	82%	NG				8	15	7	
Rooftop	Partial 2nd Floor	Carrier	1	48GX-024040301--	4201611256	R-22	12	24,000	HTX	40	32.8	82%	NG	208/230	1		8	15	7	
Rooftop	Partial 2nd Floor	Carrier	1	48HJF007---641HE	4001G23516			72,000		120/150	96/120	80%	NG	460			8	15	7	
Rooftop	Partial 2nd Floor	Carrier	1	48HJF007---641HE	4001G23514			72,000		120/150	96/120	80%	NG				8	15	7	
Rooftop	Partial 2nd Floor	Carrier	1	48GX-030040501	2801G14623	R-22		30,000						208			8	15	7	
Rooftop	Partial 2nd Floor	Carrier	1	48HJF007---641HE	4001G23515			72,000		120/150	96/120	80%	NG	460			8	15	7	
Rooftop	Area E	Carrier	1	48HJD006---541HE	4301G22097		11.9	59,000		50/72	41/59	82%	NG	208/230			8	15	7	
Rooftop	Area E	Carrier	1	48HJD006---541HE	4001G23543		11.9	59,000		50/72	41/59	82%	NG				8	15	7	
Rooftop (AC-2)	Auditorium	Air Fan	1	P1-2-60	96-35665	R-22		462,480	HTX				-				10	15	5	
Rooftop (AC-3)	Auditorium	Air Fan	1	LMP-2-60	96-65666	R-22		462,480	HTX				-				10	15	5	

AC Condensers

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity	Cooling Eff. (EER)	Refrigerant	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Rooftop		Mitshubishi	1	MU09TW	2004643 T	9000			115	1	5	15	10	Indoor Unit MS09 TW
Rooftop	Partial 2nd Floor	Mitshubishi	2	PU18EK1	56U00533C	18000						15		
Rooftop	Partial 2nd Floor	Carrier	1	38AN009110	2602V22499	102000			115	1	7	15	8	
Rooftop	Area F	Sanyo	1	C0911	211163	9000			115	1		15		
Rooftop	Area F	Carrier	1	38HDC018341	2301X10585	18000					8	15	7	
Rooftop	Area D	Carrier	1	38HDC036321	2901X13520	36000					8	15	7	
Rooftop	Area F	Carrier	1	38HDC024331	1501X05053	24000			208/230		7	15	8	
Rooftop	Area D	Carrier	1	38AN012310	3602Y10763	12000					6	15	9	
Rooftop	Partial 2nd Floor	Carrier	1	38HDC018341	2901X13709	18000					7	15	8	
Rooftop	Area E	Air Fan	1	LPM-2-60	96-65666	732000			208	3	13	15	2	S/A 10 hp 28.7 FLA R/A 5 hp 15.71 FLA total amps 301 Compressor 1
Rooftop	Area E	Air Fan	1	P1-60	96-35665	732000								
Rooftop	Area D	Rheem	1	RAKA-048DAS	4972 M3301 06100	46,000	9.7		460	3	8	15	7	
Rooftop	Partial 2nd Floor	Rheem	1	RAKA-024JAZ	5882F210107054	22,800	8.9		208	1	8	15	7	
Rooftop	Partial 2nd Floor	Rheem	1	RAKA-060 CAS	4991 M2300 17825	56,500	9.7		208	3	9	15	6	
Rooftop	Partial 2nd Floor	Rheem	2	RAKA-042DAS	4982 M3701 05295	40,000	9.15		460	3	8	15	7	
Rooftop	Partial 2nd Floor	Rheem	1	RAKA-060DAS	4995 M3001 07612	56,500	9.7		460	3	8	15	7	
Rooftop	Area D	Rheem	1	RAKA-048DAS	4972 M3301 06105	46,000	9.7		460	3	8	15	7	
Rooftop	Area D	Rheem	2	RAKA-048DAS	4972 M3301 06106	46,000	9.7		460	3	8	15	7	
Rooftop	Partial 2nd Floor	Rheem	1	RAKA-060DAS	4995 M3001 07613	56,500	9.7		460	3	8	15	7	
Rooftop	Partial 2nd Floor	Rheem	1	RAKA-0245AZ	5882 M2101 06817	23,400	9.15		208/230	3	8	15	7	
Rooftop	Area D	Rheem	1	RAKA-048DAS	4972 M3301 06103	46,000	9.7		460	3	8	15	7	
Rooftop	Area D	Rheem	1	RAKA-024JAZ	5882F210107051	22,800	8.9		208/230	1	8	15	7	
Rooftop	Partial 2nd Floor	Rheem	1	RAKA-060DAS	4995 M3001 07614	56,500	9.7		460	3	8	15	7	
Rooftop	Partial 2nd Floor	Rheem	1	RAKA-060DAS	4995 M3001 07619	56,500	9.7		460	3	8	15	7	

Unit Heaters and Cabinet Unit Heaters

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Heating Type	Heating Capacity (MBH)	CFM	RPM / HP	GPM	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
New Boiler Rm	2001 Addition	Airtherm	1	HA-136A	M01248241001001	HW	35.9	1100	1/25		8	20	12	

Split Systems and AC Condensers

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity	Eff.	Refrigerant	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Rooftop	Area D	Mitsubishi	1	PU18EK1	2081230	18000			208/230	1			15		
Tech Office	Tech Office	Carrier	1	42KN6A3407A	7182-6442			R22	115	1	3.1		15		
Orchestra Rm		Sanyo	2	KS3632	0024451 & 0024951	36000						4	15	11	
Choral Rm		Sanyo	2	KS3632	0024251 & 0024351	36000						4	15	11	
Tech Closet		Carrier	1										15		
Library Server Room		EMI	1	BC79M553H2									15		

Air Compressor

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	Pressure	Capacity	Volts	Phase	FLA	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Orig Boiler Room	H&V Controls	Quincy	1	QC03012D00300	20061215-0102	(2) 3HP	86	13 cfm @80 psig				2	20	18	

Heating and Ventilation Units

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Heating Coil	Capacity (Btu/h)	Fan HP	Fan RPM	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Classroom A-132	Classroom A-132	NesbittAire	1	TXW515001L000C00-EEETWXOCS	0108-0140	HW		1/6		120	1	3		20		100 inch long, 1500 cfm, DX cooling, HW heating
	Classrooms	NesbittAire	4	TXW515001L000C00-EEETWXOCS		HW		1/6		120	1	3		20		100 inch long, 1500 cfm, DX cooling, HW heating
	Classrooms	NesbittAire	22			HW		1/6						20		
B156	Classrooms	Nesbitt	2	MCR1242LO2C00014WEEETXOBS	PN00045M 1 AND 3 OF 5	HW	24,000	1/6		208	1	13.4		20		60 inch long, 640 cfm, DX cooling, HW heating
B154	Classrooms	Nesbitt	2					1/6		208	1	13.4		20		
Corr at B151	Corridor	Nesbitt	1					1/6		208	1	13.4		20		
B158	Classrooms	Nesbitt	2	MCR1242LO2C00014WEEETXOBS	PN00045M 2 AND 3 OF 5	HW	24,000	1/6		208	1	13.4		20		60 inch long, 640 cfm, DX cooling, HW heating
B160	Classrooms	Nesbitt	2	MCR1242LO2C00014WEEETXOBS	PN00045M 9 of 15	HW	24,000	1/6		208	1	13.4		20		60 inch long, 640 cfm, DX cooling, HW heating
B162, B164, B166	Classrooms	Nesbitt	6	MCR1242LO2C00014WEEETXOBS		HW	24,000	1/6		208	1	13.4		20		60 inch long, 640 cfm, DX cooling, HW heating
M15	MUSIC	Nesbitt	1			HW	24,000	1/6		208	1	13.4		20		60 inch long, 640 cfm, DX cooling, HW heating
B159	Classrooms	Nesbitt	2			HW	24,000	1/6		208	1	13.4		20		60 inch long, 640 cfm, DX cooling, HW heating
B158	Classrooms	Nesbitt	2		PN00045M 4 of 15	HW	24,000	1/6		208	1	13.4		20		60 inch long, 640 cfm, DX cooling, HW heating
B157	Classrooms	Nesbitt	2													
C141	Classrooms	Nesbitt	1													
C143	Classrooms	Nesbitt	1													
Science Rm	Classrooms	Nesbitt	1													
C138	Classrooms	Nesbitt	1													
C136	Classrooms	Nesbitt	1		RMCA4045208	S										

Kitchen Hood

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Fan HP	Fan RPM	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Roof	Kitchen Hood	Penn Vent	2	Fumex		1		208-230/460			8	25	17	

Window AC Units

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling	Heating Capacity -	Fan HP	Volts	Phase	Amps	Approx. Age	ASHRAE Service	Remaining Life	Notes
A124	Classroom	Panasonic	1	CW-XC183HU	302KA01437	17800			230/208	1	7.4		10		10.7 EER
A126	Classroom	Panasonic	1	CW-XC183HU		17800			230/208				10		
A119	Classroom	Friedrich	1	KN18L30-C	LHHZ00194	17800			230/208	1	8.1	1	10	9	10.0 EER
A119	Classroom	Friedrich	1	KN18L30-A	LFBR08408	17800			230/208	1	8.1	3	10	7	10.0 EER
A117	Classroom	Friedrich	1	KN18L30-B	LGGR05179	17800			230/208	1	8.1	2	10	8	10.0 EER
A115	Classroom	Friedrich	1	KN18L30-B	LGGR06084	17800			230/208	1	8.1	2	10	8	10.0 EER
A113	Classroom	Friedrich	1	KN18L30-B	LGCR0523KM18LB0B	17800			230/208	1	8.1	2	10	8	10.0 EER
A114	Classroom	CARRIER	2										10		
A111	Classroom	Friedrich	1	KN18L30-B	LGGR00414	17800			230/208	1	8.1	2	10	8	10.0 EER
A109	Classroom	Friedrich	1	KN18L30-B	LGDR13225	17800			230/208	1	8.1	2	10	8	10.0 EER
A107	Classroom	Friedrich	1	KN18L30-B	LGDR13236	17800			230/208	1	8.1	2	10	8	10.0 EER
A108	Classroom	Panasonic	1	CW-XC183HU	302KA00080	17800			230/208	1	7.4		10		10.7 EER
A106	Classroom	Panasonic	1	CW-XC183HU	301KAD1917	17800			230/208	1	7.4		10		10.7 EER
Health Office	Health Office	Emerson	1	Quiet Cool											

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Chatham High School

Building ID: 1830578
For 12-month Period Ending: July 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: September 24, 2009

Facility
Chatham High School
255 Lafayette Avenue
Chatham, NJ 07928

Facility Owner
School District of the Chathams
58 Meyersville Road
Chatham, NJ 07928

Primary Contact for this Facility
Ralph Goodwin
58 Meyersville Road
Chatham, NJ 07928

Year Built: 1962
Gross Floor Area (ft²): 253,663

Energy Performance Rating[2] (1-100) 62

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	6,390,267
Natural Gas (kBtu)[4]	9,191,023
Total Energy (kBtu)	15,581,290

Energy Intensity[5]	
Site (kBtu/ft²/yr)	61
Source (kBtu/ft²/yr)	122

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	1,462

Electric Distribution Utility
Jersey Central Power & Lt Co

National Average Comparison	
National Average Site EUI	69
National Average Source EUI	137
% Difference from National Average Source EUI	-11%
Building Type	K-12 School

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Meets Industry Standards[6] for Indoor Environmental Conditions:

Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Certifying Professional
Raymond Johnson
520 South Burnt Mill Road
Voorhees, NJ 08043

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.
NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Chatham High School	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	K-12 School	Is this an accurate description of the space in question?		☐
Location	255 Lafayette Avenue, Chatham, NJ 07928	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐

High School 1973 Addition (K-12 School)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	60,081 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Open Weekends?	No	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	53	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	0	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	No	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	12 (Optional)	Is this school in operation for at least 8 months of the year?		☐

High School?	Yes	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐

High School 2001 Addition (K-12 School)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	73,142 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Open Weekends?	No	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	148	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	0	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	No	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	12 (Optional)	Is this school in operation for at least 8 months of the year?		☐
High School?	Yes	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐

High School original building (K-12 School)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	120,440 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐

Open Weekends?	No	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	189	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	2	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	Yes	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	12 (Optional)	Is this school in operation for at least 8 months of the year?		☐
High School?	Yes	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Jersey Central Power & Lt Co

Fuel Type: Electricity

Meter: High School Electric (kWh (thousand Watt-hours))
Space(s): Entire Facility
Generation Method: Grid Purchase

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
07/01/2009	07/31/2009	163,760.00
06/01/2009	06/30/2009	125,040.00
05/01/2009	05/31/2009	148,440.00
04/01/2009	04/30/2009	174,680.00
03/01/2009	03/31/2009	134,880.00
02/01/2009	02/28/2009	154,240.00
01/01/2009	01/31/2009	169,720.00
12/01/2008	12/31/2008	145,120.00
11/01/2008	11/30/2008	147,160.00
10/01/2008	10/31/2008	159,880.00
09/01/2008	09/30/2008	147,480.00
08/01/2008	08/31/2008	202,480.00
High School Electric Consumption (kWh (thousand Watt-hours))		**1,872,880.00**
High School Electric Consumption (kBtu (thousand Btu))		**6,390,266.56**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**6,390,266.56**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

Meter: Natural Gas Facility Total (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
07/01/2009	07/31/2009	406.69
06/01/2009	06/30/2009	1,868.46
05/01/2009	05/31/2009	4,157.48
04/01/2009	04/30/2009	4,667.44
03/01/2009	03/31/2009	11,221.82
02/01/2009	02/28/2009	17,100.95
01/01/2009	01/31/2009	20,502.47
12/01/2008	12/31/2008	17,618.38
11/01/2008	11/30/2008	9,963.09
10/01/2008	10/31/2008	2,949.30

09/01/2008	09/30/2008	841.01
08/01/2008	08/31/2008	613.14
Natural Gas Facility Total Consumption (therms)		**91,910.23**
Natural Gas Facility Total Consumption (kBtu (thousand Btu))		**9,191,023.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**9,191,023.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

Additional Fuels	
Do the fuel consumption totals shown above represent the total energy use of this building? Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.	☐

On-Site Solar and Wind Energy	
Do the fuel consumption totals shown above include all on-site solar and/or wind power located at your facility? Please confirm that no on-site solar or wind installations have been omitted from this list. All on-site systems must be reported.	☐

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same as the PE that signed and stamped the SEP.)

Name: ____ Date: _____________

Signature: _____________________________________

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
Chatham High School
255 Lafayette Avenue
Chatham, NJ 07928

Facility Owner
School District of the Chathams
58 Meyersville Road
Chatham, NJ 07928

Primary Contact for this Facility
Ralph Goodwin
58 Meyersville Road
Chatham, NJ 07928

General Information

Chatham High School	
Gross Floor Area Excluding Parking: (ft^2)	253,663
Year Built	1962
For 12-month Evaluation Period Ending Date:	July 31, 2009

Facility Space Use Summary

High School 1973 Addition	
Space Type	K-12 School
Gross Floor Area(ft^2)	60,081
Open Weekends?	No
Number of PCs	53
Number of walk-in refrigeration/freezer units	0
Presence of cooking facilities	No
Percent Cooled	100
Percent Heated	100
Months°	12
High School?	Yes
School District°	Chatham

High School original building	
Space Type	K-12 School
Gross Floor Area(ft^2)	120,440
Open Weekends?	No
Number of PCs	189
Number of walk-in refrigeration/freezer units	2
Presence of cooking facilities	Yes
Percent Cooled	100
Percent Heated	100
Months°	12
High School?	Yes
School District°	Chatham

High School 2001 Addition	
Space Type	K-12 School
Gross Floor Area(ft^2)	73,142
Open Weekends?	No
Number of PCs	148
Number of walk-in refrigeration/freezer units	0
Presence of cooking facilities	No
Percent Cooled	100
Percent Heated	100
Months°	12
High School?	Yes
School District°	Chathams

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 07/31/2009)	**Baseline** (Ending Date 07/31/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	62	62	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	61	61	54	N/A	69
Source (kBtu/ft^2)	122	122	107	N/A	137
Energy Cost					
$/year	$ 444,191.02	$ 444,191.02	$ 390,682.74	N/A	$ 499,651.63

$/ft2/year	$ 1.75	$ 1.75	$ 1.54	N/A	$ 1.97
Greenhouse Gas Emissions					
$MtCO_2e$/year	1,462	1,462	1,286	N/A	1,645
$kgCO_2e/ft^2$/year	6	6	5	N/A	7

More than 50% of your building is defined as K-12 School. Please note that your rating accounts for all of the spaces listed. The National Average column presents energy performance data your building would have if your building had an average rating of 50.

Notes:
o - This attribute is optional.
d - A default value has been supplied by Portfolio Manager.

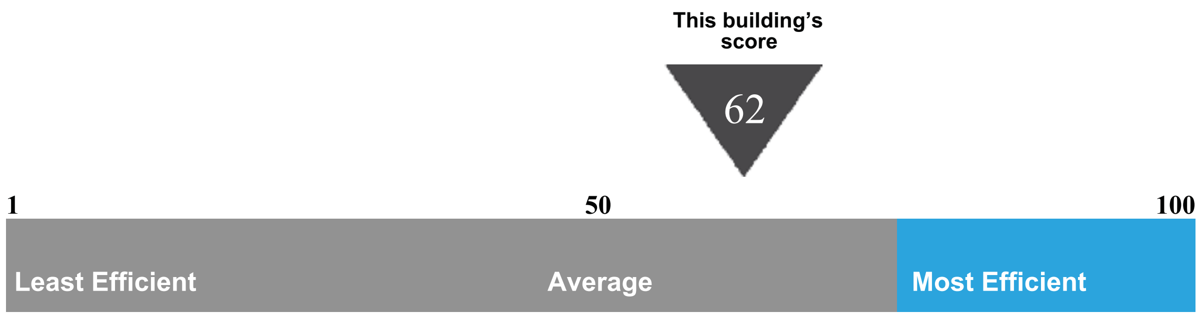
Statement of Energy Performance

2009

Chatham High School
255 Lafayette Avenue
Chatham, NJ 07928

Portfolio Manager Building ID: 1830578

The energy use of this building has been measured and compared to other similar buildings using the Environmental Protection Agency's (EPA's) Energy Performance Scale of 1–100, with 1 being the least energy efficient and 100 the most energy efficient. For more information, visit energystar.gov/benchmark.



This building uses 122 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending July 2009

Buildings with a score of 75 or higher may qualify for EPA's ENERGY STAR.

I certify that the information contained within this statement is accurate and in accordance with U.S. Environmental Protection Agency's measurement standards, found at energystar.gov

Date of certification

EPA United States Environmental Protection Agency

Date Generated: 09/24/2009

CEG Job #: 9C09078
Project: Chatham School District
Address: 255 Lafayette Avenue
City: Chatham
Building SF: 253,663

Chatham High School

DATE: 11/3/2009
KWH COST: **$0.166**

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
1	Front Hall	8760	11	4	T8 4x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	1.20	10,503.2	$1,743.54	11	0	No Change	109	1.20	10503.24	$1,743.54	$0.00	$0.00	0.00	0	$0.00	0.00
2	Hall Behind Cafeteria	8760	7	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.41	3,556.6	$590.39	7	0	No Change	58	0.41	3556.56	$590.39	$0.00	$0.00	0.00	0	$0.00	0.00
3	Maintenance Hall	8760	5	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.29	2,540.4	$421.71	5	0	No Change	58	0.29	2540.4	$421.71	$0.00	$0.00	0.00	0	$0.00	0.00
25	Maintenance Hall	8760	1	1	Incadescent Surface Mounting	100	0.10	876.0	$145.42	1	0	Eiko-30w mini sprial	30	0.03	262.8	$43.62	$6.00	$6.00	0.07	613.2	$101.79	0.06
3	Kitchen	2080	34	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	1.97	4,101.8	$680.89	34	0	No Change	58	1.97	4101.76	$680.89	$0.00	$0.00	0.00	0	$0.00	0.00
3	Cafeteria Manager	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	No Change	58	0.12	241.28	$40.05	$0.00	$0.00	0.00	0	$0.00	0.00
4	Secondary Kitchen	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.66	1,364.5	$226.50	8	0	No Change	82	0.66	1364.48	$226.50	$0.00	$0.00	0.00	0	$0.00	0.00
3	Storage	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	No Change	58	0.12	241.28	$40.05	$0.00	$0.00	0.00	0	$0.00	0.00
3	Hall Between Caf & Storage	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	No Change	58	0.12	241.28	$40.05	$0.00	$0.00	0.00	0	$0.00	0.00
2	Cafeteria	2080	40	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	2.32	4,825.6	$801.05	40	0	No Change	58	2.32	4825.6	$801.05	$0.00	$0.00	0.00	0	$0.00	0.00
26	Cafeteria	2080	5	1	Incadescent Pendant Mounting	100	0.50	1,040.0	$172.64	5	0	Eiko-30w mini sprial	30	0.15	312	$51.79	$6.00	$30.00	0.35	728	$120.85	0.25
19	Cafeteria	2080	5	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	73	0.37	759.2	$126.03	5	0	No Change	73	0.37	759.2	$126.03	$0.00	$0.00	0.00	0	$0.00	0.00
2	Bathrooms	2080	6	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.35	723.8	$120.16	6	0	No Change	58	0.35	723.84	$120.16	$0.00	$0.00	0.00	0	$0.00	0.00
5	Front Hall	8760	17	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	1.85	16,232.3	$2,694.56	17	0	No Change	109	1.85	16232.28	$2,694.56	$0.00	$0.00	0.00	0	$0.00	0.00
3	Hall Between Library	8760	3	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.17	1,524.2	$253.02	3	0	No Change	58	0.17	1524.24	$253.02	$0.00	$0.00	0.00	0	$0.00	0.00
13	Conference Room	2080	10	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	0.58	1,206.4	$200.26	10	0	No Change	58	0.58	1206.4	$200.26	$0.00	$0.00	0.00	0	$0.00	0.00
14	A104	2080	24	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	1.39	2,895.4	$480.63	24	0	No Change	58	1.39	2895.36	$480.63	$0.00	$0.00	0.00	0	$0.00	0.00
15	Counseling	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.49	1,023.4	$169.88	6	0	No Change	82	0.49	1023.36	$169.88	$0.00	$0.00	0.00	0	$0.00	0.00
2	Counseling	2080	8	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.46	965.1	$160.21	8	0	No Change	58	0.46	965.12	$160.21	$0.00	$0.00	0.00	0	$0.00	0.00

18	Main Office Hall	8760	14	2	T8 4' 2 Lamps Electronic Ballast Side Wall Mount	80	1.12	9,811.2	$1,628.66	14	0	No Change	80	1.12	9811.2	$1,628.66	$0.00	$0.00	0.00	0	$0.00	0.00
20	Main Office Hall	8760	1	1	T12 8' 1 Lamp Magnetic Ballast Surface Mounting No Lens	93	0.09	814.7	$135.24	1	2	(2 in tandem) 4' - 1-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N SNF132	56	0.06	490.56	$81.43	$246.00	$246.00	0.04	324.12	$53.80	4.57
2	Main Office	8760	9	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.52	4,572.7	$759.07	9	0	No Change	58	0.52	4572.72	$759.07	$0.00	$0.00	0.00	0	$0.00	0.00
2	Assistant Prin	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	No Change	58	0.12	241.28	$40.05	$0.00	$0.00	0.00	0	$0.00	0.00
13	Communications	2080	1	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	0.06	120.6	$20.03	1	0	No Change	58	0.06	120.64	$20.03	$0.00	$0.00	0.00	0	$0.00	0.00
4	Principal 1	2080	1	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.08	170.6	$28.31	1	0	No Change	82	0.08	170.56	$28.31	$0.00	$0.00	0.00	0	$0.00	0.00
2	Principal 1	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	No Change	58	0.12	241.28	$40.05	$0.00	$0.00	0.00	0	$0.00	0.00
2	Principal 2	2080	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.17	361.9	$60.08	3	0	No Change	58	0.17	361.92	$60.08	$0.00	$0.00	0.00	0	$0.00	0.00
6	Bathrooms	2080	2	2	T12 2x2 2 U-Tube Lamps Magnetic Ballast Recessed Mounting Prismatic Lens	70	0.14	291.2	$48.34	2	0	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast, Architectural surface or Recessed static METALUX 2AC-217-UNV-EB81-U	34	0.07	141.44	$23.48	$204.00	$408.00	0.07	149.76	$24.86	16.41
2	Security	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$20.03	1	0	No Change	58	0.06	120.64	$20.03	$0.00	$0.00	0.00	0	$0.00	0.00
2	Office	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$240.31	12	0	No Change	58	0.70	1447.68	$240.31	$0.00	$0.00	0.00	0	$0.00	0.00
2	Office	2080	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.17	361.9	$60.08	3	0	No Change	58	0.17	361.92	$60.08	$0.00	$0.00	0.00	0	$0.00	0.00
2	Office	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$20.03	1	0	No Change	58	0.06	120.64	$20.03	$0.00	$0.00	0.00	0	$0.00	0.00
13	A106	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	No Change	58	1.04	2171.52	$360.47	$0.00	$0.00	0.00	0	$0.00	0.00
14	A108	2080	21	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	1.22	2,533.4	$420.55	21	0	No Change	58	1.22	2533.44	$420.55	$0.00	$0.00	0.00	0	$0.00	0.00
14	A107	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	No Change	58	1.04	2171.52	$360.47	$0.00	$0.00	0.00	0	$0.00	0.00
2	Athletic Director	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$240.31	12	0	No Change	58	0.70	1447.68	$240.31	$0.00	$0.00	0.00	0	$0.00	0.00
14	A109	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	No Change	58	1.04	2171.52	$360.47	$0.00	$0.00	0.00	0	$0.00	0.00
14	A111	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	No Change	58	1.04	2171.52	$360.47	$0.00	$0.00	0.00	0	$0.00	0.00
14	Social Studies Office	2080	14	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	0.81	1,689.0	$280.37	14	0	No Change	58	0.81	1688.96	$280.37	$0.00	$0.00	0.00	0	$0.00	0.00
7	Infront of SS Office	2080	1	2	T12 2x4 2 Lamps Magnetic Ballast Recessed Mounting Prismatic Lens	73	0.07	151.8	$25.21	1	0	2'x4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.06	126.88	$21.06	$120.00	$120.00	0.01	24.96	$4.14	28.96
2	A117, 118, Hall	2080	8	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.46	965.1	$160.21	8	0	No Change	58	0.46	965.12	$160.21	$0.00	$0.00	0.00	0	$0.00	0.00

14	A113	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	No Change	58	1.04	2171.52	$360.47	$0.00	$0.00	0.00	0	$0.00	0.00
14	A114	2080	45	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	2.61	5,428.8	$901.18	45	0	No Change	58	2.61	5428.8	$901.18	$0.00	$0.00	0.00	0	$0.00	0.00
2	A114	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	No Change	58	0.12	241.28	$40.05	$0.00	$0.00	0.00	0	$0.00	0.00
14	A115	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	No Change	58	1.04	2171.52	$360.47	$0.00	$0.00	0.00	0	$0.00	0.00
5	Hall to Courtyard	2080	5	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.55	1,133.6	$188.18	5	0	No Change	109	0.55	1133.6	$188.18	$0.00	$0.00	0.00	0	$0.00	0.00
14	A117	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	No Change	58	1.04	2171.52	$360.47	$0.00	$0.00	0.00	0	$0.00	0.00
14	A116	2080	59	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	3.42	7,117.8	$1,181.55	59	0	No Change	58	3.42	7117.76	$1,181.55	$0.00	$0.00	0.00	0	$0.00	0.00
2	A116	2080	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.17	361.9	$60.08	3	0	No Change	58	0.17	361.92	$60.08	$0.00	$0.00	0.00	0	$0.00	0.00
2	A120	2080	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	2,412.8	$400.52	20	0	No Change	58	1.16	2412.8	$400.52	$0.00	$0.00	0.00	0	$0.00	0.00
14	A119	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	No Change	58	1.04	2171.52	$360.47	$0.00	$0.00	0.00	0	$0.00	0.00
15	Child Study Office	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.98	2,046.7	$339.76	12	0	No Change	82	0.98	2046.72	$339.76	$0.00	$0.00	0.00	0	$0.00	0.00
2	Hallway	2080	16	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.93	1,930.2	$320.42	16	0	No Change	58	0.93	1930.24	$320.42	$0.00	$0.00	0.00	0	$0.00	0.00
15	Server Room	2080	2	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.16	341.1	$56.63	2	0	No Change	82	0.16	341.12	$56.63	$0.00	$0.00	0.00	0	$0.00	0.00
13	A123	2080	12	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	0.70	1,447.7	$240.31	12	0	No Change	58	0.70	1447.68	$240.31	$0.00	$0.00	0.00	0	$0.00	0.00
13	A125	2080	16	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	0.93	1,930.2	$320.42	16	0	No Change	58	0.93	1930.24	$320.42	$0.00	$0.00	0.00	0	$0.00	0.00
2	Math Supervisor	2080	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.23	482.6	$80.10	4	0	No Change	58	0.23	482.56	$80.10	$0.00	$0.00	0.00	0	$0.00	0.00
11	Math Supervisor	2080	1	2	T8 1x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$20.03	1	0	No Change	58	0.06	120.64	$20.03	$0.00	$0.00	0.00	0	$0.00	0.00
13	A124	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	No Change	58	1.04	2171.52	$360.47	$0.00	$0.00	0.00	0	$0.00	0.00
13	A127	2080	12	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	0.70	1,447.7	$240.31	12	0	No Change	58	0.70	1447.68	$240.31	$0.00	$0.00	0.00	0	$0.00	0.00
13	A126	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	No Change	58	1.04	2171.52	$360.47	$0.00	$0.00	0.00	0	$0.00	0.00
13	A128	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	No Change	58	1.04	2171.52	$360.47	$0.00	$0.00	0.00	0	$0.00	0.00
13	A129	2080	22	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.28	2,654.1	$440.58	22	0	No Change	58	1.28	2654.08	$440.58	$0.00	$0.00	0.00	0	$0.00	0.00
3	A131	2080	21	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	1.22	2,533.4	$420.55	21	0	No Change	58	1.22	2533.44	$420.55	$0.00	$0.00	0.00	0	$0.00	0.00

13	A130	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	No Change	58	1.04	2171.52	$360.47	$0.00	$0.00	0.00	0	$0.00	0.00
13	A132	2080	21	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.22	2,533.4	$420.55	21	0	No Change	58	1.22	2533.44	$420.55	$0.00	$0.00	0.00	0	$0.00	0.00
13	A133	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	No Change	58	1.04	2171.52	$360.47	$0.00	$0.00	0.00	0	$0.00	0.00
24	Faculty Bathroom	2080	3	1	Incadescent High Hat	100	0.30	624.0	$103.58	3	0	Eiko-30w mini sprial	30	0.09	187.2	$31.08	$6.00	$18.00	0.21	436.8	$72.51	0.25
13	A134	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	No Change	58	1.04	2171.52	$360.47	$0.00	$0.00	0.00	0	$0.00	0.00
15	A134	2080	10	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.82	1,705.6	$283.13	10	0	No Change	82	0.82	1705.6	$283.13	$0.00	$0.00	0.00	0	$0.00	0.00
2	Hallway	8760	7	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.41	3,556.6	$590.39	7	0	No Change	58	0.41	3556.56	$590.39	$0.00	$0.00	0.00	0	$0.00	0.00
13	Coach Office	2080	7	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	0.41	844.5	$140.18	7	0	No Change	58	0.41	844.48	$140.18	$0.00	$0.00	0.00	0	$0.00	0.00
18	Coach Office	2080	1	2	T8 4' 2 Lamps Electronic Ballast Side Wall Mount	80	0.08	166.4	$27.62	1	0	No Change	80	0.08	166.4	$27.62	$0.00	$0.00	0.00	0	$0.00	0.00
3	Coach Locker Room	2080	26	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	1.51	3,136.6	$520.68	26	0	No Change	58	1.51	3136.64	$520.68	$0.00	$0.00	0.00	0	$0.00	0.00
3	Coach Locker Room	2080	1	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.06	120.6	$20.03	1	0	No Change	58	0.06	120.64	$20.03	$0.00	$0.00	0.00	0	$0.00	0.00
23	Coach Locker Room	2080	8	4	T8 4' 4 Lamps Surface Mounting	109	0.87	1,813.8	$301.08	8	0	No Change	109	0.87	1813.76	$301.08	$0.00	$0.00	0.00	0	$0.00	0.00
3	Girls Locker Room	2080	26	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	1.51	3,136.6	$520.68	26	0	No Change	58	1.51	3136.64	$520.68	$0.00	$0.00	0.00	0	$0.00	0.00
3	Locker Office	2080	6	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.35	723.8	$120.16	6	0	No Change	58	0.35	723.84	$120.16	$0.00	$0.00	0.00	0	$0.00	0.00
3	Hall	8760	7	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.41	3,556.6	$590.39	7	0	No Change	58	0.41	3556.56	$590.39	$0.00	$0.00	0.00	0	$0.00	0.00
24	Workout Room	2080	8	1	Incadescent High Hat	100	0.80	1,664.0	$276.22	8	0	Eiko-30w mini sprial	30	0.24	499.2	$82.87	$6.00	$48.00	0.56	1164.8	$193.36	0.25
28	Library	2080	60	1	T8 2x2 1 Lamp Electronic Ballast Recessed Mounting Direct/Indirect Lens	20	1.20	2,496.0	$414.34	60	0	No Change	20	1.20	2496	$414.34	$0.00	$0.00	0.00	0	$0.00	0.00
29	Library	2080	117	3	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	82	9.59	19,955.5	$3,312.62	117	0	No Change	82	9.59	19955.52	$3,312.62	$0.00	$0.00	0.00	0	$0.00	0.00
13	Library	2080	14	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	0.81	1,689.0	$280.37	14	0	No Change	58	0.81	1688.96	$280.37	$0.00	$0.00	0.00	0	$0.00	0.00
15	Library	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.66	1,364.5	$226.50	8	0	No Change	82	0.66	1364.48	$226.50	$0.00	$0.00	0.00	0	$0.00	0.00
30	Server Room	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting No lens	58	0.12	241.3	$40.05	2	0	No Change	58	0.12	241.28	$40.05	$0.00	$0.00	0.00	0	$0.00	0.00
13	Storage	2080	20	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.16	2,412.8	$400.52	20	0	No Change	58	1.16	2412.8	$400.52	$0.00	$0.00	0.00	0	$0.00	0.00
13	L11	2080	48	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	2.78	5,790.7	$961.26	48	0	No Change	58	2.78	5790.72	$961.26	$0.00	$0.00	0.00	0	$0.00	0.00
13	L10	2080	28	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.62	3,377.9	$560.73	28	0	No Change	58	1.62	3377.92	$560.73	$0.00	$0.00	0.00	0	$0.00	0.00
13	L12	2080	33	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.91	3,981.1	$660.87	33	0	No Change	58	1.91	3981.12	$660.87	$0.00	$0.00	0.00	0	$0.00	0.00

3	L12	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	No Change	58	0.12	241.28	$40.05	$0.00	$0.00	0.00	0	$0.00	0.00
3	L12	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	No Change	58	0.12	241.28	$40.05	$0.00	$0.00	0.00	0	$0.00	0.00
31	L12	2080	1	1	Incandescent Pendant	200	0.20	416.0	$69.06	1	0	65 W CFL Lamp	65	0.07	135.2	$22.44	$17.00	$17.00	0.14	280.8	$46.61	0.36
13	L14	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	0.12	241.3	$40.05	2	0	No Change	58	0.12	241.28	$40.05	$0.00	$0.00	0.00	0	$0.00	0.00
2	L14	2080	38	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	2.20	4,584.3	$761.00	38	0	No Change	58	2.20	4584.32	$761.00	$0.00	$0.00	0.00	0	$0.00	0.00
2	Electrical Panels	520	5	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.29	150.8	$25.03	5	0	No Change	58	0.29	150.8	$25.03	$0.00	$0.00	0.00	0	$0.00	0.00
9	L15	2080	18	1	T8 1x4 1 Lamp Electronic Ballast Surface Mounting Prismatic Lens	28	0.50	1,048.3	$174.02	18	0	No Change	28	0.50	1048.32	$174.02	$0.00	$0.00	0.00	0	$0.00	0.00
10	L15	2080	3	2	T8 1x2 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	20	0.06	124.8	$20.72	3	0	No Change	20	0.06	124.8	$20.72	$0.00	$0.00	0.00	0	$0.00	0.00
9	L13	2080	12	1	T8 1x4 1 Lamp Electronic Ballast Surface Mounting Prismatic Lens	28	0.34	698.9	$116.01	12	0	No Change	28	0.34	698.88	$116.01	$0.00	$0.00	0.00	0	$0.00	0.00
10	L13	2080	3	2	T8 1x2 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	20	0.06	124.8	$20.72	3	0	No Change	20	0.06	124.8	$20.72	$0.00	$0.00	0.00	0	$0.00	0.00
3	Boys Room	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	No Change	58	0.12	241.28	$40.05	$0.00	$0.00	0.00	0	$0.00	0.00
24	Storage	520	1	1	Incadescent High Hat	100	0.10	52.0	$8.63	1	0	Eiko-30w mini sprial	30	0.03	15.6	$2.59	$6.00	$6.00	0.07	36.4	$6.04	0.99
3	Girls Room	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	No Change	58	0.12	241.28	$40.05	$0.00	$0.00	0.00	0	$0.00	0.00
2	Hall	2080	6	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.35	723.8	$120.16	6	0	No Change	58	0.35	723.84	$120.16	$0.00	$0.00	0.00	0	$0.00	0.00
2	Elevator	8760	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	508.1	$84.34	1	0	No Change	58	0.06	508.08	$84.34	$0.00	$0.00	0.00	0	$0.00	0.00
24	Elevator	8760	3	1	Incadescent High Hat	100	0.30	2,628.0	$436.25	3	0	Eiko-30w mini sprial	30	0.09	788.4	$130.87	$6.00	$18.00	0.21	1839.6	$305.37	0.06
32	Elevator	8760	1	1	Compact Fluorescent High Hat 1 lamp	100	0.10	876.0	$145.42	1	0	No Change	100	0.10	876	$145.42	$0.00	$0.00	0.00	0	$0.00	0.00
15	Math Office	2080	16	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.31	2,729.0	$453.01	16	0	No Change	82	1.31	2728.96	$453.01	$0.00	$0.00	0.00	0	$0.00	0.00
13	Electrical Room	520	3	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	0.17	90.5	$15.02	3	0	No Change	58	0.17	90.48	$15.02	$0.00	$0.00	0.00	0	$0.00	0.00
8	Stairwell	8760	3	2	T12 1x4 2 Lamps Electronic Ballast Surface Wall Mounting No Lens	94	0.28	2,470.3	$410.07	3	0	4' 2-Lamp T-8 32W wall Mtd.Metalux BC232	58	0.17	1524.24	$253.02	$170.00	$510.00	0.11	946.08	$157.05	3.25
21	Stairwell	8760	1	2	T8 1x4 2 Lamps Electronic Ballast Surface Wall Mounting	58	0.06	508.1	$84.34	1	0	No Change	58	0.06	508.08	$84.34	$0.00	$0.00	0.00	0	$0.00	0.00
2	Bathrooms	2080	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.23	482.6	$80.10	4	0	No Change	58	0.23	482.56	$80.10	$0.00	$0.00	0.00	0	$0.00	0.00
33	Bathrooms	2080	2	2	Compact Fluorescent High Hat - 2 lamp	56	0.11	233.0	$38.67	2	0	No Change	56	0.11	232.96	$38.67	$0.00	$0.00	0.00	0	$0.00	0.00
15	B160	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.98	2,046.7	$339.76	12	0	No Change	82	0.98	2046.72	$339.76	$0.00	$0.00	0.00	0	$0.00	0.00
2	B162	2080	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	2,412.8	$400.52	20	0	No Change	58	1.16	2412.8	$400.52	$0.00	$0.00	0.00	0	$0.00	0.00
15	B163	2080	24	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.97	4,093.4	$679.51	24	0	No Change	82	1.97	4093.44	$679.51	$0.00	$0.00	0.00	0	$0.00	0.00

15	B161	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.49	1,023.4	$169.88	6	0	No Change	82	0.49	1023.36	$169.88	$0.00	$0.00	0.00	0	$0.00	0.00
2	B164	2080	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	2,412.8	$400.52	20	0	No Change	58	1.16	2412.8	$400.52	$0.00	$0.00	0.00	0	$0.00	0.00
2	B166	2080	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	2,412.8	$400.52	20	0	No Change	58	1.16	2412.8	$400.52	$0.00	$0.00	0.00	0	$0.00	0.00
32	B166	2080	2	1	Compact Fluorescent High Hat 1 lamp	100	0.20	416.0	$69.06	2	0	No Change	100	0.20	416	$69.06	$0.00	$0.00	0.00	0	$0.00	0.00
15	B165	2080	14	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.15	2,387.8	$396.38	14	0	No Change	82	1.15	2387.84	$396.38	$0.00	$0.00	0.00	0	$0.00	0.00
34	B167	2080	9	1	Mercury Start 1 Lamp Magnetic Ballast	175	1.58	3,276.0	$543.82	9	1	Cylinder 9.5" Surface Cylinder 42W Triple Twin Tube Portfolio M/N C19242E	85	0.77	1591.2	$264.14	$265.00	$2,385.00	0.81	1684.8	$279.68	8.53
15	B167	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.98	2,046.7	$339.76	12	0	No Change	82	0.98	2046.72	$339.76	$0.00	$0.00	0.00	0	$0.00	0.00
21	Stairwell	2080	3	2	T8 1x4 2 Lamps Electronic Ballast Surface Wall Mounting	58	0.17	361.9	$60.08	3	0	No Change	58	0.17	361.92	$60.08	$0.00	$0.00	0.00	0	$0.00	0.00
31	Auditorium	2080	102	1	Incandescent Pendant	200	20.40	42,432.0	$7,043.71	102	0	65 W CFL Lamp	65	6.63	13790.4	$2,289.21	$17.00	$1,734.00	13.77	28641.6	$4,754.51	0.36
31	Auditorium Lobby	2080	14	1	Incandescent Pendant	200	2.80	5,824.0	$966.78	14	0	65 W CFL Lamp	65	0.91	1892.8	$314.20	$17.00	$238.00	1.89	3931.2	$652.58	0.36
31	Auditorium Lobby	2080	45	1	Incandescent Pendant	200	9.00	18,720.0	$3,107.52	45	0	65 W CFL Lamp	65	2.93	6084	$1,009.94	$17.00	$765.00	6.08	12636	$2,097.58	0.36
24	Auditorium Lobby	2080	32	1	Incadescent High Hat	100	3.20	6,656.0	$1,104.90	32	0	Eiko-30w mini sprial	30	0.96	1996.8	$331.47	$6.00	$192.00	2.24	4659.2	$773.43	0.25
11	Bathrooms	2080	12	2	T8 1x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$240.31	12	0	No Change	58	0.70	1447.68	$240.31	$0.00	$0.00	0.00	0	$0.00	0.00
2	B156	2080	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	2,412.8	$400.52	20	0	No Change	58	1.16	2412.8	$400.52	$0.00	$0.00	0.00	0	$0.00	0.00
15	B153	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.66	1,364.5	$226.50	8	0	No Change	82	0.66	1364.48	$226.50	$0.00	$0.00	0.00	0	$0.00	0.00
15	B154	2080	16	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.31	2,729.0	$453.01	16	0	No Change	82	1.31	2728.96	$453.01	$0.00	$0.00	0.00	0	$0.00	0.00
15	B151	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.98	2,046.7	$339.76	12	0	No Change	82	0.98	2046.72	$339.76	$0.00	$0.00	0.00	0	$0.00	0.00
15	World Language	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.66	1,364.5	$226.50	8	0	No Change	82	0.66	1364.48	$226.50	$0.00	$0.00	0.00	0	$0.00	0.00
15	B150	2080	15	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.23	2,558.4	$424.69	15	0	No Change	82	1.23	2558.4	$424.69	$0.00	$0.00	0.00	0	$0.00	0.00
19	B150	2080	1	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	73	0.07	151.8	$25.21	1	0	No Change	73	0.07	151.84	$25.21	$0.00	$0.00	0.00	0	$0.00	0.00
31	Storage	2080	2	1	Incandescent Pendant	200	0.40	832.0	$138.11	2	0	65 W CFL Lamp	65	0.13	270.4	$44.89	$17.00	$34.00	0.27	561.6	$93.23	0.36
33	B Hallway	8760	10	2	Compact Fluorescent High Hat - 2 lamp	56	0.56	4,905.6	$814.33	10	0	No Change	56	0.56	4905.6	$814.33	$0.00	$0.00	0.00	0	$0.00	0.00
2	B Hallway	8760	52	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	3.02	26,420.2	$4,385.75	52	0	No Change	58	3.02	26420.16	$4,385.75	$0.00	$0.00	0.00	0	$0.00	0.00
32	B Hallway	8760	2	1	Compact Fluorescent High Hat 1 lamp	100	0.20	1,752.0	$290.83	2	0	No Change	100	0.20	1752	$290.83	$0.00	$0.00	0.00	0	$0.00	0.00
3	Projection Room	2080	3	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.17	361.9	$60.08	3	0	No Change	58	0.17	361.92	$60.08	$0.00	$0.00	0.00	0	$0.00	0.00
24	Projection Room	2080	1	1	Incandescent High Hat	100	0.10	208.0	$34.53	1	0	Eiko-30w mini sprial	30	0.03	62.4	$10.36	$6.00	$6.00	0.07	145.6	$24.17	0.25
15	M20	2080	4	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.33	682.2	$113.25	4	0	No Change	82	0.33	682.24	$113.25	$0.00	$0.00	0.00	0	$0.00	0.00
15	M19	2080	4	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.33	682.2	$113.25	4	0	No Change	82	0.33	682.24	$113.25	$0.00	$0.00	0.00	0	$0.00	0.00

22	Band Room	2080	56	4	T8 2x2 4 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	56	3.14	6,522.9	$1,082.80	56	0	No Change	56	3.14	6522.88	$1,082.80	$0.00	$0.00	0.00	0	$0.00	0.00
15	Band Office	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.66	1,364.5	$226.50	8	0	No Change	82	0.66	1364.48	$226.50	$0.00	$0.00	0.00	0	$0.00	0.00
5	Band Storage	2080	8	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.87	1,813.8	$301.08	8	0	No Change	109	0.87	1813.76	$301.08	$0.00	$0.00	0.00	0	$0.00	0.00
15	Band Practice	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.49	1,023.4	$169.88	6	0	No Change	82	0.49	1023.36	$169.88	$0.00	$0.00	0.00	0	$0.00	0.00
5	M Hall	8760	18	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	1.96	17,187.1	$2,853.06	18	0	No Change	109	1.96	17187.12	$2,853.06	$0.00	$0.00	0.00	0	$0.00	0.00
27	M Hall	8760	5	1	Incadescent High Hat	60	0.30	2,628.0	$436.25	5	0	13 W CFL Lamp	13	0.07	569.4	$94.52	$5.75	$28.75	0.24	2058.6	$341.73	0.08
33	M Hall	8760	2	2	Compact Fluorescent High Hat - 2 lamp	56	0.11	981.1	$162.87	2	0	No Change	56	0.11	981.12	$162.87	$0.00	$0.00	0.00	0	$0.00	0.00
5	Bathrooms	2080	6	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.65	1,360.3	$225.81	6	0	No Change	109	0.65	1360.32	$225.81	$0.00	$0.00	0.00	0	$0.00	0.00
15	M18	2080	1	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.08	170.6	$28.31	1	0	No Change	82	0.08	170.56	$28.31	$0.00	$0.00	0.00	0	$0.00	0.00
2	M17	2080	24	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.39	2,895.4	$480.63	24	0	No Change	58	1.39	2895.36	$480.63	$0.00	$0.00	0.00	0	$0.00	0.00
11	Orchastra Office Hall	8760	5	2	T8 1x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.29	2,540.4	$421.71	5	0	No Change	58	0.29	2540.4	$421.71	$0.00	$0.00	0.00	0	$0.00	0.00
2	Director Office	2080	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.17	361.9	$60.08	3	0	No Change	58	0.17	361.92	$60.08	$0.00	$0.00	0.00	0	$0.00	0.00
2	Office	2080	6	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.35	723.8	$120.16	6	0	No Change	58	0.35	723.84	$120.16	$0.00	$0.00	0.00	0	$0.00	0.00
2	M16	2080	24	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.39	2,895.4	$480.63	24	0	No Change	58	1.39	2895.36	$480.63	$0.00	$0.00	0.00	0	$0.00	0.00
4	Music Tech Room	2080	24	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	1.97	4,093.4	$679.51	24	0	No Change	82	1.97	4093.44	$679.51	$0.00	$0.00	0.00	0	$0.00	0.00
11	M Wing Hall	8760	13	2	T8 1x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.75	6,605.0	$1,096.44	13	0	No Change	58	0.75	6605.04	$1,096.44	$0.00	$0.00	0.00	0	$0.00	0.00
2	M Wing Hall	8760	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	508.1	$84.34	1	0	No Change	58	0.06	508.08	$84.34	$0.00	$0.00	0.00	0	$0.00	0.00
2	Hallway Exit B	8760	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.17	1,524.2	$253.02	3	0	No Change	58	0.17	1524.24	$253.02	$0.00	$0.00	0.00	0	$0.00	0.00
2	B159	2080	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	2,412.8	$400.52	20	0	No Change	58	1.16	2412.8	$400.52	$0.00	$0.00	0.00	0	$0.00	0.00
2	B158	2080	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	2,412.8	$400.52	20	0	No Change	58	1.16	2412.8	$400.52	$0.00	$0.00	0.00	0	$0.00	0.00
2	B157	2080	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	2,412.8	$400.52	20	0	No Change	58	1.16	2412.8	$400.52	$0.00	$0.00	0.00	0	$0.00	0.00
33	Hallway	8760	7	2	Compact Fluorescent High Hat - 2 lamp	56	0.39	3,433.9	$570.03	7	0	No Change	56	0.39	3433.92	$570.03	$0.00	$0.00	0.00	0	$0.00	0.00
5	Hallway	8760	15	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	1.64	14,322.6	$2,377.55	15	0	No Change	109	1.64	14322.6	$2,377.55	$0.00	$0.00	0.00	0	$0.00	0.00
5	Hallway	8760	49	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	5.34	46,787.2	$7,766.67	49	0	No Change	109	5.34	46787.16	$7,766.67	$0.00	$0.00	0.00	0	$0.00	0.00

33	Hallway	8760	4	2	Compact Fluorescent High Hat - 2 lamp	56	0.22	1,962.2	$325.73	4	0	No Change	56	0.22	1962.24	$325.73	$0.00	$0.00	0.00	0	$0.00	0.00
2	Health Office	2080	14	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.81	1,689.0	$280.37	14	0	No Change	58	0.81	1688.96	$280.37	$0.00	$0.00	0.00	0	$0.00	0.00
18	Health Office	2080	1	2	T8 4' 2 Lamps Electronic Ballast Side Wall Mount	80	0.08	166.4	$27.62	1	0	No Change	80	0.08	166.4	$27.62	$0.00	$0.00	0.00	0	$0.00	0.00
2	Health Office	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$20.03	1	0	No Change	58	0.06	120.64	$20.03	$0.00	$0.00	0.00	0	$0.00	0.00
35	Health Office	2080	1	2	T8 2 Tube 4' Indust Electronic Ballast Surface Mounting No Lens	58	0.06	120.6	$20.03	1	0	No Change	58	0.06	120.64	$20.03	$0.00	$0.00	0.00	0	$0.00	0.00
36	Health Office	2080	2	1	T8 6' 1 Lamp Electronic Ballast Surface Wall Mounted Prismatic Lens	28	0.06	116.5	$19.34	2	0	No Change	28	0.06	116.48	$19.34	$0.00	$0.00	0.00	0	$0.00	0.00
15	C137	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	No Change	82	2.05	4264	$707.82	$0.00	$0.00	0.00	0	$0.00	0.00
15	Storage	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.49	1,023.4	$169.88	6	0	No Change	82	0.49	1023.36	$169.88	$0.00	$0.00	0.00	0	$0.00	0.00
15	C139	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	No Change	82	2.05	4264	$707.82	$0.00	$0.00	0.00	0	$0.00	0.00
15	C141	2080	16	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.31	2,729.0	$453.01	16	0	No Change	82	1.31	2728.96	$453.01	$0.00	$0.00	0.00	0	$0.00	0.00
15	C143	2080	14	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.15	2,387.8	$396.38	14	0	No Change	82	1.15	2387.84	$396.38	$0.00	$0.00	0.00	0	$0.00	0.00
15	Office	2080	2	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.16	341.1	$56.63	2	0	No Change	82	0.16	341.12	$56.63	$0.00	$0.00	0.00	0	$0.00	0.00
16	Bathrooms	2080	6	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.65	1,360.3	$225.81	6	0	No Change	109	0.65	1360.32	$225.81	$0.00	$0.00	0.00	0	$0.00	0.00
33	Hallway	8760	4	2	Compact Fluorescent High Hat - 2 lamp	56	0.22	1,962.2	$325.73	4	0	No Change	56	0.22	1962.24	$325.73	$0.00	$0.00	0.00	0	$0.00	0.00
15	Science Room	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.98	2,046.7	$339.76	12	0	No Change	82	0.98	2046.72	$339.76	$0.00	$0.00	0.00	0	$0.00	0.00
15	C138	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	No Change	82	2.05	4264	$707.82	$0.00	$0.00	0.00	0	$0.00	0.00
15	Prep Room	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.49	1,023.4	$169.88	6	0	No Change	82	0.49	1023.36	$169.88	$0.00	$0.00	0.00	0	$0.00	0.00
15	C136	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	No Change	82	2.05	4264	$707.82	$0.00	$0.00	0.00	0	$0.00	0.00
5	Bathrooms	2080	6	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.65	1,360.3	$225.81	6	0	No Change	109	0.65	1360.32	$225.81	$0.00	$0.00	0.00	0	$0.00	0.00
33	Bathrooms	2080	2	2	Compact Fluorescent High Hat - 2 lamp	56	0.11	233.0	$38.67	2	0	No Change	56	0.11	232.96	$38.67	$0.00	$0.00	0.00	0	$0.00	0.00
5	Electric Closet	520	5	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.55	283.4	$47.04	5	0	No Change	109	0.55	283.4	$47.04	$0.00	$0.00	0.00	0	$0.00	0.00
5	Storage	2080	4	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.44	906.9	$150.54	4	0	No Change	109	0.44	906.88	$150.54	$0.00	$0.00	0.00	0	$0.00	0.00
5	Stairwell	8760	20	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	2.18	19,096.8	$3,170.07	20	0	No Change	109	2.18	19096.8	$3,170.07	$0.00	$0.00	0.00	0	$0.00	0.00
2	Stairwell	8760	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	1,016.2	$168.68	2	0	No Change	58	0.12	1016.16	$168.68	$0.00	$0.00	0.00	0	$0.00	0.00

17	C205	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Surface Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	No Change	82	2.05	4264	$707.82	$0.00	$0.00	0.00	0	$0.00	0.00
17	Storage	2080	2	3	T8 2x4 3 Lamps Electronic Ballast Surface Mounting Parabolic Lens	82	0.16	341.1	$56.63	2	0	No Change	82	0.16	341.12	$56.63	$0.00	$0.00	0.00	0	$0.00	0.00
15	Science Office	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.66	1,364.5	$226.50	8	0	No Change	82	0.66	1364.48	$226.50	$0.00	$0.00	0.00	0	$0.00	0.00
15	C203	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	No Change	82	2.05	4264	$707.82	$0.00	$0.00	0.00	0	$0.00	0.00
15	Prep Room	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.49	1,023.4	$169.88	6	0	No Change	82	0.49	1023.36	$169.88	$0.00	$0.00	0.00	0	$0.00	0.00
15	Storage	2080	4	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.33	682.2	$113.25	4	0	No Change	82	0.33	682.24	$113.25	$0.00	$0.00	0.00	0	$0.00	0.00
15	C201	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	No Change	82	2.05	4264	$707.82	$0.00	$0.00	0.00	0	$0.00	0.00
12	Greenhouse	2080	4	6	T8 8' 6 Lamps (4') Electronic Ballast Surface Mounting Prismatic Lens Vapor Proof	167	0.67	1,389.4	$230.65	4	0	No Change	167	0.67	1389.44	$230.65	$0.00	$0.00	0.00	0	$0.00	0.00
5	Electrical Room	2080	12	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	1.31	2,720.6	$451.63	12	0	No Change	109	1.31	2720.64	$451.63	$0.00	$0.00	0.00	0	$0.00	0.00
5	C Wing Up Stairs Hall	8760	38	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	4.14	36,283.9	$6,023.13	38	0	No Change	109	4.14	36283.92	$6,023.13	$0.00	$0.00	0.00	0	$0.00	0.00
33	C Wing Up Stairs Hall	8760	6	2	Compact Fluorescent High Hat - 2 lamp	56	0.34	2,943.4	$488.60	6	0	No Change	56	0.34	2943.36	$488.60	$0.00	$0.00	0.00	0	$0.00	0.00
5	Storage	2080	3	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.33	680.2	$112.91	3	0	No Change	109	0.33	680.16	$112.91	$0.00	$0.00	0.00	0	$0.00	0.00
5	Bathrooms	2080	6	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.65	1,360.3	$225.81	6	0	No Change	109	0.65	1360.32	$225.81	$0.00	$0.00	0.00	0	$0.00	0.00
33	Bathrooms	2080	2	2	Compact Fluorescent High Hat - 2 lamp	56	0.11	233.0	$38.67	2	0	No Change	56	0.11	232.96	$38.67	$0.00	$0.00	0.00	0	$0.00	0.00
15	C200	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	No Change	82	2.05	4264	$707.82	$0.00	$0.00	0.00	0	$0.00	0.00
15	Prep Room	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.49	1,023.4	$169.88	6	0	No Change	82	0.49	1023.36	$169.88	$0.00	$0.00	0.00	0	$0.00	0.00
15	Storage	2080	4	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.33	682.2	$113.25	4	0	No Change	82	0.33	682.24	$113.25	$0.00	$0.00	0.00	0	$0.00	0.00
15	C202	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	No Change	82	2.05	4264	$707.82	$0.00	$0.00	0.00	0	$0.00	0.00
15	C204	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	No Change	82	2.05	4264	$707.82	$0.00	$0.00	0.00	0	$0.00	0.00
15	Storage	2080	3	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.25	511.7	$84.94	3	0	No Change	82	0.25	511.68	$84.94	$0.00	$0.00	0.00	0	$0.00	0.00
4	Bathrooms	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.49	1,023.4	$169.88	6	0	No Change	82	0.49	1023.36	$169.88	$0.00	$0.00	0.00	0	$0.00	0.00
39	Boiler Room - Original	2080	8	1	Incadescent Pendant Mounting	150	1.20	2,496.0	$414.34	8	1	40 W CFL Lamp	40	0.32	665.6	$110.49	$9.60	$76.80	0.88	1830.4	$303.85	0.25
40	Boiler Room - 2001 Addition	2080	9	2	4' - 2-Lamp 32W T-8 Industrial Strip w/ Elect Ballast and Wire guard	73	0.66	1,366.6	$226.85	9	2	No Change	73	0.66	1366.56	$226.85	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		2754	495			213.70	639,038.2	$106,080.33	2754	6			185.623	576344.6	$95,673.21		$6,886.55	28.07	62693.5	$10,407.12	0.66

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

CEG Job #: 9C09078
Project: Chatham School District
Address: 255 Lafayette Avenue
City: Chatham
Building SF: 253,663

Chatham High School

DATE: 11/3/2009
KWH COST: $0.166

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost INSTALLED	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
1	Front Hall	8760	11	4	T8 4x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	1.20	10,503.2	$1,743.54	11	0	No Change	109	1.20	0%	10503.24	$1,743.54	$0.00	$0.00	0.00	0	$0.00	0.00
2	Hall Behind Cafeteria	8760	7	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.41	3,556.6	$590.39	7	0	No Change	58	0.41	0%	3556.56	$590.39	$0.00	$0.00	0.00	0	$0.00	0.00
3	Maintenance Hall	8760	5	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.29	2,540.4	$421.71	5	0	No Change	58	0.29	0%	2540.40	$421.71	$0.00	$0.00	0.00	0	$0.00	0.00
25	Maintenance Hall	8760	1	1	Incadescent Surface Mounting	100	0.10	876.0	$145.42	1	0	No Change	100	0.10	0%	876.00	$145.42	$0.00	$0.00	0.00	0	$0.00	0.00
3	Kitchen	2080	34	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	1.97	4,101.8	$680.89	34	0	No Change	58	1.97	0%	4101.76	$680.89	$0.00	$0.00	0.00	0	$0.00	0.00
3	Cafeteria Manager	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	Dual Technology Occupancy Sensor	58	0.12	10%	217.15	$36.05	$160.00	$160.00	0.00	24.128	$4.01	39.95
4	Secondary Kitchen	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.66	1,364.5	$226.50	8	0	Dual Technology Occupancy Sensor	82	0.66	10%	1228.03	$203.85	$160.00	$160.00	0.00	136.448	$22.65	7.06
3	Storage	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	Dual Technology Occupancy Sensor	58	0.12	10%	217.15	$36.05	$160.00	$160.00	0.00	24.128	$4.01	39.95
3	Hall Between Caf & Storage	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	No Change	58	0.12	0%	241.28	$40.05	$0.00	$0.00	0.00	0	$0.00	0.00
2	Cafeteria	2080	40	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	2.32	4,825.6	$801.05	40	0	Dual Technology Occupancy Sensor	58	2.32	10%	4343.04	$720.94	$160.00	$160.00	0.00	482.56	$80.10	2.00
26	Cafeteria	2080	5	1	Incadescent Pendant Mounting	100	0.50	1,040.0	$172.64	5	0	Dual Technology Occupancy Sensor	100	0.50	10%	936.00	$155.38	$160.00	$160.00	0.00	104	$17.26	9.27
19	Cafeteria	2080	5	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	73	0.37	759.2	$126.03	5	0	Dual Technology Occupancy Sensor	73	0.37	10%	683.28	$113.42	$160.00	$160.00	0.00	75.92	$12.60	12.70
2	Bathrooms	2080	6	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.35	723.8	$120.16	6	0	No Change	58	0.35	0%	723.84	$120.16	$0.00	$0.00	0.00	0	$0.00	0.00
5	Front Hall	8760	17	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	1.85	16,232.3	$2,694.56	17	0	No Change	109	1.85	0%	16232.28	$2,694.56	$0.00	$0.00	0.00	0	$0.00	0.00
3	Hall Between Library	8760	3	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.17	1,524.2	$253.02	3	0	No Change	58	0.17	0%	1524.24	$253.02	$0.00	$0.00	0.00	0	$0.00	0.00
13	Conference Room	2080	10	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	0.58	1,206.4	$200.26	10	0	Dual Technology Occupancy Sensor	58	0.58	10%	1085.76	$180.24	$160.00	$160.00	0.00	120.64	$20.03	7.99
14	A104	2080	24	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	1.39	2,895.4	$480.63	24	0	Dual Technology Occupancy Sensor	58	1.39	10%	2605.82	$432.57	$160.00	$160.00	0.00	289.536	$48.06	3.33
15	Counseling	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.49	1,023.4	$169.88	6	0	Dual Technology Occupancy Sensor	82	0.49	10%	921.02	$152.89	$160.00	$160.00	0.00	102.336	$16.99	9.42
2	Counseling	2080	8	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.46	965.1	$160.21	8	0	Dual Technology Occupancy Sensor	58	0.46	10%	868.61	$144.19	$160.00	$160.00	0.00	96.512	$16.02	9.99
18	Main Office Hall	8760	14	2	T8 4' 2 Lamps Electronic Ballast Side Wall Mount	80	1.12	9,811.2	$1,628.66	14	0	No Change	80	1.12	0%	9811.20	$1,628.66	$0.00	$0.00	0.00	0	$0.00	0.00
20	Main Office Hall	8760	1	1	T12 8' 1 Lamp Magnetic Ballast Surface Mounting No Lens	93	0.09	814.7	$135.24	1	2	No Change	93	0.09	0%	814.68	$135.24	$0.00	$0.00	0.00	0	$0.00	0.00
2	Main Office	8760	9	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.52	4,572.7	$759.07	9	0	No Change	58	0.52	0%	4572.72	$759.07	$0.00	$0.00	0.00	0	$0.00	0.00
2	Assistant Prin	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	Dual Technology Occupancy Sensor	58	0.12	10%	217.15	$36.05	$160.00	$160.00	0.00	24.128	$4.01	39.95

13	Communications	2080	1	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	0.06	120.6	$20.03	1	0	Dual Technology Occupancy Sensor	58	0.06	10%	108.58	$18.02	$160.00	$160.00	0.00	12.064	$2.00	79.90
4	Principal 1	2080	1	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.08	170.6	$28.31	1	0	Dual Technology Occupancy Sensor	82	0.08	10%	153.50	$25.48	$160.00	$160.00	0.00	17.056	$2.83	56.51
2	Principal 1	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	Dual Technology Occupancy Sensor	58	0.12	10%	217.15	$36.05	$160.00	$160.00	0.00	24.128	$4.01	39.95
2	Principal 2	2080	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.17	361.9	$60.08	3	0	Dual Technology Occupancy Sensor	58	0.17	10%	325.73	$54.07	$160.00	$160.00	0.00	36.192	$6.01	26.63
6	Bathrooms	2080	2	2	T12 2x2 2 U-Tube Lamps Magnetic Ballast Recessed Mounting Prismatic Lens	70	0.14	291.2	$48.34	2	0	Dual Technology Occupancy Sensor	70	0.14	10%	262.08	$43.51	$160.00	$160.00	0.00	29.12	$4.83	33.10
2	Security	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$20.03	1	0	Dual Technology Occupancy Sensor	58	0.06	10%	108.58	$18.02	$160.00	$160.00	0.00	12.064	$2.00	79.90
2	Office	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$240.31	12	0	Dual Technology Occupancy Sensor	58	0.70	10%	1302.91	$216.28	$160.00	$160.00	0.00	144.768	$24.03	6.66
2	Office	2080	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.17	361.9	$60.08	3	0	Dual Technology Occupancy Sensor	58	0.17	10%	325.73	$54.07	$160.00	$160.00	0.00	36.192	$6.01	26.63
2	Office	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$20.03	1	0	Dual Technology Occupancy Sensor	58	0.06	10%	108.58	$18.02	$160.00	$160.00	0.00	12.064	$2.00	79.90
13	A106	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	Dual Technology Occupancy Sensor	58	1.04	10%	1954.37	$324.43	$160.00	$160.00	0.00	217.152	$36.05	4.44
14	A108	2080	21	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	1.22	2,533.4	$420.55	21	0	Dual Technology Occupancy Sensor	58	1.22	10%	2280.10	$378.50	$160.00	$160.00	0.00	253.344	$42.06	3.80
14	A107	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	Dual Technology Occupancy Sensor	58	1.04	10%	1954.37	$324.43	$160.00	$160.00	0.00	217.152	$36.05	4.44
2	Athletic Director	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$240.31	12	0	Dual Technology Occupancy Sensor	58	0.70	10%	1302.91	$216.28	$160.00	$160.00	0.00	144.768	$24.03	6.66
14	A109	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	Dual Technology Occupancy Sensor	58	1.04	10%	1954.37	$324.43	$160.00	$160.00	0.00	217.152	$36.05	4.44
14	A111	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	Dual Technology Occupancy Sensor	58	1.04	10%	1954.37	$324.43	$160.00	$160.00	0.00	217.152	$36.05	4.44
14	Social Studies Office	2080	14	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	0.81	1,689.0	$280.37	14	0	Dual Technology Occupancy Sensor	58	0.81	10%	1520.06	$252.33	$160.00	$160.00	0.00	168.896	$28.04	5.71
7	Infront of SS Office	2080	1	2	T12 2x4 2 Lamps Magnetic Ballast Recessed Mounting Prismatic Lens	73	0.07	151.8	$25.21	1	0	No Change	73	0.07	0%	151.84	$25.21	$0.00	$0.00	0.00	0	$0.00	0.00
2	A117, 118, Hall	8760	8	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.46	4,064.6	$674.73	8	0	No Change	58	0.46	0%	4064.64	$674.73	$0.00	$0.00	0.00	0	$0.00	0.00
14	A113	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	Dual Technology Occupancy Sensor	58	1.04	10%	1954.37	$324.43	$160.00	$160.00	0.00	217.152	$36.05	4.44
14	A114	2080	45	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	2.61	5,428.8	$901.18	45	0	Dual Technology Occupancy Sensor	58	2.61	10%	4885.92	$811.06	$160.00	$160.00	0.00	542.88	$90.12	1.78
2	A114	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	Dual Technology Occupancy Sensor	58	0.12	10%	217.15	$36.05	$160.00	$160.00	0.00	24.128	$4.01	39.95
14	A115	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	Dual Technology Occupancy Sensor	58	1.04	10%	1954.37	$324.43	$160.00	$160.00	0.00	217.152	$36.05	4.44
5	Hall to Courtyard	2080	5	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.55	1,133.6	$188.18	5	0	No Change	109	0.55	0%	1133.60	$188.18	$0.00	$0.00	0.00	0	$0.00	0.00
14	A117	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	Dual Technology Occupancy Sensor	58	1.04	10%	1954.37	$324.43	$160.00	$160.00	0.00	217.152	$36.05	4.44
14	A116	2080	59	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	3.42	7,117.8	$1,181.55	59	0	Dual Technology Occupancy Sensor	58	3.42	10%	6405.98	$1,063.39	$160.00	$160.00	0.00	711.776	$118.15	1.35
2	A116	2080	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.17	361.9	$60.08	3	0	Dual Technology Occupancy Sensor	58	0.17	10%	325.73	$54.07	$160.00	$160.00	0.00	36.192	$6.01	26.63
2	A120	2080	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	2,412.8	$400.52	20	0	Dual Technology Occupancy Sensor	58	1.16	10%	2171.52	$360.47	$160.00	$160.00	0.00	241.28	$40.05	3.99

14	A119	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	Dual Technology Occupancy Sensor	58	1.04	10%	1954.37	$324.43	$160.00	$160.00	0.00	217.152	$36.05	4.44
15	Child Study Office	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.98	2,046.7	$339.76	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$305.78	$160.00	$160.00	0.00	204.672	$33.98	4.71
2	Hallway	2080	16	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.93	1,930.2	$320.42	16	0	No Change	58	0.93	0%	1930.24	$320.42	$0.00	$0.00	0.00	0	$0.00	0.00
15	Server Room	2080	2	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.16	341.1	$56.63	2	0	Dual Technology Occupancy Sensor	82	0.16	10%	307.01	$50.96	$160.00	$160.00	0.00	34.112	$5.66	28.26
13	A123	2080	12	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	0.70	1,447.7	$240.31	12	0	Dual Technology Occupancy Sensor	58	0.70	10%	1302.91	$216.28	$160.00	$160.00	0.00	144.768	$24.03	6.66
13	A125	2080	16	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	0.93	1,930.2	$320.42	16	0	Dual Technology Occupancy Sensor	58	0.93	10%	1737.22	$288.38	$160.00	$160.00	0.00	193.024	$32.04	4.99
2	Math Supervisor	2080	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.23	482.6	$80.10	4	0	Dual Technology Occupancy Sensor	58	0.23	10%	434.30	$72.09	$160.00	$160.00	0.00	48.256	$8.01	19.97
11	Math Supervisor	2080	1	2	T8 1x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$20.03	1	0	Dual Technology Occupancy Sensor	58	0.06	10%	108.58	$18.02	$160.00	$160.00	0.00	12.064	$2.00	79.90
13	A124	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	Dual Technology Occupancy Sensor	58	1.04	10%	1954.37	$324.43	$160.00	$160.00	0.00	217.152	$36.05	4.44
13	A127	2080	12	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	0.70	1,447.7	$240.31	12	0	Dual Technology Occupancy Sensor	58	0.70	10%	1302.91	$216.28	$160.00	$160.00	0.00	144.768	$24.03	6.66
13	A126	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	Dual Technology Occupancy Sensor	58	1.04	10%	1954.37	$324.43	$160.00	$160.00	0.00	217.152	$36.05	4.44
13	A128	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	Dual Technology Occupancy Sensor	58	1.04	10%	1954.37	$324.43	$160.00	$160.00	0.00	217.152	$36.05	4.44
13	A129	2080	22	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.28	2,654.1	$440.58	22	0	Dual Technology Occupancy Sensor	58	1.28	10%	2388.67	$396.52	$160.00	$160.00	0.00	265.408	$44.06	3.63
3	A131	2080	21	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	1.22	2,533.4	$420.55	21	0	Dual Technology Occupancy Sensor	58	1.22	10%	2280.10	$378.50	$160.00	$160.00	0.00	253.344	$42.06	3.80
13	A130	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	Dual Technology Occupancy Sensor	58	1.04	10%	1954.37	$324.43	$160.00	$160.00	0.00	217.152	$36.05	4.44
13	A132	2080	21	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.22	2,533.4	$420.55	21	0	Dual Technology Occupancy Sensor	58	1.22	10%	2280.10	$378.50	$160.00	$160.00	0.00	253.344	$42.06	3.80
13	A133	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	Dual Technology Occupancy Sensor	58	1.04	10%	1954.37	$324.43	$160.00	$160.00	0.00	217.152	$36.05	4.44
24	Faculty Bathroom	2080	3	1	Incadescent High Hat	100	0.30	624.0	$103.58	3	0	No Change	100	0.30	0%	624.00	$103.58	$0.00	$0.00	0.00	0	$0.00	0.00
13	A134	2080	18	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.04	2,171.5	$360.47	18	0	Dual Technology Occupancy Sensor	58	1.04	10%	1954.37	$324.43	$160.00	$160.00	0.00	217.152	$36.05	4.44
15	A134	2080	10	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.82	1,705.6	$283.13	10	0	Dual Technology Occupancy Sensor	82	0.82	10%	1535.04	$254.82	$160.00	$160.00	0.00	170.56	$28.31	5.65
2	Hallway	8760	7	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.41	3,556.6	$590.39	7	0	No Change	58	0.41	0%	3556.56	$590.39	$0.00	$0.00	0.00	0	$0.00	0.00
24	Gym	2080	20	1	Incadescent High Hat	100	2.00	4,160.0	$690.56	20	0	Dual Technology Occupancy Sensor	100	2.00	10%	3744.00	$621.50	$160.00	$160.00	0.00	416	$69.06	2.32
13	Coach Office	2080	7	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	0.41	844.5	$140.18	7	0	Dual Technology Occupancy Sensor	58	0.41	10%	760.03	$126.17	$160.00	$160.00	0.00	84.448	$14.02	11.41
18	Coach Office	2080	1	2	T8 4' 2 Lamps Electronic Ballast Side Wall Mount	80	0.08	166.4	$27.62	1	0	Dual Technology Occupancy Sensor	80	0.08	10%	149.76	$24.86	$160.00	$160.00	0.00	16.64	$2.76	57.92
3	Coach Locker Room	2080	26	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	1.51	3,136.6	$520.68	26	0	Dual Technology Occupancy Sensor	58	1.51	10%	2822.98	$468.61	$160.00	$160.00	0.00	313.664	$52.07	3.07
3	Coach Locker Room	2080	1	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.06	120.6	$20.03	1	0	Dual Technology Occupancy Sensor	58	0.06	10%	108.58	$18.02	$160.00	$160.00	0.00	12.064	$2.00	79.90
23	Coach Locker Room	2080	8	4	T8 4' 4 Lamps Surface Mounting	109	0.87	1,813.8	$301.08	8	0	Dual Technology Occupancy Sensor	109	0.87	10%	1632.38	$270.98	$160.00	$160.00	0.00	181.376	$30.11	5.31
3	Girls Locker Room	2080	26	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	1.51	3,136.6	$520.68	26	0	Dual Technology Occupancy Sensor	58	1.51	10%	2822.98	$468.61	$160.00	$160.00	0.00	313.664	$52.07	3.07

3	Locker Office	2080	6	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.35	723.8	$120.16	6	0	Dual Technology Occupancy Sensor	58	0.35	10%	651.46	$108.14	$160.00	$160.00	0.00	72.384	$12.02	13.32
3	Hall	8760	7	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.41	3,556.6	$590.39	7	0	Dual Technology Occupancy Sensor	58	0.41	10%	3200.90	$531.35	$160.00	$160.00	0.00	355.656	$59.04	2.71
24	Workout Room	2080	8	1	Incadescent High Hat	100	0.80	1,664.0	$276.22	8	0	Dual Technology Occupancy Sensor	100	0.80	10%	1497.60	$248.60	$160.00	$160.00	0.00	166.4	$27.62	5.79
23	Gym 2	2080	24	4	T8 4' 4 Lamps Surface Mounting	109	2.62	5,441.3	$903.25	24	0	Dual Technology Occupancy Sensor	109	2.62	10%	4897.15	$812.93	$160.00	$160.00	0.00	544.128	$90.33	1.77
24	Gym 2	2080	4	1	Incadescent High Hat	100	0.40	832.0	$138.11	4	0	Dual Technology Occupancy Sensor	100	0.40	10%	748.80	$124.30	$160.00	$160.00	0.00	83.2	$13.81	11.58
28	Library	2080	60	1	T8 2x2 1 Lamp Electronic Ballast Recessed Mounting Direct/Indirect Lens	20	1.20	2,496.0	$414.34	60	0	No Change	20	1.20	0%	2496.00	$414.34	$0.00	$0.00	0.00	0	$0.00	0.00
29	Library	2080	117	3	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	82	9.59	19,955.5	$3,312.62	117	0	No Change	82	9.59	0%	19955.52	$3,312.62	$0.00	$0.00	0.00	0	$0.00	0.00
13	Library	2080	14	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	0.81	1,689.0	$280.37	14	0	No Change	58	0.81	0%	1688.96	$280.37	$0.00	$0.00	0.00	0	$0.00	0.00
15	Library	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.66	1,364.5	$226.50	8	0	No Change	82	0.66	0%	1364.48	$226.50	$0.00	$0.00	0.00	0	$0.00	0.00
30	Server Room	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting No lens	58	0.12	241.3	$40.05	2	0	Dual Technology Occupancy Sensor	58	0.12	10%	217.15	$36.05	$160.00	$160.00	0.00	24.128	$4.01	39.95
13	Storage	2080	20	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.16	2,412.8	$400.52	20	0	Dual Technology Occupancy Sensor	58	1.16	10%	2171.52	$360.47	$160.00	$160.00	0.00	241.28	$40.05	3.99
13	L11	2080	48	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	2.78	5,790.7	$961.26	48	0	Dual Technology Occupancy Sensor	58	2.78	10%	5211.65	$865.13	$160.00	$160.00	0.00	579.072	$96.13	1.66
13	L10	2080	28	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.62	3,377.9	$560.73	28	0	Dual Technology Occupancy Sensor	58	1.62	10%	3040.13	$504.66	$160.00	$160.00	0.00	337.792	$56.07	2.85
13	L12	2080	33	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	1.91	3,981.1	$660.87	33	0	Dual Technology Occupancy Sensor	58	1.91	10%	3583.01	$594.78	$160.00	$160.00	0.00	398.112	$66.09	2.42
3	L12	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	Dual Technology Occupancy Sensor	58	0.12	10%	217.15	$36.05	$160.00	$160.00	0.00	24.128	$4.01	39.95
3	L12	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	Dual Technology Occupancy Sensor	58	0.12	10%	217.15	$36.05	$160.00	$160.00	0.00	24.128	$4.01	39.95
31	L12	2080	1	1	Incandescent Pendant	200	0.20	416.0	$69.06	1	0	Dual Technology Occupancy Sensor	200	0.20	10%	374.40	$62.15	$160.00	$160.00	0.00	41.6	$6.91	23.17
13	L14	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	0.12	241.3	$40.05	2	0	Dual Technology Occupancy Sensor	58	0.12	10%	217.15	$36.05	$160.00	$160.00	0.00	24.128	$4.01	39.95
2	L14	2080	38	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	2.20	4,584.3	$761.00	38	0	Dual Technology Occupancy Sensor	58	2.20	10%	4125.89	$684.90	$160.00	$160.00	0.00	458.432	$76.10	2.10
2	Electrical Panels	520	5	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.29	150.8	$25.03	5	0	No Change	58	0.29	0%	150.80	$25.03	$0.00	$0.00	0.00	0	$0.00	0.00
9	L15	2080	18	1	T8 1x4 1 Lamp Electronic Ballast Surface Mounting Prismatic Lens	28	0.50	1,048.3	$174.02	18	0	Dual Technology Occupancy Sensor	28	0.50	10%	943.49	$156.62	$160.00	$160.00	0.00	104.832	$17.40	9.19
10	L15	2080	3	2	T8 1x2 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	20	0.06	124.8	$20.72	3	0	Dual Technology Occupancy Sensor	20	0.06	10%	112.32	$18.65	$160.00	$160.00	0.00	12.48	$2.07	77.23
9	L13	2080	12	1	T8 1x4 1 Lamp Electronic Ballast Surface Mounting Prismatic Lens	28	0.34	698.9	$116.01	12	0	Dual Technology Occupancy Sensor	28	0.34	10%	628.99	$104.41	$160.00	$160.00	0.00	69.888	$11.60	13.79
10	L13	2080	3	2	T8 1x2 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	20	0.06	124.8	$20.72	3	0	Dual Technology Occupancy Sensor	20	0.06	10%	112.32	$18.65	$160.00	$160.00	0.00	12.48	$2.07	77.23
3	Boys Room	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	Dual Technology Occupancy Sensor	58	0.12	10%	217.15	$36.05	$160.00	$160.00	0.00	24.128	$4.01	39.95
24	Storage	520	1	1	Incadescent High Hat	100	0.10	52.0	$8.63	1	0	No Change	100	0.10	0%	52.00	$8.63	$0.00	$0.00	0.00	0	$0.00	0.00
3	Girls Room	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.12	241.3	$40.05	2	0	Dual Technology Occupancy Sensor	58	0.12	10%	217.15	$36.05	$160.00	$160.00	0.00	24.128	$4.01	39.95
2	Hall	2080	6	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.35	723.8	$120.16	6	0	No Change	58	0.35	0%	723.84	$120.16	$0.00	$0.00	0.00	0	$0.00	0.00
2	Elevator	8760	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	508.1	$84.34	1	0	No Change	58	0.06	0%	508.08	$84.34	$0.00	$0.00	0.00	0	$0.00	0.00

24	Elevator	8760	3	1	Incadescent High Hat	100	0.30	2,628.0	$436.25	3	0	No Change	100	0.30	0%	2628.00	$436.25	$0.00	$0.00	0.00	0	$0.00	0.00
32	Elevator	8760	1	1	Compact Fluorescent High Hat 1 lamp	100	0.10	876.0	$145.42	1	0	No Change	100	0.10	0%	876.00	$145.42	$0.00	$0.00	0.00	0	$0.00	0.00
15	Math Office	2080	16	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.31	2,729.0	$453.01	16	0	Dual Technology Occupancy Sensor	82	1.31	10%	2456.06	$407.71	$160.00	$160.00	0.00	272.896	$45.30	3.53
13	Electrical Room	520	3	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Parabolic Lens	58	0.17	90.5	$15.02	3	0	No Change	58	0.17	0%	90.48	$15.02	$0.00	$0.00	0.00	0	$0.00	0.00
8	Stairwell	8760	3	2	T12 1x4 2 Lamps Electronic Ballast Surface Wall Mounting No Lens	94	0.28	2,470.3	$410.07	3	0	No Change	94	0.28	0%	2470.32	$410.07	$0.00	$0.00	0.00	0	$0.00	0.00
21	Stairwell	8760	1	2	T8 1x4 2 Lamps Electronic Ballast Surface Wall	58	0.06	508.1	$84.34	1	0	No Change	58	0.06	0%	508.08	$84.34	$0.00	$0.00	0.00	0	$0.00	0.00
2	Bathrooms	2080	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.23	482.6	$80.10	4	0	Dual Technology Occupancy Sensor	58	0.23	10%	434.30	$72.09	$160.00	$160.00	0.00	48.256	$8.01	19.97
33	Bathrooms	2080	2	2	Compact Fluorescent High Hat - 2 lamp	56	0.11	233.0	$38.67	2	0	Dual Technology Occupancy Sensor	56	0.11	10%	209.66	$34.80	$160.00	$160.00	0.00	23.296	$3.87	41.37
15	B160	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.98	2,046.7	$339.76	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$305.78	$160.00	$160.00	0.00	204.672	$33.98	4.71
2	B162	2080	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	2,412.8	$400.52	20	0	Dual Technology Occupancy Sensor	58	1.16	10%	2171.52	$360.47	$160.00	$160.00	0.00	241.28	$40.05	3.99
15	B163	2080	24	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.97	4,093.4	$679.51	24	0	Dual Technology Occupancy Sensor	82	1.97	10%	3684.10	$611.56	$160.00	$160.00	0.00	409.344	$67.95	2.35
15	B161	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.49	1,023.4	$169.88	6	0	Dual Technology Occupancy Sensor	82	0.49	10%	921.02	$152.89	$160.00	$160.00	0.00	102.336	$16.99	9.42
2	B164	2080	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	2,412.8	$400.52	20	0	Dual Technology Occupancy Sensor	58	1.16	10%	2171.52	$360.47	$160.00	$160.00	0.00	241.28	$40.05	3.99
2	B166	2080	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	2,412.8	$400.52	20	0	Dual Technology Occupancy Sensor	58	1.16	10%	2171.52	$360.47	$160.00	$160.00	0.00	241.28	$40.05	3.99
32	B166	2080	2	1	Compact Fluorescent High Hat 1 lamp	100	0.20	416.0	$69.06	2	0	Dual Technology Occupancy Sensor	100	0.20	10%	374.40	$62.15	$160.00	$160.00	0.00	41.6	$6.91	23.17
15	B165	2080	14	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.15	2,387.8	$396.38	14	0	Dual Technology Occupancy Sensor	82	1.15	10%	2149.06	$356.74	$160.00	$160.00	0.00	238.784	$39.64	4.04
34	B167	2080	9	1	Mercury Start 1 Lamp Magnetic Ballast	175	1.58	3,276.0	$543.82	9	1	Dual Technology Occupancy Sensor	175	1.58	10%	2948.40	$489.43	$160.00	$160.00	0.00	327.6	$54.38	2.94
15	B167	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.98	2,046.7	$339.76	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$305.78	$160.00	$160.00	0.00	204.672	$33.98	4.71
21	Stairwell	2080	3	2	T8 1x4 2 Lamps Electronic Ballast Surface Wall	58	0.17	361.9	$60.08	3	0	No Change	58	0.17	0%	361.92	$60.08	$0.00	$0.00	0.00	0	$0.00	0.00
31	Auditorium	2080	102	1	Incandescent Pendant	200	20.40	42,432.0	$7,043.71	102	0	No Change	200	20.40	0%	42432.00	$7,043.71	$0.00	$0.00	0.00	0	$0.00	0.00
31	Auditorium Lobby	2080	14	1	Incandescent Pendant	200	2.80	5,824.0	$966.78	14	0	No Change	200	2.80	0%	5824.00	$966.78	$0.00	$0.00	0.00	0	$0.00	0.00
31	Auditorium Lobby	2080	45	1	Incandescent Pendant	200	9.00	18,720.0	$3,107.52	45	0	No Change	200	9.00	0%	18720.00	$3,107.52	$0.00	$0.00	0.00	0	$0.00	0.00
24	Auditorium Lobby	2080	32	1	Incadescent High Hat	100	3.20	6,656.0	$1,104.90	32	0	No Change	100	3.20	0%	6656.00	$1,104.90	$0.00	$0.00	0.00	0	$0.00	0.00
11	Bathrooms	2080	12	2	T8 1x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$240.31	12	0	Dual Technology Occupancy Sensor	58	0.70	10%	1302.91	$216.28	$160.00	$160.00	0.00	144.768	$24.03	6.66
2	B156	2080	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	2,412.8	$400.52	20	0	Dual Technology Occupancy Sensor	58	1.16	10%	2171.52	$360.47	$160.00	$160.00	0.00	241.28	$40.05	3.99
15	B153	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.66	1,364.5	$226.50	8	0	Dual Technology Occupancy Sensor	82	0.66	10%	1228.03	$203.85	$160.00	$160.00	0.00	136.448	$22.65	7.06
15	B154	2080	16	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.31	2,729.0	$453.01	16	0	Dual Technology Occupancy Sensor	82	1.31	10%	2456.06	$407.71	$160.00	$160.00	0.00	272.896	$45.30	3.53
15	B151	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.98	2,046.7	$339.76	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$305.78	$160.00	$160.00	0.00	204.672	$33.98	4.71
15	World Language	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.66	1,364.5	$226.50	8	0	Dual Technology Occupancy Sensor	82	0.66	10%	1228.03	$203.85	$160.00	$160.00	0.00	136.448	$22.65	7.06
15	B150	2080	15	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.23	2,558.4	$424.69	15	0	Dual Technology Occupancy Sensor	82	1.23	10%	2302.56	$382.22	$160.00	$160.00	0.00	255.84	$42.47	3.77
19	B150	2080	1	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	73	0.07	151.8	$25.21	1	0	Dual Technology Occupancy Sensor	73	0.07	10%	136.66	$22.68	$160.00	$160.00	0.00	15.184	$2.52	63.48
31	Storage	2080	2	1	Incandescent Pendant	200	0.40	832.0	$138.11	2	0	Dual Technology Occupancy Sensor	200	0.40	10%	748.80	$124.30	$160.00	$160.00	0.00	83.2	$13.81	11.58
33	B Hallway	8760	10	2	Compact Fluorescent High Hat - 2 lamp	56	0.56	4,905.6	$814.33	10	0	No Change	56	0.56	0%	4905.60	$814.33	$0.00	$0.00	0.00	0	$0.00	0.00

2	B Hallway	8760	52	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	3.02	26,420.2	$4,385.75	52	0	No Change	58	3.02	0%	26420.16	$4,385.75	$0.00	$0.00	0.00	0	$0.00	0.00
32	B Hallway	8760	2	1	Compact Fluorescent High Hat 1 lamp	100	0.20	1,752.0	$290.83	2	0	No Change	100	0.20	0%	1752.00	$290.83	$0.00	$0.00	0.00	0	$0.00	0.00
3	Projection Room	2080	3	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.17	361.9	$60.08	3	0	No Change	58	0.17	0%	361.92	$60.08	$0.00	$0.00	0.00	0	$0.00	0.00
24	Projection Room	2080	1	1	Incadescent High Hat	100	0.10	208.0	$34.53	1	0	No Change	100	0.10	0%	208.00	$34.53	$0.00	$0.00	0.00	0	$0.00	0.00
15	M20	2080	4	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.33	682.2	$113.25	4	0	Dual Technology Occupancy Sensor	82	0.33	10%	614.02	$101.93	$160.00	$160.00	0.00	68.224	$11.33	14.13
15	M19	2080	4	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.33	682.2	$113.25	4	0	Dual Technology Occupancy Sensor	82	0.33	10%	614.02	$101.93	$160.00	$160.00	0.00	68.224	$11.33	14.13
22	Band Room	2080	56	4	T8 2x2 4 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	56	3.14	6,522.9	$1,082.80	56	0	Dual Technology Occupancy Sensor	56	3.14	10%	5870.59	$974.52	$160.00	$160.00	0.00	652.288	$108.28	1.48
15	Band Office	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.66	1,364.5	$226.50	8	0	Dual Technology Occupancy Sensor	82	0.66	10%	1228.03	$203.85	$160.00	$160.00	0.00	136.448	$22.65	7.06
5	Band Storage	2080	8	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.87	1,813.8	$301.08	8	0	Dual Technology Occupancy Sensor	109	0.87	10%	1632.38	$270.98	$160.00	$160.00	0.00	181.376	$30.11	5.31
15	Band Practice	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.49	1,023.4	$169.88	6	0	Dual Technology Occupancy Sensor	82	0.49	10%	921.02	$152.89	$160.00	$160.00	0.00	102.336	$16.99	9.42
5	M Hall	8760	18	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	1.96	17,187.1	$2,853.06	18	0	No Change	109	1.96	0%	17187.12	$2,853.06	$0.00	$0.00	0.00	0	$0.00	0.00
27	M Hall	8760	5	1	Incadescent High Hat	60	0.30	2,628.0	$436.25	5	0	No Change	60	0.30	0%	2628.00	$436.25	$0.00	$0.00	0.00	0	$0.00	0.00
33	M Hall	8760	2	2	Compact Fluorescent High Hat - 2 lamp	56	0.11	981.1	$162.87	2	0	No Change	56	0.11	0%	981.12	$162.87	$0.00	$0.00	0.00	0	$0.00	0.00
5	Bathrooms	2080	6	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.65	1,360.3	$225.81	6	0	Dual Technology Occupancy Sensor	109	0.65	10%	1224.29	$203.23	$160.00	$160.00	0.00	136.032	$22.58	7.09
15	M18	2080	1	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.08	170.6	$28.31	1	0	Dual Technology Occupancy Sensor	82	0.08	10%	153.50	$25.48	$160.00	$160.00	0.00	17.056	$2.83	56.51
2	M17	2080	24	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.39	2,895.4	$480.63	24	0	Dual Technology Occupancy Sensor	58	1.39	10%	2605.82	$432.57	$160.00	$160.00	0.00	289.536	$48.06	3.33
11	Orchastra Office Hall	8760	5	2	T8 1x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.29	2,540.4	$421.71	5	0	Dual Technology Occupancy Sensor	58	0.29	10%	2286.36	$379.54	$160.00	$160.00	0.00	254.04	$42.17	3.79
2	Director Office	2080	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.17	361.9	$60.08	3	0	Dual Technology Occupancy Sensor	58	0.17	10%	325.73	$54.07	$160.00	$160.00	0.00	36.192	$6.01	26.63
2	Office	2080	6	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.35	723.8	$120.16	6	0	Dual Technology Occupancy Sensor	58	0.35	10%	651.46	$108.14	$160.00	$160.00	0.00	72.384	$12.02	13.32
2	M16	2080	24	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.39	2,895.4	$480.63	24	0	Dual Technology Occupancy Sensor	58	1.39	10%	2605.82	$432.57	$160.00	$160.00	0.00	289.536	$48.06	3.33
4	Music Tech Room	2080	24	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	1.97	4,093.4	$679.51	24	0	Dual Technology Occupancy Sensor	82	1.97	10%	3684.10	$611.56	$160.00	$160.00	0.00	409.344	$67.95	2.35
11	M Wing Hall	8760	13	2	T8 1x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.75	6,605.0	$1,096.44	13	0	No Change	58	0.75	0%	6605.04	$1,096.44	$0.00	$0.00	0.00	0	$0.00	0.00
2	M Wing Hall	8760	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	508.1	$84.34	1	0	No Change	58	0.06	0%	508.08	$84.34	$0.00	$0.00	0.00	0	$0.00	0.00
2	Hallway Exit B	8760	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.17	1,524.2	$253.02	3	0	No Change	58	0.17	0%	1524.24	$253.02	$0.00	$0.00	0.00	0	$0.00	0.00
2	B159	2080	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	2,412.8	$400.52	20	0	Dual Technology Occupancy Sensor	58	1.16	10%	2171.52	$360.47	$160.00	$160.00	0.00	241.28	$40.05	3.99
2	B158	2080	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	2,412.8	$400.52	20	0	Dual Technology Occupancy Sensor	58	1.16	10%	2171.52	$360.47	$160.00	$160.00	0.00	241.28	$40.05	3.99
2	B157	2080	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	2,412.8	$400.52	20	0	Dual Technology Occupancy Sensor	58	1.16	10%	2171.52	$360.47	$160.00	$160.00	0.00	241.28	$40.05	3.99
33	Hallway	8760	7	2	Compact Fluorescent High Hat - 2 lamp	56	0.39	3,433.9	$570.03	7	0	No Change	56	0.39	0%	3433.92	$570.03	$0.00	$0.00	0.00	0	$0.00	0.00
5	Hallway	8760	15	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	1.64	14,322.6	$2,377.55	15	0	No Change	109	1.64	0%	14322.60	$2,377.55	$0.00	$0.00	0.00	0	$0.00	0.00

5	Hallway	8760	49	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	5.34	46,787.2	$7,766.67	49	0	No Change	109	5.34	0%	46787.16	$7,766.67	$0.00	$0.00	0.00	0	$0.00	0.00
33	Hallway	8760	4	2	Compact Fluorescent High Hat - 2 lamp	56	0.22	1,962.2	$325.73	4	0	No Change	56	0.22	0%	1962.24	$325.73	$0.00	$0.00	0.00	0	$0.00	0.00
2	Health Office	2080	14	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.81	1,689.0	$280.37	14	0	Dual Technology Occupancy Sensor	58	0.81	10%	1520.06	$252.33	$160.00	$160.00	0.00	168.896	$28.04	5.71
18	Health Office	2080	1	2	T8 4' 2 Lamps Electronic Ballast Side Wall Mount	80	0.08	166.4	$27.62	1	0	Dual Technology Occupancy Sensor	80	0.08	10%	149.76	$24.86	$160.00	$160.00	0.00	16.64	$2.76	57.92
2	Health Office	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$20.03	1	0	Dual Technology Occupancy Sensor	58	0.06	10%	108.58	$18.02	$160.00	$160.00	0.00	12.064	$2.00	79.90
35	Health Office	2080	1	2	T8 2 Tube 4' Indust Electronic Ballast Surface Mounting No Lens	58	0.06	120.6	$20.03	1	0	Dual Technology Occupancy Sensor	58	0.06	10%	108.58	$18.02	$160.00	$160.00	0.00	12.064	$2.00	79.90
36	Health Office	2080	2	1	T8 6' 1 Lamp Electronic Ballast Surface Wall Mounted Prismatic Lens	28	0.06	116.5	$19.34	2	0	Dual Technology Occupancy Sensor	28	0.06	10%	104.83	$17.40	$160.00	$160.00	0.00	11.648	$1.93	82.75
15	C137	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	Dual Technology Occupancy Sensor	82	2.05	10%	3837.60	$637.04	$160.00	$160.00	0.00	426.4	$70.78	2.26
15	Storage	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.49	1,023.4	$169.88	6	0	Dual Technology Occupancy Sensor	82	0.49	10%	921.02	$152.89	$160.00	$160.00	0.00	102.336	$16.99	9.42
15	C139	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	Dual Technology Occupancy Sensor	82	2.05	10%	3837.60	$637.04	$160.00	$160.00	0.00	426.4	$70.78	2.26
15	C141	2080	16	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.31	2,729.0	$453.01	16	0	Dual Technology Occupancy Sensor	82	1.31	10%	2456.06	$407.71	$160.00	$160.00	0.00	272.896	$45.30	3.53
15	C143	2080	14	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.15	2,387.8	$396.38	14	0	Dual Technology Occupancy Sensor	82	1.15	10%	2149.06	$356.74	$160.00	$160.00	0.00	238.784	$39.64	4.04
15	Office	2080	2	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.16	341.1	$56.63	2	0	Dual Technology Occupancy Sensor	82	0.16	10%	307.01	$50.96	$160.00	$160.00	0.00	34.112	$5.66	28.26
16	Bathrooms	2080	6	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	109	0.65	1,360.3	$225.81	6	0	Dual Technology Occupancy Sensor	109	0.65	10%	1224.29	$203.23	$160.00	$160.00	0.00	136.032	$22.58	7.09
33	Hallway	8760	4	2	Compact Fluorescent High Hat - 2 lamp	56	0.22	1,962.2	$325.73	4	0	No Change	56	0.22	0%	1962.24	$325.73	$0.00	$0.00	0.00	0	$0.00	0.00
15	Science Room	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.98	2,046.7	$339.76	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$305.78	$160.00	$160.00	0.00	204.672	$33.98	4.71
15	C138	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	Dual Technology Occupancy Sensor	82	2.05	10%	3837.60	$637.04	$160.00	$160.00	0.00	426.4	$70.78	2.26
15	Prep Room	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.49	1,023.4	$169.88	6	0	Dual Technology Occupancy Sensor	82	0.49	10%	921.02	$152.89	$160.00	$160.00	0.00	102.336	$16.99	9.42
15	C136	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	Dual Technology Occupancy Sensor	82	2.05	10%	3837.60	$637.04	$160.00	$160.00	0.00	426.4	$70.78	2.26
5	Bathrooms	2080	6	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.65	1,360.3	$225.81	6	0	Dual Technology Occupancy Sensor	109	0.65	10%	1224.29	$203.23	$160.00	$160.00	0.00	136.032	$22.58	7.09
33	Bathrooms	2080	2	2	Compact Fluorescent High Hat - 2 lamp	56	0.11	233.0	$38.67	2	0	Dual Technology Occupancy Sensor	56	0.11	10%	209.66	$34.80	$160.00	$160.00	0.00	23.296	$3.87	41.37
5	Electric Closet	520	5	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.55	283.4	$47.04	5	0	No Change	109	0.55	0%	283.40	$47.04	$0.00	$0.00	0.00	0	$0.00	0.00
5	Storage	2080	4	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.44	906.9	$150.54	4	0	Dual Technology Occupancy Sensor	109	0.44	10%	816.19	$135.49	$160.00	$160.00	0.00	90.688	$15.05	10.63
5	Stairwell	8760	20	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	2.18	19,096.8	$3,170.07	20	0	No Change	109	2.18	0%	19096.80	$3,170.07	$0.00	$0.00	0.00	0	$0.00	0.00
2	Stairwell	8760	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	1,016.2	$168.68	2	0	No Change	58	0.12	0%	1016.16	$168.68	$0.00	$0.00	0.00	0	$0.00	0.00
17	C205	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Surface Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	Dual Technology Occupancy Sensor	82	2.05	10%	3837.60	$637.04	$160.00	$160.00	0.00	426.4	$70.78	2.26
17	Storage	2080	2	3	T8 2x4 3 Lamps Electronic Ballast Surface Mounting Parabolic Lens	82	0.16	341.1	$56.63	2	0	Dual Technology Occupancy Sensor	82	0.16	10%	307.01	$50.96	$160.00	$160.00	0.00	34.112	$5.66	28.26
15	Science Office	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.66	1,364.5	$226.50	8	0	Dual Technology Occupancy Sensor	82	0.66	10%	1228.03	$203.85	$160.00	$160.00	0.00	136.448	$22.65	7.06

15	C203	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	Dual Technology Occupancy Sensor	82	2.05	10%	3837.60	$637.04	$160.00	$160.00	0.00	426.4	$70.78	2.26
15	Prep Room	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.49	1,023.4	$169.88	6	0	Dual Technology Occupancy Sensor	82	0.49	10%	921.02	$152.89	$160.00	$160.00	0.00	102.336	$16.99	9.42
15	Storage	2080	4	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.33	682.2	$113.25	4	0	Dual Technology Occupancy Sensor	82	0.33	10%	614.02	$101.93	$160.00	$160.00	0.00	68.224	$11.33	14.13
15	C201	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	Dual Technology Occupancy Sensor	82	2.05	10%	3837.60	$637.04	$160.00	$160.00	0.00	426.4	$70.78	2.26
12	Greenhouse	2080	4	6	T8 8' 6 Lamps (4') Electronic Ballast Surface Mounting Prismatic Lens Vapor Proof	167	0.67	1,389.4	$230.65	4	0	Dual Technology Occupancy Sensor	167	0.67	10%	1250.50	$207.58	$160.00	$160.00	0.00	138.944	$23.06	6.94
5	Electrical Room	2080	12	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	1.31	2,720.6	$451.63	12	0	Dual Technology Occupancy Sensor	109	1.31	10%	2448.58	$406.46	$160.00	$160.00	0.00	272.064	$45.16	3.54
5	C Wing Up Stairs Hall	8760	38	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	4.14	36,283.9	$6,023.13	38	0	No Change	109	4.14	0%	36283.92	$6,023.13	$0.00	$0.00	0.00	0	$0.00	0.00
33	C Wing Up Stairs Hall	8760	6	2	Compact Fluorescent High Hat - 2 lamp	56	0.34	2,943.4	$488.60	6	0	No Change	56	0.34	0%	2943.36	$488.60	$0.00	$0.00	0.00	0	$0.00	0.00
5	Storage	2080	3	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.33	680.2	$112.91	3	0	Dual Technology Occupancy Sensor	109	0.33	10%	612.14	$101.62	$160.00	$160.00	0.00	68.016	$11.29	14.17
5	Bathrooms	2080	6	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.65	1,360.3	$225.81	6	0	Dual Technology Occupancy Sensor	109	0.65	10%	1224.29	$203.23	$160.00	$160.00	0.00	136.032	$22.58	7.09
33	Bathrooms	2080	2	2	Compact Fluorescent High Hat - 2 lamp	56	0.11	233.0	$38.67	2	0	Dual Technology Occupancy Sensor	56	0.11	10%	209.66	$34.80	$160.00	$160.00	0.00	23.296	$3.87	41.37
15	C200	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	Dual Technology Occupancy Sensor	82	2.05	10%	3837.60	$637.04	$160.00	$160.00	0.00	426.4	$70.78	2.26
15	Prep Room	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.49	1,023.4	$169.88	6	0	Dual Technology Occupancy Sensor	82	0.49	10%	921.02	$152.89	$160.00	$160.00	0.00	102.336	$16.99	9.42
15	Storage	2080	4	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.33	682.2	$113.25	4	0	Dual Technology Occupancy Sensor	82	0.33	10%	614.02	$101.93	$160.00	$160.00	0.00	68.224	$11.33	14.13
15	C202	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	Dual Technology Occupancy Sensor	82	2.05	10%	3837.60	$637.04	$160.00	$160.00	0.00	426.4	$70.78	2.26
15	C204	2080	25	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	2.05	4,264.0	$707.82	25	0	Dual Technology Occupancy Sensor	82	2.05	10%	3837.60	$637.04	$160.00	$160.00	0.00	426.4	$70.78	2.26
15	Storage	2080	3	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.25	511.7	$84.94	3	0	Dual Technology Occupancy Sensor	82	0.25	10%	460.51	$76.44	$160.00	$160.00	0.00	51.168	$8.49	18.84
4	Bathrooms	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.49	1,023.4	$169.88	6	0	Dual Technology Occupancy Sensor	82	0.49	10%	921.02	$152.89	$160.00	$160.00	0.00	102.336	$16.99	9.42
39	Boiler Room - Original	2080	8	1	Incadescent Pendant Mounting	150	1.20	2,496.0	$414.34	8	1	No Change	150	1.20	0%	2496.00	$414.34	$0.00	$0.00	0.00	0	$0.00	0.00
40	Boiler Room - 2001 Addition	2080	9	2	4' - 2-Lamp 32W T-8 Industrial Strip w/ Elect Ballast and Wire guard	73	0.66	1,366.6	$226.85	9	2	No Change	73	0.66	0%	1366.56	$226.85	$0.00	$0.00	0.00	0	$0.00	0.00
37		8760	67	2	Exit Sign (2) 15 W	30	2.01	17,607.6	$2,922.86	67	0	No Change	30	2.01	0%	17607.60	$2,922.86	$0.00	$0.00	0.00	0	$0.00	0.00
38		8760	28	0	Exit Sign - LED red	4	0.11	981.1	$162.87	28	0	No Change	4	0.11	0%	981.12	$162.87	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		2897	503			220.84	671,159.7	$111,412.51	2897	6			220.84		642,852.70	$106,713.55		$25,280.00	0.00	28307.0	$4,698.96	5.38

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

CEG Job #: 9C09078
Project: Chatham School District
Address: 255 Lafayette Avenue
City: Chatham
Building SF: 253,663

Chatham High School

DATE: 11/3/2009
KWH COST: **$0.166**

ECM #3: LED Exit Signs

EXISTING LIGHTING										**PROPOSED LIGHTING**										**SAVINGS**			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
37	Throughout	8760	67	2	Exit Sign (2) 15 W incadescent	30	2.01	17,607.6	$2,922.86	67	0	Exit Sign - LED red	4	0.27	2347.68	$389.71	$56.00	$3,752.00	1.74	15259.92	$2,533.15	1.48
38	Throughout	8760	28	0	Exit Sign - LED red	4	0.11	981.1	$162.87	28	0	No Change	4	0.11	981.12	$162.87	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		95	2			2.12	18,588.7	$3,085.73	95	0			0.38	3328.8	$552.58		$3,752.00	1.74	15259.9	$2,533.15	1.48

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

CEG Job #: 9C09078
Project: Chatham School District
Address: 255 Lafayette Avenue
City: Chatham
Building SF: 253,663

Chatham High School

DATE: 11/3/2009
KWH COST: $0.166

ECM #4: Lighting Upgrade - Gym

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
41	Gym	2080	20	1	Metal Halide -High-Bay Fixture	292	5.84	12,147.2	$2,016.44	20	3	3-Lamp T-5 HO Cooper F-Bay	182	3.64	7571.2	$1,256.82	$300.00	$6,000.00	2.20	4576	$759.62	7.90
23	Gym 2	2080	24	4	T8 4' 4 Lamps Surface Mounting	109	2.62	5,441.3	$903.25	24	0	No Change	109	2.62	5441.28	$903.25	$0.00	$0.00	0.00	0	$0.00	0.00
41	Gym 2	2080	4	1	Metal Halide -High-Bay Fixture	292	1.17	2,429.4	$403.29	4	3	3-Lamp T-5 HO Cooper F-Bay	182	0.73	1514.24	$251.36	$300.00	$1,200.00	0.44	915.2	$151.92	7.90
	Totals		48	6			9.62	20,017.9	$3,322.97	48	6			6.984	14526.72	$2,411.44		$7,200.00	2.64	5491.2	$911.54	7.90

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

Project Name: LGEA Solar PV Project - 9C09078 Chatham High School
Location: Chatham, NJ
Description: Photovoltaic System 95% Financing - 25 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 25 year	
Total Construction Cost	$3,055,320	
Annual kWh Production	392,286	
Annual Energy Cost Reduction	$65,119	
Annual SREC Revenue	$137,300	
First Cost Premium	**$3,055,320**	
Simple Payback:	**15.09**	Years

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	95%
Financing Term (mths):	300	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.166**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	7.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$152,766	0	0	0	$0	0	0	(152,766)	0
1	$0	392,286	$65,119	$0	$137,300	$201,772	$44,404	($43,756)	($196,522)
2	$0	390,325	$67,073	$0	$136,614	$198,562	$47,614	($42,489)	($239,011)
3	$0	388,373	$69,085	$0	$135,931	$195,120	$51,056	($41,160)	($280,171)
4	$0	386,431	$71,158	$0	$135,251	$191,429	$54,746	($39,767)	($319,938)
5	$0	384,499	$73,293	$3,960	$134,575	$187,472	$58,704	($42,269)	($362,207)
6	$0	382,576	$75,491	$3,941	$133,902	$183,228	$62,948	($40,723)	($402,931)
7	$0	380,664	$77,756	$3,921	$133,232	$178,678	$67,498	($39,108)	($442,039)
8	$0	378,760	$80,089	$3,901	$132,566	$173,798	$72,378	($37,422)	($479,461)
9	$0	376,866	$82,491	$3,882	$131,903	$168,566	$77,610	($35,663)	($515,124)
10	$0	374,982	$84,966	$3,862	$131,244	$162,955	$83,220	($33,828)	($548,952)
11	$0	373,107	$87,515	$3,843	$130,588	$156,939	$89,236	($31,916)	($580,868)
12	$0	371,242	$90,141	$3,824	$129,935	$150,489	$95,687	($29,924)	($610,793)
13	$0	369,385	$92,845	$3,805	$129,285	$143,571	$102,604	($27,851)	($638,643)
14	$0	367,539	$95,630	$3,786	$128,638	$136,154	$110,022	($25,693)	($664,336)
15	$0	365,701	$98,499	$3,767	$127,995	$128,201	$117,975	($23,448)	($687,784)
16	$0	363,872	$101,454	$3,748	$127,355	$119,672	$126,504	($21,114)	($708,899)
17	$0	362,053	$104,498	$3,729	$126,719	$110,527	$135,649	($18,689)	($727,587)
18	$0	360,243	$107,633	$3,710	$126,085	$100,721	$145,455	($16,169)	($743,756)
19	$0	358,441	$110,862	$3,692	$125,455	$90,206	$155,970	($13,552)	($757,308)
20	$0	356,649	$114,187	$3,673	$124,827	$78,931	$167,245	($10,835)	($768,142)
21	$0	354,866	$117,613	$3,655	$124,203	$71,912	$153,749	$12,500	($755,643)
22	$0	353,092	$121,141	$3,637	$123,582	$58,110	$126,521	$56,455	($699,188)
23	$0	351,326	$124,776	$3,619	$122,964	$0	$0	$244,121	($455,067)
24	$0	349,570	$128,519	$3,601	$122,349	$0	$0	$247,268	($207,799)
25	$0	347,822	$132,374	$3,583	$121,738	$0	$0	$250,530	$42,731
	Totals:	9,240,670	$2,374,208	$79,138	$3,234,234	$3,187,015	$2,146,794	$195,497	($12,749,439)
				Net Present Value (NPV)				**($310,409)**	
				Internal Rate of Return (IRR)				**0.3%**	

Project Name: LGEA Solar PV Project - 9C09078 Chatham High School
Location: Chatham, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

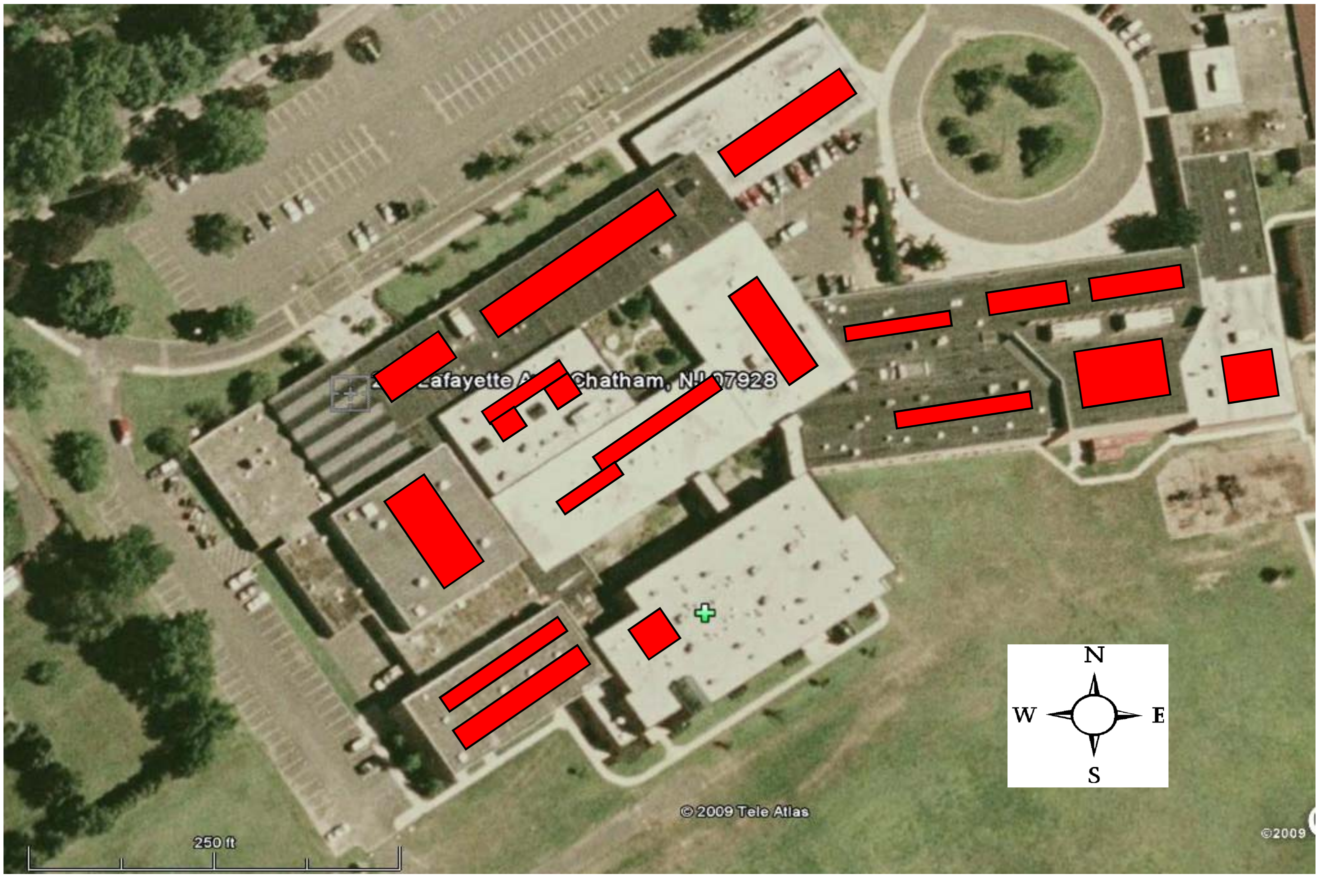
	Photovoltaic System - Direct Purchase
Total Construction Cost	$3,055,320
Annual kWh Production	392,286
Annual Energy Cost Reduction	$65,119
Annual SREC Revenue	$137,300
First Cost Premium	**$3,055,320**
Simple Payback:	**15.09** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.166**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Cumulative Cash Flow
0	$3,055,320	0	0	0	$0	(3,055,320)	0
1	$0	392,286	$65,119	$0	$137,300	$202,420	($2,852,900)
2	$0	390,325	$67,073	$0	$136,614	$203,687	($2,649,214)
3	$0	388,373	$69,085	$0	$135,931	$205,016	($2,444,198)
4	$0	386,431	$71,158	$0	$135,251	$206,409	($2,237,789)
5	$0	384,499	$73,293	$3,960	$134,575	$203,907	($2,033,882)
6	$0	382,576	$75,491	$3,941	$133,902	$205,453	($1,828,430)
7	$0	380,664	$77,756	$3,921	$133,232	$207,067	($1,621,362)
8	$0	378,760	$80,089	$3,901	$132,566	$208,754	($1,412,609)
9	$0	376,866	$82,491	$3,882	$131,903	$210,513	($1,202,096)
10	$0	374,982	$84,966	$3,862	$131,244	$212,348	($989,748)
11	$0	373,107	$87,515	$3,843	$130,588	$214,260	($775,489)
12	$0	371,242	$90,141	$3,824	$129,935	$216,251	($559,237)
13	$0	369,385	$92,845	$3,805	$129,285	$218,325	($340,912)
14	$0	367,539	$95,630	$3,786	$128,638	$220,483	($120,429)
15	$0	365,701	$98,499	$3,767	$127,995	$222,728	$102,298
16	$0	363,872	$101,454	$3,748	$127,355	$225,061	$327,360
17	$0	362,053	$104,498	$3,729	$126,719	$227,487	$554,847
18	$0	360,243	$107,633	$3,710	$126,085	$230,007	$784,854
19	$0	358,441	$110,862	$3,692	$125,455	$232,624	$1,017,478
20	$0	356,649	$114,187	$3,673	$124,827	$235,341	$1,252,819
21	$1	354,866	$117,613	$3,655	$124,203	$238,161	$1,490,980
22	$2	353,092	$121,141	$3,637	$123,582	$241,087	$1,732,067
23	$3	351,326	$124,776	$3,619	$122,964	$244,121	$1,976,188
24	$4	349,570	$128,519	$3,601	$122,349	$247,268	$2,223,456
25	$5	347,822	$132,374	$3,583	$121,738	$250,530	$2,473,985
	Totals:	9,240,670	$2,374,208	$79,138	$3,234,234	$5,529,305	($7,131,966)
			Net Present Value (NPV)			**$2,474,010**	
			Internal Rate of Return (IRR)			**5.0%**	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
High School	21700	Sunpower SPR230	1476	14.7	21,703	339.48	392,286	48,708	15.64



.= Proposed PV Layout

Notes:

1. Estimated kWH based on the National Renewable Energy Laboratory PVWatts Version 1 Calculator Program.

PVWatts

Click on **Calculate** if default values are acceptable, or after selecting your system specifications. Click on **Help** for information about system specifications. To use a DC to AC derate factor other than the default, click on **Derate Factor Help** for information.

Station Identification:

WBAN Number:	14734
City:	Newark
State:	New_Jersey

PV System Specifications:

DC Rating (kW):	339.48	
DC to AC Derate Factor:	.81	DERATE FACTOR HELP
Array Type:	Fixed Tilt	

Fixed Tilt or 1-Axis Tracking System:

Array Tilt (degrees):	10	(Default = Latitude)
Array Azimuth (degrees):	180.0	(Default = South)

Energy Data:

Cost of Electricity (cents/kWh): 0.166

Calculate | HELP | Reset Form

Please send questions and comments to Webmaster

RReDC

Return to RREDC Home Page (*http://rredc.nrel.gov/*)

PVWatts * * * AC Energy & Cost Savings

Cautions for Interpreting the Results

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	339.5 kW
DC to AC Derate Factor:	0.810
AC Rating:	275.0 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	0.2 ¢/kWh

Results			
Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	2.39	20368	33.81
2	3.17	24693	40.99
3	4.07	34559	57.37
4	4.83	38289	63.56
5	5.70	45554	75.62
6	5.94	44514	73.89
7	5.77	44168	73.32
8	5.38	40909	67.91
9	4.65	35197	58.43
10	3.61	28973	48.10
11	2.35	18480	30.68
12	2.01	16581	27.52
Year	4.16	392286	651.19

Output Hourly Performance Data * Output Results as Text

About the Hourly Performance Data

Saving Text from a Browser

Run PVWATTS v.1 for another US location or an International location
Run PVWATTS v.2 (US only)

Please send questions and comments regarding PVWATTS to Webmaster

RReDC Return to RReDC home page (*http://rredc.nrel.gov*)

ENERGY AUDIT – FINAL REPORT

SCHOOL DISTRICT OF THE CHATHAMS
CHATHAM MIDDLE SCHOOL

480 MAIN STREET
CHATHAM, NJ 07928
ATTN: RALPH GOODWIN
SCHOOL BUSINESS ADMINISTRATOR BOARD SECRETARY

CEG PROJECT NO. 9C09078

CONCORD ENGINEERING GROUP

520 SOUTH BURNT MILL ROAD
VOORHEES, NJ 08043
TELEPHONE: (856) 427-0200
FACSIMILE: (856) 427-6529
WWW.CEG-INC.NET

CONTACT: MICHAEL FISCHETTE, PRESIDENT
EMAIL: mfischette@ceg-inc.net

Table of Contents

REPORT DISCLAIMER

The information contained within this report, including any attachment(s), is intended solely for use by the named addressee(s). If you are not the intended recipient, or a person designated as responsible for delivering such messages to the intended recipient, you are not authorized to disclose, copy, distribute or retain this report, in whole or in part, without written authorization from Concord Engineering Group, Inc., 520 S. Burnt Mill Road, Voorhees, NJ 08043.

This report may contain proprietary, confidential or privileged information. If you have received this report in error, please notify the sender immediately. Thank you for your anticipated cooperation.

I. EXECUTIVE SUMMARY

This report presents the findings of the energy audit conducted for:

Chatham School District
Chatham Middle School
480 Main Street
Chatham, NJ 07928

Municipal Contact Person: Ralph Goodwin
Facility Contact Person: John Cataldo

This audit is performed in connection with the New Jersey Clean Energy - Local Government Energy Audit Program. The energy audit is conducted to promote the mission of the office of Clean Energy, which is to use innovation and technology to solve energy and environmental problems in a way that improves the State's economy. This can be achieved through the wiser and more efficient use of energy.

The annual energy costs at this facility are as follows:

Electricity	$ 206,786
Natural Gas	$ 115,630
Total	$ 322,416

The potential annual energy cost savings for each energy conservation measure (ECM) and renewable energy measure (REM) are shown below in Table 1. Be aware that the ECM's are not additive because of the interrelation of some of the measures. This audit is consistent with an ASHRAE level 2 audit. The cost and savings for each measure is ± 20%. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

Table 1
Financial Summary Table

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Lighting Upgrade - General	$3,062	$812	3.8	297.8%
ECM #2	Install Compact Fluorescents	$426	$2,053	0.2	7137.4%
ECM #3	Lighting Contrls	$6,215	$5,535	1.1	1235.9%
ECM #4	Install T-5 Lighting System in Gym	$9,000	$1,412	6.4	135.3%
ECM #5	Boiler Replacement	$277,414	$12,069	23.0	52.3%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	253.46 KW PV System	$2,281,140	$150,543	15.2	65.0%

Notes: A. Cost takes into consideration applicable NJ Smart StartTM incentives.
B. Savings takes into consideration applicable maintenance savings.

The estimated demand and energy savings for each ECM and REM is shown below in Table 2. The information in this table corresponds to the ECM's and REM's in Table 1.

Table 2
Estimated Energy Savings Summary Table

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION			
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)	
ECM #1	Lighting Upgrade - General	4.75	9,874	0	
ECM #2	Install Compact Fluorescents	6.02	12,517	0	
ECM #3	Lighting Contrls	0	33,749	0	
ECM #4	Install T-5 Lighting System in Gym	4.07	8,461	0	
ECM #5	Boiler Replacement	0	0	6,936	
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION			
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)	
REM #1	253.46 KW PV System	253	292,885	0	*

Elec. Demand Savings are calculated for cooling season only. Elec. consumption savings are totaled annually.

Concord Engineering Group (CEG) recommends proceeding with the implementation of all ECM's that provide a calculated simple payback at or under ten (10) years. The following Energy Conservation Measures are recommended for the facility:

- **ECM #1:** Lighting Upgrade - General
- **ECM #2:** Install Compact Fluorescents
- **ECM #3:** Lighting Controls
- **ECM #4:** Intall T-5 Lighting System in Gym

Although ECM #5 does not provide a payback less than 10 years, it is recommended to proceed with the installation of efficient boiler units as suggested in ECM #5 (or equal) for the Middle School, since the existing boilers are past their expected lifespan.

In addition to the ECMs, there are maintenance and operational measures that can provide significant energy savings and provide immediate benefit. The ECMs listed above represent investments that can be made to the facility which are justified by the savings seen overtime. However, the maintenance items and small operational improvements below are typically achievable with on site staff or maintenance contractors and in turn have the potential to provide substantial operational savings compared to the costs associated. The following are recommendations which should be considered a priority in achieving an energy efficient building:

1. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.
2. Maintain all weather stripping on entrance doors.
3. Clean all light fixtures to maximize light output.
4. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

Incentives provide financial motivation and much needed support for the implementation of energy conservation measures. Along with the NJ Smart Start program, the Pay for Performance Program incentives, sponsored by NJ Clean Energy Program, are suited favorably for this facility and its energy saving opportunities. It is expected through the implementation of multiple recommended ECMs, that this facility could reduce its overall energy consumption by more than 15%. The existing average operating demand above 200 KW and high energy consumption suggests the potential to qualify for the pay for performance program through the implementation of multiple ECMs. The incentive based on a 15% energy reduction for this facility would qualify for an additional $75,840 in the pay for performance program. This option is one to consider for a whole-building approach to energy reduction. CEG recommends the Owner review this option in more detail with a Pay for Performance Partner.

II. INTRODUCTION

The comprehensive energy audit covers the 148,396 square foot Middle School, which includes classrooms, auditorium, library, gymnasiums, locker rooms, cafeteria and offices.

Electrical and natural gas utility information is collected and analyzed for one full year's energy use of the building. The utility information allows for analysis of the building's operational characteristics; calculate energy benchmarks for comparison to industry averages, estimated savings potential, and baseline usage/cost to monitor the effectiveness of implemented measures. A computer spreadsheet is used to calculate benchmarks and to graph utility information (see the utility profiles below).

The Energy Use Index (EUI) is established for the building. Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year ($BTU/ft^2/yr$), which is used to compare energy consumption to similar building types or to track consumption from year to year in the same building. The EUI is calculated by converting the annual consumption of all energy sources to BTU's and dividing by the area (gross square footage) of the building. Blueprints (where available) are utilized to verify the gross area of the facility. The EUI is a good indicator of the relative potential for energy savings. A low EUI indicates less potential for energy savings, while a high EUI indicates poor building performance therefore a high potential for energy savings.

Existing building architectural and engineering drawings (where available) are utilized for additional background information. The building envelope, lighting systems, HVAC equipment, and controls information gathered from building drawings allow for a more accurate and detailed review of the building. The information is compared to the energy usage profiles developed from utility data. Through the review of the architectural and engineering drawings a building profile can be defined that documents building age, type, usage, major energy consuming equipment or systems, etc.

The preliminary audit information is gathered in preparation for the site survey. The site survey provides critical information in deciphering where energy is spent and opportunities exist within a facility. The entire site is surveyed to inventory the following to gain an understanding of how each facility operates:

- Building envelope (roof, windows, etc.)
- Heating, ventilation, and air conditioning equipment (HVAC)
- Lighting systems and controls
- Facility-specific equipment

The building site visit is performed to survey all major building components and systems. The site visit includes detailed inspection of energy consuming components. Summary of building occupancy schedules, operating and maintenance practices, and energy management programs provided by the building manager are collected along with the system and components to determine a more accurate impact on energy consumption.

III. METHOD OF ANALYSIS

Post site visit work includes evaluation of the information gathered, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on HVAC, lighting and building envelope improvements. Data collected is processed using energy engineering calculations to anticipate energy usage for each of the proposed energy conservation measures (ECMs). The actual building's energy usage is entered directly from the utility bills provided by the owner. The anticipated energy usage is compared to the historical data to determine energy savings for the proposed ECMs.

It is pertinent to note, that the savings noted in this report are not additive. The savings for each recommendation is calculated as standalone energy conservation measures. Implementation of more than one ECM may in some cases affect the savings of each ECM. The savings may in some cases be relatively higher if an individual ECM is implemented in lieu of multiple recommended ECMs. For example implementing reduced operating schedules for inefficient lighting will result in a greater relative savings. Implementing reduced operating schedules for newly installed efficient lighting will result in a lower relative savings, because there is less energy to be saved. If multiple ECM's are recommended to be implemented, the combined savings is calculated and identified appropriately.

ECMs are determined by identifying the building's unique properties and deciphering the most beneficial energy saving measures available that meet the specific needs of the facility. The building construction type, function, operational schedule, existing conditions, and foreseen future plans are critical in the evaluation and final recommendations. Energy savings are calculated base on industry standard methods and engineering estimations. Energy consumption is calculated based on manufacturer's cataloged information when new equipment is proposed.

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers. The NJ Smart Start Building® program incentives savings (where applicable) are included for the appropriate ECM's and subtracted from the installed cost. Maintenance savings are calculated where applicable and added to the energy savings for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The costs and savings are applied and a simple payback, simple lifetime savings, and simple return on investment are calculated. See below for calculation methods:

ECM Calculation Equations:

$$Simple\ Payback = \left(\frac{Net\ Cost}{Yearly\ Savings}\right)$$

$$Simple\ Lifetime\ Savings = \left(Yearly\ Savings \times ECM\ Lifetime\right)$$

$$Simple\ Lifetime\ ROI = \frac{(Simple\ Lifetime\ Savings - Net\ Cost)}{Net\ Cost}$$

$$Lifetime\ Maintenance\ Savings = \left(Yearly\ Maintenance\ Savings \times ECM\ Lifetime\right)$$

$$Internal\ Rate\ of\ Return = \sum_{n=0}^{N}\left(\frac{Cash\ Flow\ of\ Period}{(1+IRR)^n}\right)$$

$$Net\ Present\ Value = \sum_{n=0}^{N}\left(\frac{Cash\ Flow\ of\ Period}{(1+DR)^n}\right)$$

Net Present Value calculations based on Interest Rate of 3%.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

The electric usage profile (below) represents the actual electrical usage for the facility. Jersey Central Power and Light (JCP&L) provides electricity to the facility under their General Service Secondary Three-Phase rate structure. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile shows the actual natural gas energy usage for the facility. Public Service Electric and Gas (PSE&G) provides natural gas to the facility under the Large Volume Gas (LVG) rate structure. In addition to PSE&G providing primary service, HESS is a third party supplier for the middle school. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

The overall cost for utilities is calculated by dividing the total cost by the total usage. Based on the utility history provide, the average cost for utilities at this facility is as follows:

Description	Average
Electricity	16.4¢ / kWh
Natural Gas	$1.74 / Therm

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY			
Utility Provider:	JCP&L, General Service Secondary 3 phase		
Rate:	JC_GS3_01F		
Meter No:	(G28873585, G21060890)		
Customer ID No:	(0801577897 0000424954, 0801577897 0005984109)		
TPS Meter / Acct No:	(10 00 06 2966 59, 10 00 42 4972 8 7)		
MONTH OF USE	**CONSUMPTION**	**DEMAND**	**TOTAL BILL**
Sep-08	95,035	420.4	$18,050
Oct-08	98,961	401.5	$16,169
Nov-08	106,111	327.8	$16,735
Dec-08	107,931	329.7	$17,325
Jan-09	111,020	311.2	$18,220
Feb-09	100,203	322.9	$16,781
Mar-09	106,580	318.9	$17,499
Apr-09	97,778	313.8	$15,999
May-09	98,286	315.0	$16,027
Jun-09	106,761	362.6	$16,673
Jul-09	89,108	353.2	$14,719
Aug-09	92,072	260.5	$13,716
Totals	**1,209,846**	**420.4 Max**	**$197,913**

AVERAGE DEMAND	**336.5**	**KW average**
AVERAGE RATE	**$0.164**	**$/kWh**

Figure 1
Electricity Usage Profile

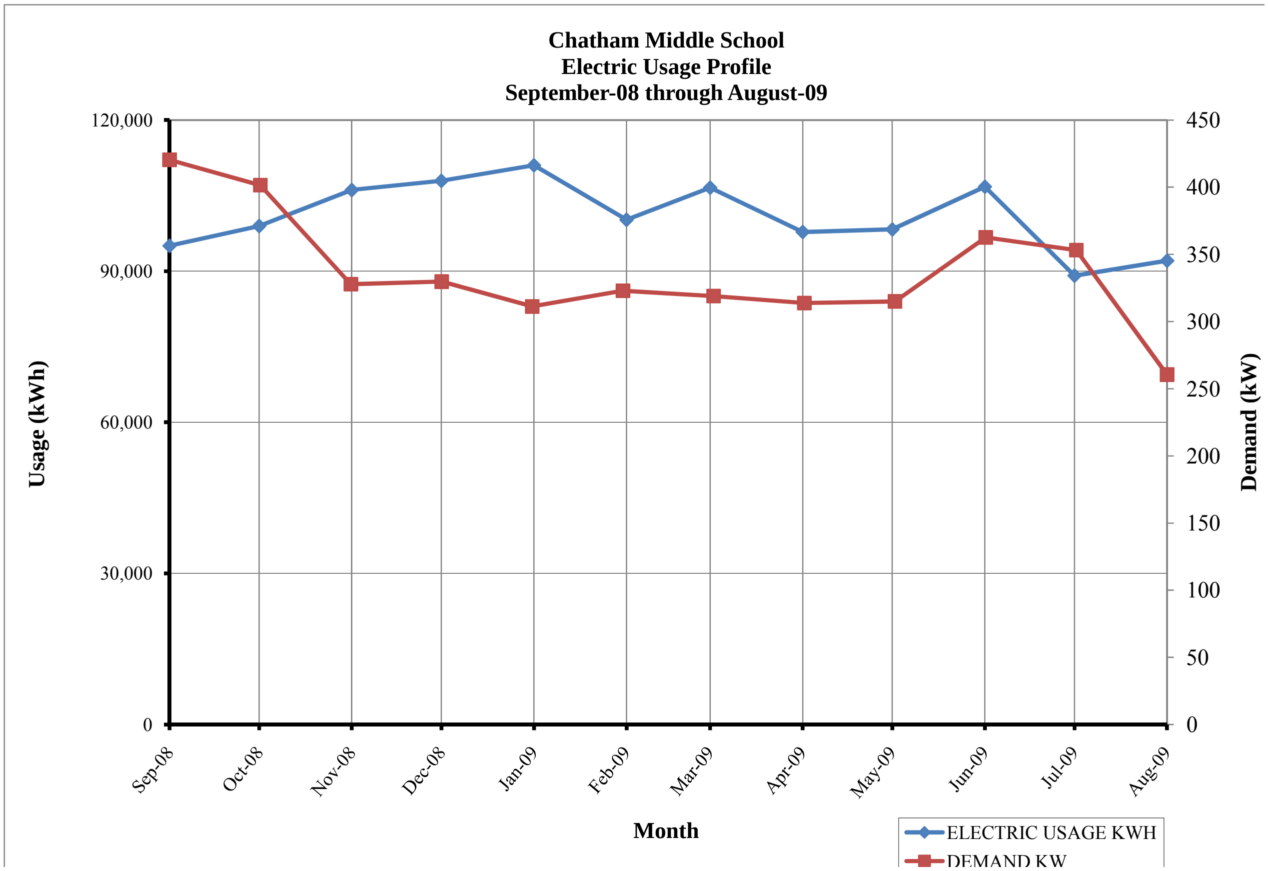


Table 4
Natural Gas Billing Data

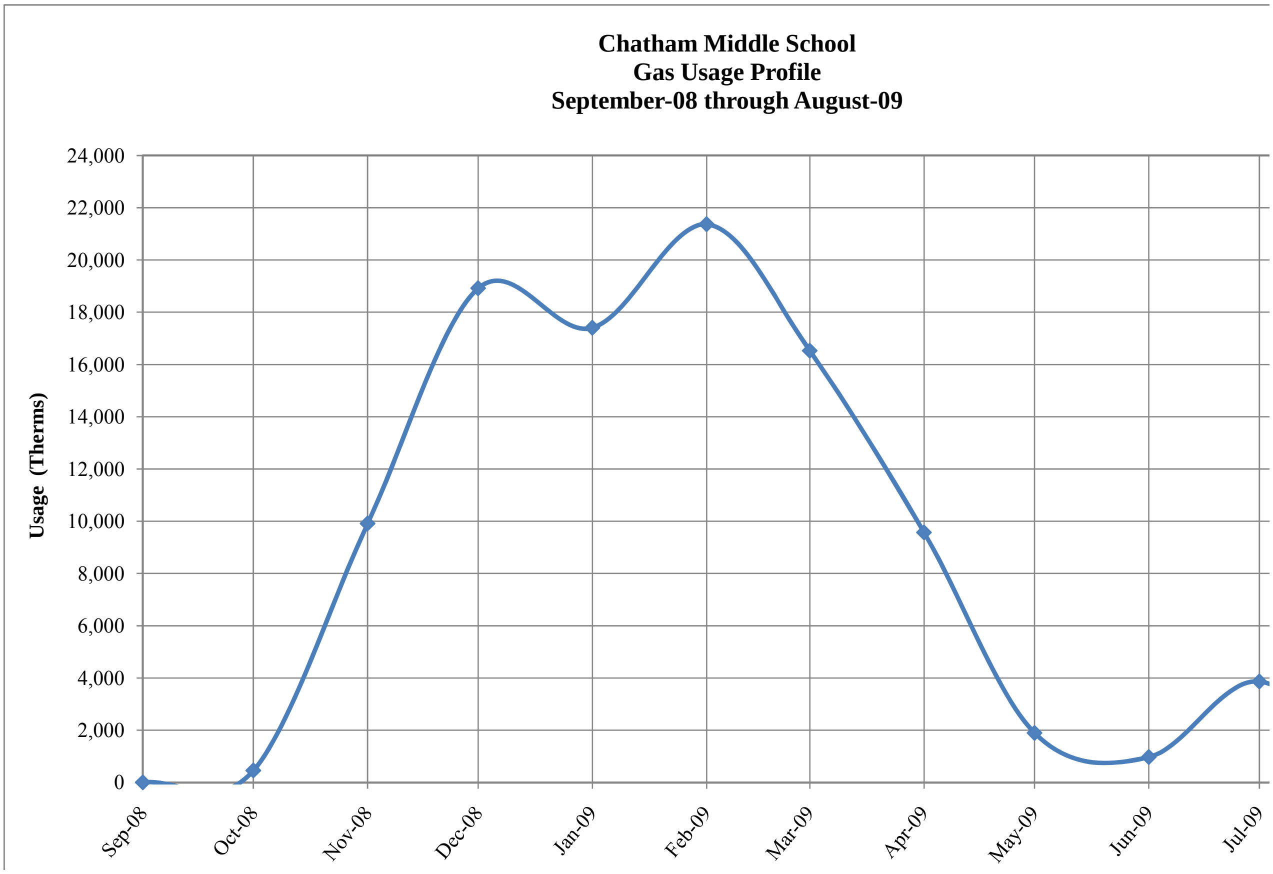
NATURAL GAS USAGE SUMMARY

Utility Provider: PSE&G
Rate: LVG
Meter No: 1810088
Point of Delivery ID: PG000009701158904569
Third Party Utility Provider: HESS
TPS Meter No: 394872/394900

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
Sep-08	7.30	$102.11
Oct-08	462.31	$710.11
Nov-08	9,915.48	$14,951.08
Dec-08	18,918.68	$28,321.73
Jan-09	17,404.92	$26,161.17
Feb-09	21,368.43	$32,225.97
Mar-09	16,526.88	$25,515.46
Apr-09	9,571.25	$46,632.53
May-09	1,897.06	$2,564.25
Jun-09	977.14	$1,377.79
Jul-09	3,866.72	$478.81
Aug-09	48.75	$99.54
TOTALS	**100,964.91**	**$179,140.55**

AVERAGE RATE: $1.774 $/THERM

Figure 2
Natural Gas Usage Profile



B. Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's annual energy utilization per square foot of building. This calculation is completed by converting all utility usage consumed by a building for one year, to British Thermal Units (BTU) and dividing this number by the building square footage. EUI is a good measure of a building's energy use and is utilized regularly for comparison of energy performance for similar building types. The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of Energy maintains a Benchmarking Building Energy Performance Program. The ORNL website determines how a building's energy use compares with similar facilities throughout the U.S. and in a specific region or state.

Source use differs from site usage when comparing a building's energy consumption with the national average. Site energy use is the energy consumed by the building at the building site only. Source energy use includes the site energy use as well as all of the losses to create and distribute the energy to the building. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses, which allows for a complete assessment of energy efficiency in a building. The type of utility purchased has a substantial impact on the source energy use of a building. The EPA has determined that source energy is the most comparable unit for evaluation purposes and overall global impact. Both the site and source EUI ratings for the building are provided to understand and compare the differences in energy use.

The site and source EUI for this facility is calculated as follows. (See Table 5 for details):

$$Building\ Site\ EUI = \frac{(Electric\ Usage\ in\ kBtu + Gas\ Usage\ in\ kBtu)}{Building\ Square\ Footage}$$

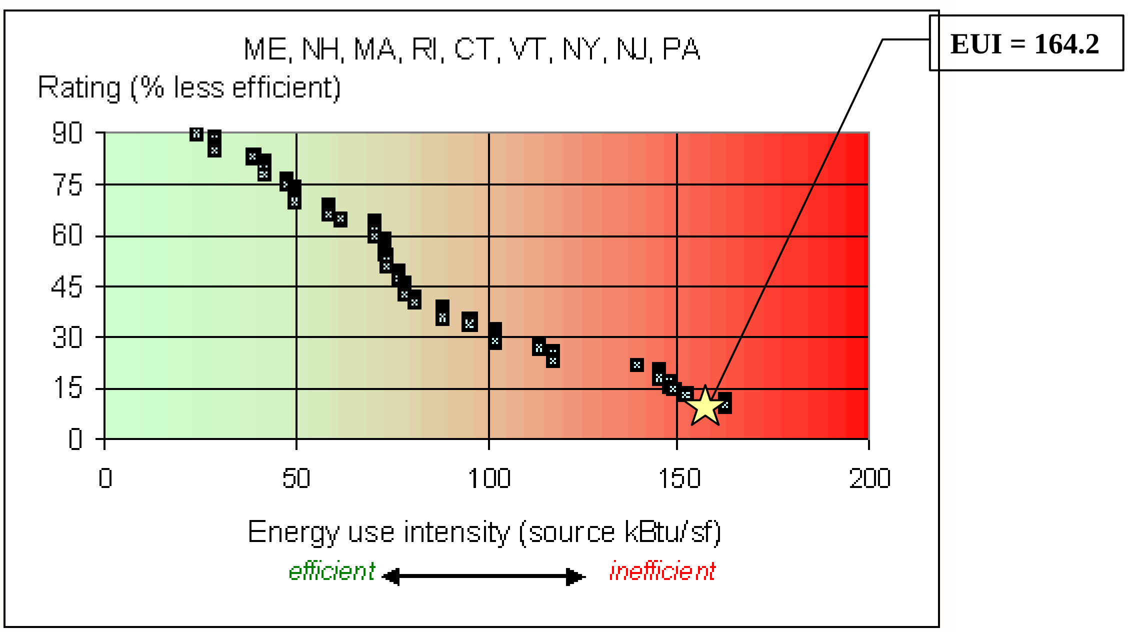
$$Building\ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ X\ SS\ Ratio + Gas\ Usage\ in\ kBtu\ X\ SS\ Ratio)}{Building\ Square\ Footage}$$

Table 5
Chatham Middle School EUI Calculations

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	BUILDING USE			SITE ENERGY kBtu	SITE-SOURCE RATIO	SOURCE ENERGY kBtu
	kWh	Therms	Gallons			
ELECTRIC	1209845.5			4,130,413	3.340	13,795,578
NATURAL GAS		100964.9		10,096,491	1.047	10,571,026
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				14,226,904		24,366,604
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		148,396	SQUARE FEET			
BUILDING SITE EUI		*95.87*	kBtu/SF/YR			
BUILDING SOURCE EUI		*164.20*	kBtu/SF/YR			

Table Figure 3 below depicts a national EUI grading for the source use of Elementary/ Middle Schools.

Figure 3
Source Energy Use Intensity Distributions: Elementary/ Middle School



C. EPA Energy Benchmarking System

The United States Environmental Protection Agency (EPA) in an effort to promote energy management has created a system for benchmarking energy use amongst various end users. The benchmarking tool utilized for this analysis is entitled Portfolio Manager. The Portfolio Manager tool allows tracking and assessment of energy consumption via the template forms located on the ENERGY STAR website (www.energystar.gov). The importance of benchmarking for local government municipalities is becoming more important as utility costs continue to increase and emphasis is being placed on carbon reduction, greenhouse gas emissions and other environmental impacts.

Based on information gathered from the ENERGY STAR website, Government agencies spend more than $10 billion a year on energy to provide public services and meet constituent needs. Furthermore, energy use in commercial buildings and industrial facilities is responsible for more than 50 percent of U.S. carbon dioxide emissions. It is vital that local government municipalities assess facility energy usage, benchmark energy usage utilizing Portfolio Manager, set priorities and goals to lessen energy usage and move forward with priorities and goals.

In accordance with the Local Government Energy Audit Program, CEG has created an ENERGY STAR account for the municipality to access and monitoring the facility's yearly energy usage as it compares to facilities of similar type. The login page for the account can be accessed at the following web address; the username and password are also listed below:

https://www.energystar.gov/istar/pmpam/index.cfm?fuseaction=login.login

User Name: chathamsd
Password: lgeaceg2009

Security Question: What city were you born in?
Security Answer: "chatham"

The utility bills and other information gathered during the energy audit process are entered into the Portfolio Manager. The following is a summary of the results for the facility:

Table 6
ENERGY STAR Performance Rating

ENERGY STAR PERFORMANCE RATING		
FACILITY DESCRIPTION	ENERGY PERFORMANCE RATING	NATIONAL AVERAGE
Chatham Middle School	25	50

Refer to **Statement of Energy Performance Appendix** for the detailed energy summary.

V. FACILITY DESCRIPTION

The 148,396 SF Middle School is a two story building comprised of an auditorium, cafeteria, kitchen, classrooms, offices, gymnasiums, locker rooms, and library. The building operates for 40 hours during a typical week. The building was originally 115,294 SF when it was built in 1957 and has been through several additions. The first addition in 1989 added approximately 3,200 SF. The second addition in 2000 added approximately 10,091 SF. The last addition was in 2006 and added 19,811 SF. There are three (3) different roofing types for this building. The first type is built up roofing with gravel topping and two (2) inches of insulation which is located on the original building. There is a roof section on the new gymnasium which is part of the 2006 addition built containing built up rubber roofing. The last roof type is on the 1989 music room addition which is comprised of rubber spray on roofing. Exterior walls are brick construction. The windows throughout the facility are in good condition and appear to be maintained. Typical windows throughout the facility are double pane, ¼" clear glass with aluminum frames.

Heating System

There is one boiler plant providing hot water for heating and there are natural gas fired roof top air handling and split system units that provide heat for this facility. The boiler plant consists of two (2) Smith cast iron boilers, model M450A, 3,603 MBH input, natural gas, water boiler. These boilers provide heating hot water to unit heaters, unit ventilators, unit heaters and packaged rooftop units.

Cooling System

Cooling for the building is provided through packaged rooftop DX units, split AC units, window air conditioning units, unit ventilators, and supply fans. The rooftop units are mostly manufactured by Aaon and range in capacity from 5 tons to 31 tons and provide cooling to larger areas such as the new gym, library, cafeteria, etc. Almost every classroom contains a window air conditioning unit or Airedale model CMX.

Exhaust System

Air is exhausted from the toilet rooms through the roof exhausters. The toilet room exhaust fan is operated based on the facility occupancy schedule. In addition to this ventilation, there is a fan room located below the old gym. This fan room contains two (2) large fan blower units which provide make up are and ventilation to the old gym.

Domestic Hot Water

A 28 gallon A.O. Smith gas fired hot water heater, capacity of 300,000 Btu/h, runs only during the summer months to supplement the boiler in the supply of hot water to the Middle School. During the winter months when the two (2) Smith boilers are active, they heat a holding tank for domestic hot water use. In the summer months when the boilers are shut down, this small A.O. Smith heater supplies the hot water thereafter. The domestic hot water is circulated throughout the building by a hot water re-circ pump. The domestic hot water piping insulation appeared to be in good condition.

Lighting

Typical lighting throughout building are fluorescent tube lay-in fixtures with T-8 lamps and electronic ballasts. Storage rooms and closets lit with a mixture of incandescent lamps, compact fluorescent lamps, and industrial surface mounted T-8 fixtures. The parking lot is lit with light poles and high pressure sodium lamps.

VI. MAJOR EQUIPMENT LIST

The equipment list is considered major energy consuming equipment and through energy conservation measures could yield substantial energy savings. The list shows the major equipment in the facility and all pertinent information utilized in energy savings calculations. An approximate age was assigned to the equipment in some cases if a manufactures date was not shown on the equipment's nameplate. The ASHRAE service life for the equipment along with the remaining useful life is also shown in the Appendix.

Refer to the **Major Equipment List Appendix** for this facility.

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade – General

Description:

The Chatham Middle School is comprised mostly of T-8 and fluorescent fixtures throughout. There are a few places in the Middle School which contain T-12 and incandescent lighting which should be retrofitted to match the rest of the school.

This ECM includes replacement of the existing fixtures containing T12 lamps and magnetic ballasts with fixtures containing T8 lamps and electronic ballasts. The new energy efficient, T8 fixtures will provide adequate lighting and will save the owner on electrical costs due to the better performance of the lamp and ballasts. This ECM will also provide maintenance savings through the reduced number of lamps replaced per year. The expected lamp life of a T8 lamp is approximately 30,000 burn-hours, in comparison to the existing T12 lamps which is approximately 20,000 burn-hours. The facility will need 33% less lamps replaced per year.

This ECM also includes replacement of all incandescent fixtures to compact fluorescent fixtures. The energy usage of an incandescent compared to a compact fluorescent approximately 3 to 4 times greater. In addition to the energy savings, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours.

Hours of Operation: 2,080 Hrs per year.

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix** outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, the replacement of a T-12 fixture to a T-5 or T-8 fixture warrants the following incentive: T-5 or T-8 (1-2 lamp) = $10 per fixture; T-5 or T-8 (3-4 lamp) = $20 per fixture.

$$\text{Smart Start® } Incentive = (\#\ of\ \ 1-2\ lamp\ \ fixtures \times\ \$\,10) + (\#\ of\ \ 3-4\ lamp\ \ fixtures \times\ \$\,20)$$

$$\text{Smart Start® } Incentive = (2 \times\ \$\,10) + (18 \times\ \$\,20) = \underline{\$380}$$

Replacement and Maintenance Savings are calculated as follows:

$$Savings = (reduction\ in\ lamps\ replaced\ \ per\ \ year) \times (repacment\ \$\ per\ lamp + Labor\ \$\ per\ lamp)$$
$$Savings = (58\ lamps\ \ per\ \ year) \times (\$2.00 + \$5.00) = \underline{\$580}$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$3,442
NJ Smart Start Equipment Incentive ($):	$380
Net Installation Cost ($):	$3,062
Maintenance Savings ($/Yr):	$580
Energy Savings ($/Yr):	$232
Total Yearly Savings ($/Yr):	$812
Estimated ECM Lifetime (Yr):	15
Simple Payback	3.8
Simple Lifetime ROI	297.8%
Simple Lifetime Maintenance Savings	$8,700
Simple Lifetime Savings	$12,180
Internal Rate of Return (IRR)	26%
Net Present Value (NPV)	$6,631.60

ECM #2: Install Compact Fluorescent Lamps

Description:

Compact fluorescent lamps (CFL's) were created to be direct replacements for the standard incandescent lamps which are common to table lamps, spot lights, hi-hats, bathroom vanity lighting, etc. The light output of the CFL has been designed to resemble the incandescent lamp. The color rendering index (CRI) of the CFL is much higher than standard fluorescent lighting, and therefore provides a much "truer" light. The CFL is available in a myriad of shapes and sizes depending on the specific application. Typical replacements are: a 13-Watt CFL for a 40-Watt incandescent lamp, a 15-Watt CFL for a 60-Watt incandescent lamp, an 18-Watt CFL for a 75-Watt incandescent lamp, and a 23-Watt CFL for a 100-Watt incandescent lamp.

The CFL is also available for a number of "brightness colors" that is indicated by the Kelvin rating. A 2700K CFL is the "warmest" color available and is closest in color to the incandescent lamp. CFL's are also available in 3000K, 3500K, and 4100K. The 4100K would be the "brightest" or "coolest" output. A CFL can be chosen to screw right into your existing fixtures, or hardwired into your existing fixtures.

This ECM involves replacing all incandescent lamps in the facility with energy efficient compact fluorescent lamps.

Energy Savings Calculations:

There are two (2) 75-Watt and seventy-two (72) 100-Watt incandescent lamps in the facility that can be upgraded to 18 Watt CFL units respectively. The average operating hours for these lamps is estimated to be 2,080.

<u>Energy cost savings</u>:

[2 units * (75W – 18W) + 72 units * (100W – 18W)] 2,080 hours * 1 kW/1,000 W * $0.164/kWh] = <u>$2,053.00/yr</u>

The installed cost of seventy-four (74) 18-Watt CFL's is $425.50.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$426
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$426
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,053
Total Yearly Savings ($/Yr):	$2,053
Estimated ECM Lifetime (Yr):	15
Simple Payback	0.2
Simple Lifetime ROI	7137.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$30,795
Internal Rate of Return (IRR)	482%
Net Present Value (NPV)	$24,083.08

ECM #3: Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. In many cases the lights are left on because of the inconvenience to manually switch lights off when a room is left or on when a room is first occupied. This is common in storage rooms that are occupied for only short periods and only a few times per day. In some instances lights are left on due to the misconception that it is better to keep the lights on rather than to continuously switch lights on and off. Although increased switching reduces lamp life, the energy savings outweigh the lamp replacement costs. The payback timeframe for when to turn the lights off is approximately two minutes. If the lights are off for at least a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is adequate to provide reduced lighting levels when full light output is not needed. Occupancy sensors detect motion and will switch the lights on when the room is occupied. Occupancy sensors can either be mounted in place of a current wall switch, or on the ceiling to cover large areas. Photocell control senses light levels and turn off or reduce lights when there is adequate daylight. Photocells are mostly used outside, but are becoming more popular in energy-efficient interior lighting designs as well.

The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings is based on the “Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways,” document posted for public use April 2005. The study has found that commercial buildings have the potential to achieve significant energy savings through the use of building controls. The average energy savings are as follows based on the report:

- Occupancy Sensors for Lighting Control - 20%-28%.

The ECM includes replacement of standard wall switches with sensors wall switches for individual classrooms, ceiling mount sensors for large cafeteria areas or restrooms. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent. See the “Investment Grade Lighting Audit” appendix for details.

The **Investment Grade Lighting Audit Appendix** of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by 20% for all areas that include occupancy sensor lighting controls.

Light Energy = 168,746 kWh/Yr. occupancy sensor controlled lighting

Energy Savings Calculations:

$$Energy\ Savings = 20\% \times Occupancy\ Sensored\ Light\ Energy\ (kWh/Yr)$$

$$Energy\ Savings = 20\% \times 168{,}746\ (kWh) = 33{,}749.2\ (kWh)$$

$$Savings. = Energy\ Savings\ (kWh) \times Ave\ Elec\ Cost\left(\frac{\$}{kWh}\right)$$

$$Savings. = 33{,}749.2\ (kWh) \times 0.164\left(\frac{\$}{kWh}\right) = \$5{,}535$$

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is $75/unit including material and labor.

Installation Cost = $75 x 113 motion sensors = $8,475

From the **Smart Start Incentive Appendix**, the installation of a lighting control device warrants the following incentive: occupancy = $20 per fixture, daylight = $25 per fixture.

$$\text{Smart Start® } Incentive = (\#\ of\ \ wall\ mount\ devices \times\ \$\ 20) = (113 \times \$20) = \$2{,}260$$
$$\text{Smart Start® } Incentive = \$2{,}260\ Total$$

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$8,475
NJ Smart Start Equipment Incentive ($):	$2,260
Net Installation Cost ($):	$6,215
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$5,535
Total Yearly Savings ($/Yr):	$5,535
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.1
Simple Lifetime ROI	1235.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$83,025
Internal Rate of Return (IRR)	89%
Net Present Value (NPV)	$59,861.47

ECM #4: Install T-5 Lighting System in Gym

Description:

The Upstairs Gym is currently lit via thirty-six (36) HID, 250 W Metal Halide fixtures that are mounted approximately 20'-0" above the finished floor. The lighting system is antiquated and the space would be better served with a more efficient, fluorescent lighting system. Studies have shown that metal halide lighting systems have a steep lumen depreciation rate (rate at which light is produced from fixture) which equates to approximately a 26% to 35% reduction in lighting output at 40% of the rated lamp life. In addition, the new fluorescent system will provide a better quality of light and save the Owner many dollars on replacement of the highly expensive metal halide lamps.

CEG recommends upgrading the lighting within the Gym to an energy-efficient T-5 lighting system that includes new lighting fixtures with high efficiency, electronic ballasts and T-5 high output (HO) lamps. The T-5 HO lamps are rated for 20,000 hours versus the 10,000 hours for the 250W Metal Halide lamps so there would be a savings in replacement cost and labor. In addition to the standard lighting features of the T-5 fixtures; a day-lighting option could be selected for the outside rows of light to take advantage of the natural daylight that provides light to the room during the day via the clerestory.

This measure replaces all the HID, 250 W Metal Halide fixtures in the Gym with a well-designed T-5 lighting system. Approximately thirty-sex (36), 3-lamp T5HO high bay fixtures with reflectors and high-efficiency, electronic ballasts will be required in order to meet the mandated 50 foot-candle average within the Gym.

Energy Savings Calculations:

A detailed **Investment Grade Lighting Audit Appendix** that outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, the replacement of a 250 W HID fixture to a T-5 or T-8 fixture warrants the following incentive: $50 per fixture.

$$\text{Smart Start® } Incentive = (\#\ of\ \ fixtures \times\ \$50) = (36 \times \$50) = \underline{\$1,800}$$

Maintenance savings are calculated based on the facility operational hours as indicated by the Owner. For the Gym, the estimated operational hours are 2,080 hours per year. Based on the lamp life comparison, there will be five (5) complete lamp replacements required for the metal halide system at the time when two (2) complete lamp replacements would be required for the fluorescent lighting system. Based on industry pricing, the lamp cost for a 250W metal halide lamp is approximately ±$25 per lamp and a T-5 54HO fluorescent lamp is approximately ±$5 per lamp. Therefore, the maintenance savings are calculated as follows:

$$Maint\,eance\ Savings = (\#\ of\ \ MH\ \ lamps \times\ \$25\ \ per\ lamp) - (\#\ of\ \ T5HO\ lamps \times \$5\ \ per\ lamp)$$

$$Maint\,eance\ Savings = (36\ lamps \times\ \$25\ \ per\ lamp) - (108\ lamps \times \$5\ \ per\ lamp) = \underline{\$360}$$

= $360 / 15 years = $24/year average maintenance savings

It is pertinent to note, that installation labor was not included in the maintenance savings.

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$10,800
NJ Smart Start Equipment Incentive ($):	$1,800
Net Installation Cost ($):	$9,000
Maintenance Savings ($/Yr):	$24
Energy Savings ($/Yr):	$1,388
Total Yearly Savings ($/Yr):	$1,412
Estimated ECM Lifetime (Yr):	15
Simple Payback	6.4
Simple Lifetime ROI	135.3%
Simple Lifetime Maintenance Savings	$360
Simple Lifetime Savings	$21,180
Internal Rate of Return (IRR)	13%
Net Present Value (NPV)	$7,856.36

ECM #5: Boiler Replacement

Description:

There is one boiler plant providing hot water for heating and there are natural gas fired roof top air handling and split system units that provide heat for this facility. The boiler plant consists of two (2) Smith cast iron boilers, model M450A, 3,603 MBH input, natural gas, water boiler. The existing units are inefficient with an estimated combustion efficiency of 80% for heating, when new. The estimated service life for this type of gas fired boiler is thirty-five (35) years; these hot water boilers are 42 years old and have exceeded their ASHRAE service life and should be replaced due to their poor condition.

This energy conservation measure will replace the gas fired boilers serving the facility. Calculation is based on the following equipment: Aerco, Benchmark BMK-3.0GWB condensing boiler or equivalent replacing the hot water boiler. The existing units will be replaced with high energy efficient units with capacities typical of the existing units.

Energy Savings Calculations:

<u>Existing Gas Fired Hot Water Boilers, Typical for (2) Iron Fireman:</u>

Rated Capacity = 7,212 MBh Input, 6,434 MBh Output (Natural Gas)

Combustion Efficiency = 89%
Age & Radiation Losses = 10%
Thermal Efficiency = 79%

<u>Replacement Gas Fired Boiler (Hot water) (3 Aerco Benchmark):</u>

High-Efficiency Gas Fired Boiler

Rated Capacity = 9,000 MBh Input, 8,343 MBh Output (Natural Gas)

Combustion Efficiency = 87.5%
Radiation Losses = 0.5%
Thermal Efficiency = 87%

Natural Gas Equipment List - Estimated Annual Usage per unit						
Concord Engineering Group						
Chatham Middle School						
Location	**Qty.**	**Model #**	**Serial #**	**Input (MBh)**	**% of Total Input**	**Estimated Annual Therms**
Boiler Room 1	1	M450A	MB95-20	3603	37.36%	37,715.66
Boiler Room 1	1	M450A	MB95-20	3603	37.36%	37,715.66
Boiler Room 1	1	HW 300 932	932 E 00 56787	300	3.11%	3,140.35
Rooftop (RTU-1)	1	RN-031-3-0-BB04-3A9	200609-BNGU02289	540	5.60%	5,652.64
Rooftop (RTU-2)	1	RM-008-3-0-BA02-339	200609-AMGH28518	180	1.87%	1,884.21
Rooftop (RTU-3)	1	RM-A02-9-0-BA01-319	200609-AMGB28530	69	0.72%	722.28
Rooftop (RTU-4)	1	DL-10N24ATAAA3B	NANM001143	0.24	0.00%	2.51
Rooftop (RTU-5)	1	RM-013-3-0-BB02-349	200609-AMGK28548	270	2.80%	2,826.32
Rooftop	1	RM-008-3-0-BA02-339	200609-AMGH28519	180	1.87%	1,884.21
Rooftop	1	RN-031-3-0-BB04-3A9	200609-BNGU02288	540	5.60%	5,652.64
Boiler Room 1	1	RM-013-3-0-B002-349	200609-AMGK28547	270	2.80%	2,826.32
Boiler Room 2	2	RM-A05-3-0-BB01-329	200 609-AMGE29054	90	0.93%	942.11
			Total Input MBH	**9,645**		
			Total Input Therms	96.5		
			Total Gas Consumption Therms / yr.	100964.91		

Operating Data:

Heating Season Fuel Consumption = 2 x 37,715.66 = 75,431 Therms

$$Heating\ Energy\ Savings = Fuel\ Consumption \times (New\ Furnace\ Efficiency - Old\ Furnace\ Efficiency)$$

Heating Energy Savings = 75,431 Therms x ((87% - 79%) / (87%)) = 6,936 Therms

Total Heating Cost savings

Heating Energy Cost Savings = Annual Energy Savings x $/Therm

Heating Energy Cost Savings = 6,936 Therms x $1.74/Therm = $12,069/ yr.

Installed cost of a new gas fired heating plant $293,164. Cost for asbestos abatement was not included in this estimate.

Equipment Incentives:

Heating Smart Start Equipment Incentive = $2.00/MBh for boilers < 300 MBh and $1.75/MBh for boilers ≥ 300 MBh.

Total Smart Start Equipment Incentive = ($1.75/MBh x 9,000 MBh)
Total Smart Start Equipment Incentive = $15,750

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$293,164
NJ Smart Start Equipment Incentive ($):	$15,750
Net Installation Cost ($):	$277,414
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$12,069
Total Yearly Savings ($/Yr):	$12,069
Estimated ECM Lifetime (Yr):	35
Simple Payback	23.0
Simple Lifetime ROI	52.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$422,415
Internal Rate of Return (IRR)	3%
Net Present Value (NPV)	($18,084.74)

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

Globally, renewable energy has become a priority affecting international and domestic energy policy. The State of New Jersey has taken a proactive approach, and has recently adopted in its Energy Master Plan a goal of 30% renewable energy by 2020. To help reach this goal New Jersey created the Office of Clean Energy under the direction of the Board of Public Utilities and instituted a Renewable Energy Incentive Program to provide additional funding to private and public entities for installing qualified renewable technologies. A renewable energy source can greatly reduce a building's operating expenses while producing clean environmentally friendly energy. CEG has assessed the feasibility of installing renewable energy measures (REM) for the municipality utilizing renewable technologies and concluded that there is potential for solar energy generation. The solar photovoltaic system calculation summary will be concluded as **REM#1** within this report.

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which will be mounted on all south and southwestern facades of the building. Flat roof, as well as sloped areas can be utilized; flat areas will have the panels turned to an optimum solar absorbing angle. (A structural survey of the roof would be necessary before the installation of PV panels is considered). The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit is around $350, this value was used in our financial calculations. This equates to $0.35 per kWh generated.

CEG has reviewed the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 18,000 S.F. can be utilized for a PV system. A depiction of the area utilized is shown in **Renewable / Distributed Energy Measures Calculation Appendix**. Using this square footage it was determined that a system size of 253.46 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 292,885 KWh annually, reducing the overall utility bill by approximately 24% percent. A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix**. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

The proposed photovoltaic array layout is designed based on the specifications for the Sun Power SPR-230 panel. This panel has a "DC" rated full load output of 230 watts, and has a total panel conversion efficiency of 18%. Although panels rated at higher wattages are available through Sun Power and other various manufacturers, in general most manufacturers who produce commercially available solar panels produce a similar panel in the 200 to 250 watt range. This provides more manufacturer options to the public entity if they wish to pursue the proposed solar recommendation without losing significant system capacity.

The array system capacity was sized on available roof space on the existing facility. Estimated solar array generation was then calculated based on the National Renewable Energy Laboratory PVWatts Version 1.0 Calculator. In order to calculate the array generation an appropriate location with solar data on file must be selected. In addition the system DC rated kilowatt (kW) capacity must be inputted, a DC to AC de-rate factor, panel tilt angle, and array azimuth angle. The DC to AC de-rate factor is based on the panel nameplate DC rating, inverter and transformer efficiencies (95%), mismatch factor (98%), diodes and connections (100%), dc and ac wiring(98%, 99%), soiling, (95%), system availability (95%), shading (if applicable), and age(new/100%). The overall DC to AC de-rate factor has been calculated at an overall rating of 81%. The PVWatts Calculator program then calculates estimated system generation based on average monthly solar irradiance and user provided inputs. The monthly energy generation and offset electric costs from the PVWatts calculator is shown in the **Renewable/Distributed Energy Measures Calculation Appendix**.

The proposed solar array is qualified by the New Jersey Board of Public Utilities Net Metering Guidelines as a Class I Renewable Energy Source. These guidelines allow onsite customer generation using renewable energy sources such as solar and wind with a capacity of 2 megawatts (MW) or less. This limits a customer system design capacity to being a net user and not a net generator of electricity on an annual basis. Although these guidelines state that if a customer does net generate (produce more electricity than they use), the customer will be credited those kilowatt-hours generated to be carried over for future usage on a month to month basis. Then, on an annual basis if the customer is a net generator the customer will then be compensated by the utility the average annual PJM Grid LMP price per kilowatt-hour for the over generation. Due to the aforementioned legislation, the customer is at limited risk if they generate more than they use at times throughout the year. With the inefficiency of today's energy storage systems, such as batteries, the added cost of storage systems is not warranted and was not considered in the proposed design.

CEG has reviewed financing options for the owner. Two options were studied and they are as follows: Self-financed and direct purchase without finance. Self-finance was calculated with 95% of the total project cost financed at a 7% interest rate over 25 years. Direct purchase involves the local government paying for 100% of the total project cost upfront via one of the methods noted in the Installation Funding Options section below. Both of these calculations include a utility inflation rate as well as the degradation of the solar panels over time. Based on our calculations the following are the payback periods for the respective method of payment:

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM			
PAYMENT TYPE	**SIMPLE PAYBACK**	**SIMPLE ROI**	**INTERNAL RATE OF RETURN**
Self-Finance	15.15 Years	-	-
Direct Purchase	15.15 Years	65%	4.9%

*The solar energy measure is shown for reference in the executive summary Renewable Energy Measure (REM) table

The resultant Internal Rate of Return indicates that if the Owner was able to "self-finance" the solar project, the project would be slightly more beneficial to the Owner. However, if the Owner was able to work out a Power Purchase Agreement with a third-party and agree upon a decent base energy rate for kilowatt hour production, the "direct purchase" option could also, prove to be a beneficial route.

In addition to the Solar Analysis, CEG also conducted a review of the applicability of wind energy for the facility. Wind energy production is another option available through the Renewable Energy Incentive Program. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. Based on CEG's review of the applicability of wind energy for the facility, it was determined that the average wind speed is not adequate, and the kilowatt demand for the building is below the threshold (200 kW) for purchase of a commercial wind turbine. Therefore, wind energy is not a viable option to implement.

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

Load Profile analysis was performed to determine the seasonal energy usage of the facility. Irregularities in the load profile will indicate potential problems within the facility. Consequently based on the profile a recommendation will be made to remedy the irregularity in energy usage. For this report, the facility's energy consumption data was gathered in table format and plotted in graph form to create the load profile. Refer to the Electric and Natural Gas Usage Profiles included within this report to reference the respective electricity and natural gas usage load profiles.

Electricity:

The Electric Usage Profile demonstrates a very flat load shape throughout the year. This is a bit unusual for a school, because typically schools are closed in the summer. However the steady load profile (especially the summer) is supported by summer school, auditorium, locker rooms, kitchen, library, weekend activities and some ongoing projects. The auditorium is in use throughout the year. A steady load throughout the summer is a sign of consistent cooling load (air-conditioning). Air-conditioning in this facility is provided by packaged DX roof-top units, split AC units, window units, unit ventilators and supply fans. The roof-top units range in capacity from 5 – 31 tons. Almost every classroom contains a unit ventilator and either a window unit or Airedale model CMX. A flatter load profile of this type, will allow for more competitive energy prices when shopping for alternative energy suppliers.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical heating load profile. An increase in consumption is observed October through April during the standard heating season. Heating for this facility is supplied by (1) one, boiler plant providing hot-water for heating and natural gas fired roof top air handling and split system units that provide heat for the facility. The boiler plant consists of (2) two Smith cast iron boilers. The boilers provide hot water to unit heaters, unit ventilators and packaged roof-top units. Domestic hot water for the restrooms and kitchen lounge is provided by a 1,625 gallon A.O. Smith natural gas fired hot water heater. The domestic hot water is circulated throughout the building by a hot water re-circ pump.

Natural gas Delivery-service is provided by Public Service Electric and Gas Company (PSE&G) on an LVG rate schedule. Commodity service is supplied by the Hess Corporation, the Third Party Supplier. This consistent load profile is beneficial when looking at supply options with a Third Party Supplier.

Tariff:

Electricity:

This facility receives electrical service through Jersey Central Power & Light (JCP&L) on a GSS (General Service Secondary – 3 Phase) rate. Service classification GS is available for general service purposes on secondary voltages not included under Service Classifications RS, RT, RGT or GST. This facility's rate is a three phase service at secondary voltages. For electric supply (generation), the customer uses the service of a JCP&L. This facility uses the Delivery Service of the utility (JCP&L). The Delivery Service includes the following charges: Customer Charge, Supplemental Customer Charge, Distribution Charge (kW Demand), kWh Charge, Non-utility Generation Charge, TEFA, SBC, SCC, Standby Fee and RGGI. The Generation Service is provided by JCP&L under BGS (Basic Generation Service). BGS Energy and Reconciliation Charges are provided in Rider BGS-FP (fixed pricing) or BGS-CIEP (Commercial Industrial Energy Pricing). BGS also has a Transmission component to its charge.

Natural Gas:

This facility receives utility service through Public Service Electric and Gas Company (PSE&G). This facility utilizes the Delivery Service from PSE&G while receiving Commodity service from a Third Party Supplier (TPS), Hess Corporation.

LVG Rate: This utility tariff is for "firm" delivery service for general purposes. This rate schedule has a Delivery Charge, Balancing Charge, Societal Benefits Charge, Realignment Adjustment Charge, Margin Adjustment Charge, RGGI Charge and Customer Account Service Charge. The customer can elect to have the Commodity Charge serviced through the utility or by a Third Party Supplier (TPS). Note: Should the TPS not deliver, the customer may receive service from PSE&G under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service.

"Firm" delivery service defines the reliability of the transportation segment of the pricing. Much like the telecom industry, natural gas pipelines were un-bundled in the late 1990's and the space was divided up and marketed into reliability of service. Firm Service is said to be the most reliable and last in the pecking order for interruption. This service should not be interrupted.

Commodity Charges: Customer may choose to receive gas supply from either: A TPS or PSE&G through its Basic Gas Supply Service default service. PSE&G may also supply Emergency Sales Service in certain instances. This is at a much higher than normal rate. It should be perceived as a penalty.

This facility utilizes the services of a Third Party Supplier, The Hess Corporation. The contract is administered by The Alliance for Competitive Service (ACES). ACES is the energy aggregation program of the New Jersey School Boards Association of School Administrator's. The process was reviewed and approved by the New Jersey Department of Community Affairs.

Please see CEG recommendations below.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities. Good potential savings can be seen equally in the electric costs and the natural gas costs. The average price per kWh (kilowatt hour) for the High School based on a historical 1-year weighted average fixed price from the utility JCP&L is $.1415 / kWh (this is the fixed "price to compare" when shopping for energy procurement alternatives). The fixed weighted average price per decatherm for natural gas service in the High School, provided by the Hess Corporation (TPS) is $ 12.08 / dth (dth, is the common unit of measure). The natural gas prices are also the "prices to compare".

The "price to compare" is the netted cost of the energy (including other costs), that the customer will use to compare to Third Party Supply sources when shopping for alternative suppliers. For electricity this cost would not include the utility transmission and distribution chargers. For natural gas the cost would not include the utility distribution charges and is said to be delivered to the utilities city-gate.

Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. Chatham School District could see improvement in its energy costs if it were to take advantage of these current market prices quickly, before energy prices increase. Based on electric supply from JCP&L and utilizing the historical consumption data provided (August 2008 through July 2009) and current electric rates, the school(s) could see an improvement in its electric costs of up to 25 % annually. (Note: Savings were calculated using Average Annual Consumption and a variance to a Fixed Average One-Year commodity contract). CEG recommends aggregating the entire electric load to gain the most optimal energy costs. CEG recommends advisement for alternative sourcing and supply of energy on a "managed approach".

CEG's second recommendation coincides with the natural gas costs. Based on the current alternative market pricing supplied by the Hess Corporation (ACES Agreement), CEG feels that School District could see an improvement of up to 33 % in its natural gas costs. CEG has experience with the mechanism for schools to buy energy in New Jersey. It is through the ACES Agreement (The Alliance for Competitive Energy Services) which is an energy aggregation program. From our experience, the basis price is the reason that the overall average price per dekatherm is ($12.08/dth). Therefore the average pricing formula supplied by Hess is 25 % above today's competitive market pricing. CEG recommends the school receive further advisement on these prices through an energy advisor. They should also consider procuring energy (natural gas) through an alternative supply source.

CEG also recommends scheduling a meeting with the current utility providers to review their utility charges and current tariff structures for electricity and natural gas. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), the municipality can learn more about the competitive supply process. The county can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu. They should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the information for ongoing demand-side management projects. Furthermore, special attention should be given to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with the utility representative. The School District should ask the utility representative about alternative billing options, such as consolidated billing when utilizing the service of a Third Party Supplier. Finally, if the supplier for energy (natural gas) is changed, closely monitor balancing, particularly when the contract is close to termination. This could be performed with the aid of an "energy advisor".

X. INSTALLATION FUNDING OPTIONS

CEG has reviewed various funding options for the facility owner to utilize in subsidizing the costs for installing the energy conservation measures noted within this report. Below are a few alternative funding methods:

i. *Energy Savings Improvement Program (ESIP)* – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and par for the costs using the value of energy savings that result from the improvements. The "Energy Savings Improvement Program (ESIP)" law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources.

ii. *Municipal Bonds* – Municipal bonds are a bond issued by a city or other local government, or their agencies. Potential issuers of municipal bonds include cities, counties, redevelopment agencies, school districts, publicly owned airports and seaports, and any other governmental entity (or group of governments) below the state level. Municipal bonds may be general obligations of the issuer or secured by specified revenues. Interest income received by holders of municipal bonds is often exempt from the federal income tax and from the income tax of the state in which they are issued, although municipal bonds issued for certain purposes may not be tax exempt.

iii. *Power Purchase Agreement* – Public Law 2008, Chapter 3 authorizes contractor of up to fifteen (15) years for contracts commonly known as "power purchase agreements." These are programs where the contracting unit (Owner) procures a contract for, in most cases, a third party to install, maintain, and own a renewable energy system. These renewable energy systems are typically solar panels, windmills or other systems that create renewable energy. In exchange for the third party's work of installing, maintaining and owning the renewable energy system, the contracting unit (Owner) agrees to purchase the power generated by the renewable energy system from the third party at agreed upon energy rates.

iv. *Pay For Performance* – The New Jersey Smart Start Pay for Performance program includes incentives based on savings resulted from implemented ECMs. The program is available for all buildings with average demand loads above 200 KW. The facility's participation in the program is assisted by an approved program partner. An "Energy Reduction Plan" is created with the facility and approved partner to shown at least 15% reduction in the building's current energy use. Multiple energy conservation measures implemented together are applicable toward the total savings of at least 15%. No more than 50% of the total energy savings can result from lighting upgrades / changes.

Total incentive is capped at 50% of the project cost. The program savings is broken down into three benchmarks; Energy Reduction Plan, Project Implementation, and

Measurement and Verification. Each step provides additional incentives as the energy reduction project continues. The benchmark incentives are as follows:

1. Energy Reduction Plan – Upon completion of an energy reduction plan by an approved program partner, the incentive will grant $0.10 per square foot between $5,000 and $50,000, and not to exceed 50% of the facility's annual energy expense. (Benchmark #1 is not provided in addition to the local government energy audit program incentive.)

2. Project Implementation – Upon installation of the recommended measures along with the "Substantial Completion Construction Report," the incentive will grant savings per KWH or Therm based on the program's rates. Minimum saving must be 15%. (Example $0.11 / kWh for 15% savings, $0.12/ kWh for 17% savings, … and $1.10 / Therm for 15% savings, $1.20 / Therm for 17% saving, …) Increased incentives result from projected savings above 15%.

3. Measurement and Verification – Upon verification 12 months after implementation of all recommended measures, that actual savings have been achieved, based on a completed verification report, the incentive will grant additional savings per kWh or Therm based on the program's rates. Minimum savings must be 15%. (Example $0.07 / kWh for 15% savings, $0.08/ kWh for 17% savings, … and $0.70 / Therm for 15% savings, $0.80 / Therm for 17% saving, …) Increased incentives result from verified savings above 15%.

CEG recommends the Owner review the use of the above-listed funding options in addition to utilizing their standard method of financing for facilities upgrades in order to fund the proposed energy conservation measures.

XI. ADDITIONAL RECOMMENDATIONS

The following recommendations include no cost/low cost measures, Operation & Maintenance (O&M) items, and water conservation measures with attractive paybacks. These measures are not eligible for the Smart Start Buildings incentives from the office of Clean Energy but save energy none the less.

A. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.

B. Maintain all weather stripping on windows and doors.

C. Clean all light fixtures to maximize light output.

D. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

E. Confirm that outside air economizers on the rooftop units are functioning properly to take advantage of free cooling and avoid excess outside air during occupied periods.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Chatham Middle School

ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT./ SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM #1	Lighting Upgrade - General	$3,442	$0	$380	$3,062	$232	$580	$812	15	$12,180	$8,700	297.8%	3.8	25.66%	$6,631.60
ECM #2	Install Compact Fluorescents	$426	$0	$0	$426	$2,053	$0	$2,053	15	$30,795	$0	7137.4%	0.2	482.49%	$24,083.08
ECM #3	Lighting Contrls	$8,475	$0	$2,260	$6,215	$5,535	$0	$5,535	15	$83,025	$0	1235.9%	1.1	89.05%	$59,861.47
ECM #4	Install T-5 Lighting System in Gym	$10,800	$0	$1,800	$9,000	$1,388	$24	$1,412	15	$21,180	$360	135.3%	6.4	13.27%	$7,856.36
ECM #5	Boiler Replacement	$293,164	$0	$15,750	$277,414	$12,069	$0	$12,069	35	$422,415	$0	52.3%	23.0	2.55%	($18,084.74)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	253.46 KW PV System	$2,281,140	$0	$0	$2,281,140	$48,033	$102,510	$150,543	25	$3,763,575	$2,562,750	65.0%	15.2	4.29%	$340,287.49

Notes: 1) The variable Cn in the formulas for Internal Rate of Return and Net Present Value stands for the cash flow during each period.
2) The variable DR in the NPV equation stands for Discount Rate
3) For NPV and IRR calculations: From n=0 to N periods where N is the *lifetime of ECM* and Cn is the *cash flow during each period*.

Concord Engineering Group, Inc.

520 BURNT MILL ROAD
VOORHEES, NEW JERSEY 08043
PHONE: (856) 427-0200
FAX: (856) 427-6508

SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of January, 2009:

Electric Chillers

Water-Cooled Chillers	$12 - $170 per ton
Air-Cooled Chillers	$8 - $52 per ton

Gas Cooling

Gas Absorption Chillers	$185 - $400 per ton
Gas Engine-Driven Chillers	Calculated through custom measure path)

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	$73 - $93 per ton
Air-to-Air Heat Pumps	$73 - $92 per ton
Water-Source Heat Pumps	$81 per ton
Packaged Terminal AC & HP	$65 per ton
Central DX AC Systems	$40- $72 per ton
Dual Enthalpy Economizer Controls	$250

Ground Source Heat Pumps

Closed Loop & Open Loop	$370 per ton

Gas Heating

Gas Fired Boilers < 300 MBH	$300 per unit
Gas Fired Boilers ≥ 300 - 1500 MBH	$1.75 per MBH
Gas Fired Boilers ≥1500 - ≤ 4000 MBH	$1.00 per MBH
Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	$300 - $400 per unit

Variable Frequency Drives

Variable Air Volume	$65 - $155 per hp
Chilled-Water Pumps	$60 per hp
Compressors	$5,250 to $12,500 per drive

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons	$50 per unit
Gas-Fired Water Heaters >50 gallons	$1.00 - $2.00 per MBH
Gas-Fired Booster Water Heaters	$17 - $35 per MBH

Premium Motors

Three-Phase Motors	$45 - $700 per motor

Prescriptive Lighting

T-5 and T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 - $30 per fixture, (depending on quantity)
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start	$25 per fixture
LED Exit Signs	$10 - $20 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $284 per fixture

Lighting Controls – Occupancy Sensors

Wall Mounted	$20 per control
Remote Mounted	$35 per control
Daylight Dimmers	$25 per fixture
Occupancy Controlled hi-low Fluorescent Controls	$25 per fixture controlled

Lighting Controls – HID or Fluorescent Hi-Bay Controls

Occupancy hi-low	$75 per fixture controlled
Daylight Dimming	$75 per fixture controlled

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2004 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Chatham Middle School"

Boiler

Location	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room	Smith	2	M450A	MB95-20	3603	3217	89%	Natural Gas	42	35	(7.00)	

Boiler - Pumps

Location	Manufacturer	Qty.	Model #	Serial #	HP	RPM	GPM	Ft. Hd	Frame Size	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Fan Room	Baldor Pumps	1	VM3159T	F0502170957	1.5	1140	-	-	-	230/460	3	9	10	1	
Fan Room	Baldor Pumps	1	VM5154	F295	1.5	1725	-	-	-	208-230/480	3	14	10	-4	
Boiler Room	Baldor Pumps	2	VM33NT	F0406090209	7 1/2	1725	-	-	-	208-230/460	3	5	10	5	
Boiler Room	Allied Pump Corp	2	4SE	41161	-	-	-	-	-	-	-	14	10	-4	
Boiler Room	Marathon Electric	2	EVA 56T34F5326E P	-	3	3450	-	-	56C-80	208-230/460	3	14	10	-4	CAT# P107
Boiler Room	Baldor Pumps	2	VJMM3154T	35E422-372	1 1/2	1725	-	-	-	230-460	3	9	10	1	
Boiler Room	A.O. Smith	2	7-850115-01-05	BX05	7 1/2	1745	-	-	-	230/460	3	4	10	6	
Boiler Room	Bell & Gossett	1	FVJ 48T17D177B P	903585	1	1725	-	-	-	208-230/460	3	19	10	-9	
Boiler Room	Baldor Pumps	2	EJMM3311T	37F784T863	7 1/2	1770	-	-	-	230/460	3	9	10	1	

Domestic Hot Water Heater

Location	Manufacturer	Qty	Model #	Serial #	Input (MBh)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room	A.O. Smith	1	HW 300 932	932 E 00 56787	300	247	28	82%	Natural Gas	9	12	3	

DHW - Pumps

Location	Manufacturer	Qty.	Model #	Serial #	HP	Volts	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room	B&G	1	M80037	-	0.5	208/230/460	-	10	10	0	
Boiler Room	B&G	1	M10711-1-1	-	0.167	115	-	10	10	0	
Boiler Room	B&G	2	M09181	-	0.083	115	-	10	10	0	

Air Handling Units

Location	Manufacturer	Qty	Model #	Serial #	Cooling Coil	Cooling Eff. (EER)	Cooling Capacity (Tons)	Heating Type	Input (MBh)	Output (MBh)	Heating Eff. (%)	Fuel	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Rooftop	AAON	1	RN-031-3-0-BB04-3A9	200609-BNGU02289	410A	-	31	HTX	540	437	81%	NG	460	3	"	3	15	12	
Rooftop	AAON	1	RM-008-3-0-BA02-339	200609-AMGH28518	410A	-	8	HTX	180	146	81%	NG	460	3	"	3	15	12	
Rooftop	York	1	D1EE036A25EBC	(S) WHKM102586	-	-	-	-	-	-	-	-	208/230	3	"	26	15	-11	
Rooftop	AAON	1	RM-A02-9-0-BA01-319	200609-AMGB28530	410A	-	2	HTX	69	58	84%	NG	208	1	"	3	15	12	
Rooftop	York	1	DL-10N24ATAAA3B	NANM001143	-	-	-	-	0.24	-	-	-	208/230	3	"	29	15	-14	
Rooftop	AAON	1	RM-013-3-0-BB02-349	200609-AMGK28548	410A	-	13	HTX	270	219	81%	NG	460	3	"	3	15	12	
Rooftop	AAON	1	RM-008-3-0-BA02-339	200609-AMGH28519	410A	-	8	HTX	180	146	81%	NG	460	3	"	3	15	12	
Rooftop	AAON	1	RN-031-3-0-BB04-3A9	200609-BNGU02288	410A	-	31	HTX	540	437	81%	NG	460	3	"	3	15	12	
Rooftop	AAON	1	RM-013-3-0-B002-349	200609-AMGK28547	410A	-	13	HTX	270	219	81%	NG	460	3	"	3	15	12	
Rooftop	AAON	1	RM-A05-3-0-BB01-329	200 609-AMGE29054	410A	-	5	HTX	90	73	81%	NG	460	3	"	3	15	12	

Unit Heaters and Cabinet Unit Heaters

Location	Manufacturer	Qty.	Model #	Serial #	Heating Type	Heating Capacity (MBH)	CFM	RPM / HP	GPM	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Work Shop Classroom	Modine	1	PA50A	01011173R	HX	50000	-	-	-	9	13	4	

Split Systems and AC Condensers

Location	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity	Eff.	Refrigerant	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Rooftop	EMI	1	S1CA2000D00	1-06-L-8427-48	-	-	R-22	208/230	1	-	3	15	12	
Rooftop	EMI	1	S1CAA2000D00	1-06-L-8425-48	-	-	R-22	208/230	1	-	3	15	12	
Rooftop	York	1	H2RD024S06B	W0L6087475	-	-	R-22	208/230	1	-	3	15	12	
Rooftop	York	1	H2RD024S06B	W0L6087468	-	-	R-22	208/230	1	-	3	15	12	
Rooftop	AAON	1	CA0185 CA-02-3:0AA00A0	200610-CCCB06595	-	-	R-22	460	3	-	3	15	12	
Rooftop	AAON	1	CA0853 CA-03-3:0AA00A0	200610-CCCC06592	-	-	R-22	460	3	-	3	15	12	
Rooftop	Mitsubishi	1	MU09TW	3000449	-	-	R-22	115	1	-	9	15	6	
Rooftop	Mitsubishi	1	PUY-A18NHA	51U00641B	-	-	R410A	208/230	1	-	9	15	6	
Rooftop	AAON	1	CA0853 CA-03-3:0AA00A0	200610-CCCC06591	-	-	R-22	460	3	-	3	15	12	
Rooftop	EMI	1	S1CA2000D00	1-06-L-8426-48	-	-	R-22	208/230	1	-	3	15	12	
Rooftop	AAON	1	CA0185 CA-02-3:0AA00A0	200610-CCCB06596	-	-	R-22	460	3	-	3	15	12	
Rooftop	AAON	1	CA0853 CA-03-3:0AA00A0	200610-CCCC06593	-	-	R-22	460	3	-	3	15	12	
Rooftop	AAON	1	CA0853 CA-03-3:0AA00A0	200610-CCCC06594	-	-	R-22	460	3	-	3	15	12	
Rooftop	York	1	DIEE036A25EBC	NHKM102587	-	-	R-22	208/230	3	-	8	15	7	

Heating and Ventilation Units

Location	Manufacturer	Qty.	Model #	Serial #	Heating Coil	Capacity (Btu/h)	Fan HP	Fan RPM	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Classroms	Nesbit	11	580 NR 4 W	-	HW	24,000	1/12 HP	-	208	1	-	21	20	-1	
Classroms	AAF	11	V.AVV.6.S15.A.Z.65.S.23.AK.22.G.W	E803748010	HW	-	1/4 HP	-	115	1	-	21	20	-1	
Fan Room	Delco AC Motor	1	62450	J77	HEX	-	3 HP	1160	240/460	3	-	21	20	-1	
Fan Room	General Electric	1	5K215AG601	-	HEX	-	3 HP	1160	240/260	3	-	21	20	-1	
Fan Room	General Electric	2	5K184AG611	2N		-	1.5 HP	-	208-220/440	3	-	21	20	-1	

PTAC - Units

Location	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity - DX	Heating Capacity - HW	Fan HP	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Classrooms	Airedale	13	CMX4-460	S321500303154406-1363	45500	N/A	-	460	3	-	3	10	7	
Classrooms	Panasonic	3	CW-C200NU	1465900459	20300	N/A	-	208	1	-	12	10	-2	
Classrooms	Westinghouse	5	WAS185F2A1	JK70312176	18000/17600	N/A	-	208	1	-	12	10	-2	
Classrooms	Friedrich	3	KS15L10-A	LECR02945	14500	N/A	-	115	1	-	12	10	-2	
Classrooms	Friedrich	8	KM18L30-B	LGAR 14019	17800/17600	N/A	-	208	1	-	12	10	-2	
Classrooms	Air Temp	1	B3J12E7A	AG563726 0185	12000/11500	N/A	-	208/230	-	-	12	10	-2	
Classrooms	Emerson Quiet Coo	3	7NW76K	DR 634618 118E	-	N/A	-	-	-	-	12	10	-2	

STATEMENT OF ENERGY PERFORMANCE
Chatham Middle School

Building ID: 1830612
For 12-month Period Ending: August 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: October 26, 2009

Facility
Chatham Middle School
480 Main Street
Chatham, NJ 07928

Facility Owner
School District of the Chathams
58 Meyersville Road
Chatham, NJ 07928

Primary Contact for this Facility
Ralph Goodwin
58 Meyersville Road
Chatham, NJ 07928

Year Built: 1957
Gross Floor Area (ft^2): 148,396

Energy Performance Rating[2] (1-100) 25

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	4,127,995
Natural Gas (kBtu)[4]	10,096,492
Total Energy (kBtu)	14,224,487

Energy Intensity[5]	
Site ($kBtu/ft^2/yr$)	96
Source ($kBtu/ft^2/yr$)	164

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	1,166

Electric Distribution Utility
Jersey Central Power & Lt Co

National Average Comparison	
National Average Site EUI	77
National Average Source EUI	131
% Difference from National Average Source EUI	25%
Building Type	K-12 School

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Meets Industry Standards[6] for Indoor Environmental Conditions:

Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Certifying Professional
Raymond Johnson
520 South Burnt Mill Road
Voorhees, NJ 08043

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.
NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Chatham Middle School	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	K-12 School	Is this an accurate description of the space in question?		☐
Location	480 Main Street, Chatham, NJ 07928	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐

Chatham Middle School (K-12 School)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	148,396 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Open Weekends?	Yes	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	235	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	0	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	Yes	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	60 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	10 (Optional)	Is this school in operation for at least 8 months of the year?		☐

High School?	No	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Jersey Central Power & Lt Co

Fuel Type: Electricity

Meter: Middle School Electric (kWh (thousand Watt-hours))
Space(s): Entire Facility
Generation Method: Grid Purchase

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
08/01/2009	08/31/2009	92,072.00
07/01/2009	07/31/2009	89,108.00
06/01/2009	06/30/2009	106,761.00
05/01/2009	05/31/2009	98,286.00
04/01/2009	04/30/2009	97,778.00
03/01/2009	03/31/2009	106,580.00
02/01/2009	02/28/2009	100,203.00
01/01/2009	01/31/2009	111,020.00
12/01/2008	12/31/2008	107,931.00
11/01/2008	11/30/2008	106,111.00
10/01/2008	10/31/2008	98,961.00
09/01/2008	09/30/2008	95,035.00
Middle School Electric Consumption (kWh (thousand Watt-hours))		**1,209,846.00**
Middle School Electric Consumption (kBtu (thousand Btu))		**4,127,994.55**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**4,127,994.55**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

Meter: Middle School Gas (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
08/01/2009	08/31/2009	48.75
07/01/2009	07/31/2009	3,866.72
06/01/2009	06/30/2009	977.14
05/01/2009	05/31/2009	1,897.06
04/01/2009	04/30/2009	9,571.25
03/01/2009	03/31/2009	16,526.88
02/01/2009	02/28/2009	21,368.43
01/01/2009	01/31/2009	17,404.92
12/01/2008	12/31/2008	18,918.68
11/01/2008	11/30/2008	9,915.48

10/01/2008	10/31/2008	462.31
09/01/2008	09/30/2008	7.30
Middle School Gas Consumption (therms)		**100,964.92**
Middle School Gas Consumption (kBtu (thousand Btu))		**10,096,492.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**10,096,492.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

Additional Fuels	
Do the fuel consumption totals shown above represent the total energy use of this building? Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.	☐

On-Site Solar and Wind Energy	
Do the fuel consumption totals shown above include all on-site solar and/or wind power located at your facility? Please confirm that no on-site solar or wind installations have been omitted from this list. All on-site systems must be reported.	☐

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same as the PE that signed and stamped the SEP.)

Name: ____ Date: _____________

Signature: _______________________________________

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
Chatham Middle School
480 Main Street
Chatham, NJ 07928

Facility Owner
School District of the Chathams
58 Meyersville Road
Chatham, NJ 07928

Primary Contact for this Facility
Ralph Goodwin
58 Meyersville Road
Chatham, NJ 07928

General Information

Chatham Middle School	
Gross Floor Area Excluding Parking: (ft²)	148,396
Year Built	1957
For 12-month Evaluation Period Ending Date:	August 31, 2009

Facility Space Use Summary

Chatham Middle School	
Space Type	K-12 School
Gross Floor Area(ft²)	148,396
Open Weekends?	Yes
Number of PCs	235
Number of walk-in refrigeration/freezer units	0
Presence of cooking facilities	Yes
Percent Cooled	60
Percent Heated	100
Months°	10
High School?	No
School District°	Chatham

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 08/31/2009)	**Baseline** (Ending Date 08/31/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	25	25	75	N/A	50
Energy Intensity					
Site (kBtu/ft²)	96	96	60	N/A	77
Source (kBtu/ft²)	164	164	103	N/A	131
Energy Cost					
$/year	$ 389,449.55	$ 389,449.55	$ 243,868.15	N/A	$ 311,844.06
$/ft²/year	$ 2.62	$ 2.62	$ 1.64	N/A	$ 2.10
Greenhouse Gas Emissions					
$MtCO_2e$/year	1,166	1,166	730	N/A	934
$kgCO_2e/ft^2$/year	8	8	5	N/A	6

More than 50% of your building is defined as K-12 School. Please note that your rating accounts for all of the spaces listed. The National Average column presents energy performance data your building would have if your building had an average rating of 50.

Notes:
o - This attribute is optional.
d - A default value has been supplied by Portfolio Manager.

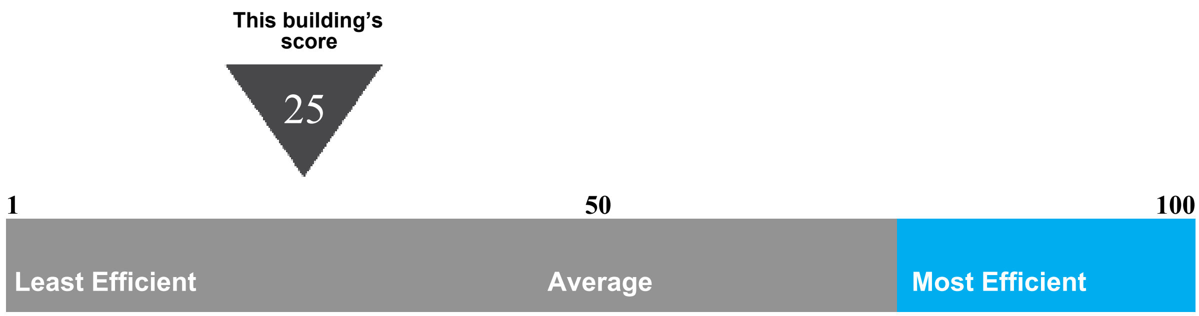
Statement of Energy Performance

2009

Chatham Middle School
480 Main Street
Chatham, NJ 07928

Portfolio Manager Building ID: 1830612

The energy use of this building has been measured and compared to other similar buildings using the Environmental Protection Agency's (EPA's) Energy Performance Scale of 1–100, with 1 being the least energy efficient and 100 the most energy efficient. For more information, visit energystar.gov/benchmark.



This building uses 164 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending August 2009

Buildings with a score of 75 or higher may qualify for EPA's ENERGY STAR.

I certify that the information contained within this statement is accurate and in accordance with U.S. Environmental Protection Agency's measurement standards, found at energystar.gov

Date of certification

EPA United States Environmental Protection Agency

Date Generated: 10/26/2009

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C09078
Project: Chatham School District Energy Audit — **"Chatham Middle School"**
Address: 480 Main Street
City: Chatham, NJ
Building SF: **148,396**

DATE: 11/4/2009
KWH COST: **$0.164**

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
Line No.		Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
1		Audio Visual	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting No Lense	2080	58	0.12	241.28	$39.57	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
2		201	8	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.66	1364.48	$223.77	8	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
3		203	9	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.74	1535.04	$251.75	9	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
4		207	8	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.66	1364.48	$223.77	8	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
5		204	12	T8 16' Total 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	2080	82	0.98	2046.72	$335.66	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
6		206	16	T8 16' Total 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	2080	82	1.31	2728.96	$447.55	16	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
7		Women's Room	3	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	0.17	361.92	$59.35	3	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
8		208	10	T8 16' Total 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	2080	82	0.82	1705.6	$279.72	10	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
9		210	14	T8 4' Sections 3 Lamps Electronic Ballast Pendant Mounting Prismatic Lens	2080	82	1.15	2387.84	$391.61	14	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
10		212	6	T8 4' Sections 3 Lamps Electronic Ballast Pendant Mounting Prismatic Lens	2080	82	0.49	1023.36	$167.83	6	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
11		214	8	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	109	0.87	1813.76	$297.46	8	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
12		214	2	U Tube 2 Lamps 2x2 Electronic Ballast Recessed Mounting Prismatic Lens	2080	73	0.15	303.68	$49.80	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00

13		216	4	T8 4' Sections 2 Lamps Electronic Ballast Pendant Mounting Prismatic Lens	2080	58	0.23	482.56	$79.14	4	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
14		Men's Room	1	CFL 1 Lamp Electronic Ballast Surface Mounting Parabolic Lens	2080	16	0.02	33.28	$5.46	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
15		270	12	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.98	2046.72	$335.66	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
16		272	12	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.98	2046.72	$335.66	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
17		274	12	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.98	2046.72	$335.66	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
18		276	12	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.98	2046.72	$335.66	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
19		200	6	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.49	1023.36	$167.83	6	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
20		205	8	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.66	1364.48	$223.77	8	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
21		202	12	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	2080	82	0.98	2046.72	$335.66	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
22		209	8	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.66	1364.48	$223.77	8	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
23		Men's Room	3	T8 1x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.17	361.92	$59.35	3	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
24		Custodial Closet	1	1 Florecent Lamp Magnetic Ballast Surface Mounting No Lens	2080	75	0.08	156	$25.58	1	18 W CFL Lamp	18	0.02	37.44	$6.14	$5.75	$5.75	0.06	118.56	19.44384	0.30
25		211	14	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	2080	82	1.15	2387.84	$391.61	14	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
26		213	14	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	2080	82	1.15	2387.84	$391.61	14	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
27		215	5	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.29	603.2	$98.92	5	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
28		217	10	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.58	1206.4	$197.85	10	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
29		221	8	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.46	965.12	$158.28	8	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
30		221	2	T8 1x1 U-Tube Electronic Ballast Recessed Mounting Prismatic Lens	2080	35	0.07	145.6	$23.88	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
31		223	14	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	2080	82	1.15	2387.84	$391.61	14	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
32		222	10	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.58	1206.4	$197.85	10	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
33		219	8	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.46	965.12	$158.28	8	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
34		219	1	T8 1x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.06	120.64	$19.78	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
35		Women's Room	2	T8 1x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.12	241.28	$39.57	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
36		271	16	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	1.31	2728.96	$447.55	16	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
37		273	16	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	1.31	2728.96	$447.55	16	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00

38		275	16	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	1.31	2728.96	$447.55	16	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
39		Electric Closet	1	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Prismatic Lens	2080	58	0.06	120.64	$19.78	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
40		Locker Rooms	18	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	82	1.48	3070.08	$503.49	18	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
41		Locker Rooms	8	T8 2x2 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	47	0.38	782.08	$128.26	8	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
42		Team Locker Room	1	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	0.06	120.64	$19.78	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
43		Team Locker Room	5	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	0.29	603.2	$98.92	5	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
44		Upstairs Gym	36	Metal Halide 1 Lamp Pendant Mounting Clear Lens	2080	295	10.62	22089.6	$3,622.69	36	3-Lamp T-5 HO Cooper F-Bay	182	6.55	13628.2	$2,235.02	$300.00	$10,800.00	4.07	8461.44	1387.67616	7.78
45		Locker Rooms	26	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Prismatic Lens	2080	58	1.51	3136.64	$514.41	26	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
46		Locker Rooms	1	Inc 1 Lamp Magnetic Ballast Surface Mounting No Lens	2080	100	0.10	208	$34.11	1	18 W CFL Lamp	18	0.02	37.44	$6.14	$5.75	$5.75	0.08	170.56	27.97184	0.21
47		1st Floor Hallway	23	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	1.33	2774.72	$455.05	23	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
48		1st Floor Hallway	9	CFL 2 Lamp High Hat Electronic Ballast Recessed Mounting No Cover	2080	16	0.14	299.52	$49.12	9	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
49		1st Floor Hallway	48	T8 2x4 4 Lamp Electronic Ballast Recessed Mounting Prismatic Lens	2080	109	5.23	10882.6	$1,784.74	48	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
50		1st Floor Hallway	4	T8 or T5 3 Twin Tube Electronic Ballast Recessed Mounting Direct/Indirect Lens	2080	96	0.38	798.72	$130.99	4	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
51		1st Floor Hallway	4	T8 1x4 1 Lamp Electronic Ballast Surface Mounting Prismatic Lens	2080	28	0.11	232.96	$38.21	4	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
52		Cafeteria	30	T8 2x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	1.74	3619.2	$593.55	30	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
53		Cafeteria	15	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	82	1.23	2558.4	$419.58	15	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
54		Cafeteria	20	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	1.64	3411.2	$559.44	20	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
55		Cafeteria	33	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	1.91	3981.12	$652.90	33	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
56		Electric Closet	2	T8 2x4 3 Lamps Electronic Ballast Recessed Surface Prismatic Lens	2080	82	0.16	341.12	$55.94	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
57		2nd Floor Hallway	5	T12 2x2 6 Lamps Magnetic Ballast Surface Mounting Prismatic Lens	2080	138	0.69	1435.2	$235.37	5	2'x 2' Troffer 3 Lamp T5 FB40BX Electronic Ballast (Biax)	130	0.65	1352	$221.73	$168.21	$841.05	0.04	83.2	13.6448	61.64
58		2nd Floor Hallway	31	T8 or T5 3 Twin Tube Electronic Ballast Recessed Mounting Direct/Indirect Lens	2080	96	2.98	6190.08	$1,015.17	31	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
59		2nd Floor Hallway	22	CFL 2 Lamp High Hat Electronic Ballast Recessed Mounting No Cover	2080	32	0.70	1464.32	$240.15	22	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
60		2nd Floor Hallway	25	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	1.45	3016	$494.62	25	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
61		Stairwell	6	T8 or T5 3 Twin Tube Electronic Ballast Recessed Mounting Direct/Indirect Lens	2080	96	0.58	1198.08	$196.49	6	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00

62			7	CFL 2 Lamp Wall Mount Electronic Ballast Surface Mounting Prismatic Cover	2080	32	0.22	465.92	$76.41	7	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
63		Closet	1	T8 2x4 4 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	109	0.11	226.72	$37.18	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
64		D Gym	16	CFL 8 Lamps Electronic Ballast Surface Mounting No Cover	2080	128	2.05	4259.84	$698.61	16	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
65		D Gym	2	CFL High Hat 2 Lamps Electronic Ballast Recessed Mounting No cover	2080	32	0.06	133.12	$21.83	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
66		Storage	8	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	0.46	965.12	$158.28	8	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
67		Storage	36	T8 or T5 3 Twin Tube Electronic Ballast Recessed Mounting Direct/Indirect Lens	2080	96	3.46	7188.48	$1,178.91	36	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
68		Stairwell	3	CFL Wall Mount 2 Lamp Electronic Ballast Surface Mounting Prismatic Lens	2080	32	0.10	199.68	$32.75	3	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
69		Stairwell	12	T8 or T5 3 Twin Tube Electronic Ballast Recessed Mounting Direct/Indirect Lens	2080	120	1.44	2995.2	$491.21	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
70		Cafeteria Hall	1	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	0.06	120.64	$19.78	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
71		Cafeteria Hall	1	CFL 1 Lamp Electronic Ballast	2080	23	0.02	47.84	$7.85	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
72		Custodial Closet	1	Inc 1 Lamp Magnetic Ballast Surface Mounting	2080	100	0.10	208	$34.11	1	18 W CFL Lamp	18	0.02	37.44	$6.14	$5.75	$5.75	0.08	170.56	27.97184	0.21
73		Attendance Office	12	T8 2x2 3 U Tubes Electronic Ballast Recessed Mounting Parabolic Lens	2080	108	1.30	2695.68	$442.09	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
74		Attendance Office	7	T8 2x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	2080	82	0.57	1193.92	$195.80	7	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
75		Attendance Office	1	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	0.06	120.64	$19.78	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
76		Guidance Office	16	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.93	1930.24	$316.56	16	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
77		Storage	3	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	0.17	361.92	$59.35	3	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
78		Office	5	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	0.29	603.2	$98.92	5	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
79		Office	12	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.70	1447.68	$237.42	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
80		Office	1	Inc 1 Lamp Magnetic Ballast Surface Mounting	2080	100	0.10	208	$34.11	1	18 W CFL Lamp	18	0.02	37.44	$6.14	$5.75	$5.75	0.08	170.56	27.97184	0.21
81		100	6	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.49	1023.36	$167.83	6	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
82		Library	26	T8 2x2 3 U Tubes Electronic Ballast Recessed Mounting Parabolic Lens	2080	108	2.81	5840.64	$957.86	26	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
83		Library	41	CFL 2 Lamps Electronic Ballast Recessed Mounting No Cover	2080	46	1.89	3922.88	$643.35	41	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
84		Library	36	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	2.95	6140.16	$1,006.99	36	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
85		Library	8	CFL Wall Mount 2 Lamp Electronic Ballast Surface Mounting Direct/Indirect Lens	2080	140	1.12	2329.6	$382.05	8	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
86		118	14	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	0.81	1688.96	$276.99	14	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
87		Men's Room	4	T8 1x4 4 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	109	0.44	906.88	$148.73	4	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
88		Women's Room	3	T8 1x4 4 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	109	0.33	680.16	$111.55	3	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00

89		Custodial Closet	1	Inc 1 Lamp Magnetic Ballast Surface Mounting	2080	100	0.10	208	$34.11	1	18 W CFL Lamp	18	0.02	37.44	$6.14	$5.75	$5.75	0.08	170.56	27.97184	0.21
90		Men's Room	3	T8 1x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	109	0.33	680.16	$111.55	3	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
91		Women's Room	3	T8 1x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	109	0.33	680.16	$111.55	3	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
92		Nurse's Office	9	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.52	1085.76	$178.06	9	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
93		Nurse's Office	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	0.12	241.28	$39.57	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
94		Nurse's Office	1	T8 2x2 4 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	56	0.06	116.48	$19.10	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
95		Office	12	T8 2x4 2 Lamps Electonic Ballast Recessed Mounting Prismatic Lens	2080	58	0.70	1447.68	$237.42	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
96		Office	1	T8 Circular Lamp Electronic Ballast Surface Mounting Prismatic Lens	2080		0.00	0	$0.00	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
97		Library	8	CFL 2 Lamps Electronic Ballast Surface Mounting Direct/Indirect	2080	140	1.12	2329.6	$382.05	8	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
98		119	29	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Prismatic Lens	2080	82	2.38	4946.24	$811.18	29	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
99		121	12	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.70	1447.68	$237.42	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
100		125	6	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	82	0.49	1023.36	$167.83	6	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
101		127	16	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Prismatic Lens	2080	82	1.31	2728.96	$447.55	16	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
102		129	18	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Prismatic Lens	2080	82	1.48	3070.08	$503.49	18	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
103		134	24	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	2080	82	1.97	4093.44	$671.32	24	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
104		Storage	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.12	241.28	$39.57	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
105		126	10	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Prismatic Lens	2080	82	0.82	1705.6	$279.72	10	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
106		128	12	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	2080	28	0.34	698.88	$114.62	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
107		130	4	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Prismatic Lens	2080	82	0.33	682.24	$111.89	4	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
108		131	12	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Prismatic Lens	2080	82	0.98	2046.72	$335.66	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
109		132	12	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Prismatic Lens	2080	82	0.98	2046.72	$335.66	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
110		136	24	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Prismatic Lens	2080	82	1.97	4093.44	$671.32	24	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
111		Men's Room	3	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	0.17	361.92	$59.35	3	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
112		Women's Room	3	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	0.17	361.92	$59.35	3	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
113		Closet	1	Inc 1 Lamp Magnetic Ballast Surface Mounting	2080	100	0.10	208	$34.11	1	18 W CFL Lamp	18	0.02	37.44	$6.14	$5.75	$5.75	0.08	170.56	27.97184	0.21
114		Hallway	12	T12 2x2 6 Lamps Magnetic Ballast Surface Mounting Prismatic Lens	2080	138	1.66	3444.48	$564.89	12	2'x 2' Troffer 3 Lamp T5 FB40BX Electronic Ballast (Biax)	103	1.24	2570.88	$421.62	$168.21	$2,018.52	0.42	873.6	143.2704	14.09

115		143	2	T12 8' 2 Lamps Magnetic Ballast Surface Mounting Prismatic Lens	2080	210	0.42	873.6	$143.27	2	8' 2-Lamp T-8 Cooper Metalux, Electronic Ballast M/N 8TDIM-232-UNV-EB81-U	118	0.24	490.88	$80.50	$207.00	$414.00	0.18	382.72	62.76608	6.60
116		144	1	Inc 1 Lamp Magnetic Ballast Surface Mounting	2080	100	0.10	208	$34.11	1	18 W CFL Lamp	18	0.02	37.44	$6.14	$5.75	$5.75	0.08	170.56	27.97184	0.21
117		160	9	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.52	1085.76	$178.06	9	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
118		162	9	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.52	1085.76	$178.06	9	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
119		164	9	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.52	1085.76	$178.06	9	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
120		171	12	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.98	2046.72	$335.66	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
121		173	12	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.98	2046.72	$335.66	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
122		175	12	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.98	2046.72	$335.66	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
123		Front Stairwell	3	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	0.17	361.92	$59.35	3	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
124		Front Stairwell	3	Inc 1 Lamp Magnetic Ballast Recessed Mounting	2080	100	0.30	624	$102.34	3	18 W CFL Lamp	18	0.05	112.32	$18.42	$5.75	$17.25	0.25	511.68	83.91552	0.21
125		Stairwell	1	T12 2x2 6 Lamps Magnetic Ballast Surface Mounting Prismatic Lens	2080	138	0.14	287.04	$47.07	1	2'x 2' Troffer 3 Lamp T5 FB40BX Electronic Ballast (Biax)	103	0.10	214.24	$35.14	$168.21	$168.21	0.04	72.8	11.9392	14.09
126		Stairwell	4	Inc 1 Lamp Magnetic Ballast Recessed Mounting Prismatic Lens	2080	100	0.40	832	$136.45	4	18 W CFL Lamp	18	0.07	149.76	$24.56	$5.75	$23.00	0.33	682.24	111.88736	0.21
127		141	21	T8 1x4 3 Lamps Electronic Ballast Pendant Mouting Prismatic Lens	2080	82	1.72	3581.76	$587.41	21	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
128		146	16	T8 1x4 3 Lamps Electronic Ballast Pendant Mouting Prismatic Lens	2080	82	1.31	2728.96	$447.55	16	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
129		146	6	T8 1x4 2 Lamps Electronic Ballast Pendant Mouting Prismatic Lens	2080	58	0.35	723.84	$118.71	6	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
130		147	45	T8 1x4 2 Lamps Electronic Ballast Pendant Mouting Prismatic Lens	2080	58	2.61	5428.8	$890.32	45	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
131		147	1	T8 1x4 4 Lamps Electronic Ballast Pendant Mouting No Lens	2080	109	0.11	226.72	$37.18	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
132		147	1	T8 1x4 2 Lamps Electronic Ballast Pendant Mouting Prismatic Lens	2080	58	0.06	120.64	$19.78	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
133		151	6	T8 1x4 2 Lamps Electronic Ballast Pendant Mouting Prismatic Lens	2080	58	0.35	723.84	$118.71	6	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
134		152	20	T8 1x4 3 Lamps Electronic Ballast Pendant Mouting Prismatic Lens	2080	82	1.64	3411.2	$559.44	20	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
135		152	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mouting Parabolic Lens	2080	58	0.12	241.28	$39.57	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
136		152	1	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Prismatic Lens	2080	58	0.06	120.64	$19.78	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
137		153	12	T8 1x4 3 Lamps Electronic Ballast Surface Mouting Prismatic Lens	2080	82	0.98	2046.72	$335.66	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
138		153	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Prismatic Lens	2080	58	0.12	241.28	$39.57	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
139		153	1	Inc 1 Lamp Magnetic Ballast Surface Mounting No Cover	2080	75	0.08	156	$25.58	1	18 W CFL Lamp	18	0.02	37.44	$6.14	$5.75	$5.75	0.06	118.56	19.44384	0.30
140		153	1	CFL 1 Lamp Electronic Ballast Surface Mounting No Lens	2080	26	0.03	54.08	$8.87	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00

141		Band Room	38	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	2.20	4584.32	$751.83	38	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
142		Hallway	6	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.35	723.84	$118.71	6	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
143		Hallway	19	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	1.10	2292.16	$375.91	19	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
144		Stairwell	5	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	0.29	603.2	$98.92	5	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
145		Auditorium	54	Inc 1 Lamp High Hat Magnetic Ballast Recessed Mounting No Cover	2080	100	5.40	11232	$1,842.05	54	18 W CFL Lamp	18	0.97	2021.76	$331.57	$5.75	$310.50	4.43	9210.24	1510.47936	0.21
146		Auditorium	5	Inc 1 Lamp Magnetic Ballast Surface Mounting Prismatic Lens	2080	100	0.50	1040	$170.56	5	18 W CFL Lamp	18	0.09	187.2	$30.70	$5.75	$28.75	0.41	852.8	139.8592	0.21
147		Auditorium	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	2080	58	0.12	241.28	$39.57	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
148		Hallway	4	T8 2 U Tubes Electronic Ballast Recessed Mounting Prismatic Lens	2080	73	0.29	607.36	$99.61	4	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
149		Hallway	4	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.23	482.56	$79.14	4	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
150		161	9	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.52	1085.76	$178.06	9	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
151		163	9	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.52	1085.76	$178.06	9	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
152		165	9	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.52	1085.76	$178.06	9	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
153		167	9	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.52	1085.76	$178.06	9	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
154		166	9	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.52	1085.76	$178.06	9	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
155		170	12	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.98	2046.72	$335.66	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
156		172	12	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.98	2046.72	$335.66	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
157		174	12	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.98	2046.72	$335.66	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
158		176	12	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.98	2046.72	$335.66	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
159		177 Closet	1	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.06	120.64	$19.78	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
160		177 Closet	1	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	2080	82	0.08	170.56	$27.97	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
161		Stairwell	3	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	2080	58	0.17	361.92	$59.35	3	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
162		Stairwell	6	T8 or T5 3 Twin Tube Electronic Ballast Recessed Mounting Direct/Indirect Lens	2080	96	0.58	1198.08	$196.49	6	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
163		Middle School	56	LED Exit Sign	8760	4	0.22	1962.24	$321.81	56	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
164		Middle School	3	INC Exit Sign	8760	15	0.05	394.2	$64.65	3	LED Exit Sign	4	0.01	105.12	$17.24	$56.00	$168.00	0.03	289.08	47.40912	3.54
165							0.00	0	$0.00	0			0.00	0	$0.00		$0.00	0.00	0	0	0.00
		Totals	1733				136.13	284949	$46,731.70	1733			10.12	21131.8	$3,465.62		$14,835.28	10.80	22680.3	$3,719.57	3.99

Project Name: LGEA Solar PV Project -Chatham Middle School
Location: Chatham, NJ
Description: Photovoltaic System 95% Financing - 25 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 25 year
Total Construction Cost	$2,281,140
Annual kWh Production	292,885
Annual Energy Cost Reduction	$48,033
Annual SREC Revenue	$102,510
First Cost Premium	**$2,281,140**
Simple Payback:	**15.15** Years

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	95%
Financing Term (mths):	300	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.164**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	7.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$114,057	0	0	0	$0	0	0	(114,057)	0
1	$0	292,885	$48,033	$0	$102,510	$150,646	$33,152	($33,255)	($147,312)
2	$0	291,421	$49,474	$0	$101,997	$148,249	$35,549	($32,327)	($179,639)
3	$0	289,963	$50,958	$0	$101,487	$145,679	$38,119	($31,352)	($210,991)
4	$0	288,514	$52,487	$0	$100,980	$142,924	$40,874	($30,331)	($241,322)
5	$0	287,071	$54,062	$2,957	$100,475	$139,969	$43,829	($32,218)	($273,540)
6	$0	285,636	$55,684	$2,942	$99,973	$136,800	$46,998	($31,084)	($304,624)
7	$0	284,208	$57,354	$2,927	$99,473	$133,403	$50,395	($29,899)	($334,522)
8	$0	282,787	$59,075	$2,913	$98,975	$129,760	$54,038	($28,661)	($363,183)
9	$0	281,373	$60,847	$2,898	$98,480	$125,853	$57,945	($27,369)	($390,552)
10	$0	279,966	$62,672	$2,884	$97,988	$121,665	$62,133	($26,021)	($416,573)
11	$0	278,566	$64,553	$2,869	$97,498	$117,173	$66,625	($24,617)	($441,189)
12	$0	277,173	$66,489	$2,855	$97,011	$112,357	$71,441	($23,153)	($464,343)
13	$0	275,787	$68,484	$2,841	$96,526	$107,192	$76,606	($21,629)	($485,972)
14	$0	274,408	$70,538	$2,826	$96,043	$101,654	$82,144	($20,043)	($506,015)
15	$0	273,036	$72,654	$2,812	$95,563	$95,716	$88,082	($18,393)	($524,408)
16	$0	271,671	$74,834	$2,798	$95,085	$89,349	$94,449	($16,677)	($541,085)
17	$0	270,313	$77,079	$2,784	$94,609	$82,521	$101,277	($14,894)	($555,979)
18	$0	268,961	$79,391	$2,770	$94,136	$75,200	$108,598	($13,040)	($569,019)
19	$0	267,616	$81,773	$2,756	$93,666	$67,349	$116,449	($11,115)	($580,135)
20	$0	266,278	$84,226	$2,743	$93,197	$58,931	$124,867	($9,117)	($589,251)
21	$0	264,947	$86,753	$2,729	$92,731	$53,690	$114,791	$8,274	($580,977)
22	$0	263,622	$89,356	$2,715	$92,268	$43,386	$94,462	$41,060	($539,917)
23	$0	262,304	$92,036	$2,702	$91,806	$0	$0	$181,141	($358,776)
24	$0	260,992	$94,798	$2,688	$91,347	$0	$0	$183,457	($175,320)
25	$0	259,688	$97,641	$2,675	$90,891	$0	$0	$185,857	$10,538
	Totals:	6,899,185	$1,751,253	$59,085	$2,414,715	$2,379,465	$1,602,823	$124,595	($9,764,106)
				Net Present Value (NPV)			**($239,609)**		
				Internal Rate of Return (IRR)			**N/A**		

Project Name: LGEA Solar PV Project -Chatham Middle School
Location: Chatham, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$2,281,140
Annual kWh Production	292,885
Annual Energy Cost Reduction	$48,033
Annual SREC Revenue	$102,510
First Cost Premium	**$2,281,140**
Simple Payback:	**15.15** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.164**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Cumulative Cash Flow
0	$2,281,140	0	0	0	$0	(2,281,140)	0
1	$0	292,885	$48,033	$0	$102,510	$150,543	($2,130,597)
2	$0	291,421	$49,474	$0	$101,997	$151,471	($1,979,126)
3	$0	289,963	$50,958	$0	$101,487	$152,446	($1,826,680)
4	$0	288,514	$52,487	$0	$100,980	$153,467	($1,673,213)
5	$0	287,071	$54,062	$2,957	$100,475	$151,580	($1,521,634)
6	$0	285,636	$55,684	$2,942	$99,973	$152,714	($1,368,920)
7	$0	284,208	$57,354	$2,927	$99,473	$153,899	($1,215,020)
8	$0	282,787	$59,075	$2,913	$98,975	$155,137	($1,059,883)
9	$0	281,373	$60,847	$2,898	$98,480	$156,429	($903,454)
10	$0	279,966	$62,672	$2,884	$97,988	$157,777	($745,677)
11	$0	278,566	$64,553	$2,869	$97,498	$159,181	($586,496)
12	$0	277,173	$66,489	$2,855	$97,011	$160,645	($425,851)
13	$0	275,787	$68,484	$2,841	$96,526	$162,169	($263,682)
14	$0	274,408	$70,538	$2,826	$96,043	$163,755	($99,927)
15	$0	273,036	$72,654	$2,812	$95,563	$165,405	$65,478
16	$0	271,671	$74,834	$2,798	$95,085	$167,121	$232,598
17	$0	270,313	$77,079	$2,784	$94,609	$168,904	$401,503
18	$0	268,961	$79,391	$2,770	$94,136	$170,758	$572,260
19	$0	267,616	$81,773	$2,756	$93,666	$172,682	$744,943
20	$0	266,278	$84,226	$2,743	$93,197	$174,681	$919,624
21	$1	264,947	$86,753	$2,729	$92,731	$176,756	$1,096,379
22	$2	263,622	$89,356	$2,715	$92,268	$178,908	$1,275,288
23	$3	262,304	$92,036	$2,702	$91,806	$181,141	$1,456,429
24	$4	260,992	$94,798	$2,688	$91,347	$183,457	$1,639,885
25	$5	259,688	$97,641	$2,675	$90,891	$185,857	$1,825,743
	Totals:	6,899,185	$1,751,253	$59,085	$2,414,715	$4,106,883	($5,570,031)
			Net Present Value (NPV)			**$1,825,768**	
			Internal Rate of Return (IRR)			**4.9%**	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW_{DC}	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
CMS	18000	Sunpower SPR230	1102	14.7	16,204	253.46	292,885	36,366	15.64

Notes:
1. Estimated kWH based on the National Renewable Energy Laboratory PVWatts Version 1 Calculator Program.

PVWatts Version 1 Input Screen

PV System Specifications:

DC Rating (kW):	253.46	Inputted From Roof Space Cell "G2" Total KW
DC to AC Derate Factor:	0.81	Inputted From Derate Factor Calculated Below in Cell "B37"
Array Type:	Fixed Tilt 1 - Axis Tracking 2 - Axis Tracking	There are 3 inputs for Array Type in all cases you should be using **Fixed Tilt** as the Selection

Fixed Tilt of Single Axis Tracking System:

Array Tilt (degrees):	10	Based on Roof Type: For Flat Roof use 10 degrees, For Pitched Roof this is based on roof pitch.
Array Azimuth (degrees):	180	Based on Direction Array is Facing.

PV Watts Derate Factor for AC Power Rating at STC		
Component Derate Factors	PVWatts Default	Range
PV module nameplate DC rating	1.00	0.80–1.05
Inverter and transformer	0.95	0.88–0.96
Mismatch	0.98	0.97–0.995
Diodes and connections	1.00	0.99–0.997
DC wiring	0.98	0.97–0.99
AC wiring	0.99	0.98–0.993
Soiling	0.95	0.30–0.995
System availability	0.95	0.00–0.995
Shading	1.00	0.00–1.00
Sun-tracking	1.00	0.95–1.00
Age	1.00	0.70–1.00
Overall DC-to-AC derate factor	**0.81**	0.96001–0.09999

PVWatts * * * **AC Energy & Cost Savings**

Cautions for Interpreting the Results

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	253.5 kW
DC to AC Derate Factor:	0.810
AC Rating:	205.3 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	0.2 ¢/kWh

Results			
Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	2.39	15207	24.94
2	3.17	18436	30.24
3	4.07	25802	42.32
4	4.83	28587	46.88
5	5.70	34011	55.78
6	5.94	33235	54.51
7	5.77	32976	54.08
8	5.38	30543	50.09
9	4.65	26279	43.10
10	3.61	21632	35.48
11	2.35	13797	22.63
12	2.01	12380	20.30
Year	4.16	292885	480.33

Output Hourly Performance Data * Output Results as Text

About the Hourly Performance Data   Saving Text from a Browser

Run PVWATTS v.1 for another US location or an International location
Run PVWATTS v.2 (US only)

Please send questions and comments regarding PVWATTS to Webmaster

RReDC Return to RReDC home page (*http://rredc.nrel.gov*)

ENERGY AUDIT – FINAL REPORT

SCHOOL DISTRICT OF THE CHATHAMS
LAFAYETTE SCHOOL

221 LAFAYETTE AVENUE
CHATHAM, NJ 07928
ATTN: RALPH GOODWIN
SCHOOL BUSINESS ADMINISTRATOR BOARD SECRETARY

CEG PROJECT NO. 9C09078

CONCORD ENGINEERING GROUP

520 SOUTH BURNT MILL ROAD
VOORHEES, NJ 08043
TELEPHONE: (856) 427-0200
FACSIMILE: (856) 427-6529
WWW.CEG-INC.NET

CONTACT: MICHAEL FISCHETTE, PRESIDENT
EMAIL: mfischette@ceg-inc.net

Table of Contents

REPORT DISCLAIMER

The information contained within this report, including any attachment(s), is intended solely for use by the named addressee(s). If you are not the intended recipient, or a person designated as responsible for delivering such messages to the intended recipient, you are not authorized to disclose, copy, distribute or retain this report, in whole or in part, without written authorization from Concord Engineering Group, Inc., 520 S. Burnt Mill Road, Voorhees, NJ 08043.

This report may contain proprietary, confidential or privileged information. If you have received this report in error, please notify the sender immediately. Thank you for your anticipated cooperation.

I. EXECUTIVE SUMMARY

This report presents the findings of an energy audit conducted for:

Lafayette School
221 Lafayette Avenue
Chatham, NJ 07928

Facility Contact Person: John Cataldo
Municipal Contact Person: Ralph Goodwin

This audit was performed in connection with the New Jersey Clean Energy Local Government Energy Audit Program. These energy audits are conducted to promote the office of Clean Energy's mission, which is to use innovation and technology to solve energy and environmental problems in a way that improves the State's economy. This can be achieved through the wiser and more efficient use of energy.

The annual energy costs at this facility are as follows:

Electricity	$108,728
Natural Gas	$97,868
Total	$206,596

The potential annual energy cost savings for each energy conservation measure (ECM) and renewable energy measure (REM) are shown below in Table 1. Be aware that the ECM's are not additive because of the interrelation of some of the measures. This audit is consistent with an ASHRAE level 2 audit. The cost and savings for each measure is ± 20%. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

Table 1
Financial Summary Table

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Lighting Upgrade - General	$13,218	$2,887	4.6	446.1%
ECM #2	Lighting Controls	$10,220	$2,718	3.8	298.9%
ECM #3	Lighting Upgrade - Gym	$4,500	$805	5.6	347.3%
ECM #4	Boiler Replacement – High Efficiency Upgrade	$294,500	$8,430	34.9	0.2%
ECM #5	Domestic Water Heater Replacement	$14,692	$451	32.6	-63.2%
ECM #6	Indoor Air handling Unit Replacement	$37,700	$2,605	14.5	3.6%
ECM #7	DDC System – Lafayette Avenue School	$301,072	$14,531	20.7	-27.6%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	Solar PV Project	$904,590	$66,284	13.6	83.2%

Notes: A. Cost takes into consideration applicable NJ Smart StartTM incentives.
B. Savings takes into consideration applicable maintenance savings.

The estimated demand and energy savings for each ECM and REM is shown below in Table 2. The information in this table corresponds to the ECM's and REM in Table 1.

Table 2
Estimated Energy Savings Summary Table

ENERGY CONSERVATION MEASURES (ECM's)				
		ANNUAL UTILITY REDUCTION		
ECM NO.	DESCRIPTION	ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	Lighting Upgrade - General	3.9	16128.3	-
ECM #2	Lighting Controls	N/A	15183.5	-
ECM #3	Lighting Upgrade - Gym	2.0	4118.4	-
ECM #4	Boiler Replacement – High Efficiency Upgrade	-	-	5583.0
ECM #5	Domestic Water Heater Replacement	-	-	298.4
ECM #6	Indoor Air Handling Unit Replacement	0.4	1587.0	-
ECM #7	DDC System – Lafayette Avenue School	-	23281.5	5141.9
RENEWABLE ENERGY MEASURES (REM's)				
		ANNUAL UTILITY REDUCTION		
ECM NO.	**DESCRIPTION**	**ELECTRIC DEMAND (KW)**	**ELECTRIC CONSUMPTION (KWH)**	**NATURAL GAS (THERMS)**
REM #1	Solar PV Project	0.4	156850.0	-

Recommendation:

Concord Engineering Group (CEG) strongly recommends the implementation of all ECM's that provide a calculated simple payback at or under ten (10) years. The following Energy Conservation Measures are recommended for the Lafayette School:

- **ECM #1:** Lighting Upgrade
- **ECM #2:** Install Lighting Controls
- **ECM #3:** Install T-5 Lighting in Gym

ECM #5 does not provide a payback. These systems are past the ASHRAE recommended useful service life and will need to be replaced. The water heaters can be replaced with more efficient equipment that will provide some energy savings and improve the schools carbon foot print.

Systems that have past their useful service life should be replaced such as the systems described in ECM#4 and 6. Although these ECMs will not have a payback in less than 10 years, they are systems that should be replaced and will save a substantial amount of energy as summarized in Table 2 on page 5 and will pay back in the system lifetime.

In addition to the ECMs, there are maintenance and operational measures that can provide significant energy savings and provide immediate benefit. The ECMs listed above represent investments that can be made to the facility which are justified by the savings seen overtime. However, the maintenance items and small operational improvements below are typically achievable with on site staff or maintenance contractors and in turn have the potential to provide substantial operational savings compared to the costs associated. The following are recommendations which should be considered a priority in achieving an energy efficient building:

1. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.
2. Maintain all weather stripping on entrance doors.
3. Clean all light fixtures to maximize light output.
4. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.
5. Confirm that outside air economizers on the rooftop units are functioning properly to take advantage of free cooling and avoid excess outside air during occupied periods.

Efficient HVAC equipment replacements are difficult to justify with the energy savings alone. The replacement of HVAC equipment such as the heating and ventilation units at Lafayette Avenue School is typically initiated when the equipment stops working, surpasses the life expectancy, or maintenance requirements grow beyond the ability to continue to support it. When replacing the equipment becomes necessary, the additional cost to install high efficiency systems becomes a great value for the investment.

The existing facility does not qualify as Pay for Performance project because the average operating demand is below 200 KW.

II. INTRODUCTION

The Lafayette School is a 75,268 square foot facility that includes classrooms, offices, media center, gymnasium, cafeteria, music room, music tech room, art room and boiler rooms.

Electrical and natural gas utility information is collected and analyzed for one full year's energy use of the building. The utility information allows for analysis of the building's operational characteristics; calculate energy benchmarks for comparison to industry averages, estimated savings potential, and baseline usage/cost to monitor the effectiveness of implemented measures. A computer spreadsheet is used to calculate benchmarks and to graph utility information (see the utility profiles below).

The Energy Use Index (EUI) is established for the building. Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year (BTU/ft^2/yr), which is used to compare energy consumption to similar building types or to track consumption from year to year in the same building. The EUI is calculated by converting the annual consumption of all energy sources to BTU's and dividing by the area (gross square footage) of the building. Blueprints (where available) are utilized to verify the gross area of the facility. The EUI is a good indicator of the relative potential for energy savings. A low EUI indicates less potential for energy savings, while a high EUI indicates poor building performance therefore a high potential for energy savings.

Existing building architectural and engineering drawings (where available) are utilized for additional background information. The building envelope, lighting systems, HVAC equipment, and controls information gathered from building drawings allow for a more accurate and detailed review of the building. The information is compared to the energy usage profiles developed from utility data. Through the review of the architectural and engineering drawings a building profile can be defined that documents building age, type, usage, major energy consuming equipment or systems, etc.

The preliminary audit information is gathered in preparation for the site survey. The site survey provides critical information in deciphering where energy is spent and opportunities exist within a facility. The entire site is surveyed to inventory the following to gain an understanding of how each facility operates:

- Building envelope (roof, windows, etc.)
- Heating, ventilation, and air conditioning equipment (HVAC)
- Lighting systems and controls
- Facility-specific equipment

The building site visit is performed to survey all major building components and systems. The site visit includes detailed inspection of energy consuming components. Summary of building occupancy schedules, operating and maintenance practices, and energy management programs provided by the building manager are collected along with the system and components to determine a more accurate impact on energy consumption.

III. METHOD OF ANALYSIS

Post site visit work includes evaluation of the information gathered, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on HVAC, lighting and building envelope improvements. Data collected is processed using energy engineering calculations to anticipate energy usage for each of the proposed energy conservation measures (ECMs). The actual building's energy usage is entered directly from the utility bills provided by the owner. The anticipated energy usage is compared to the historical data to determine energy savings for the proposed ECMs.

It is pertinent to note, that the savings noted in this report are not additive. The savings for each recommendation is calculated as standalone energy conservation measures. Implementation of more than one ECM may in some cases affect the savings of each ECM. The savings may in some cases be relatively higher if an individual ECM is implemented in lieu of multiple recommended ECMs. For example implementing reduced operating schedules for inefficient lighting will result in a greater relative savings. Implementing reduced operating schedules for newly installed efficient lighting will result in a lower relative savings, because there is less energy to be saved. If multiple ECM's are recommended to be implemented, the combined savings is calculated and identified appropriately.

ECMs are determined by identifying the building's unique properties and deciphering the most beneficial energy saving measures available that meet the specific needs of the facility. The building construction type, function, operational schedule, existing conditions, and foreseen future plans are critical in the evaluation and final recommendations. Energy savings are calculated base on industry standard methods and engineering estimations. Energy consumption is calculated based on manufacturer's cataloged information when new equipment is proposed.

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers. The NJ SmartStart Building® program incentives savings (where applicable) are included for the appropriate ECM's and subtracted from the installed cost. Maintenance savings are calculated where applicable and added to the energy savings for each ECM. The costs and savings are applied and a simple payback and simple return on investment (ROI) is calculated. The simple payback is based on the years that it takes for the savings to pay back the net installation cost (Net Installation divided by Net Savings.) A simple return on investment is calculated as the percentage of the net installation cost that is saved in one year (Net Savings divided by Net Installation.)

A simple life-time calculation is shown for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The energy savings is extrapolated throughout the life-time of the ECM and the total energy savings is calculated as the total life-time savings.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

The energy usage for the facility has been tabulated and plotted in graph form as depicted within this section. Each energy source has been identified and monthly consumption and cost noted per the information provided by the Owner.

There are three electric services for the facility. The primary service is located at the original boiler room. The secondary service is located at the boiler room in the 2001 addition. A third service for outdoor lighting was not located. The electric usage profile (below) represents the combined total actual electrical usage for the facility. Jersey Central Power and Light (JCP&L) provides electricity to the facility under their General Service Primary Three-Phase rate structure, General Service Secondary Day/Night Three-Phase rate structure and Outdoor Lighting Service. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile shows the actual natural gas energy usage for the facility. Public Service Electric and Gas (PSE&G) provides natural gas to the facility under the Basic General Supply Service- Large Volume Gas (LVG) rate structure. Hess Corporation is a third party supplier. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

The overall cost for utilities is calculated by dividing the total cost by the total usage. Based on the utility history provide, the average cost for utilities at this facility is as follows:

Description	Average
Electricity	17.9¢ / kWh
Natural Gas	$1.51 / Therm

Table 3
Electricity Billing Data

Electric Usage Summary

Utility Provider: JCP&L, General Service Secondary 3 phase

Meter: S07013739 Customer Number: 0801577897 0000554662

Meter: Customer Number: 0800644719 0003075605

Meter: Customer Number: 0800644719 0005007742

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Aug-08	55,946	144.1	$10,586
Sep-08	54,920	259.8	$9,944
Oct-08	60,359	177.5	$10,196
Nov-08	61,423	171.1	$10,575
Dec-08	55,646	152.3	$9,859
Jan-09	58,364	149.9	$10,271
Feb-09	54,648	147.2	$9,567
Mar-09	43,029	273.8	$7,794
Apr-09	37,031	140.4	$6,755
May-09	52,021	198.8	$9,270
Jun-09	38,221	157.7	$7,104
Jul-09	36,027	159.9	$6,807
Totals	**607,635**	**273.8 Max**	**$108,728**

AVERAGE DEMAND 177.7 KW average
AVERAGE RATE $0.179 $/kWh

Figure 1
Electricity Usage Profile

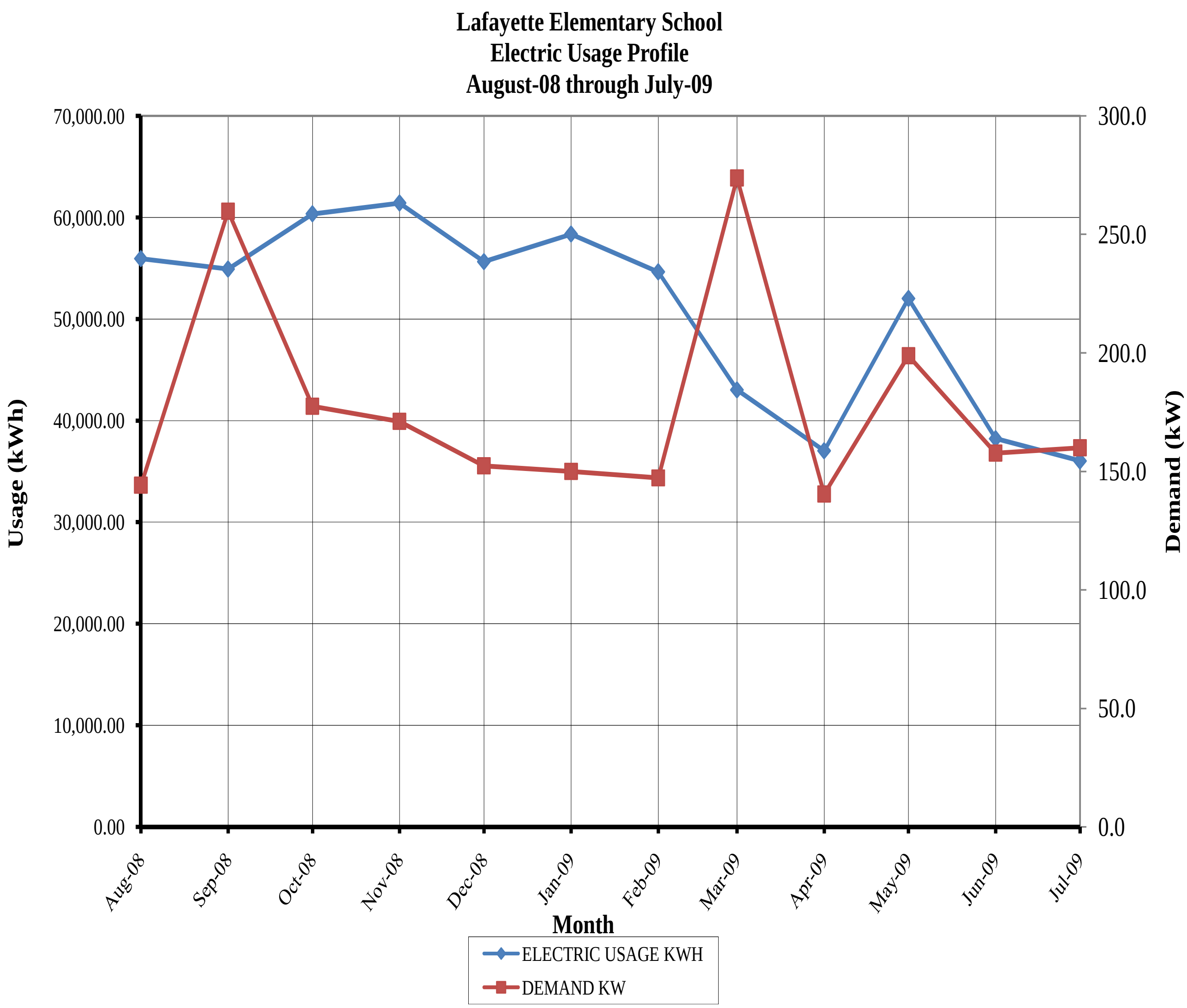


Table 4
Natural Gas Billing Data

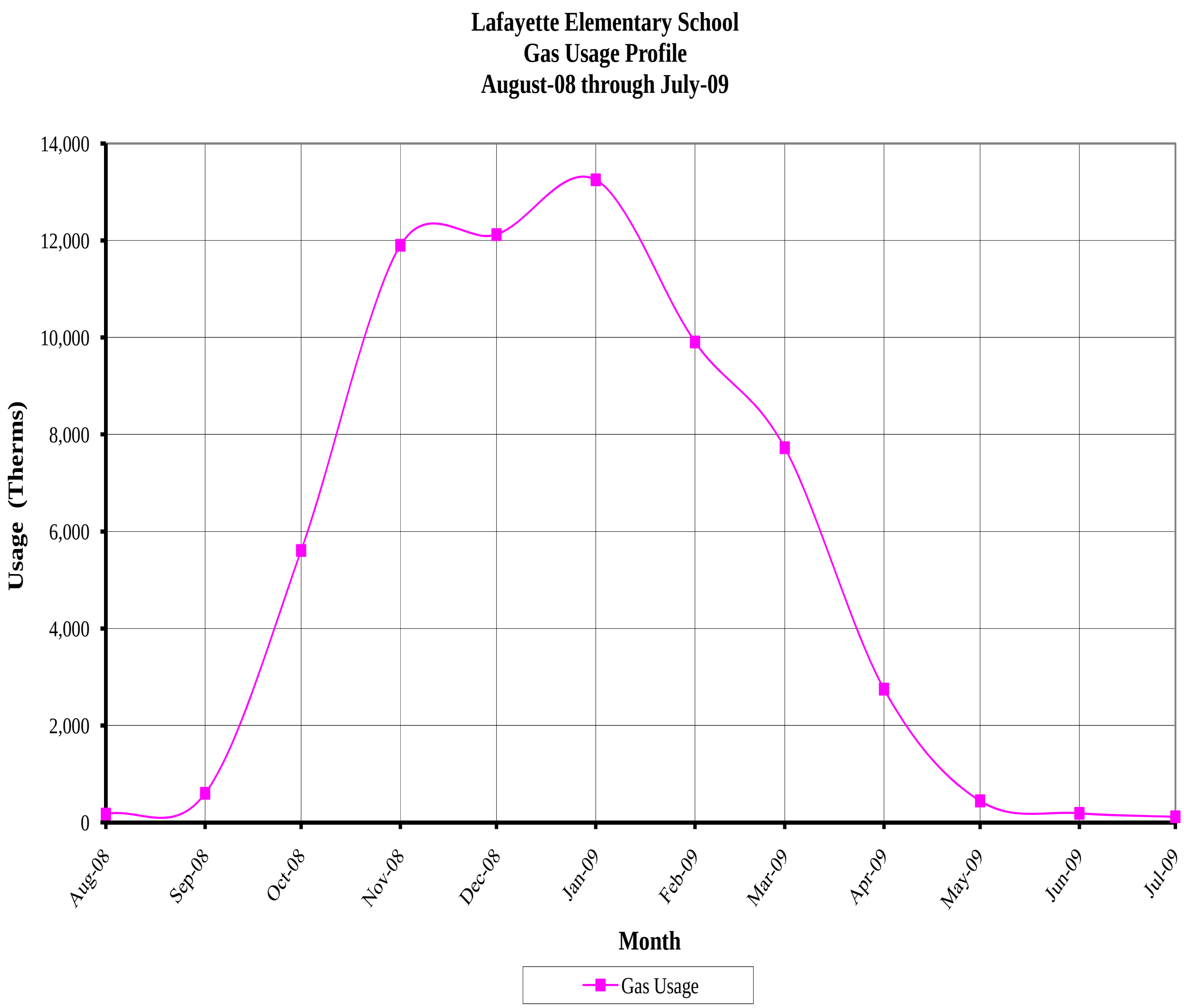
Natural Gas Usage Summary

Utility Provider: PSE&G 3164343
PoD ID: PG000009458410904631
Third Party Utility Provider: HESS
HESS Meters: 394872/394899

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
Aug-08	174.42	$333.09
Sep-08	600.23	$894.11
Oct-08	5,609.23	$9,556.05
Nov-08	11,904.14	$18,224.70
Dec-08	12,125.22	$18,584.82
Jan-09	13,253.04	$20,123.96
Feb-09	9,907.93	$15,488.39
Mar-09	7,729.24	$10,091.60
Apr-09	2,751.75	$3,667.51
May-09	445.77	$679.57
Jun-09	191.69	$116.11
Jul-09	118.21	$107.83
TOTALS	**64,810.85**	**$97,867.74**

AVERAGE RATE: **$1.510** **$/THERM**

Figure 2
Natural Gas Usage Profile



B. Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's annual energy utilization per square foot of building. This calculation is completed by converting all utility usage consumed by a building for one year, to British Thermal Units (BTU) and dividing this number by the building square footage. EUI is a good measure of a building's energy use and is utilized regularly for comparison of energy performance for similar building types. The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of Energy maintains a Benchmarking Building Energy Performance Program. The ORNL website determines how a building's energy use compares with similar facilities throughout the U.S. and in a specific region or state.

Source use differs from site usage when comparing a building's energy consumption with the national average. Site energy use is the energy consumed by the building at the building site only. Source energy use includes the site energy use as well as all of the losses to create and distribute the energy to the building. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses, which allows for a complete assessment of energy efficiency in a building. The type of utility purchased has a substantial impact on the source energy use of a building. The EPA has determined that source energy is the most comparable unit for evaluation purposes and overall global impact. Both the site and source EUI ratings for the building are provided to understand and compare the differences in energy use.

The site and source EUI for this facility is calculated as follows. (See Table 5 for details):

$$Building\ Site\ EUI = \frac{(Electric\ Usage\ in\ kBtu + Gas\ Usage\ in\ kBtu)}{Building\ Square\ Footage}$$

$$Building\ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ x\ SS\ Ratio + Gas\ Usage\ in\ kBtu\ x\ SS\ Ratio)}{Building\ Square\ Footage}$$

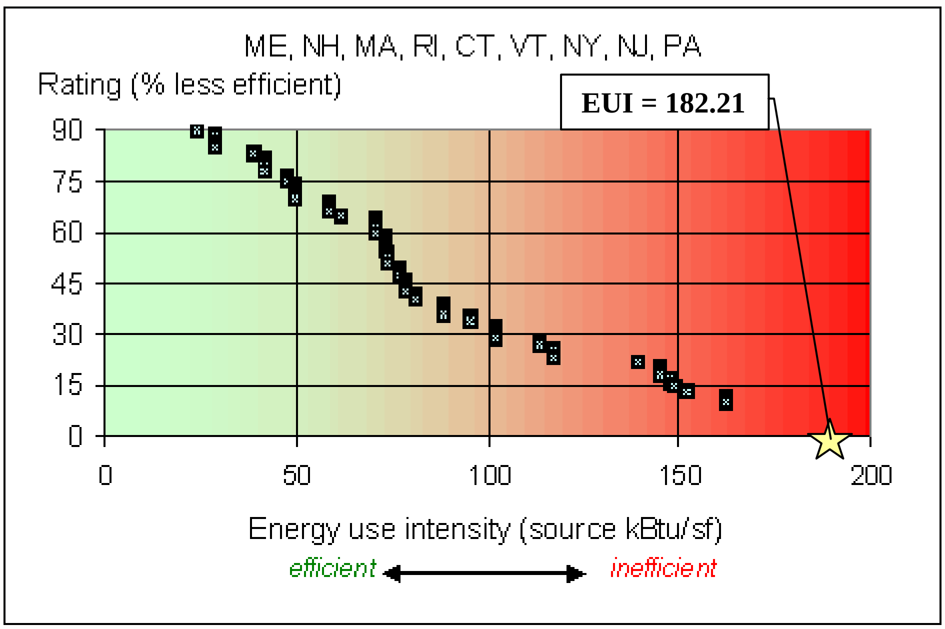
Table 5
Lafayette School EUI Calculations

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE RATIO	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu		kBtu
ELECTRIC	607635.0			2,074,466	3.340	6,928,716
NATURAL GAS		64810.9		6,481,085	1.047	6,785,696
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				8,555,551		13,714,412

*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.

BUILDING AREA	75,268	SQUARE FEET
BUILDING SITE EUI	*113.67*	kBtu/SF/YR
BUILDING SOURCE EUI	*182.21*	kBtu/SF/YR

Figure 3
Source Energy Use Intensity Distributions: Elementary Schools



C. EPA Energy Benchmarking System

The United States Environmental Protection Agency (EPA) in an effort to promote energy management has created a system for benchmarking energy use amongst various end users. The benchmarking tool utilized for this analysis is entitled Portfolio Manager. The Portfolio Manager tool allows tracking and assessment of energy consumption via the template forms located on the ENERGY STAR website (www.energystar.gov). The importance of benchmarking for local government municipalities is becoming more important as utility costs continue to increase and emphasis is being placed on carbon reduction, greenhouse gas emissions and other environmental impacts.

Based on information gathered from the ENERGY STAR website, Government agencies spend more than $10 billion a year on energy to provide public services and meet constituent needs. Furthermore, energy use in commercial buildings and industrial facilities is responsible for more than 50 percent of U.S. carbon dioxide emissions. It is vital that local government municipalities assess facility energy usage, benchmark energy usage utilizing Portfolio Manager, set priorities and goals to lessen energy usage and move forward with priorities and goals.

In accordance with the Local Government Energy Audit Program, CEG has created an ENERGY STAR account for the municipality to access and monitoring the facility's yearly energy usage as it compares to facilities of similar type. The following is the user name and password for this account:

https://www.energystar.gov/istar/pmpam/index.cfm?fuseaction=login.login

Username: chathamsd
Password: lgeaceg2009

Security Question: What city were you born in?
Security Answer: "chatham"

The utility bills and other information gathered during the energy audit process are entered into the Portfolio Manager. The following is a summary of the results for the facility:

Table 6
ENERGY STAR Performance Rating

FACILITY DESCRIPTION	ENERGY PERFORMANCE RATING	NATIONAL AVERAGE
Lafayette School	25	50

Refer to the Statement of Energy Performance appendix for the detailed energy summary.

V. FACILITY DESCRIPTION

The Lafayette School is a one-story, block with brick faced building. The facility houses the boiler rooms, kitchen, cafeteria, offices, classrooms, gymnasium, locker rooms, restrooms, media center, general music, art room, tech labs and the boiler room. The original building was approximately 39,862 square feet and was built in 1953. There were additions in 1995 that added approximately 12,438 square feet, an addition in 2001 added approximately 10,425 square feet, and an addition in 2006 added 12,543 square feet, bringing the building total to 75,268 square feet. The building operates for 40 hours during a typical week. There are different roof types on the building. There is an asphalt shingle roof on the original building The 1995, 2001 and 2006 additions have rigid insulation on steel deck on steel beams. The windows are tempered, insulated glass with aluminum frame.

Heating System

There are two boiler plants providing hot water for heating and there are natural gas fired roof top air handling units that provide heat for this facility. The boiler plant in the original building consists of two (2) Cyclotherm model 3500W-W4-SP, 4,190 MBH Natural Gas input each, natural gas burner water boilers, are 80% efficient, in poor condition and were manufactured in 1953. These boilers provide heating hot water to unit heaters, unit ventilators, convectors, heat & ventilation unit, and radiant floor panels. There are two 7.5 hp system pumps piped in parallel located in the original boiler room and operating in a lead/lag configuration. These pumps are approximately 10 years old and in good to fair condition with 90.2% motor efficiency. The seven (7) packaged roof top units with natural gas heat have inputs ranging from 50,000 BTUH up to 390,000 BTUH and are 81% efficient. There are five (5) units that are three (3) years old and are in very good condition. There are two (2) units that are eight (8) years old and are in fair condition. There is one (1) heat and ventilation unit that is original to the building and is in poor condition.

The 2001 addition added a boiler plant that serves the 2001 addition. The boiler is a HB Smith model Series 28A-8 cast iron boiler, 2499 maximum MBH natural gas input and is 82.9% efficient. The boiler is eight years old and in good condition. There are two 5 hp system pumps piped in parallel located in the 2001 addition boiler room and operating in a lead/lag configuration. The pumps are eight years old and are in fair condition.

Domestic Hot Water

There is an A.O. Smith model HW 200M 942, natural gas, domestic water heater provides hot water for the original building. This unit has an input of 199,000 Btu/h, and a recovery rate of 181.0 gallons per hour, is 82% thermal efficient. The water heater was manufactured in 1998 and is in fair condition.

There is an A.O. Smith model BTR 120 110, natural gas, domestic water heater provides hot water for the 2001 addition. This unit has an input of 120,000 Btu/h, 71 gallon tank and a recovery rate of 116.4 gallons per hour, is 80% thermal efficient. The water heater was manufactured in 2001 and is in good condition.

Cooling System

The facility is cooled via thirty-two (32) split system air conditioning systems, five (5) window air conditioners and seven (7) roof top units. All cooling units are air cooled, direct expansion cooling. These units vary in sizes ranging from 0.75 nominal tons to 25 nominal tons. The split systems are three (3) to thirteen (13) years old and range from good to fair condition. The window air conditioners are four (4) years old and are in good condition.

The seven (7) roof top units are heating and cooling and are described in the heating section above. Again, there are five (5) units that are three (3) years old and are in very good condition and there are two (2) units that are eight (8) years old and are in fair condition.

Controls System

There are Johnson Controls pneumatic controls serving the original boiler room and original school building. A Quincy air compressor, approximately 3 years old, with (2) 2hp motors provides air to the controls system. The system operates on a hot water reset schedule as follows: 0°F Outside air temperature (OA): 200°F Leaving Water Temperature (LWT), 15°F Outside air temperature (OA): 175°F Leaving Water Temperature (LWT), 30°F Outside air temperature (OA): 150°F Leaving Water Temperature (LWT), 45°F Outside air temperature (OA): 125°F Leaving Water Temperature (LWT), 60°F Outside air temperature (OA): 100°F Leaving Water Temperature (LWT). The system appears to be operational but is antiquated.

Exhaust System

There are many roof top centrifugal fans exhausting the toilet rooms, kitchen, all purpose room and locker room areas. They are fractional horse power fan motors and the largest exhaust fans is less than 1 horsepower.

Lighting

The building is lit by varying types and sizes of light bulb types. The types used include the use of T-12 fluorescent, T-8 fluorescent, incandescent, halogen and compact fluorescent. The lamp wattages range from 26 watts to 150 watts with the majority being fluorescent T8 light fixtures with 32 Watt lamps. The incandescent lamps range from 100 watts to 150 watts. There are 25 LED exit signs.

VI. MAJOR EQUIPMENT LIST

The equipment list is considered major energy consuming equipment and through energy conservation measures could yield substantial energy savings. The list shows the major equipment in the facility and all pertinent information utilized in energy savings calculations. An approximate age was assigned to the equipment in some cases if a manufactures date was not shown on the equipment's nameplate. The ASHRAE service life for the equipment along with the remaining useful life is also shown in the Appendix.

Refer to the **Major Equipment List Appendix** for this facility.

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade - General

Description: General

The lighting in the Lafayette School is primarily made up of fluorescent fixtures with T-12 lamps and magnetic ballasts, T-8 lamps with electronic ballasts, incandescent lamps and compact fluorescent lamps. There are a few storage rooms, original boiler room and closets with incandescent lighting and compact fluorescent fixtures.

This ECM includes replacement of the existing fixtures containing T12 lamps and magnetic ballasts with fixtures containing T8 lamps and electronic ballasts. The new energy efficient, T8 fixtures will provide adequate lighting and will save the owner on electrical costs due to the better performance of the lamp and ballasts. This ECM will also provide maintenance savings through the reduced number of lamps replaced per year. The expected lamp life of a T8 lamp is approximately 30,000 burn-hours, in comparison to the existing T12 lamps which is approximately 20,000 burn-hours. The facility will need 33% less lamps replaced per year.

This ECM also includes replacement of all incandescent lamps to compact fluorescent lamps. The energy usage of an incandescent compared to a compact fluorescent approximately 3 to 4 times greater. In addition to the energy savings, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours.

Energy Savings Calculations:

The **Grade Lighting Audit ECM#1- General Appendix** outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, the replacement of a T-12 fixture to a T-5 or T-8 fixture warrants the following incentive: T-5 or T-8 (1-2 lamp) = $25 per fixture; T-5 or T-8 (3-4 lamp) = $30 per fixture.

$$\text{Smart Start® } Incentive = (\#\ of\ 1-2\ lamp\ \ fixtures \times\ \$\,25) + (\#\ of\ 3-4\ lamp\ \ fixtures \times\ \$\,30)$$
$$\text{Smart Start® } Incentive = (4 \times\ \$\,25) = \underline{\$100}$$

Replacement and Maintenance Savings are calculated as follows:

$$Savings = T12\cos t - T8\cos t$$

96T12: 2 fixtures x 2 lamps x ($4.30/lamp+ $5 labor/lamp) x 25 years x 2080 hrs/yr / 20,000 hours/lamp = $96.72
40T12: 2 fixtures x 1 lamp x ($1.95/lamp+ $5 labor/lamp) x 25 years x 2080 hrs/yr / 20,000 hours/lamp = $36.14

T12 cost = 96T12 + 40T12 = $96.72 + $36.14 = $132.86 lifetime cost

32T8: 10 lamps x ($1.95/lamp+ $5 labor/lamp) x 25 years x 2080 hrs/yr / 30,000 hours/lamp = $120.47

Savings = T12 cost – T8 cost = $132.86 - $120.47 = $12.39 lifetime maintenance and cost savings

From the **Smart Start Incentive Appendix**, there is no incentive for replacing incandescent lamps with compact fluorescent lamps. The incentive is only available if the entire light fixture is replaced. In most cases, the existing fixtures can be re-lamped by the facility's staff to obtain the energy savings without the expense of a new fixture and the involvement of an electrician to install a new fixture.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$13,218
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$13,218
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,887
Total Yearly Savings ($/Yr):	$2,887
Estimated ECM Lifetime (Yr):	25
Simple Payback	4.6
Simple Lifetime ROI	446.1%
Simple Lifetime Maintenance Savings	$12
Simple Lifetime Savings	$72,186
Internal Rate of Return (IRR)	22%
Net Present Value (NPV)	$37,061.61

* ECM#1 Calculations DO NOT include lighting control changes implemented in ECM#2. If ECM#1 and #2 are implemented together the savings will be relatively lower than shown above.

ECM #2: Install Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. There has been a belief that it is better to keep the lights on rather than to continuously switch them on and off. This on/off dilemma was studied, and it was determined that the best option is to turn the lights off whenever possible. Although this practice reduces the lamp life, the energy savings far outweigh the lamp replacement costs.

Lighting controls are available in many forms. Lighting controls can be as simplistic as an additional switch. Timeclocks are often used which allow the user to set an on/off schedule. Timeclocks range from a dial clock with on/off indicators to a small box the size of a thermostat with user programs for on/off schedule in digital format. Occupancy sensors detect motion and will switch the lights on when the room is occupied. They can either be mounted in place of the current wall switch, or they can be mounted on the ceiling to cover large areas. Lastly, photocells are a lighting control that sense light levels and will turn the lights off when there is adequate daylight. These are mostly used outside, but they are becoming much more popular in energy-efficient office designs as well.

To determine an estimated savings for lighting controls, we used ASHRAE 90.1-2004 (NJ Energy Code). Appendix G states that occupancy sensors have a 10% power adjustment factor for daytime occupancies for buildings over 5,000 SF. CEG recommends the installation of dual technology occupancy sensors in all private offices, conference rooms, restrooms, lunch rooms, storage rooms, lounges, file rooms, etc.

Energy Savings Calculations:

The **Investment Grade Lighting Audit ECM#2- Lighting Controls Appendix** outlines the proposed retrofits, costs, savings, and payback periods. The hallways of the building is a 24/7 facility while the majority of the building is only occupied 40 hours a week and other areas are only a few hours a day. Ten percent of this value is the resultant energy savings due to installation of occupancy sensors and was calculated to be 15,183.5 kWh/year and $2,718/year.

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is $160/unit including material and labor. The SmartStart Buildings® incentive is $20 per control which equates to an installed cost of $140/unit. Total number of rooms to be retrofitted is 73. Total cost to install sensors is $140/ceiling unit x 73 units = $10,220.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$11,680
NJ Smart Start Equipment Incentive ($):	$1,460
Net Installation Cost ($):	$10,220
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,718
Total Yearly Savings ($/Yr):	$2,718
Estimated ECM Lifetime (Yr):	15
Simple Payback	3.8
Simple Lifetime ROI	298.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$40,770
Internal Rate of Return (IRR)	26%
Net Present Value (NPV)	$22,227.31

ECM #3: Install T-5 Lighting System in Gym

Description:

The Gym is currently lit via eighteen (18) HID, 250 W Metal Halide fixtures that are mounted approximately 20’-0” above the finished floor. The lighting system is antiquated and the space would be better served with a more efficient, fluorescent lighting system. Studies have shown that metal halide lighting systems have a steep lumen depreciation rate (rate at which light is produced from fixture) which equates to approximately a 26% to 35% reduction in lighting output at 40% of the rated lamp life. In addition, the new fluorescent system will provide a better quality of light and save the Owner many dollars on replacement of the highly expensive metal halide lamps.

CEG recommends upgrading the lighting within the Gym to an energy-efficient T-5 lighting system that includes new lighting fixtures with high efficiency, electronic ballasts and T-5 high output (HO) lamps. The T-5 HO lamps are rated for 20,000 hours versus the 10,000 hours for the 250W Metal Halide lamps so there would be a savings in replacement cost and labor. In addition to the standard lighting features of the T-5 fixtures; a day-lighting option could be selected for the outside rows of light to take advantage of the natural daylight that provides light to the room during the day via the clerestory.

This measure replaces all the HID, 250 W Metal Halide fixtures in the Gym with a well-designed T-5 lighting system. Approximately twenty (18), 3-lamp T5HO high bay fixtures with reflectors and high-efficiency, electronic ballasts will be required in order to meet the mandated 50 foot-candle average within the Gym.

Energy Savings Calculations:

A detailed **Grade Lighting Audit ECM#3- T-5 Lighting System in Gym Appendix** that outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

From Appendix C, the replacement of a 250 W HID fixture to a T-5 or T-8 fixture warrants the following incentive: \$50 per fixture.

$$\text{Smart Start® } Incentive = (\#\ of\ \ fixtures \times\ \$50) = (18 \times \$50) = \underline{\$900}$$

Maintenance savings are calculated based on the facility operational hours as indicated by the Owner. For the Gym, the estimated operational hours are 2,080 hours per year. Based on the lamp life comparison, there will be five (5) complete lamp replacements required for the metal halide system at the time when two (2) complete lamp replacement would be required for the fluorescent lighting system. Based on industry pricing, the lamp cost for a 250W metal halide lamp is approximately ±\$25 per lamp and a T-5 54HO fluorescent lamp is approximately ±\$5 per lamp. Therefore, the maintenance savings are calculated as follows:

$$Ma\text{int}eance\ Savings = (\#\ of\ \ MH\ \ lamps \times\ \$25\ \ per\ lamp) - (\#\ of\ \ T5HO\ lamps \times \$5\ \ per\ lamp)$$

$$Maintenance\ Savings = (90\ lamps \times \$25\ per\ lamp) - (108\ lamps \times \$5\ per\ lamp) = \underline{\$1,710}$$

= \$1,710 / 25 years = \$68/year average maintenance savings

It is pertinent to note, that installation labor was not included in the maintenance savings.

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$5,400
NJ Smart Start Equipment Incentive ($):	$900
Net Installation Cost ($):	$4,500
Maintenance Savings ($/Yr):	$68
Energy Savings ($/Yr):	$737
Total Yearly Savings ($/Yr):	$805
Estimated ECM Lifetime (Yr):	25
Simple Payback	5.6
Simple Lifetime ROI	347.3%
Simple Lifetime Maintenance Savings	$1,700
Simple Lifetime Savings	$20,130
Internal Rate of Return (IRR)	18%
Net Present Value (NPV)	$9,520.89

ECM #4: Boiler Replacement – High Efficiency Upgrade

Description:

Heating is provided to the facility by two heating plants. The original heating plant, built in 1953 is outdated and can be more efficient. The newer heating plant, built in 2001 is adequately efficient and should remain in service.

In regards to the original plant, there are two (2) two Cyclotherm model 3500W-W4-SP, 4,190 MBH Natural Gas input each, natural gas burner water boilers, which have a combustion efficiency of 80% when new. These boilers are 21 years past its ASHRAE useful service life.

This energy conservation measure will replace the gas fired boilers serving the original facility. The calculation is based on the following equipment: Aerco, Benchmark BMK-3.0LN-3 condensing boiler or equivalent. The existing units will be replaced with high energy efficient units with capacities typical of the existing units.

Energy Savings Calculations:

Existing 4,190 MBH Gas Fired Boiler:

Rated Capacity = 8,380 MBh Input, 6,700 MBh Output (Natural Gas)

Combustion Efficiency = 80%
Age & Radiation Losses = 5%
Thermal Efficiency = 75%

Replacement Gas Fired Boiler:

High-Efficiency Gas Fired Boiler

Rated Capacity = 9,000 MBh Input, 8,343 MBh maximum Output (Natural Gas)

Combustion Efficiency = 86.5%
Radiation Losses = 0.5%
Thermal Efficiency = 86%

Operating Data:

Heating Season Fuel Consumption = 43,648 Therms of natural (based on natural gas billing data and the square footage of the facility).

$$\textit{Heating Energy Savings} = \textit{Fuel Consumption} \times (\textit{New Furnace Efficiency} - \textit{Old Furnace Efficiency})$$

Heating Energy Savings = 43,648 Therms x ((86% - 75%) / (86%)) = 5,583 Therms

Total Heating Cost savings

Heating Energy Cost Savings = Annual Energy Savings x $/Therm

Heating Energy Cost Savings = (5,583 Therms) x $1.51/Therm = $8,430/ yr.

Installed cost of (3) three new BMK3.0 LN 460/4, IRI 3000MBH input gas fired boilers with one (1) BMS II sequencing panel, sensor kit and installation is $294,500.

Equipment Incentives:

Heating Smart Start Equipment Incentive = ($1.75/MBh) = (9,000 MBh) x $1.75 = $15,750

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$294,500
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$294,500
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$8,430
Total Yearly Savings ($/Yr):	$8,430
Estimated ECM Lifetime (Yr):	35
Simple Payback	34.9
Simple Lifetime ROI	0.2%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$295,050
Internal Rate of Return (IRR)	0%
Net Present Value (NPV)	($113,362.73)

ECM #5: Domestic Water Heater Replacement

Description:

The existing domestic water heater (WH-1) is a A.O. Smith model HW-200M with 199,000 BTUH input natural gas heater with 82% thermal efficiency and (WH-2) is a is a A.O Smith model BTR-120 with a 71 gallon tank and 120,000 BTUH input natural gas heater with an 80% thermal efficiency and a nameplate recovery rate of 116 gallons per hour.

This energy conservation measure will replace the existing natural WH-1 with a 92% thermal efficient Bradford White model EF-60T-199E-3N gas fired domestic hot water heater having 199 MBH input and 60-gallon storage capacity or equivalent. This energy conservation measure will replace the existing natural WH-2 with a 96% thermal efficient Bradford White model EF-60T-125E-3NA gas fired domestic hot water heater having 125 MBH input and 60-gallon storage capacity or equivalent. This ECM requires coordination with the utility due to increase in natural gas demand for the facility. CEG advises the owner to contact the utility provider regarding the installation of this ECM.

Energy Savings Calculations:

Existing Natural Gas DW Heater (WH1)
Rated Capacity = 199 MBH input
Combustion Efficiency = 82%
Age & Radiation Losses = 5%
Thermal Efficiency = 77%

Proposed Natural Gas-Fired, High-Efficiency DW Heater (WH1)
Rated Capacity = 199 MBH input; 60 gallons storage
Thermal Efficiency = 92%
Radiation Losses = 0.5%
Net Efficiency = 91.5%

Existing Natural Gas DW Heater (WH2)
Rated Capacity = 120 MBH input; 71 gallons storage
Combustion Efficiency = 80%
Age & Radiation Losses = 5%
Thermal Efficiency = 75%

Proposed Natural Gas-Fired, High-Efficiency DW Heater (WH2)
Rated Capacity = 125 MBH input; 60 gallons storage
Thermal Efficiency = 96%
Radiation Losses = 0.5%
Net Efficiency = 95.5%

Operating Data for DW Heater

Natural Gas Equipment List - Estimated Annual Usage per unit

Concord Engineering Group

Lafayette Avenue School

Location	Qty.	Model #	Serial #	Input (MBh)	% of Total Input	Estimated Annual Therms
Boiler Room 1 (B1)	1	3500W-W4-SP	7481	4190	33.67%	E
Boiler Room 1 (B2)	1	3500W-W4-SP	7480	4190	33.67%	21,824.11
Boiler Room 2 (B3)	1	28A-8	N2001-810	2499	20.08%	13,016.34
Rooftop (RTU-1)	1	RM-025-8-0-BA02-369	200612-AMGR29908	390	3.13%	2,031.36
Rooftop (RTU-2)	1	RM-A05-8-0-BB01-339	200612-AMGE29896	180	1.45%	937.55
Rooftop (RTU-3)	1	RM-A02-1-0-BA01-319	200612-AMGB29897	69	0.55%	359.39
Rooftop (RTU-4)	1	RM-A02-1-0-BA01-319	200612-AMGB29898	69	0.55%	359.39
Rooftop (RTU-5)	1	RM-008-8-0-BB02-339	200611-AMGH29881	180	1.45%	937.55
Rooftop	1	RMF100NG317BH3BB01A4501B0DD31	N0912011001	285	2.29%	1,484.46
Rooftop	1	48HJD006---531HE	1301G24542	72	0.58%	375.02
Boiler Room 1	1	HW 200M 942	942 B 98 43192	199	1.60%	1,036.52
Boiler Room 2	1	BTR 120 110	MD011025 463	**120**	0.96%	**625.03**
			Total Input MBH	**12,443**		
			Total Input Therms	124.4		
			Total Gas Consumption Therms / yr.	64810.85		

$$\text{Estimated Consumption(WH1)} = \frac{199\,MBHinput}{12{,}443\,MBHbldginput}\, x64{,}810.85\,Therms/year = 1036.52\,Therms/year$$

$$\text{Estimated Consumption(WH2)} = \frac{120\,MBHinput}{12{,}443\,MBHbldginput}\, x64{,}810.85\,Therms/year = 625.03\,Therms/year$$

Energy Savings = Old Water Heater Energy Input x ((New Water Heater Efficiency – Old Water Heater) / New Water Heater Efficiency))

$$\text{Energy Savings (WH1)} = 1036.52 \text{ Therms x } \left(\frac{91.5\% - 77\%}{(91.5\%)}\right) = 164.26 \text{ Therms}$$

$$\text{Energy Savings (WH2)} = 625.03 \text{ Therms x } \left(\frac{95.5\% - 75\%}{(95.5\%)}\right) = 134.17 \text{ Therms}$$

Total Energy Savings = (WH1) + (WH2) = 164.26 Therms + 134.17 Therms = 298.43 Therms

Average Cost of Natural Gas = $1.51/Therm

Yearly Savings = 298.43 Therm x $1.51/ Therm = $451/year

Cost of (2) two Commercial Domestic Water Heater and Installation = $15,340

Simple Payback = $15,340 / $451 = 34 years

Smart Start Incentive = $2.00/MBh x (199+125) /installed MBh = $648.

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$15,340
NJ Smart Start Equipment Incentive ($):	$648
Net Installation Cost ($):	$14,692
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$451
Total Yearly Savings ($/Yr):	$451
Estimated ECM Lifetime (Yr):	12
Simple Payback	32.6
Simple Lifetime ROI	-63.2%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$5,412
Internal Rate of Return (IRR)	-13%
Net Present Value (NPV)	($10,202.74)

ECM #6: Indoor Air Handling Unit Replacement

Description:

One (1) indoor air handling units with hot water heating coils have surpassed there expected service life of fifteen (15) years as outlined in Chapter 36 of the 2007 ASHRAE Applications Handbook. These units appear to be 1953 vintage, and are excellent candidates for replacement. Due to escalating owning and maintenance costs, these units should be replaced. Each of these units contains a hot water heating section and savings can we yielded from year round operation. The unit is 12,600 CFM (cubic feet per minute) capacity.

This energy conservation measure would replace the air handling unit with fan motors equal to or greater than 1 HP with units having NEMA Premium® Efficient Motors. NEMA Premium® is the most efficient motor designation in the marketplace today. The Trane M-series or equivalents were utilized as a basis of design. Because many units operate 40-80 hours per week, even small increases in efficiency can yield substantial energy and dollar savings.

Energy Savings Calculations:

Existing: Unit in Original Boiler Room has a fan motor with the following characteristics:
Existing Motor Efficiency = 78%
Existing motor HP = 5 HP
Annual Hours of Operations = 4500 (Average)
1 HP = 0.746 Watt
Load Factor = 75%
Cost of electricity = $0.179 / kWh

Existing AHU Motor Operating Cost =
{0.746 Watt/HP x Motor HP x Load Factor x Hours of Operation x Cost of Electricity] ÷ Motor Efficiency
= [0.746 x 5 x 0.75 x 4,500 x 0.179] ÷ 0.78 = $2,889 / Year

New AHU with NEMA Premium Motor Efficiency = 86.5%

New AHU with NEMA Premium Efficiency Motor Operating Cost =
{0.746 x 5 x 0.75 x 4,500 x 0.179} ÷ 0.865 = $2,605 / Year

Savings = $2,889 - $2,605 = $284 / Year

Installed Cost of a 12,600 CFM AHU with a 5 HP NEMA Premium® Efficiency Motor = $38,000
The SmartStart Building® incentive of 5hp x $60/hp is $300
Net installed Cost = $38,000 - $300 = $37,700.

Simple Payback = $37,700 / $2,605 = 14.5 Years

kWh saved = $284 / $0.179/kWh = 1,587 kWh
kW saved = 1,587 kWh / 4,500 hrs./yr. =0.35kW

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$38,000
NJ Smart Start Equipment Incentive ($):	$300
Net Installation Cost ($):	$37,700
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,605
Total Yearly Savings ($/Yr):	$2,605
Estimated ECM Lifetime (Yr):	15
Simple Payback	14.5
Simple Lifetime ROI	3.6%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$39,075
Internal Rate of Return (IRR)	0%
Net Present Value (NPV)	($6,601.68)

ECM #7: DDC System – Lafayette Avenue School

Description:

The current HVAC systems within the Lafayette Avenue School are controlled via three types of systems. The original building has pneumatic thermostats. A Johnson Controls electronic control system was installed in the 1995 addition but has since been ripped out and is now controlled manually. An Automated Logic Direct Digital Control (DDC) system is serving the 2000 and 2006 additions and is not a web based system. Thermostats are 2-stage for a day/night (occupied/unoccupied) function by means if a mechanical time clock. During initial discussions with the Owner it was noted that the hours of operation of the facility are generally 40 hours per week. Occasionally, there are additional after-hours usage during weeknights and weekends and thermostat adjustments are made by the person currently occupying the space instead on one general setpoint. This is a means for a cycling amongst different HVAC systems attempting to meet various setpoints throughout the year, independent of heating or cooling season. Therefore, a DDC system providing the Owner with full control over the HVAC equipment within the building appears to be an energy saving opportunity.

This ECM includes installing a Building Automation system with Direct Digital Controls (DDC) wired through an Ethernet backbone and front end controller within the Lafayette School only. The system will include new thermostat controllers for all indoor air-handling systems and the rooftop units, in addition to each piece of equipment being wired back to a front end controller and computer interface. With the communication between the devices and the front end computer interface, the Owner will be able to take advantage of equipment scheduling for occupied and unoccupied periods based on the actual occupancy of the facility. Due to the fact that the Lafayette School has diverse hours of occupancy, including evening and weekend hours, having supervisory control over all of the equipment makes sense. The DDC system will also aid in the response time to service / maintenance issues when the facility is not under normal maintenance supervision, i.e. after-hours.

The new DDC system has the potential to provide substantial savings by controlling the HVAC systems as a whole and provide operating schedules and features such as space averaging, night set-back, temperature override control, etc. The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings is based on the "Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways," document posted for public use April 2005. The study has found that commercial buildings have the potential to achieve significant energy savings through the use of building controls. The average energy savings are as follows based on the referenced report:

- Energy Management and Control System Savings: 5%-15%.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 10% of the total energy cost for the facility.

The cost of a full DDC system with new field devices, controllers, computer, software, programming, etc. is approximately $4.00 per SF in accordance with recent Contractor pricing for systems of this magnitude. Savings from the implementation of this ECM will be from the reduced energy consumption currently used by the HVAC system by proper control of schedule and temperatures via the DDC system.

Cost of complete DDC System = ($4.00/SF x 75,268 SF) = $301,072

Heating Season Heating Degree Days	= 4,996 HDD
Average Cost of Gas	= $1.51 / Therm
Cooling Season Full Load Cooling Hrs.	= 1,129 hrs / yr
Average Cost of Electricity	= $0.179/ kWh

Note: Degree Days and Full Load Hours referenced from ASHRAE Weather Data for Newark, NJ.

Energy Savings Calculations:

10% Savings on Heating Calculations

$$Heat\ Load = \frac{Heat\ Loss\left(\frac{Btu}{Hr\ SF}\right) \times Area\ (SF)}{1000\left(\frac{Btu}{kBtu}\right)}$$

$$Heat\ Load = \frac{50\left(\frac{Btu}{Hr\ SF}\right) \times 75{,}268\ (SF)}{1000\left(\frac{Btu}{kBtu}\right)} = 3{,}763\left(\frac{kBtu}{Hr}\right)$$

$$Est\ Heat\ Cons. = \frac{Heat\ Load\left(\frac{kBtu}{Hr}\right) \times Heat\ Deg\ Days \times 24\ Hrs \times Correction\ Factor}{Design\ Temp\ Difference(°F) \times Efficiency(\%) \times Fuel\ Heat\ Value\left(\frac{kBtu}{Therm}\right)}$$

$$Est\ Heat\ Cons. = \frac{3{,}763\left(\frac{kBtu}{Hr}\right) \times 4{,}996\ (HDD) \times 24\ Hrs \times 0.6}{65\ (°F) \times 81\% \times 100\left(\frac{kBtu}{Therm}\right)} = 51{,}419(Therms)$$

$$Savings. = Heat\ Cons.(Therms) \times 10\%\ Savings \times Ave\ Gas\ Cost\left(\frac{\$}{Therm}\right)$$

$$Savings. = 51{,}419\,(Therms) \times 10\% \times 1.51\left(\frac{\$}{Therm}\right) = \underline{\$7{,}764}$$

10% Savings on Cooling Calculations**:**

$$Est\ Cool\ Cons. = \frac{Cool\ Load\ (Tons) \times 12{,}000\left(\frac{Btu}{Ton\ Hr}\right) \times Full\ Load\ Cooling\ Hrs.}{Ave\ Energy\ Efficiency\ Ratio\left(\frac{Btu}{Wh}\right) \times 1000\left(\frac{Wh}{kWh}\right)}$$

$$Est\ Cool\ Cons. = \frac{177\,(Tons) \times 12{,}000\left(\frac{Btu}{Ton\ Hr}\right) \times 1{,}129\ Hrs.}{10.3\left(\frac{Btu}{Wh}\right) \times 1000\left(\frac{Wh}{kWh}\right)} = 232{,}815(kWh)$$

$$Savings. = Cool\ Cons.(kWh) \times 10\%\ Savings \times Ave\ Elec\ Cost\left(\frac{\$}{kWh}\right)$$

$$Savings. = 232{,}815\,(kWh) \times 10\% \times 0.179\left(\frac{\$}{kWh}\right) = \underline{\$4{,}167}$$

Total Annual Energy Savings = $7,764 + $4,167 = $11,931 per year

It is pertinent to note that electric demand savings were unable to be estimated. Also, incentives for the installation of the DDC system are not currently available and maintenance savings could not be adequately calculated because information was not available to baseline the savings.

Estimated Maintenance Savings:

As stated before, a Johnson Controls electronic control system was installed in the 1995 addition but has since been ripped out and is now controlled manually. This ECM would eliminate the need to manually control this equipment and the savings is estimated as follows:

Maintenance Savings = 0.5 hrs/day x 5 days/week x 52 weeks/year x $20/hour = $2,600

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$301,072
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$301,072
Maintenance Savings ($/Yr):	$2,600
Energy Savings ($/Yr):	$11,931
Total Yearly Savings ($/Yr):	$14,531
Estimated ECM Lifetime (Yr):	15
Simple Payback	20.7
Simple Lifetime ROI	-27.6%
Simple Lifetime Maintenance Savings	$39,000
Simple Lifetime Savings	$217,965
Internal Rate of Return (IRR)	-4%
Net Present Value (NPV)	($127,601.87)

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

Globally, renewable energy has become a priority affecting international and domestic energy policy. The State of New Jersey has taken a proactive approach, and has recently adopted in its Energy Master Plan a goal of 30% renewable energy by 2020. To help reach this goal New Jersey created the Office of Clean Energy under the direction of the Board of Public Utilities and instituted a Renewable Energy Incentive Program to provide additional funding to private and public entities for installing qualified renewable technologies. A renewable energy source can greatly reduce a building's operating expenses while producing clean environmentally friendly energy. CEG has assessed the feasibility of installing renewable energy measures (REM) for the municipality utilizing renewable technologies and concluded that there is potential for solar energy generation. The solar photovoltaic system calculation summary will be concluded as **REM#1** within this report.

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which will be mounted on all south and southwestern facades of the building. Flat roof, as well as sloped areas can be utilized; flat areas will have the panels turned to an optimum solar absorbing angle. (A structural survey of the roof would be necessary before the installation of PV panels is considered). The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit is around $350, this value was used in our financial calculations. This equates to $0.35 per kWh generated.

CEG has reviewed the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 6,426 S.F. can be utilized for a PV system. A depiction of the area utilized is shown in Renewable / Distributed Energy Measures Calculation appendix. Using this square footage it was determined that a system size of 100.51 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 125,300 KWh annually, reducing the overall utility bill by approximately 20.6% percent. A detailed financial analysis can be found in the Renewable / Distributed Energy Measures Calculation appendix. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

The proposed photovoltaic array layout is designed based on the specifications for the Sun Power SPR-230 panel. This panel has a "DC" rated full load output of 230 watts, and has a total panel conversion efficiency of 18%. Although panels rated at higher wattages are available through Sun Power and other various manufacturers, in general most manufacturers who produce commercially available solar panels produce a similar panel in the 200 to 250 watt range. This provides more manufacturer options to the public entity if they wish to pursue the proposed solar recommendation without losing significant system capacity.

The array system capacity was sized on available roof space on the existing facility. Estimated solar array generation was then calculated based on the National Renewable Energy Laboratory PVWatts Version 1.0 Calculator. In order to calculate the array generation an appropriate location with solar data on file must be selected. In addition the system DC rated kilowatt (kW) capacity must be inputted, a DC to AC de-rate factor, panel tilt angle, and array azimuth angle. The DC to AC derate factor is based on the panel nameplate DC rating, inverter and transformer efficiencies (95%), mismatch factor (98%), diodes and connections (100%), dc and ac wiring(98%, 99%), soiling, (95%), system availability (95%), shading (if applicable), and age(new/100%). The overall DC to AC de-rate factor has been calculated at an overall rating of 81%. The PVWatts Calculator program then calculates estimated system generation based on average monthly solar irradiance and user provided inputs. The monthly energy generation and offset electric costs from the PVWatts calculator is shown in the **Renewable/Distributed Energy Measures Calculation Appendix**.

The proposed solar array is qualified by the New Jersey Board of Public Utilities Net Metering Guidelines as a Class I Renewable Energy Source. These guidelines allow onsite customer generation using renewable energy sources such as solar and wind with a capacity of 2 megawatts (MW) or less. This limits a customer system design capacity to being a net user and not a net generator of electricity on an annual basis. Although these guidelines state that if a customer does net generate (produce more electricity than they use), the customer will be credited those kilowatt-hours generated to be carried over for future usage on a month to month basis. Then, on an annual basis if the customer is a net generator the customer will then be compensated by the utility the average annual PJM Grid LMP price per kilowatt-hour for the over generation. Due to the aforementioned legislation, the customer is at limited risk if they generate more than they use at times throughout the year. With the inefficiency of today's energy storage systems, such as batteries, the added cost of storage systems is not warranted and was not considered in the proposed design.

CEG has reviewed financing options for the owner. Two options were studied and they are as follows: Self-financed and direct purchase without finance. Self-finance was calculated with 95% of the total project cost financed at a 7% interest rate over 25 years. Direct purchase involves the local government paying for 100% of the total project cost upfront via one of the methods noted in the Installation Funding Options section below. Both of these calculations include a utility inflation rate as well as the degradation of the solar panels over time. Based on our calculations the following are the payback periods for the respective method of payment:

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM			
PAYMENT TYPE	**SIMPLE PAYBACK**	**SIMPLE ROI**	**INTERNAL RATE OF RETURN**
Self-Finance	13.7 Years	83.2%	1.1%
Direct Purchase	13.7 Years	83.2%	6.0%

*The solar energy measure is shown for reference in the executive summary REM table

The resultant Internal Rate of Return indicates that if the Owner was able to "Direct Purchase" the solar project, the project would be slightly more beneficial to the Owner.

In addition to the Solar Analysis, CEG also conducted a review of the applicability of wind energy for the facility. Wind energy production is another option available through the Renewable Energy Incentive Program. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. Based on CEG's review of the applicability of wind energy for the facility, it was determined that the average wind speed is not adequate for purchase of a commercial wind turbine. Therefore, wind energy is not a viable option to implement.

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:
Load Profile analysis was performed to determine the seasonal energy usage of the facility. Irregularities in the load profile will indicate potential problems within the facility. Consequently based on the profile a recommendation will be made to remedy the irregularity in energy usage. For this report, the facility's energy consumption data was gathered in table format and plotted in graph form to create the load profile. Refer to the Electric and Natural Gas Usage Profiles included within this report to reference the respective electricity and natural gas usage load profiles.

Electricity:

The Electric Usage Profile demonstrates a fairly flat load profile throughout the year. This is a unusual for a school, because typically schools are closed in the summer. However the steady and elevated summer load profile (March – July), with a peak in May is supported by summer school, the boiler rooms, kitchen, cafeteria, offices, classrooms, gymnasium, locker rooms, restrooms, media center, general music, art room and tech labs. The auditorium is in use throughout the year. A steady load throughout the summer is a sign of consistent cooling load (air-conditioning). Air-conditioning in this facility is provided by (32) thirty two split system air-conditioning units, (5) five window units and (7) seven, roof-top units. Lighting in the Lafayette School is primarily made up of T-12 lamps. These lamps use more energy than energy-efficient lamps recommended today. A flatter load profile of this type, will allow for more competitive energy prices when shopping for alternative energy suppliers.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical heating load profile. An increase in consumption is observed October through March during the standard heating season. Heating for this facility is provided by (2) two boiler plants providing hot water for heating and the presence of roof-top air handling units that also provide heat. The boiler plant consists of (2) two natural gas fired water boilers. These boilers provided hot water to unit heaters, unit ventilators, convectors, heat and ventilator units and radiant floor panels. The 2001 addition also has a boiler for this addition. Domestic hot water is provided by an A.O Smith natural gas fired hot water heater. The addition has its own smaller A.A. Smith natural gas fired hot water heater. Natural gas Delivery-service is provided by Public Service Electric and Gas Company (PSE&G) on an LVG rate schedule. Commodity service is supplied by the Hess Corporation, the Third Party Supplier. This consistent load profile is beneficial when looking at supply options with new Third Party Suppliers.

Tariff:

Electricity:

This facility receives electrical service through Jersey Central Power & Light (JCP&L) on a GSS (General Service Secondary – 3 Phase) rate. Service classification GS is available for general service purposes on secondary voltages not included under Service Classifications RS, RT, RGT or GST. This facility's rate is a three phase service at secondary voltages. For electric supply (generation), the customer uses the service of a JCP&L. This facility uses the Delivery Service of the utility (JCP&L). The Delivery Service includes the following charges: Customer Charge, Supplemental Customer Charge, Distribution Charge (kW Demand), kWh Charge, Non-utility Generation Charge, TEFA, SBC, SCC, Standby Fee and RGGI. The Generation Service is provided by JCP&L under BGS (Basic Generation Service). BGS Energy and Reconciliation Charges are provided in Rider BGS-FP (fixed pricing) or BGS-CIEP (Commercial Industrial Energy Pricing). BGS also has a Transmission component to its charge.

Natural Gas:

This facility receives utility service through Public Service Electric and Gas Company (PSE&G). This facility utilizes the Delivery Service from PSE&G while receiving Commodity service from a Third Party Supplier (TPS), Hess Corporation.

LVG Rate: This utility tariff is for "firm" delivery service for general purposes. This rate schedule has a Delivery Charge, Balancing Charge, Societal Benefits Charge, Realignment Adjustment Charge, Margin Adjustment Charge, RGGI Charge and Customer Account Service Charge. The customer can elect to have the Commodity Charge serviced through the utility or by a Third Party Supplier (TPS). Note: Should the TPS not deliver, the customer may receive service from PSE&G under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service.

"Firm" delivery service defines the reliability of the transportation segment of the pricing. Much like the telecom industry, natural gas pipelines were un-bundled in the late 1990's and the space was divided up and marketed into reliability of service. Firm Service is said to be the most reliable and last in the pecking order for interruption. This service should not be interrupted.

Commodity Charges: Customer may choose to receive gas supply from either: A TPS or PSE&G through its Basic Gas Supply Service default service. PSE&G may also supply Emergency Sales Service in certain instances. This is at a much higher than normal rate. It should be perceived as a penalty.

This facility utilizes the services of a Third Party Supplier, The Hess Corporation. The contract is administered by The Alliance for Competitive Service (ACES). ACES is the energy aggregation program of the New Jersey School Boards Association of School Administrator's. The process was reviewed and approved by the New Jersey Department of Community Affairs.

Please see CEG recommendations below.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities. Good potential savings can be seen equally in the electric costs and the natural gas costs. The average price per kWh (kilowatt hour) for the High School based on a historical 1-year weighted average fixed price from the utility JCP&L is $.1415 / kWh (this is the fixed "price to compare" when shopping for energy procurement alternatives). The fixed weighted average price per decatherm for natural gas service in the High School, provided by the Hess Corporation (TPS) is $ 12.08 / dth (dth, is the common unit of measure). The natural gas prices are also the "prices to compare".

The "price to compare" is the netted cost of the energy (including other costs), that the customer will use to compare to Third Party Supply sources when shopping for alternative suppliers. For electricity this cost would not include the utility transmission and distribution chargers. For natural gas the cost would not include the utility distribution charges and is said to be delivered to the utilities city-gate.

Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. Chatham School District could see improvement in its energy costs if it were to take advantage of these current market prices quickly, before energy prices increase. Based on electric supply from JCP&L and utilizing the historical consumption data provided (August 2008 through July 2009) and current electric rates, the school(s) could see an improvement in its electric costs of up to 25 % annually. (Note: Savings were calculated using Average Annual Consumption and a variance to a Fixed Average One-Year commodity contract). CEG recommends aggregating the entire electric load to gain the most optimal energy costs. CEG recommends advisement for alternative sourcing and supply of energy on a "managed approach".

CEG's second recommendation coincides with the natural gas costs. Based on the current alternative market pricing supplied by the Hess Corporation (ACES Agreement), CEG feels that School District could see an improvement of up to 33 % in its natural gas costs. CEG has experience with the mechanism for schools to buy energy in New Jersey. It is through the ACES Agreement (The Alliance for Competitive Energy Services) which is an energy aggregation program. From our experience, the basis price is the reason that the overall average price per dekatherm is ($12.08/dth). Therefore the average pricing formula supplied by Hess is 25 % above today's competitive market pricing. CEG recommends the school receive further advisement on these prices through an energy advisor. They should also consider procuring energy (natural gas) through an alternative supply source.

CEG also recommends scheduling a meeting with the current utility providers to review their utility charges and current tariff structures for electricity and natural gas. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), the municipality can learn more about the competitive supply process. The county can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu. They should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the information for ongoing demand-side management projects. Furthermore, special attention should be given to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with the utility representative. The School District should ask the utility representative about alternative billing options, such as consolidated billing when utilizing the service of a Third Party Supplier. Finally, if the supplier for energy (natural gas) is changed, closely monitor balancing, particularly when the contract is close to termination. This could be performed with the aid of an "energy advisor".

X. INSTALLATION FUNDING OPTIONS

CEG has reviewed various funding options for the Owner to utilize in subsidizing the costs for installing the energy conservation measures noted within this report. Below are a few alternative funding methods:

i. *Energy Savings Improvement Program (ESIP)* – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and par for the costs using the value of energy savings that result from the improvements. The “Energy Savings Improvement Program (ESIP)” law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources.

ii. *Municipal Bonds* – Municipal bonds are a bond issued by a city or other local government, or their agencies. Potential issuers of municipal bonds include cities, counties, redevelopment agencies, school districts, publicly owned airports and seaports, and any other governmental entity (or group of governments) below the state level. Municipal bonds may be general obligations of the issuer or secured by specified revenues. Interest income received by holders of municipal bonds is often exempt from the federal income tax and from the income tax of the state in which they are issued, although municipal bonds issued for certain purposes may not be tax exempt.

iii. *Power Purchase Agreement* – Public Law 2008, Chapter 3 authorizes contractor of up to fifteen (15) years for contracts commonly known as “power purchase agreements.” These are programs where the contracting unit (Owner) procures a contract for, in most cases, a third party to install, maintain, and own a renewable energy system. These renewable energy systems are typically solar panels, windmills or other systems that create renewable energy. In exchange for the third party’s work of installing, maintaining and owning the renewable energy system, the contracting unit (Owner) agrees to purchase the power generated by the renewable energy system from the third party at agreed upon energy rates.

iv. *Pay For Performance* – The New Jersey Smart Start Pay for Performance program includes incentives based on savings resulted from implemented ECMs. The program is available for all buildings with average demand loads above 200 KW. The facility’s participation in the program is assisted by an approved program partner. An “Energy Reduction Plan” is created with the facility and approved partner to shown at least 15% reduction in the building’s current energy use. Multiple energy conservation measures implemented together are applicable toward the total savings of at least 15%. No more than 50% of the total energy savings can result from lighting upgrades / changes.

Total incentive is capped at 50% of the project cost. The program savings is broken down into three benchmarks; Energy Reduction Plan, Project Implementation, and Measurement and Verification. Each step provides additional incentives as the energy reduction project continues. The benchmark incentives are as follows:

1. Energy Reduction Plan – Upon completion of an energy reduction plan by an approved program partner, the incentive will grant $0.10 per square foot between $5,000 and $50,000, and not to exceed 50% of the facility's annual energy expense. (Benchmark #1 is not provided in addition to the local government energy audit program incentive.)

2. Project Implementation – Upon installation of the recommended measures along with the "Substantial Completion Construction Report," the incentive will grant savings per KWH or Therm based on the program's rates. Minimum saving must be 15%. (Example $0.11 / kWh for 15% savings, $0.12/ kWh for 17% savings, … and $1.10 / Therm for 15% savings, $1.20 / Therm for 17% saving, …) Increased incentives result from projected savings above 15%.

3. Measurement and Verification – Upon verification 12 months after implementation of all recommended measures, that actual savings have been achieved, based on a completed verification report, the incentive will grant additional savings per kWh or Therm based on the program's rates. Minimum savings must be 15%. (Example $0.07 / kWh for 15% savings, $0.08/ kWh for 17% savings, … and $0.70 / Therm for 15% savings, $0.80 / Therm for 17% saving, …) Increased incentives result from verified savings above 15%.

CEG recommends the Owner review the use of the above-listed funding options in addition to utilizing their standard method of financing for facilities upgrades in order to fund the proposed energy conservation measures.

XI. ADDITIONAL RECOMMENDATIONS

The following recommendations include no cost/low cost measures, Operation & Maintenance (O&M) items, and water conservation measures with attractive paybacks. These measures are not eligible for the Smart Start Buildings incentives from the office of Clean Energy but save energy none the less.

A. Chemically clean the condenser and evaporator coils in the window AC units periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%. The 3-step process includes cleaning of the coils, rinsing and a micro biocide treatment. Thoroughly cleaned coils are not as susceptible to re-fouling so they stay clean longer, reducing the cleaning cycle frequency

B. Maintain all weather stripping on windows and doors.

C. Repair/replace damaged or missing ductwork insulation in the ceiling spaces.

D. Provide more frequent air filter changes to decrease overall fan horsepower requirements and maintain better IAQ.

E. Recalibrate existing zone thermostats.

F. Clean all fixtures to maximize light output.

G. Feel for air drafts around electrical outlets. Inexpensive pads are available, as are plugs for unused sockets.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Lafayette Avenue School

ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT.	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM #1	Lighting Upgrade - General	$13,218	$0	$0	$13,218	$2,887	$0	$2,887	25	$72,186	$12	446.1%	4.6	21.68%	$37,061.61
ECM #2	Lighting Controls	$11,680	$0	$1,460	$10,220	$2,718	$0	$2,718	15	$40,770	$0	298.9%	3.8	25.74%	$22,227.31
ECM #3	Lighting Upgrade - Gym	$5,400	$0	$900	$4,500	$737	$68	$805	25	$20,130	$1,700	347.3%	5.6	17.58%	$9,520.89
ECM #4	Boiler Replacement – High Efficiency Upgrade	$294,500	$0	$0	$294,500	$8,430	$0	$8,430	35	$295,050	$0	0.2%	34.9	0.01%	($113,362.73)
ECM #5	Domestic Water Heater Replacement	$15,340	$0	$648	$14,692	$451	$0	$451	12	$5,412	$0	-63.2%	32.6	-12.79%	($10,202.74)
ECM #6	Indoor Air handling Unit Replacement	$38,000	$0	$300	$37,700	$2,605	$0	$2,605	15	$39,075	$0	3.6%	14.5	0.45%	($6,601.68)
ECM #7	DDC System – Lafayette Avenue School	$301,072	$0	$0	$301,072	$11,931	$2,600	$14,531	15	$217,965	$39,000	-27.6%	20.7	-3.79%	($127,601.87)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	Solar PV Project	$904,590	$0	$0	$904,590	$22,429	$43,855	$66,284	25	$1,657,100	$1,096,375	83.2%	13.6	5.32%	$249,623.08

Notes: 1) The variable Cn in the formulas for Internal Rate of Return and Net Present Value stands for the cash flow during each period.
2) The variable DR in the NPV equation stands for Discount Rate
3) For NPV and IRR calculations: From n=0 to N periods where N is the *lifetime of ECM* and Cn is the *cash flow during each period* .

Concord Engineering Group, Inc.

520 BURNT MILL ROAD
VOORHEES, NEW JERSEY 08043
PHONE: (856) 427-0200
FAX: (856) 427-6508

SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of January, 2009:

Electric Chillers

Water-Cooled Chillers	\$12 - \$170 per ton
Air-Cooled Chillers	\$8 - \$52 per ton

Gas Cooling

Gas Absorption Chillers	\$185 - \$400 per ton
Gas Engine-Driven Chillers	Calculated through custom measure path)

Desiccant Systems

\$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	\$73 - \$93 per ton
Air-to-Air Heat Pumps	\$73 - \$92 per ton
Water-Source Heat Pumps	\$81 per ton
Packaged Terminal AC & HP	\$65 per ton
Central DX AC Systems	\$40- \$72 per ton
Dual Enthalpy Economizer Controls	\$250

Ground Source Heat Pumps

Closed Loop & Open Loop	\$370 per ton

Gas Heating

Gas Fired Boilers < 300 MBH	\$300 per unit
Gas Fired Boilers ≥ 300 - 1500 MBH	\$1.75 per MBH
Gas Fired Boilers ≥1500 - ≤ 4000 MBH	\$1.00 per MBH
Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	\$300 - \$400 per unit

Variable Frequency Drives

Variable Air Volume	$65 - $155 per hp
Chilled-Water Pumps	$60 per hp
Compressors	$5,250 to $12,500 per drive

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons	$50 per unit
Gas-Fired Water Heaters >50 gallons	$1.00 - $2.00 per MBH
Gas-Fired Booster Water Heaters	$17 - $35 per MBH

Premium Motors

Three-Phase Motors	$45 - $700 per motor

Prescriptive Lighting

T-5 and T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 - $30 per fixture, (depending on quantity)
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start	$25 per fixture
LED Exit Signs	$10 - $20 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $284 per fixture

Lighting Controls – Occupancy Sensors

Wall Mounted	$20 per control
Remote Mounted	$35 per control
Daylight Dimmers	$25 per fixture
Occupancy Controlled hi-low Fluorescent Controls	$25 per fixture controlled

Lighting Controls – HID or Fluorescent Hi-Bay Controls

Occupancy hi-low	$75 per fixture controlled
Daylight Dimming	$75 per fixture controlled

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2004 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lafayette Avenue School

Boiler

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room 1 (B1)	Original Bldg	Cyclotherm	1	3500W-W4-SP	7481	4190	3350	80%	NG	1953	35	(-21)	
Boiler Room 1 (B2)	Original Bldg	Cyclotherm	1	3500W-W4-SP	7480	4190	3350	80%	NG	1953	35	(-21)	
Boiler Room 2 (B3)	2001 Addition	Smith	1	28A-8	N2001-810	2499	1709	68	NG	2001	35	27	

Boiler - Burner

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room 1	Original Bldg	Industrial Combustion	2	HG-25-S-1	40542-1	2500	80	NG	2001	21	13	
Boiler Room 2	2001 Addition	Industrial Combustion	1	AM 4-3/4 CM	G 8946	4190	80	NG				

Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	RPM	GPM	Ft. Hd	Frame Size	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	
Boiler Room 2	Smith Boiler loop	Baldor Motor	2	HU1507AE2HCB719M		2	1750	46	51				2007	10	8	
Boiler Room 2	Smith Boiler loop	Armstrong	2	2x2x6 A380	43382	5	3600	100	72				2007	10	8	
Boiler Room 2	Smith Boiler loop	B&G	1	189162 E40		fractional							2004	10	5	
Boiler Room 1	Original Bldg.	B&G	2	1510-21/288		7.5	1760	250	55	L213T				20		90.2 %EFF
Boiler Room 1	Dom. Circ Pump	Circ Pump	1	HU BNF1	E60 102213								2006	10	7	
Boiler Room 1	Dom. Circ Pump	B&G	1	Series 100 AB	F08 106192									10		
Boiler Room 1	Circ Pump	B&G	1		P/N M80121	1/3	1725				115/230	1		10		

Domestic Hot Water Heater

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Input (MBh)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room 2		Smith	1	BTR 120 110	MD011025 463	120	116.4	71		NG	1992	12	(-5)	
Boiler Room 1		Smith	1	HW 200M 942	942 B 98 43192	199	181			NG	1998	12	1	

Air Handling Units

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Cooling Coil	Cooling Eff. (EER)	Cooling Capacity (Tons)	Heating Type	Input (MBh)	Output (MBh)	Heating Eff. (%)	Fuel	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Rooftop		Nesbitt	1	RMF100NG317BH3BB01A4501B0DD31	N0912011001	R-22			HTX	285	228	80%	NG	208	3	5	8	15	7	
Rooftop		Carrier Weather Master	1	48HJD006---531HE	1301G24542	R-22			HTX	50/72	41/59	82%	NG	208/230	3		8	15	7	
Rooftop (RTU-1)	Media Center	AAON	1	RM-025-8-0-BA02-369	200612-AMGR29908	R-410A	10.8	25	HTX	390	316	81%	NG	208	3		3	15	12	
Rooftop (RTU-2)	2006 Cooridoor & Restrooms	AAON	1	RM-A05-8-0-BB01-339	200612-AMGE29896	R-410A	13.4	5	HTX	180	146	81%	NG	208	3		3	15	12	
Rooftop (RTU-3)	2006 Conf Rm	AAON	1	RM-A02-1-0-BA01-319	200612-AMGB29897	R-410A	13.8	2	HTX	69	56	81%	NG	230	1		3	15	12	
Rooftop (RTU-4)		AAON	1	RM-A02-1-0-BA01-319	200612-AMGB29898	R-410A	13.8	2	HTX	69	56	81%	NG	230	1		3	15	12	
Rooftop (RTU-5)	Art Rm	AAON	1	RM-008-8-0-BB02-339	200611-AMGH29881	R-410A	12.7	8	HTX	180	146	81%	NG	208	3		3	15	12	
Boiler Room 1		Herman Nelson	1	SB-3180	510 967				HW											Elliot Company PE-21103007
Boiler Room 1		Air C. Quincy Climate Control	1	Q020BBD00004	5162730				HW											

Split Systems and AC Condensers

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity (Btu/h)	Eff.	Refrigerant	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Rooftop		Lennox	1	HS29-042-13Y	5807B44260	42000	13	R-22	208/230	3		2007	15	13	
Rooftop		Heat Controller	1	A-HMC18AS		18000/17800		R-22	230/208	1			15		
Rooftop		Fedders	1	C1036BBD3V	FS350727	36,000		R-22					15		
Ground		EMI	1	SHD12AAA000AA0A	1-96-J-3240-38	12000		R-22	115	1		1996	15	2	
Classrooms		Friedrich Quietmaster	4	KM18L30-C	LHHZ00186	17800/17600		R-22	230/208	1	8.1/10		10		
Classrooms		Fedders	4	ASL14E2J	FZ611051 1818	14000			115	1	12		15		
Classrooms		Carrier	2	51CMC112101	43 822364	12000	9.2		115	1	12		15		
Rooftop		Trane	2	TTP018C100A2	L1044BPBF	18000		R-22	200/230	1		Mar-96	15	2	
Rooftop		Trane	7	TTA048C300A0	L215RB4BF, L215RE4BF, L215SEUBF, L215P5PBF, L215SJNBF, L215SSKBF, L215RA5BF	48,000		R-22	200/230	3		May-95	15	1	
Rooftop		Trane	1	TTA048C300A1	N1714SEBF	48,000		R-22	200/230	3			15		
Rooftop		Trane	2	TTA060C300A0	L182TF8FF, L182TU4FF	60,000		R-22	200/230	3		Apr-96	15	2	
Rooftop		EMI	1	S1CA9000A00	1-06-R-6746-43	9,000		R-22	115	1		Jun-05	15	11	
Rooftop		Old Condensing Unit	2	Could not read tag									15		
Rooftop		Trane	3	TTA048C300A0	L215R B4BF	48,000		R-22	200/230	3		May-96	15	2	

Window AC Units

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity - DX	Heating Capacity -	Fan HP	Volts	Phase	Amps	Approx. Age	ASHRAE Service	Remaining Life	Notes
Classrooms 10, 11, 13, 14	Classrooms 10, 11, 13, 14	Friedrich Quietmaster	4	KS15L10-A	LEAR 13550	14500			115	1	12.2	2005	15	11	10.8 EER
Classrooms	Classroom 12	Fedders	1	A3L14E2A	MA664597 3399	14000			115	1					

Air Compressor

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	Pressure	Capacity	Volts	Phase	FLA	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room 1	Original Building	Quincy	1	Q020BBD00004	5162730	(2) 2							20		Fairly new but Pneumatic controls are orig/past lif

Classroom Unit Ventilator

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity - DX	Heating Capacity - HW	Fan HP	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Rm 29-33, SG1	Classroom	Airedale Classmate	6	CMX4-208	S321500303155106-1475	47000 TC / 35.25 SC	74 MBH , 3 gpm	1	208	3		2006	15	12	

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Lafayette Avenue School

Building ID: 1830623
For 12-month Period Ending: July 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: October 06, 2009

Facility
Lafayette Avenue School
221 Lafayette Ave
Chatham, NJ 07928

Facility Owner
School District of the Chathams
58 Meyersville Road
Chatham, NJ 07928

Primary Contact for this Facility
Ralph Goodwin
58 Meyersville Road
Chatham, NJ 07928

Year Built: 1954
Gross Floor Area (ft²): 75,268

Energy Performance Rating[2] (1-100) 25

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	2,073,251
Natural Gas (kBtu)[4]	6,481,087
Total Energy (kBtu)	8,554,338

Energy Intensity[5]	
Site (kBtu/ft²/yr)	114
Source (kBtu/ft²/yr)	182

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	661

Electric Distribution Utility
Jersey Central Power & Lt Co

National Average Comparison	
National Average Site EUI	90
National Average Source EUI	145
% Difference from National Average Source EUI	26%
Building Type	K-12 School

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Meets Industry Standards[6] **for Indoor Environmental Conditions:**	
Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Certifying Professional
Raymond Johnson
520 South Burnt Mill Road
Voorhees, NJ 08043

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.
NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Lafayette Avenue School	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	K-12 School	Is this an accurate description of the space in question?		☐
Location	221 Lafayette Ave, Chatham, NJ 07928	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐

Lafayette 1995 Addition (K-12 School)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	12,438 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Open Weekends?	No	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	14	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	0	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	No	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	12 (Optional)	Is this school in operation for at least 8 months of the year?		☐

High School?	No	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐
Lafayette 2001 Addition (K-12 School)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	10,425 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Open Weekends?	No	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	9	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	0	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	No	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	12 (Optional)	Is this school in operation for at least 8 months of the year?		☐
High School?	No	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐
Lafayette 2006 Addition (K-12 School)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	12,543 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐

Open Weekends?	No	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	25	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	0	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	No	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	12 (Optional)	Is this school in operation for at least 8 months of the year?		☐
High School?	No	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐

Lafayette Original Bldg (K-12 School)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	39,862 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Open Weekends?	No	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	88	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	0	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	Yes	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐

Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	12 (Optional)	Is this school in operation for at least 8 months of the year?		☐
High School?	No	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Jersey Central Power & Lt Co

Fuel Type: Electricity		
Meter: Lafayette Electric (kWh (thousand Watt-hours)) **Space(s):** Entire Facility **Generation Method:** Grid Purchase		
Start Date	**End Date**	**Energy Use (kWh (thousand Watt-hours))**
07/01/2009	07/31/2009	36,027.00
06/01/2009	06/30/2009	38,221.00
05/01/2009	05/31/2009	52,021.00
04/01/2009	04/30/2009	37,031.00
03/01/2009	03/31/2009	43,029.00
02/01/2009	02/28/2009	54,648.00
01/01/2009	01/31/2009	58,364.00
12/01/2008	12/31/2008	55,646.00
11/01/2008	11/30/2008	61,423.00
10/01/2008	10/31/2008	60,359.00
09/01/2008	09/30/2008	54,920.00
08/01/2008	08/31/2008	55,946.00
Lafayette Electric Consumption (kWh (thousand Watt-hours))		**607,635.00**
Lafayette Electric Consumption (kBtu (thousand Btu))		**2,073,250.62**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**2,073,250.62**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas		
Meter: Lafayette Gas Meter (therms) **Space(s):** Entire Facility		
Start Date	**End Date**	**Energy Use (therms)**
07/01/2009	07/31/2009	118.21
06/01/2009	06/30/2009	191.69
05/01/2009	05/31/2009	445.77
04/01/2009	04/30/2009	2,751.75
03/01/2009	03/31/2009	7,729.24
02/01/2009	02/28/2009	9,907.93
01/01/2009	01/31/2009	13,253.04
12/01/2008	12/31/2008	12,125.22
11/01/2008	11/30/2008	11,904.14
10/01/2008	10/31/2008	5,609.23

09/01/2008	09/30/2008	600.23
08/01/2008	08/31/2008	174.42
Lafayette Gas Meter Consumption (therms)		**64,810.87**
Lafayette Gas Meter Consumption (kBtu (thousand Btu))		**6,481,087.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**6,481,087.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

Additional Fuels	
Do the fuel consumption totals shown above represent the total energy use of this building? Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.	☐

On-Site Solar and Wind Energy	
Do the fuel consumption totals shown above include all on-site solar and/or wind power located at your facility? Please confirm that no on-site solar or wind installations have been omitted from this list. All on-site systems must be reported.	☐

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same as the PE that signed and stamped the SEP.)

Name: ____ Date: _____________

Signature: ______________________________________

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
Lafayette Avenue School
221 Lafayette Ave
Chatham, NJ 07928

Facility Owner
School District of the Chathams
58 Meyersville Road
Chatham, NJ 07928

Primary Contact for this Facility
Ralph Goodwin
58 Meyersville Road
Chatham, NJ 07928

General Information

Lafayette Avenue School	
Gross Floor Area Excluding Parking: (ft²)	75,268
Year Built	1954
For 12-month Evaluation Period Ending Date:	July 31, 2009

Facility Space Use Summary

Lafayette 1995 Addition		Lafayette 2006 Addition	
Space Type	K-12 School	Space Type	K-12 School
Gross Floor Area(ft²)	12,438	Gross Floor Area(ft²)	12,543
Open Weekends?	No	Open Weekends?	No
Number of PCs	14	Number of PCs	25
Number of walk-in refrigeration/freezer units	0	Number of walk-in refrigeration/freezer units	0
Presence of cooking facilities	No	Presence of cooking facilities	No
Percent Cooled	100	Percent Cooled	100
Percent Heated	100	Percent Heated	100
Months°	12	Months°	12
High School?	No	High School?	No
School District°	Chatham	School District°	Chatham

Lafayette 2001 Addition		Lafayette Original Bldg	
Space Type	K-12 School	Space Type	K-12 School
Gross Floor Area(ft²)	10,425	Gross Floor Area(ft²)	39,862
Open Weekends?	No	Open Weekends?	No
Number of PCs	9	Number of PCs	88
Number of walk-in refrigeration/freezer units	0	Number of walk-in refrigeration/freezer units	0
Presence of cooking facilities	No	Presence of cooking facilities	Yes
Percent Cooled	100	Percent Cooled	100
Percent Heated	100	Percent Heated	100
Months°	12	Months°	12
High School?	No	High School?	No
School District°	Chatham	School District°	Chatham

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 07/31/2009)	**Baseline** (Ending Date 07/31/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	25	25	75	N/A	50
Energy Intensity					
Site (kBtu/ft²)	114	114	71	N/A	90
Source (kBtu/ft²)	182	182	113	N/A	145
Energy Cost					
$/year	$ 206,595.74	$ 206,595.74	$ 128,520.18	N/A	$ 164,331.32

$/ft2/year	$ 2.74	$ 2.74	$ 1.70	N/A	$ 2.18
Greenhouse Gas Emissions					
$MtCO_2e$/year	661	661	411	N/A	526
$kgCO_2e/ft^2$/year	9	9	6	N/A	7

More than 50% of your building is defined as K-12 School. Please note that your rating accounts for all of the spaces listed. The National Average column presents energy performance data your building would have if your building had an average rating of 50.

Notes:
o - This attribute is optional.
d - A default value has been supplied by Portfolio Manager.

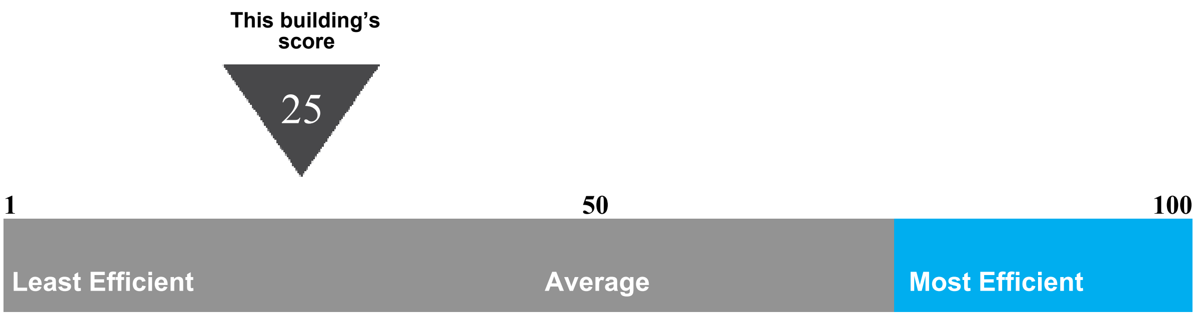
Statement of Energy Performance

2009

Lafayette Avenue School
221 Lafayette Ave
Chatham, NJ 07928

Portfolio Manager Building ID: 1830623

The energy use of this building has been measured and compared to other similar buildings using the Environmental Protection Agency's (EPA's) Energy Performance Scale of 1–100, with 1 being the least energy efficient and 100 the most energy efficient. For more information, visit energystar.gov/benchmark.



This building uses 182 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending July 2009

Buildings with a score of 75 or higher may qualify for EPA's ENERGY STAR.

I certify that the information contained within this statement is accurate and in accordance with U.S. Environmental Protection Agency's measurement standards, found at energystar.gov

Date of certification

EPA United States Environmental Protection Agency

Date Generated: 10/06/2009

CEG Job #:	9C09078	**DATE:**	11/3/2009
Project:	Chatham School District	**KWH COST:**	**$0.179**
Address:	221 Lafayette Avenue		
City:	Chatham		
Building SF:	75,268		

Lafayette Avenue School

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
2	Room 32	2080	15	3	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	82	1.23	2,558.4	$457.95	15	0	No Replacement	82	1.23	2558.4	$457.95	$0.00	$0.00	0.00	0	$0.00	0.00
2	Room 30	2080	15	3	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	82	1.23	2,558.4	$457.95	15	0	No Replacement	82	1.23	2558.4	$457.95	$0.00	$0.00	0.00	0	$0.00	0.00
2	Room 29	2080	15	3	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	82	1.23	2,558.4	$457.95	15	0	No Replacement	82	1.23	2558.4	$457.95	$0.00	$0.00	0.00	0	$0.00	0.00
4	Room 9	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	No Replacement	82	0.98	2046.72	$366.36	$0.00	$0.00	0.00	0	$0.00	0.00
4	Room 8	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	No Replacement	82	0.98	2046.72	$366.36	$0.00	$0.00	0.00	0	$0.00	0.00
1	Room 8	2080	4	2	T8 1x4 2 Lamps Electronic Ballast Pendant Parabolic	58	0.23	482.6	$86.38	4	0	No Replacement	58	0.23	482.56	$86.38	$0.00	$0.00	0.00	0	$0.00	0.00
3	Room 7	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$259.13	12	0	No Replacement	58	0.70	1447.68	$259.13	$0.00	$0.00	0.00	0	$0.00	0.00
3	Room 6	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$259.13	12	0	No Replacement	58	0.70	1447.68	$259.13	$0.00	$0.00	0.00	0	$0.00	0.00
3	Room 5	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$259.13	12	0	No Replacement	58	0.70	1447.68	$259.13	$0.00	$0.00	0.00	0	$0.00	0.00
3	Room 4	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$259.13	12	0	No Replacement	58	0.70	1447.68	$259.13	$0.00	$0.00	0.00	0	$0.00	0.00
3	Room 3	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$259.13	12	0	No Replacement	58	0.70	1447.68	$259.13	$0.00	$0.00	0.00	0	$0.00	0.00
3	Room 2	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$259.13	12	0	No Replacement	58	0.70	1447.68	$259.13	$0.00	$0.00	0.00	0	$0.00	0.00
3	Room 1	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$259.13	12	0	No Replacement	58	0.70	1447.68	$259.13	$0.00	$0.00	0.00	0	$0.00	0.00
5	Closet	520	1	1	Incadescent	100	0.10	52.0	$9.31	1	0	Eiko-30w mini sprial	30	0.03	15.6	$2.79	$6.00	$6.00	0.07	36.4	$6.52	0.92
2	Art Room	2080	20	3	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	82	1.64	3,411.2	$610.60	20	0	No Replacement	82	1.64	3411.2	$610.60	$0.00	$0.00	0.00	0	$0.00	0.00
4	Art Room	2080	3	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.25	511.7	$91.59	3	0	No Replacement	82	0.25	511.68	$91.59	$0.00	$0.00	0.00	0	$0.00	0.00
4	Office	2080	9	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.74	1,535.0	$274.77	9	0	No Replacement	82	0.74	1535.04	$274.77	$0.00	$0.00	0.00	0	$0.00	0.00
1	Office	2080	3	2	T8 1x4 2 Lamps Electronic Ballast Pendant Parabolic	58	0.17	361.9	$64.78	3	0	No Replacement	58	0.17	361.92	$64.78	$0.00	$0.00	0.00	0	$0.00	0.00
3	Faculty Room	2080	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.23	482.6	$86.38	4	0	No Replacement	58	0.23	482.56	$86.38	$0.00	$0.00	0.00	0	$0.00	0.00
8	Faculty Room	2080	2	2	2'x2' 2-Lamp T-8 U-Tube, Prism Lens Electronic Ballast	73	0.15	303.7	$54.36	2	2	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast, Architectural surface or Recessed static METALUX 2AC-217-UNV-EB81-U	34	0.07	141.44	$25.32	$204.00	$408.00	0.08	162.24	$29.04	14.05

4	Faculty Room	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	No Replacement	82	0.98	2046.72	$366.36	$0.00	$0.00	0.00	0	$0.00	0.00
6	Closet	520	1	1	Incandescent	120	0.12	62.4	$11.17	1	0	30 W CFL Lamp	30	0.03	15.6	$2.79	$8.88	$8.88	0.09	46.8	$8.38	1.06
7	Closet	520	1	1	Incandescent	150	0.15	78.0	$13.96	1	0	40 W CFL Lamp	40	0.04	20.8	$3.72	$9.60	$9.60	0.11	57.2	$10.24	0.94
1	Custodian Closet	520	2	2	T8 1x4 2 Lamps Electronic Ballast Pendant Parabolic	58	0.12	60.3	$10.80	2	0	No Replacement	58	0.12	60.32	$10.80	$0.00	$0.00	0.00	0	$0.00	0.00
5	Custodian Closet	520	1	1	Incadescent	100	0.10	52.0	$9.31	1	0	Eiko-30w mini sprial	30	0.03	15.6	$2.79	$6.00	$6.00	0.07	36.4	$6.52	0.92
10	Stairwell	8760	2	4	4' - 4 lamp T-8, Parabolic, Electronic Ballast	109	0.22	1,909.7	$341.83	2	3	4' - 3-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N SNF332	82	0.16	1436.64	$257.16	$143.00	$286.00	0.05	473.04	$84.67	3.38
1	Stairwell	8760	1	2	T8 1x4 2 Lamps Electronic Ballast Pendant Parabolic	58	0.06	508.1	$90.95	1	0	No Replacement	58	0.06	508.08	$90.95	$0.00	$0.00	0.00	0	$0.00	0.00
4	Stairwell	8760	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.49	4,309.9	$771.48	6	0	No Replacement	82	0.49	4309.92	$771.48	$0.00	$0.00	0.00	0	$0.00	0.00
9	Hallway	8760	15	3	2'x2' 3-Lamp T-8 twin-Tube, Prism Lens Electronic Ballast	108	1.62	14,191.2	$2,540.22	15	2	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast, Architectural surface or Recessed static METALUX 2AC-217-UNV-EB81-U	34	0.51	4467.6	$799.70	$204.00	$3,060.00	1.11	9723.6	$1,740.52	1.76
11	Hallway	8760	14	2	High Hat - CFL	26	0.36	3,188.6	$570.77	14	2	No Replacement	26	0.36	3188.64	$570.77	$0.00	$0.00	0.00	0	$0.00	0.00
3	Bathrooms	2600	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.23	603.2	$107.97	4	0	No Replacement	58	0.23	603.2	$107.97	$0.00	$0.00	0.00	0	$0.00	0.00
3	Closets	520	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.23	120.6	$21.59	4	0	No Replacement	58	0.23	120.64	$21.59	$0.00	$0.00	0.00	0	$0.00	0.00
4	Room 23	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	No Replacement	82	0.98	2046.72	$366.36	$0.00	$0.00	0.00	0	$0.00	0.00
4	Room 24	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	No Replacement	82	0.98	2046.72	$366.36	$0.00	$0.00	0.00	0	$0.00	0.00
4	Room 25	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	No Replacement	82	0.98	2046.72	$366.36	$0.00	$0.00	0.00	0	$0.00	0.00
3	Hallway	8760	21	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.22	10,669.7	$1,909.87	21	0	No Replacement	58	1.22	10669.68	$1,909.87	$0.00	$0.00	0.00	0	$0.00	0.00
12	Hallway	8760	3	6	4'x4' 6 lamp T8 Prism Lens Electronic Ballast	167	0.50	4,388.8	$785.59	3	6	No Replacement	167	0.50	4388.76	$785.59	$0.00	$0.00	0.00	0	$0.00	0.00
1	Boiler Room	2600	6	2	T8 1x4 2 Lamps Electronic Ballast Pendant Parabolic	58	0.35	904.8	$161.96	6	0	No Replacement	58	0.35	904.8	$161.96	$0.00	$0.00	0.00	0	$0.00	0.00
7	Boiler Room	2080	1	1	Incandescent	150	0.15	312.0	$55.85	1	0	40 W CFL Lamp	40	0.04	83.2	$14.89	$9.60	$9.60	0.11	228.8	$40.96	0.23
3	Closet	520	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	30.2	$5.40	1	0	No Replacement	58	0.06	30.16	$5.40	$0.00	$0.00	0.00	0	$0.00	0.00
2	Conference Room	8760	4	3	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	82	0.33	2,873.3	$514.32	4	0	No Replacement	82	0.33	2873.28	$514.32	$0.00	$0.00	0.00	0	$0.00	0.00
11	Conference Room	2080	3	2	High Hat - CFL	26	0.08	162.2	$29.04	3	2	No Replacement	26	0.08	162.24	$29.04	$0.00	$0.00	0.00	0	$0.00	0.00
3	Conference Room	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$21.59	1	0	No Replacement	58	0.06	120.64	$21.59	$0.00	$0.00	0.00	0	$0.00	0.00
1	Conference Room	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Pendant Parabolic	58	0.12	241.3	$43.19	2	0	No Replacement	58	0.12	241.28	$43.19	$0.00	$0.00	0.00	0	$0.00	0.00
2	SG1	2080	14	3	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	82	1.15	2,387.8	$427.42	14	0	No Replacement	82	1.15	2387.84	$427.42	$0.00	$0.00	0.00	0	$0.00	0.00
4	SG1	2080	2	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.16	341.1	$61.06	2	0	No Replacement	82	0.16	341.12	$61.06	$0.00	$0.00	0.00	0	$0.00	0.00
3	Bathrooms	2600	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.23	603.2	$107.97	4	0	No Replacement	58	0.23	603.2	$107.97	$0.00	$0.00	0.00	0	$0.00	0.00
4	Room 22	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	No Replacement	82	0.98	2046.72	$366.36	$0.00	$0.00	0.00	0	$0.00	0.00

4	Room 21	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	No Replacement	82	0.98	2046.72	$366.36	$0.00	$0.00	0.00	0	$0.00	0.00
4	Room 20	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	No Replacement	82	0.98	2046.72	$366.36	$0.00	$0.00	0.00	0	$0.00	0.00
4	Room 19	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	No Replacement	82	0.98	2046.72	$366.36	$0.00	$0.00	0.00	0	$0.00	0.00
12	Library Conference Rm	2080	4	6	4'x4' 6 lamp T8 Prism Lens Electronic Ballast	167	0.67	1,389.4	$248.71	4	6	No Replacement	167	0.67	1389.44	$248.71	$0.00	$0.00	0.00	0	$0.00	0.00
8	Library	2080	16	2	2'x2' 2-Lamp T-8 U-Tube, Prism Lens Electronic Ballast	73	1.17	2,429.4	$434.87	16	2	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast, Architectural surface or Recessed static METALUX 2AC-217-UNV-EB81-U	34	0.54	1131.52	$202.54	$204.00	$3,264.00	0.62	1297.92	$232.33	14.05
4	Library	2080	24	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	1.97	4,093.4	$732.73	24	0	No Replacement	82	1.97	4093.44	$732.73	$0.00	$0.00	0.00	0	$0.00	0.00
11	Library	2080	15	2	High Hat - CFL	26	0.39	811.2	$145.20	15	2	No Replacement	26	0.39	811.2	$145.20	$0.00	$0.00	0.00	0	$0.00	0.00
9	Boys Room	2600	5	3	2'x2' 3-Lamp T-8 twin-Tube, Prism Lens Electronic Ballast	108	0.54	1,404.0	$251.32	5	2	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast, Architectural surface or Recessed static METALUX 2AC-217-UNV-EB81-U	34	0.17	442	$79.12	$204.00	$1,020.00	0.37	962	$172.20	5.92
9	Girls Room	2600	5	3	2'x2' 3-Lamp T-8 twin-Tube, Prism Lens Electronic Ballast	108	0.54	1,404.0	$251.32	5	2	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast, Architectural surface or Recessed static METALUX 2AC-217-UNV-EB81-U	34	0.17	442	$79.12	$204.00	$1,020.00	0.37	962	$172.20	5.92
13	Room 33	2080	15	15	1'x20' 3 lamp/4' T8 electronic Ballast direct/indirect	410	6.15	12,792.0	$2,289.77	15	15	No Replacement	410	6.15	12792	$2,289.77	$0.00	$0.00	0.00	0	$0.00	0.00
13	Room 31	2080	15	15	1'x20' 3 lamp/4' T8 electronic Ballast direct/indirect	410	6.15	12,792.0	$2,289.77	15	15	No Replacement	410	6.15	12792	$2,289.77	$0.00	$0.00	0.00	0	$0.00	0.00
4	Room 10	2080	10	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.82	1,705.6	$305.30	10	0	No Replacement	82	0.82	1705.6	$305.30	$0.00	$0.00	0.00	0	$0.00	0.00
4	Room 11	2080	10	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.82	1,705.6	$305.30	10	0	No Replacement	82	0.82	1705.6	$305.30	$0.00	$0.00	0.00	0	$0.00	0.00
3	Boys Room	2600	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.17	452.4	$80.98	3	0	No Replacement	58	0.17	452.4	$80.98	$0.00	$0.00	0.00	0	$0.00	0.00
3	Girls Room	2600	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.17	452.4	$80.98	3	0	No Replacement	58	0.17	452.4	$80.98	$0.00	$0.00	0.00	0	$0.00	0.00
3	Custodial Closet	520	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	30.2	$5.40	1	0	No Replacement	58	0.06	30.16	$5.40	$0.00	$0.00	0.00	0	$0.00	0.00
3	Room 12	2080	10	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.58	1,206.4	$215.95	10	0	No Replacement	58	0.58	1206.4	$215.95	$0.00	$0.00	0.00	0	$0.00	0.00
4	Room 13	2080	10	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.82	1,705.6	$305.30	10	0	No Replacement	82	0.82	1705.6	$305.30	$0.00	$0.00	0.00	0	$0.00	0.00
4	Room 14	2080	10	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.82	1,705.6	$305.30	10	0	No Replacement	82	0.82	1705.6	$305.30	$0.00	$0.00	0.00	0	$0.00	0.00
8	Room 15	2080	16	2	2'x2' 2-Lamp T-8 U-Tube, Prism Lens Electronic Ballast	73	1.17	2,429.4	$434.87	16	2	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast, Architectural surface or Recessed static METALUX 2AC-217-UNV-EB81-U	34	0.54	1131.52	$202.54	$204.00	$3,264.00	0.62	1297.92	$232.33	14.05
4	Room 15	2080	2	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.16	341.1	$61.06	2	0	No Replacement	82	0.16	341.12	$61.06	$0.00	$0.00	0.00	0	$0.00	0.00
3	Boys Room	2600	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	301.6	$53.99	2	0	No Replacement	58	0.12	301.6	$53.99	$0.00	$0.00	0.00	0	$0.00	0.00

3	Girls Room	2600	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.17	452.4	$80.98	3	0	No Replacement	58	0.17	452.4	$80.98	$0.00	$0.00	0.00	0	$0.00	0.00
13	Room 15	2080	15	15	1'x20' 3 lamp/4' T8 electronic Ballast direct/indirect	410	6.15	12,792.0	$2,289.77	15	15	No Replacement	410	6.15	12792	$2,289.77	$0.00	$0.00	0.00	0	$0.00	0.00
5	Restroom	2600	1	1	Incadescent	100	0.10	260.0	$46.54	1	0	Eiko-30w mini sprial	30	0.03	78	$13.96	$6.00	$6.00	0.07	182	$32.58	0.18
4	Cafeteria	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	No Replacement	82	0.98	2046.72	$366.36	$0.00	$0.00	0.00	0	$0.00	0.00
14	Cafeteria	2080	15	4	2x4 4 lamp T-8	128	1.92	3,993.6	$714.85	15	4	No Replacement	128	1.92	3993.6	$714.85	$0.00	$0.00	0.00	0	$0.00	0.00
4	Music Tech	2080	16	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	1.31	2,729.0	$488.48	16	0	No Replacement	82	1.31	2728.96	$488.48	$0.00	$0.00	0.00	0	$0.00	0.00
15	Kitchen	2080	2	2	1'x8' 2-Lamp 75T12 Prismatic Lens Magnetic Ballast	158	0.32	657.3	$117.65	2	4	(2) 1'x4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	110	0.22	457.6	$81.91	$200.00	$400.00	0.10	199.68	$35.74	11.19
16	Kitchen	2080	2	1	4' - 1 lamp T-12, No Lens, Magnetic Ballast	57	0.11	237.1	$42.44	2	1	4' - 1-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N SNF132	28	0.06	116.48	$20.85	$123.00	$246.00	0.06	120.64	$21.59	11.39
3	Hallway	8760	13	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.75	6,605.0	$1,182.30	13	0	No Replacement	58	0.75	6605.04	$1,182.30	$0.00	$0.00	0.00	0	$0.00	0.00
8	Hallway	8760	1	2	2'x2' 2-Lamp T-8 U-Tube, Prism Lens Electronic Ballast	73	0.07	639.5	$114.47	1	2	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast, Architectural surface or Recessed static METALUX 2AC-217-UNV-EB81-U	34	0.03	297.84	$53.31	$204.00	$204.00	0.04	341.64	$61.15	3.34
3	Hallway	8760	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	10,161.6	$1,818.93	20	0	No Replacement	58	1.16	10161.6	$1,818.93	$0.00	$0.00	0.00	0	$0.00	0.00
11	Hallway	8760	2	2	High Hat - CFL	26	0.05	455.5	$81.54	2	2	No Replacement	26	0.05	455.52	$81.54	$0.00	$0.00	0.00	0	$0.00	0.00
4	Room 28	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.66	1,364.5	$244.24	8	0	No Replacement	82	0.66	1364.48	$244.24	$0.00	$0.00	0.00	0	$0.00	0.00
4	Room 27	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.66	1,364.5	$244.24	8	0	No Replacement	82	0.66	1364.48	$244.24	$0.00	$0.00	0.00	0	$0.00	0.00
4	Room 26	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	No Replacement	82	0.98	2046.72	$366.36	$0.00	$0.00	0.00	0	$0.00	0.00
3	Hallway	8760	14	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.81	7,113.1	$1,273.25	14	0	No Replacement	58	0.81	7113.12	$1,273.25	$0.00	$0.00	0.00	0	$0.00	0.00
4	Offices	2080	22	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	1.80	3,752.3	$671.67	22	0	No Replacement	82	1.80	3752.32	$671.67	$0.00	$0.00	0.00	0	$0.00	0.00
17	Custodial Closet	520	1	2	1'x4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	58	0.06	30.2	$5.40	1	2	No Replacement	58	0.06	30.16	$5.40	$0.00	$0.00	0.00	0	$0.00	0.00
4	Room 16	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	No Replacement	82	0.98	2046.72	$366.36	$0.00	$0.00	0.00	0	$0.00	0.00
4	Room 17	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	No Replacement	82	0.98	2046.72	$366.36	$0.00	$0.00	0.00	0	$0.00	0.00
4	Room 18	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	No Replacement	82	0.98	2046.72	$366.36	$0.00	$0.00	0.00	0	$0.00	0.00
19	Throughout	8760	25	0	Exit Sign - LED	4	0.10	876.0	$156.80	25	0	No Replacement	4	0.10	876	$156.80	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		812	264			74.43	206,404.5	$36,946.40	812	93			70.487	190276.2	$34,059.44		$13,218.08	3.94	16128.3	$2,886.96	4.58

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

CEG Job #:	9C09078
Project:	Chatham School District
Address:	221 Lafayette Avenue
City:	Chatham
Building SF:	75,268

Lafatette Avenue School

DATE: 11/3/2009
KWH COST: $0.179

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost INSTALLED	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
2	Room 32	2080	15	3	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	82	1.23	2,558.4	$457.95	15	0	Dual Technology Occupancy Sensor	82	1.23	10%	2302.56	$412.16	$0.00	$0.00	0.00	255.84	$45.80	0.00
2	Room 30	2080	15	3	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	82	1.23	2,558.4	$457.95	15	0	Dual Technology Occupancy Sensor	82	1.23	10%	2302.56	$412.16	$0.00	$0.00	0.00	255.84	$45.80	0.00
2	Room 29	2080	15	3	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	82	1.23	2,558.4	$457.95	15	0	Dual Technology Occupancy Sensor	82	1.23	10%	2302.56	$412.16	$0.00	$0.00	0.00	255.84	$45.80	0.00
4	Room 9	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$329.73	$0.00	$0.00	0.00	204.672	$36.64	0.00
4	Room 8	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$329.73	$0.00	$0.00	0.00	204.672	$36.64	0.00
1	Room 8	2080	4	2	T8 1x4 2 Lamps Electronic Ballast Pendant Parabolic	58	0.23	482.6	$86.38	4	0	Dual Technology Occupancy Sensor	58	0.23	10%	434.30	$77.74	$160.00	$160.00	0.00	48.256	$8.64	18.52
3	Room 7	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$259.13	12	0	Dual Technology Occupancy Sensor	58	0.70	10%	1302.91	$233.22	$160.00	$160.00	0.00	144.768	$25.91	6.17
3	Room 6	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$259.13	12	0	Dual Technology Occupancy Sensor	58	0.70	10%	1302.91	$233.22	$160.00	$160.00	0.00	144.768	$25.91	6.17
3	Room 5	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$259.13	12	0	Dual Technology Occupancy Sensor	58	0.70	10%	1302.91	$233.22	$0.00	$0.00	0.00	144.768	$25.91	0.00
3	Room 4	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$259.13	12	0	Dual Technology Occupancy Sensor	58	0.70	10%	1302.91	$233.22	$160.00	$160.00	0.00	144.768	$25.91	6.17
3	Room 3	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$259.13	12	0	Dual Technology Occupancy Sensor	58	0.70	10%	1302.91	$233.22	$160.00	$160.00	0.00	144.768	$25.91	6.17
3	Room 2	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$259.13	12	0	Dual Technology Occupancy Sensor	58	0.70	10%	1302.91	$233.22	$160.00	$160.00	0.00	144.768	$25.91	6.17
3	Room 1	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$259.13	12	0	Dual Technology Occupancy Sensor	58	0.70	10%	1302.91	$233.22	$0.00	$0.00	0.00	144.768	$25.91	0.00
5	Closet	520	1	1	Incadescent	100	0.10	52.0	$9.31	1	0	No Change	100	0.10	0%	52.00	$9.31	$0.00	$0.00	0.00	0	$0.00	0.00
2	Art Room	2080	20	3	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	82	1.64	3,411.2	$610.60	20	0	Dual Technology Occupancy Sensor	82	1.64	10%	3070.08	$549.54	$0.00	$0.00	0.00	341.12	$61.06	0.00
4	Art Room	2080	3	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.25	511.7	$91.59	3	0	Dual Technology Occupancy Sensor	82	0.25	10%	460.51	$82.43	$160.00	$160.00	0.00	51.168	$9.16	17.47
4	Office	2080	9	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.74	1,535.0	$274.77	9	0	Dual Technology Occupancy Sensor	82	0.74	10%	1381.54	$247.29	$160.00	$160.00	0.00	153.504	$27.48	5.82
1	Office	2080	3	2	T8 1x4 2 Lamps Electronic Ballast Pendant Parabolic	58	0.17	361.9	$64.78	3	0	Dual Technology Occupancy Sensor	58	0.17	10%	325.73	$58.31	$160.00	$160.00	0.00	36.192	$6.48	24.70
3	Faculty Room	2080	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.23	482.6	$86.38	4	0	Dual Technology Occupancy Sensor	58	0.23	10%	434.30	$77.74	$160.00	$160.00	0.00	48.256	$8.64	18.52
8	Faculty Room	2080	2	2	2'x2' 2-Lamp T-8 U-Tube, Prism Lens Electronic Ballast	73	0.15	303.7	$54.36	2	2	Dual Technology Occupancy Sensor	73	0.15	10%	273.31	$48.92	$0.00	$0.00	0.00	30.368	$5.44	0.00
4	Faculty Room	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$329.73	$0.00	$0.00	0.00	204.672	$36.64	0.00
6	Closet	520	1	1	Incandescent	120	0.12	62.4	$11.17	1	0	No Change	120	0.12	0%	62.40	$11.17	$0.00	$0.00	0.00	0	$0.00	0.00
7	Closet	520	1	1	Incandescent	150	0.15	78.0	$13.96	1	0	No Change	150	0.15	0%	78.00	$13.96	$160.00	$160.00	0.00	0	$0.00	0.00
1	Custodian Closet	520	2	2	T8 1x4 2 Lamps Electronic Ballast Pendant Parabolic	58	0.12	60.3	$10.80	2	0	No Change	58	0.12	0%	60.32	$10.80	$160.00	$160.00	0.00	0	$0.00	0.00
5	Custodian Closet	520	1	1	Incadescent	100	0.10	52.0	$9.31	1	0	No Change	100	0.10	0%	52.00	$9.31	$160.00	$160.00	0.00	0	$0.00	0.00
10	Stairwell	8760	2	4	4' - 4 lamp T-8, Parabolic, Electronic Ballast	109	0.22	1,909.7	$341.83	2	3	No Change	109	0.22	0%	1909.68	$341.83	$160.00	$160.00	0.00	0	$0.00	0.00
1	Stairwell	8760	1	2	T8 1x4 2 Lamps Electronic Ballast Pendant Parabolic	58	0.06	508.1	$90.95	1	0	No Change	58	0.06	0%	508.08	$90.95	$160.00	$160.00	0.00	0	$0.00	0.00

4	Stairwell	8760	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.49	4,309.9	$771.48	6	0	No Change	82	0.49	0%	4309.92	$771.48	$160.00	$160.00	0.00	0	$0.00	0.00
9	Hallway	8760	15	3	2'x2' 3-Lamp T-8 twin-Tube, Prism Lens Electronic Ballast	108	1.62	14,191.2	$2,540.22	15	2	No Change	108	1.62	0%	14191.20	$2,540.22	$160.00	$160.00	0.00	0	$0.00	0.00
11	Hallway	8760	14	2	High Hat - CFL	26	0.36	3,188.6	$570.77	14	2	No Change	26	0.36	0%	3188.64	$570.77	$160.00	$160.00	0.00	0	$0.00	0.00
3	Bathrooms	2600	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.23	603.2	$107.97	4	0	Dual Technology Occupancy Sensor	58	0.23	10%	542.88	$97.18	$160.00	$160.00	0.00	60.32	$10.80	14.82
3	Closets	520	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.23	120.6	$21.59	4	0	No Change	58	0.23	0%	120.64	$21.59	$160.00	$160.00	0.00	0	$0.00	0.00
4	Room 23	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$329.73	$160.00	$160.00	0.00	204.672	$36.64	4.37
4	Room 24	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$329.73	$160.00	$160.00	0.00	204.672	$36.64	4.37
4	Room 25	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$329.73	$160.00	$160.00	0.00	204.672	$36.64	4.37
3	Hallway	8760	21	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.22	10,669.7	$1,909.87	21	0	No Change	58	1.22	0%	10669.68	$1,909.87	$160.00	$160.00	0.00	0	$0.00	0.00
12	Hallway	8760	3	6	4'x4' 6 lamp T8 Prism Lens Electronic Ballast	167	0.50	4,388.8	$785.59	3	6	No Change	167	0.50	0%	4388.76	$785.59	$160.00	$160.00	0.00	0	$0.00	0.00
1	Boiler Room	2600	6	2	T8 1x4 2 Lamps Electronic Ballast Pendant Parabolic	58	0.35	904.8	$161.96	6	0	Dual Technology Occupancy Sensor	58	0.35	10%	814.32	$145.76	$160.00	$160.00	0.00	90.48	$16.20	9.88
7	Boiler Room	2080	1	1	Incandescent	150	0.15	312.0	$55.85	1	0	Dual Technology Occupancy Sensor	150	0.15	10%	280.80	$50.26	$160.00	$160.00	0.00	31.2	$5.58	28.65
3	Closet	520	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	30.2	$5.40	1	0	No Change	58	0.06	0%	30.16	$5.40	$0.00	$0.00	0.00	0	$0.00	0.00
2	Conference Room	8760	4	3	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	82	0.33	2,873.3	$514.32	4	0	Dual Technology Occupancy Sensor	82	0.33	10%	2585.95	$462.89	$0.00	$0.00	0.00	287.328	$51.43	0.00
11	Conference Room	2080	3	2	High Hat - CFL	26	0.08	162.2	$29.04	3	2	Dual Technology Occupancy Sensor	26	0.08	10%	146.02	$26.14	$160.00	$160.00	0.00	16.224	$2.90	55.09
3	Conference Room	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$21.59	1	0	Dual Technology Occupancy Sensor	58	0.06	10%	108.58	$19.44	$160.00	$160.00	0.00	12.064	$2.16	74.09
1	Conference Room	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Pendant Parabolic	58	0.12	241.3	$43.19	2	0	Dual Technology Occupancy Sensor	58	0.12	10%	217.15	$38.87	$160.00	$160.00	0.00	24.128	$4.32	37.05
2	SG1	2080	14	3	T8 1x4 3 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	82	1.15	2,387.8	$427.42	14	0	Dual Technology Occupancy Sensor	82	1.15	10%	2149.06	$384.68	$160.00	$160.00	0.00	238.784	$42.74	3.74
4	SG1	2080	2	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.16	341.1	$61.06	2	0	Dual Technology Occupancy Sensor	82	0.16	10%	307.01	$54.95	$0.00	$0.00	0.00	34.112	$6.11	0.00
3	Bathrooms	2600	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.23	603.2	$107.97	4	0	Dual Technology Occupancy Sensor	58	0.23	10%	542.88	$97.18	$160.00	$160.00	0.00	60.32	$10.80	14.82
4	Room 22	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$329.73	$160.00	$160.00	0.00	204.672	$36.64	4.37
4	Room 21	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$329.73	$160.00	$160.00	0.00	204.672	$36.64	4.37
4	Room 20	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$329.73	$160.00	$160.00	0.00	204.672	$36.64	4.37
4	Room 19	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$329.73	$160.00	$160.00	0.00	204.672	$36.64	4.37
12	Library Conference Rm	2080	4	6	4'x4' 6 lamp T8 Prism Lens Electronic Ballast	167	0.67	1,389.4	$248.71	4	6	Dual Technology Occupancy Sensor	167	0.67	10%	1250.50	$223.84	$160.00	$160.00	0.00	138.944	$24.87	6.43
8	Library	2080	16	2	2'x2' 2-Lamp T-8 U-Tube, Prism Lens Electronic Ballast	73	1.17	2,429.4	$434.87	16	2	Dual Technology Occupancy Sensor	73	1.17	10%	2186.50	$391.38	$0.00	$0.00	0.00	242.944	$43.49	0.00
4	Library	2080	24	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	1.97	4,093.4	$732.73	24	0	Dual Technology Occupancy Sensor	82	1.97	10%	3684.10	$659.45	$160.00	$160.00	0.00	409.344	$73.27	2.18
11	Library	2080	15	2	High Hat - CFL	26	0.39	811.2	$145.20	15	2	Dual Technology Occupancy Sensor	26	0.39	10%	730.08	$130.68	$160.00	$160.00	0.00	81.12	$14.52	11.02
9	Boys Room	2600	5	3	2'x2' 3-Lamp T-8 twin-Tube, Prism Lens Electronic Ballast	108	0.54	1,404.0	$251.32	5	2	Dual Technology Occupancy Sensor	108	0.54	10%	1263.60	$226.18	$160.00	$160.00	0.00	140.4	$25.13	6.37
9	Girls Room	2600	5	3	2'x2' 3-Lamp T-8 twin-Tube, Prism Lens Electronic Ballast	108	0.54	1,404.0	$251.32	5	2	Dual Technology Occupancy Sensor	108	0.54	10%	1263.60	$226.18	$160.00	$160.00	0.00	140.4	$25.13	6.37

13	Room 33	2080	15	15	1'x20' 3 lamp/4' T8 electronic Ballast direct/indirect	410	6.15	12,792.0	$2,289.77	15	15	Dual Technology Occupancy Sensor	410	6.15	10%	11512.80	$2,060.79	$160.00	$160.00	0.00	1279.2	$228.98	0.70
13	Room 31	2080	15	15	1'x20' 3 lamp/4' T8 electronic Ballast direct/indirect	410	6.15	12,792.0	$2,289.77	15	15	Dual Technology Occupancy Sensor	410	6.15	10%	11512.80	$2,060.79	$160.00	$160.00	0.00	1279.2	$228.98	0.70
4	Room 10	2080	10	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.82	1,705.6	$305.30	10	0	Dual Technology Occupancy Sensor	82	0.82	10%	1535.04	$274.77	$160.00	$160.00	0.00	170.56	$30.53	5.24
4	Room 11	2080	10	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.82	1,705.6	$305.30	10	0	Dual Technology Occupancy Sensor	82	0.82	10%	1535.04	$274.77	$160.00	$160.00	0.00	170.56	$30.53	5.24
3	Boys Room	2600	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.17	452.4	$80.98	3	0	Dual Technology Occupancy Sensor	58	0.17	10%	407.16	$72.88	$160.00	$160.00	0.00	45.24	$8.10	19.76
3	Girls Room	2600	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.17	452.4	$80.98	3	0	Dual Technology Occupancy Sensor	58	0.17	10%	407.16	$72.88	$160.00	$160.00	0.00	45.24	$8.10	19.76
3	Custodial Closet	520	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	30.2	$5.40	1	0	No Change	58	0.06	0%	30.16	$5.40	$160.00	$160.00	0.00	0	$0.00	0.00
3	Room 12	2080	10	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.58	1,206.4	$215.95	10	0	Dual Technology Occupancy Sensor	58	0.58	10%	1085.76	$194.35	$160.00	$160.00	0.00	120.64	$21.59	7.41
4	Room 13	2080	10	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.82	1,705.6	$305.30	10	0	Dual Technology Occupancy Sensor	82	0.82	10%	1535.04	$274.77	$160.00	$160.00	0.00	170.56	$30.53	5.24
4	Room 14	2080	10	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.82	1,705.6	$305.30	10	0	Dual Technology Occupancy Sensor	82	0.82	10%	1535.04	$274.77	$160.00	$160.00	0.00	170.56	$30.53	5.24
8	Room 15	2080	16	2	2'x2' 2-Lamp T-8 U-Tube, Prism Lens Electronic Ballast	73	1.17	2,429.4	$434.87	16	2	Dual Technology Occupancy Sensor	73	1.17	10%	2186.50	$391.38	$0.00	$0.00	0.00	242.944	$43.49	0.00
4	Room 15	2080	2	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.16	341.1	$61.06	2	0	Dual Technology Occupancy Sensor	82	0.16	10%	307.01	$54.95	$160.00	$160.00	0.00	34.112	$6.11	26.20
3	Boys Room	2600	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	301.6	$53.99	2	0	Dual Technology Occupancy Sensor	58	0.12	10%	271.44	$48.59	$160.00	$160.00	0.00	30.16	$5.40	29.64
3	Girls Room	2600	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.17	452.4	$80.98	3	0	Dual Technology Occupancy Sensor	58	0.17	10%	407.16	$72.88	$0.00	$0.00	0.00	45.24	$8.10	0.00
13	Room 15	2080	15	15	1'x20' 3 lamp/4' T8 electronic Ballast direct/indirect	410	6.15	12,792.0	$2,289.77	15	15	Dual Technology Occupancy Sensor	410	6.15	10%	11512.80	$2,060.79	$160.00	$160.00	0.00	1279.2	$228.98	0.70
5	Restroom	2600	1	1	Incadescent	100	0.10	260.0	$46.54	1	0	Dual Technology Occupancy Sensor	100	0.10	10%	234.00	$41.89	$160.00	$160.00	0.00	26	$4.65	34.38
18	Gym	2080	18	1	Metal Halide -High-Bay Fixture	292	5.26	10,932.5	$1,956.91	18	0	Dual Technology Occupancy Sensor	292	5.26	10%	9839.23	$1,761.22	$160.00	$160.00	0.00	1093.248	$195.69	0.82
4	Cafeteria	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$329.73	$160.00	$160.00	0.00	204.672	$36.64	4.37
14	Cafeteria	2080	15	4	2x4 4 lamp T-8	128	1.92	3,993.6	$714.85	15	4	Dual Technology Occupancy Sensor	128	1.92	10%	3594.24	$643.37	$160.00	$160.00	0.00	399.36	$71.49	2.24
4	Music Tech	2080	16	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	1.31	2,729.0	$488.48	16	0	Dual Technology Occupancy Sensor	82	1.31	10%	2456.06	$439.64	$160.00	$160.00	0.00	272.896	$48.85	3.28
15	Kitchen	2080	2	2	1'x8' 2-Lamp 75T12 Prismatic Lens Magnetic	158	0.32	657.3	$117.65	2	4	Dual Technology Occupancy Sensor	158	0.32	10%	591.55	$105.89	$160.00	$160.00	0.00	65.728	$11.77	13.60
16	Kitchen	2080	2	1	4' - 1 lamp T-12, No Lens, Magnetic Ballast	57	0.11	237.1	$42.44	2	0	Dual Technology Occupancy Sensor	57	0.11	10%	213.41	$38.20	$160.00	$160.00	0.00	23.712	$4.24	37.70
3	Hallway	8760	13	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.75	6,605.0	$1,182.30	13	0	No Change	58	0.75	0%	6605.04	$1,182.30	$160.00	$160.00	0.00	0	$0.00	0.00
8	Hallway	8760	1	2	2'x2' 2-Lamp T-8 U-Tube, Prism Lens Electronic Ballast	73	0.07	639.5	$114.47	1	2	No Change	73	0.07	0%	639.48	$114.47	$160.00	$160.00	0.00	0	$0.00	0.00
3	Hallway	8760	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	10,161.6	$1,818.93	20	0	No Change	58	1.16	0%	10161.60	$1,818.93	$160.00	$160.00	0.00	0	$0.00	0.00
11	Hallway	8760	2	2	High Hat - CFL	26	0.05	455.5	$81.54	2	2	No Change	26	0.05	0%	455.52	$81.54	$160.00	$160.00	0.00	0	$0.00	0.00
4	Room 28	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.66	1,364.5	$244.24	8	0	Dual Technology Occupancy Sensor	82	0.66	10%	1228.03	$219.82	$0.00	$0.00	0.00	136.448	$24.42	0.00
4	Room 27	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.66	1,364.5	$244.24	8	0	Dual Technology Occupancy Sensor	82	0.66	10%	1228.03	$219.82	$0.00	$0.00	0.00	136.448	$24.42	0.00
4	Room 26	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$329.73	$0.00	$0.00	0.00	204.672	$36.64	0.00
3	Hallway	8760	14	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.81	7,113.1	$1,273.25	14	0	No Change	58	0.81	0%	7113.12	$1,273.25	$0.00	$0.00	0.00	0	$0.00	0.00

4	Offices	2080	22	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	1.80	3,752.3	$671.67	22	0	Dual Technology Occupancy Sensor	82	1.80	10%	3377.09	$604.50	$160.00	$160.00	0.00	375.232	$67.17	2.38
17	Custodial Closet	520	1	2	1'x4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	58	0.06	30.2	$5.40	1	2	Dual Technology Occupancy Sensor	58	0.06	10%	27.14	$4.86	$160.00	$160.00	0.00	3.016	$0.54	296.37
4	Room 16	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$329.73	$160.00	$160.00	0.00	204.672	$36.64	4.37
4	Room 17	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$329.73	$160.00	$160.00	0.00	204.672	$36.64	4.37
4	Room 18	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$366.36	12	0	Dual Technology Occupancy Sensor	82	0.98	10%	1842.05	$329.73	$160.00	$160.00	0.00	204.672	$36.64	4.37
19	Throughout	8760	25	0	Exit Sign - LED	4	0.10	876.0	$156.80	25	0	No Change	4	0.10	0%	876.00	$156.80	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		830	265			79.69	217,337.0	$38,903.32	830	92			79.686		202,153.50	$36,185.48		$11,200.00	0.00	15183.5	$2,717.84	4.12

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

CEG Job #: 9C09078
Project: Chatham School District
Address: 221 Lafayette Avenue
City: Chatham
Building SF: 75,268

Lafayette School

DATE: 11/3/2009
KWH COST: $0.179

ECM #3: Lighting Upgrade - Gym

EXISTING LIGHTING										PROPOSED LIGHTING										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
18	Gym	2080	18	1	Metal Halide -High-Bay Fixture	292	5.26	10,932.5	$1,956.91	18	3	3-Lamp T-5 HO Cooper F-Bay	182	3.28	6814.08	$1,219.72	$300.00	$5,400.00	1.98	4118.4	$737.19	7.33
	Totals		18	1			5.26	10,932.5	$1,956.91	18	3			3.276	6814.08	$1,219.72		$5,400.00	1.98	4118.4	$737.19	7.33

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

Project Name: LGEA Solar PV Project - Lafayette Avenue School
Location: Chatham, NJ
Description: Photovoltaic System 95% Financing - 25 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 25 year
Total Construction Cost	$904,590
Annual kWh Production	125,300
Annual Energy Cost Reduction	$22,429
Annual SREC Revenue	$43,855
First Cost Premium	**$904,590**
Simple Payback:	**13.65** Years

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	95%
Financing Term (mths):	240	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.179**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	7.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$45,230	0	0	0	$0	0	0	(45,230)	0
1	$0	125,300	$22,429	$0	$43,855	$59,508	$20,444	($13,668)	($58,897)
2	$0	124,674	$23,102	$0	$43,636	$58,030	$21,922	($13,214)	($72,111)
3	$0	124,050	$23,795	$0	$43,418	$56,445	$23,506	($12,739)	($84,850)
4	$0	123,430	$24,508	$0	$43,200	$54,746	$25,206	($12,242)	($97,093)
5	$0	122,813	$25,244	$1,265	$42,984	$52,924	$27,028	($12,988)	($110,081)
6	$0	122,199	$26,001	$1,259	$42,770	$50,970	$28,982	($12,439)	($122,520)
7	$0	121,588	$26,781	$1,252	$42,556	$48,875	$31,077	($11,867)	($134,387)
8	$0	120,980	$27,584	$1,246	$42,343	$46,628	$33,323	($11,270)	($145,658)
9	$0	120,375	$28,412	$1,240	$42,131	$44,219	$35,732	($10,648)	($156,306)
10	$0	119,773	$29,264	$1,234	$41,921	$41,636	$38,315	($10,000)	($166,306)
11	$0	119,174	$30,142	$1,227	$41,711	$38,866	$41,085	($9,326)	($175,631)
12	$0	118,578	$31,047	$1,221	$41,502	$35,896	$44,055	($8,624)	($184,255)
13	$0	117,985	$31,978	$1,215	$41,295	$32,712	$47,240	($7,894)	($192,149)
14	$0	117,395	$32,937	$1,209	$41,088	$29,297	$50,655	($7,135)	($199,284)
15	$0	116,808	$33,925	$1,203	$40,883	$25,635	$54,317	($6,346)	($205,630)
16	$0	116,224	$34,943	$1,197	$40,679	$21,708	$58,243	($5,527)	($211,156)
17	$0	115,643	$35,991	$1,191	$40,475	$17,498	$62,454	($4,676)	($215,832)
18	$0	115,065	$37,071	$1,185	$40,273	$12,983	$66,968	($3,793)	($219,625)
19	$0	114,490	$38,183	$1,179	$40,071	$8,142	$71,810	($2,876)	($222,501)
20	$0	113,917	$39,329	$1,173	$39,871	$2,951	$77,001	($1,925)	($224,426)
21	$0	113,348	$40,509	$1,167	$39,672	$2,502	$70,787	$5,724	($218,701)
22	$0	112,781	$41,724	$1,162	$39,473	$1,712	$58,251	$20,072	($198,629)
23	$0	112,217	$42,976	$1,156	$39,276	$0	$0	$81,096	($117,533)
24	$0	111,656	$44,265	$1,150	$39,080	$0	$0	$82,195	($35,339)
25	$0	111,098	$45,593	$1,144	$38,884	$0	$0	$83,333	$47,994
	Totals:	2,951,561	$0	$25,277	$1,033,046	$743,880	$988,399	$93,224	($3,720,906)
				Net Present Value (NPV)				**($86,839)**	
				Internal Rate of Return (IRR)				**1.1%**	

Project Name: LGEA Solar PV Project - Lafayette Avenue School
Location: Chatham, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

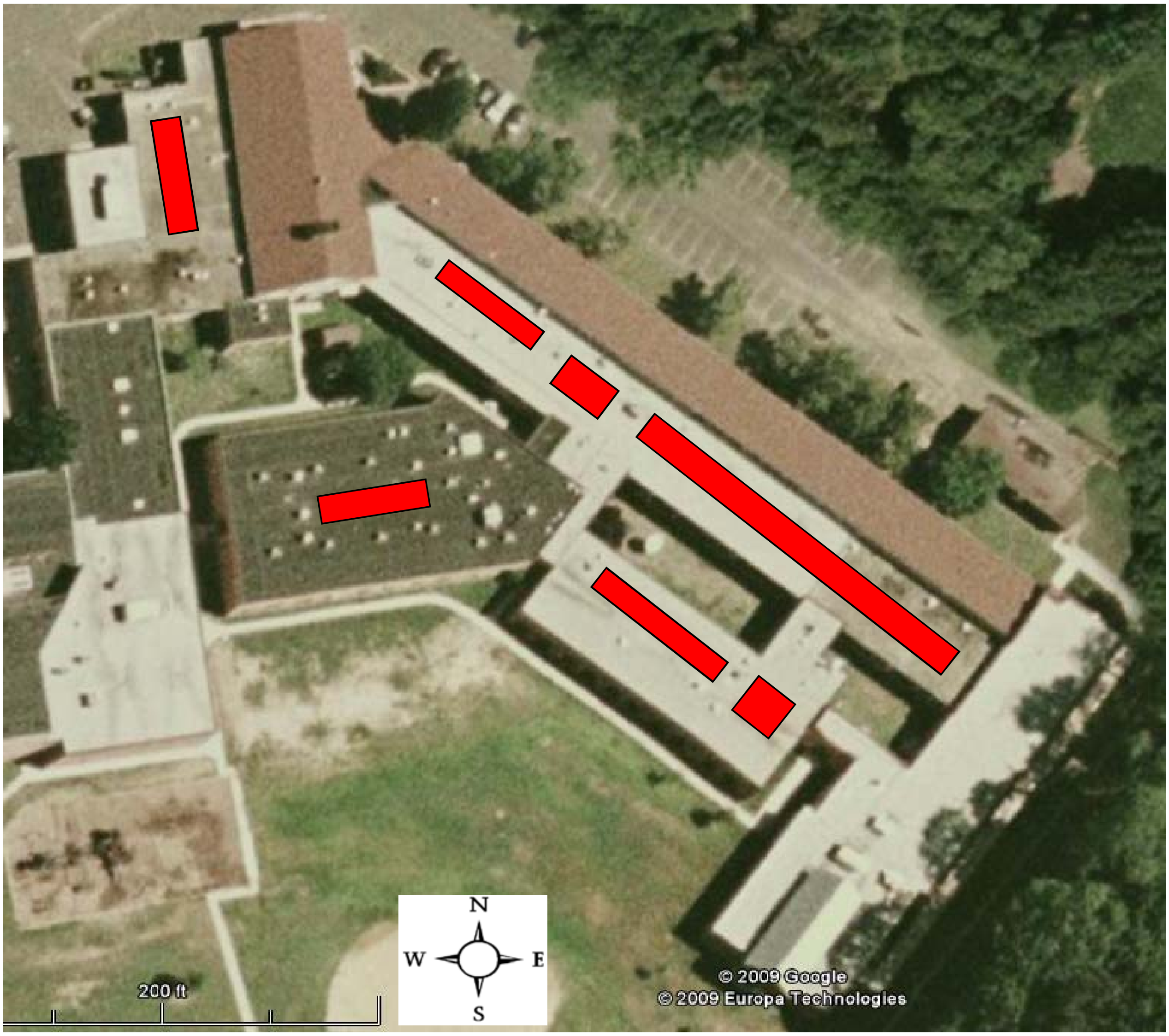
	Photovoltaic System - Direct Purchase
Total Construction Cost	$904,590
Annual kWh Production	125,300
Annual Energy Cost Reduction	$22,429
Annual SREC Revenue	$43,855
First Cost Premium	**$904,590**
Simple Payback:	**13.65** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.179**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Cumulative Cash Flow
0	$904,590	0	0	0	$0	(904,590)	0
1	$0	125,300	$22,429	$0	$43,855	$66,284	($838,306)
2	$0	124,674	$23,102	$0	$43,636	$66,737	($771,569)
3	$0	124,050	$23,795	$0	$43,418	$67,212	($704,357)
4	$0	123,430	$24,508	$0	$43,200	$67,709	($636,648)
5	$0	122,813	$25,244	$1,265	$42,984	$66,963	($569,685)
6	$0	122,199	$26,001	$1,259	$42,770	$67,512	($502,173)
7	$0	121,588	$26,781	$1,252	$42,556	$68,084	($434,088)
8	$0	120,980	$27,584	$1,246	$42,343	$68,681	($365,407)
9	$0	120,375	$28,412	$1,240	$42,131	$69,303	($296,104)
10	$0	119,773	$29,264	$1,234	$41,921	$69,951	($226,153)
11	$0	119,174	$30,142	$1,227	$41,711	$70,626	($155,527)
12	$0	118,578	$31,047	$1,221	$41,502	$71,328	($84,199)
13	$0	117,985	$31,978	$1,215	$41,295	$72,058	($12,142)
14	$0	117,395	$32,937	$1,209	$41,088	$72,817	$60,675
15	$0	116,808	$33,925	$1,203	$40,883	$73,605	$134,280
16	$0	116,224	$34,943	$1,197	$40,679	$74,425	$208,705
17	$0	115,643	$35,991	$1,191	$40,475	$75,275	$283,980
18	$0	115,065	$37,071	$1,185	$40,273	$76,159	$360,139
19	$0	114,490	$38,183	$1,179	$40,071	$77,076	$437,215
20	$0	113,917	$39,329	$1,173	$39,871	$78,027	$515,241
21	$1	113,348	$40,509	$1,167	$39,672	$79,013	$594,254
22	$2	112,781	$41,724	$1,162	$39,473	$80,036	$674,290
23	$3	112,217	$42,976	$1,156	$39,276	$81,096	$755,386
24	$4	111,656	$44,265	$1,150	$39,080	$82,195	$837,580
25	$5	111,098	$45,593	$1,144	$38,884	$83,333	$920,913
	Totals:	2,951,561	$817,734	$25,277	$1,033,046	$1,825,503	$186,298
					Net Present Value (NPV)	**$920,938**	
					Internal Rate of Return (IRR)	**6.0%**	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Lafayette	6422	Sunpower SPR230	437	14.7	6,426	100.51	125,300	14,421	15.64



.= Proposed PV Layout

Notes:

1. Estimated kWH based on the National Renewable Energy Laboratory PVWatts Version 1 Calculator Program.

PVWatts Version 1 Input Screen

PV System Specifications:

DC Rating (kW):	100.51	Inputted From Roof Space Cell "G2" Total KW
DC to AC Derate Factor:	0.81	Inputted From Derate Factor Calculated Below in Cell "B37"
Array Type:	Fixed Tilt 1 - Axis Tracking 2 - Axis Tracking	There are 3 inputs for Array Type in all cases you should be using **Fixed Tilt** as the Selection

Fixed Tilt of Single Axis Tracking System:

Array Tilt (degrees):	10	Based on Roof Type: For Flat Roof use 10 degrees, For Pitched Roof this is based on roof pitch.
Array Azimuth (degrees):	180	Based on Direction Array is Facing.

PV Watts Derate Factor for AC Power Rating at STC

Component Derate Factors	PVWatts Default	Range
PV module nameplate DC rating	1.00	0.80–1.05
Inverter and transformer	0.95	0.88–0.96
Mismatch	0.98	0.97–0.995
Diodes and connections	1.00	0.99–0.997
DC wiring	0.98	0.97–0.99
AC wiring	0.99	0.98–0.993
Soiling	0.95	0.30–0.995
System availability	0.95	0.00–0.995
Shading	1.00	0.00–1.00
Sun-tracking	1.00	0.95–1.00
Age	1.00	0.70–1.00
Overall DC-to-AC derate factor	**0.81**	0.96001–0.09999

PV Watts

Click on **Calculate** if default values are acceptable, or after selecting your system specifications. Click on **Help** for information about system specifications. To use a DC to AC derate factor other than the default, click on **Derate Factor Help** for information.

Station Identification:

WBAN Number:	14734
City:	Newark
State:	New_Jersey

PV System Specifications:

DC Rating (kW):	100.51	
DC to AC Derate Factor:	.81	DERATE FACTOR HELP
Array Type:	Fixed Tilt	

Fixed Tilt or 1-Axis Tracking System:

Array Tilt (degrees):	40.7	(Default = Latitude)
Array Azimuth (degrees):	180.0	(Default = South)

Energy Data:

Cost of Electricity (cents/kWh): .179

Calculate HELP Reset Form

Please send questions and comments to Webmaster

RReDC

Return to RREDC Home Page (*http://rredc.nrel.gov/*)

AC Energy & Cost Savings

PVWatts * * * Cautions for Interpreting the Results

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	100.5 kW
DC to AC Derate Factor:	0.810
AC Rating:	81.4 kW
Array Type:	Fixed Tilt
Array Tilt:	40.7°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	0.2 ¢/kWh

Results			
Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	3.36	8767	15.69
2	4.05	9463	16.94
3	4.58	11476	20.54
4	4.84	11221	20.09
5	5.30	12367	22.14
6	5.33	11673	20.89
7	5.27	11788	21.10
8	5.25	11659	20.87
9	5.06	11303	20.23
10	4.46	10646	19.06
11	3.15	7603	13.61
12	2.87	7335	13.13
Year	4.46	125300	224.29

Output Hourly Performance Data * Output Results as Text

About the Hourly Performance Data

Saving Text from a Browser

Run PVWATTS v.1 for another US location or an International location
Run PVWATTS v.2 (US only)

Please send questions and comments regarding PVWATTS to Webmaster

RReDC Return to RReDC home page (*http://rredc.nrel.gov*)

ENERGY AUDIT – FINAL REPORT

SCHOOL DISTRICT OF THE CHATHAMS
MILTON AVENUE SCHOOL

16 MILTON AVENUE
CHATHAM, NJ 07928
ATTN: RALPH GOODWIN
SCHOOL BUSINESS ADMINISTRATOR BOARD SECRETARY

CEG PROJECT NO. 9C09078

CONCORD ENGINEERING GROUP

520 SOUTH BURNT MILL ROAD
VOORHEES, NJ 08043
TELEPHONE: (856) 427-0200
FACSIMILE: (856) 427-6529
WWW.CEG-INC.NET

CONTACT: MICHAEL FISCHETTE, PRESIDENT
EMAIL: mfischette@ceg-inc.net

Table of Contents

REPORT DISCLAIMER

The information contained within this report, including any attachment(s), is intended solely for use by the named addressee(s). If you are not the intended recipient, or a person designated as responsible for delivering such messages to the intended recipient, you are not authorized to disclose, copy, distribute or retain this report, in whole or in part, without written authorization from Concord Engineering Group, Inc., 520 S. Burnt Mill Road, Voorhees, NJ 08043.

This report may contain proprietary, confidential or privileged information. If you have received this report in error, please notify the sender immediately. Thank you for your anticipated cooperation.

I. EXECUTIVE SUMMARY

This report presents the findings of the energy audit conducted for:

Chatham Township
Milton Avenue School
16 Milton Avenue
Chatham, NJ 07928

Municipal Contact Person: Ralph Goodwin
Facility Contact Person: John Cataldo

This audit is performed in connection with the New Jersey Clean Energy - Local Government Energy Audit Program. The energy audit is conducted to promote the mission of the office of Clean Energy, which is to use innovation and technology to solve energy and environmental problems in a way that improves the State's economy. This can be achieved through the wiser and more efficient use of energy.

The annual energy costs at this facility are as follows:

Electricity	$ 25,382
Natural Gas	$ 42,999
Total	$ 68,381

The potential annual energy cost savings for each energy conservation measure (ECM) and renewable energy measure (REM) are shown below in Table 1. <u>Be aware that the ECM's are not additive because of the interrelation of some of the measures.</u> This audit is consistent with an ASHRAE level 2 audit. The cost and savings for each measure is ± 20%. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

Table 1
Financial Summary Table

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Lighting Upgrade – General	$684	$77	8.9	68.5%
ECM #2	Lightinf Controls	$5,300	$777	6.8	119.8%
ECM #3	Lighting Upgrade - Gym	$3,000	$400	7.5	233.6%
ECM #4	LED Exit Sign	$46	$47	1.0	2443.5%
ECM #5	Domestic Water Heater Replacement	$6,950	$128	54.3	-77.9%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	21.16 KW PV System	$190,440	$12,820	14.9	68.3%

Notes: A. Cost takes into consideration applicable NJ Smart StartTM incentives.
B. Savings takes into consideration applicable maintenance savings.

The estimated demand and energy savings for each ECM and REM is shown below in Table 2. The information in this table corresponds to the ECM's and REM's in Table 1.

Table 2
Estimated Energy Savings Summary Table

ENERGY CONSERVATION MEASURES (ECM's)				
		ANNUAL UTILITY REDUCTION		
ECM NO.	DESCRIPTION	ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	Lighting Upgrade – General	0.5	387	-
ECM #2	Lightinf Controls	0	5,392	-
ECM #3	Lighting Upgrade - Gym	1	2,746	-
ECM #4	LED Exit Sign	0	228	-
ECM #5	Domestic Water Heater Replacement	-	-	83
RENEWABLE ENERGY MEASURES (REM's)				
		ANNUAL UTILITY REDUCTION		
ECM NO.	DESCRIPTION	ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	21.16 KW PV System	23.69	29,054	0

*Elec. Demand Savings are calculated for cooling season only. Elec. consumption savings are totaled annually.

Concord Engineering Group (CEG) recommends proceeding with the implementation of all ECM's that provide a calculated simple payback at or under ten (10) years. The following Energy Conservation Measures are recommended for the facility:

- **ECM #1:** Lighting Upgrade - General
- **ECM #2:** Lighting Controls
- **ECM#3:** Lighting Upgrade - Gym
- **ECM #4:** LED Exit Sign

Although ECM #5 does not provide a payback less than 10 years, it is recommended to proceed with the installation of an efficient water heater unit as suggested in ECM #5 (or equal) for the Milton Avenue School, since the existing water heater is past its expected lifespan.

In addition to the ECMs, there are maintenance and operational measures that can provide significant energy savings and provide immediate benefit. The ECMs listed above represent investments that can be made to the facility which are justified by the savings seen overtime. However, the maintenance items and small operational improvements below are typically achievable with on site staff or maintenance contractors and in turn have the potential to provide substantial operational savings compared to the costs associated. The following are recommendations which should be considered a priority in achieving an energy efficient building:

1. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.
2. Maintain all weather stripping on entrance doors.
3. Clean all light fixtures to maximize light output.
4. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

II. INTRODUCTION

The comprehensive energy audit covers the 37,964 square foot Milton Avenue School, which classrooms, auditorium, library, gymnasiums, locker rooms, cafeteria and offices.

Electrical and natural gas utility information is collected and analyzed for one full year's energy use of the building. The utility information allows for analysis of the building's operational characteristics; calculate energy benchmarks for comparison to industry averages, estimated savings potential, and baseline usage/cost to monitor the effectiveness of implemented measures. A computer spreadsheet is used to calculate benchmarks and to graph utility information (see the utility profiles below).

The Energy Use Index (EUI) is established for the building. Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year (BTU/ft^2/yr), which is used to compare energy consumption to similar building types or to track consumption from year to year in the same building. The EUI is calculated by converting the annual consumption of all energy sources to BTU's and dividing by the area (gross square footage) of the building. Blueprints (where available) are utilized to verify the gross area of the facility. The EUI is a good indicator of the relative potential for energy savings. A low EUI indicates less potential for energy savings, while a high EUI indicates poor building performance therefore a high potential for energy savings.

Existing building architectural and engineering drawings (where available) are utilized for additional background information. The building envelope, lighting systems, HVAC equipment, and controls information gathered from building drawings allow for a more accurate and detailed review of the building. The information is compared to the energy usage profiles developed from utility data. Through the review of the architectural and engineering drawings a building profile can be defined that documents building age, type, usage, major energy consuming equipment or systems, etc.

The preliminary audit information is gathered in preparation for the site survey. The site survey provides critical information in deciphering where energy is spent and opportunities exist within a facility. The entire site is surveyed to inventory the following to gain an understanding of how each facility operates:

- Building envelope (roof, windows, etc.)
- Heating, ventilation, and air conditioning equipment (HVAC)
- Lighting systems and controls
- Facility-specific equipment

The building site visit is performed to survey all major building components and systems. The site visit includes detailed inspection of energy consuming components. Summary of building occupancy schedules, operating and maintenance practices, and energy management programs provided by the building manager are collected along with the system and components to determine a more accurate impact on energy consumption.

III. METHOD OF ANALYSIS

Post site visit work includes evaluation of the information gathered, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on HVAC, lighting and building envelope improvements. Data collected is processed using energy engineering calculations to anticipate energy usage for each of the proposed energy conservation measures (ECMs). The actual building's energy usage is entered directly from the utility bills provided by the owner. The anticipated energy usage is compared to the historical data to determine energy savings for the proposed ECMs.

It is pertinent to note, that the savings noted in this report are not additive. The savings for each recommendation is calculated as standalone energy conservation measures. Implementation of more than one ECM may in some cases affect the savings of each ECM. The savings may in some cases be relatively higher if an individual ECM is implemented in lieu of multiple recommended ECMs. For example implementing reduced operating schedules for inefficient lighting will result in a greater relative savings. Implementing reduced operating schedules for newly installed efficient lighting will result in a lower relative savings, because there is less energy to be saved. If multiple ECM's are recommended to be implemented, the combined savings is calculated and identified appropriately.

ECMs are determined by identifying the building's unique properties and deciphering the most beneficial energy saving measures available that meet the specific needs of the facility. The building construction type, function, operational schedule, existing conditions, and foreseen future plans are critical in the evaluation and final recommendations. Energy savings are calculated base on industry standard methods and engineering estimations. Energy consumption is calculated based on manufacturer's cataloged information when new equipment is proposed.

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment costs to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers. The NJ Smart Start Building® program incentives savings (where applicable) are included for the appropriate ECM's and subtracted from the installed cost. Maintenance savings are calculated where applicable and added to the energy savings for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The costs and savings are applied and a simple payback, simple lifetime savings, and simple return on investment are calculated. See below for calculation methods:

ECM Calculation Equations:

$$Simple\ Payback = \left(\frac{Net\ Cost}{Yearly\ Savings} \right)$$

$$Simple\ Lifetime\ Savings = \left(Yearly\ Savings \times ECM\ Lifetime \right)$$

$$Simple\ Lifetime\ ROI = \frac{(Simple\ Lifetime\ Savings - Net\ Cost)}{Net\ Cost}$$

$$Lifetime\ Maintenance\ Savings = \left(Yearly\ Maintenance\ Savings \times ECM\ Lifetime \right)$$

$$Internal\ Rate\ of\ Return = \sum_{n=0}^{N} \left(\frac{Cash\ Flow\ of\ Period}{(1 + IRR)^n} \right)$$

$$Net\ Present\ Value = \sum_{n=0}^{N} \left(\frac{Cash\ Flow\ of\ Period}{(1 + DR)^n} \right)$$

Net Present Value calculations based on Interest Rate of 3%.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

The energy usage for the facility has been tabulated and plotted in graph form as depicted within this section. Each energy source has been identified and monthly consumption and cost noted per the information provided by the Owner.

The electric usage profile (below) represents the actual electrical usage for the facility. Jersey Central Power and Light (JCP&L) provides electricity to the facility under their General Service Secondary Three-Phase rate structure. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile shows the actual natural gas energy usage for the facility. Public Service Electric and Gas (PSE&G) provides natural gas to the facility under the Large Volume Gas (LVG) rate structure. In addition to PSE&G providing primary service, HESS is a third party supplier for Milton Avenue School. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

The overall cost for utilities is calculated by dividing the total cost by the total usage. Based on the utility history provide, the average cost for utilities at this facility is as follows:

Description	Average
Electricity	14.4¢ / kWh
Natural Gas	$1.542 / Therm

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: JCP&L
Rate: General Service Secondary 3 Phase
Meter No: G21077377
Customer ID No: 0801577897 0006273672
Third Party Utility N/A
TPS Meter / Acct No: 10 00 48 4135 0 2

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Sep-08	13,680	110.2	$2,929
Oct-08	21,480	113.9	$3,656
Nov-08	11,760	99.1	$2,246
Dec-08	16,560	113.9	$2,699
Jan-09	13,440	113.9	$2,335
Feb-09	15,240	113.9	$2,606
Mar-09	14,760	113.9	$2,512
Apr-09	16,560	67.7	$2,778
May-09	13,080	82.6	$944
Jun-09	15,120	67.3	$942
Jul-09	13,560	80.4	$984
Aug-09	11,280	113.9	$752
Totals	**176,520**	**113.9 Max**	**$25,382**

AVERAGE DEMAND **99.2 KW average**

AVERAGE RATE **$0.144 $/kWh**

Figure 1
Electricity Usage Profile

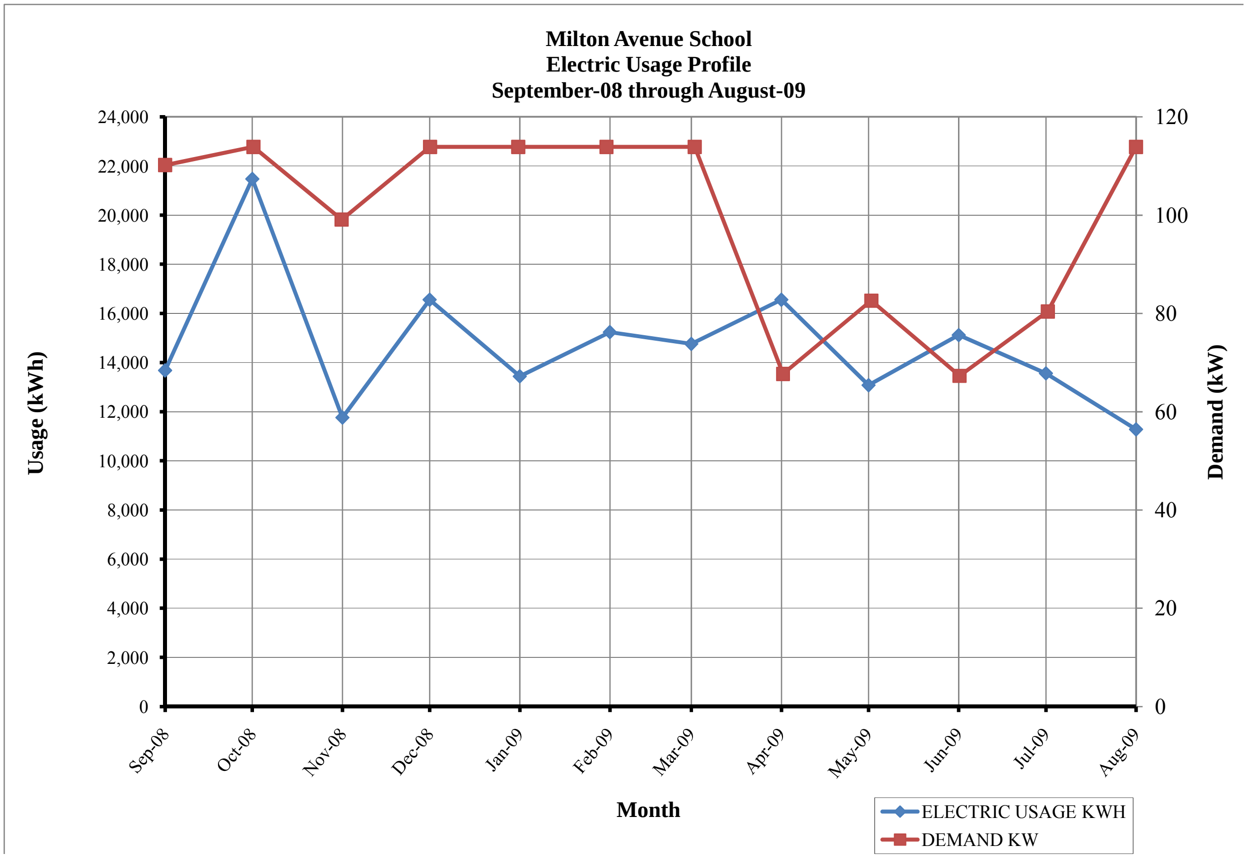


Table 4
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY

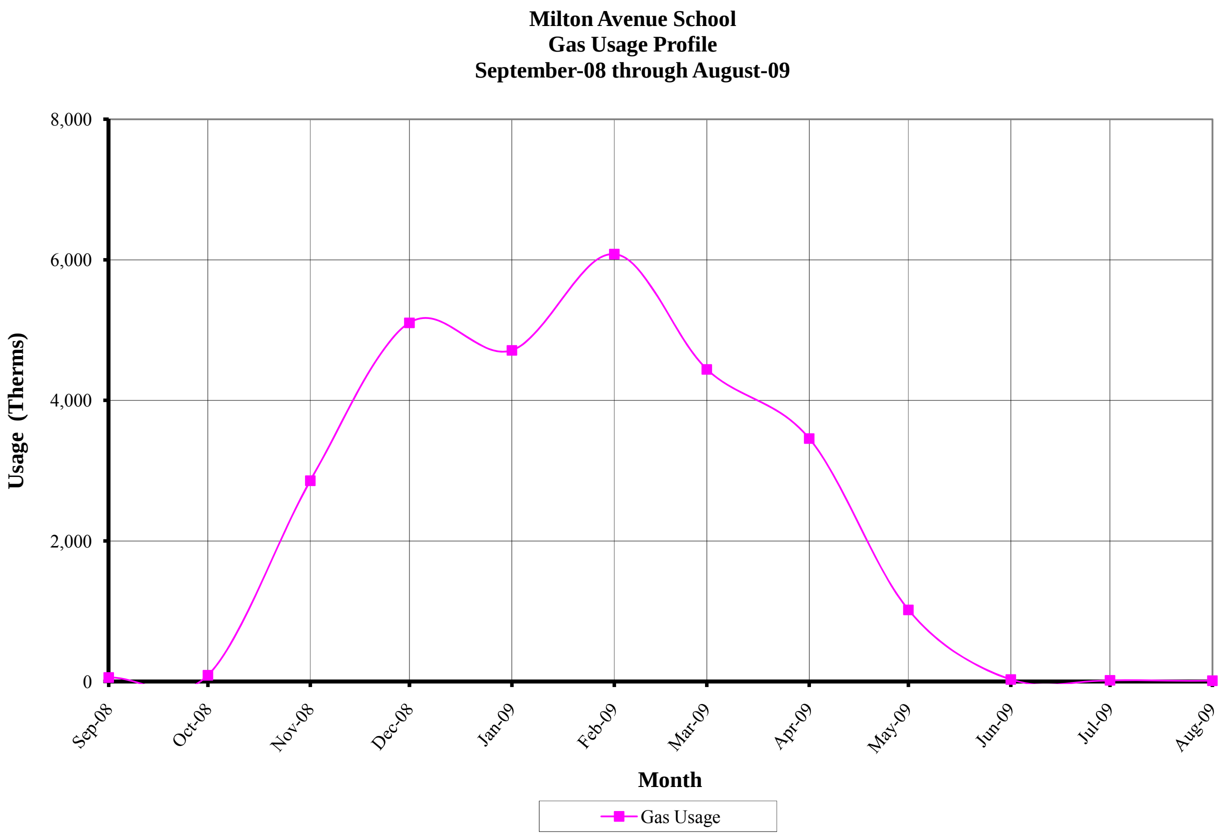
Utility Provider: PSE&G
Rate: LVG
Meter No: 3010313
Point of Delivery ID: PG000010187185304600
Third Party Utility Provider: Hess
TPS Meter No: 12 428 492 11

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
Sep-08	56.39	$169.90
Oct-08	89.47	$211.43
Nov-08	2,856.83	$4,853.83
Dec-08	5,104.56	$7,951.61
Jan-09	4,711.58	$7,248.97
Feb-09	6,082.22	$9,251.69
Mar-09	4,442.25	$6,978.81
Apr-09	3,457.11	$4,577.08
May-09	1,019.93	$1,432.15
Jun-09	29.68	$132.75
Jul-09	16.50	$95.65
Aug-09	12.10	$95.16
TOTALS	**27,878.62**	**$42,999.03**

AVERAGE RATE: $1.542 $/THERM

Figure 2

Natural Gas Usage Profile



B. Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's annual energy utilization per square foot of building. This calculation is completed by converting all utility usage consumed by a building for one year, to British Thermal Units (BTU) and dividing this number by the building square footage. EUI is a good measure of a building's energy use and is utilized regularly for comparison of energy performance for similar building types. The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of Energy maintains a Benchmarking Building Energy Performance Program. The ORNL website determines how a building's energy use compares with similar facilities throughout the U.S. and in a specific region or state.

Source use differs from site usage when comparing a building's energy consumption with the national average. Site energy use is the energy consumed by the building at the building site only. Source energy use includes the site energy use as well as all of the losses to create and distribute the energy to the building. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses, which allows for a complete assessment of energy efficiency in a building. The type of utility purchased has a substantial impact on the source energy use of a building. The EPA has determined that source energy is the most comparable unit for evaluation purposes and overall global impact. Both the site and source EUI ratings for the building are provided to understand and compare the differences in energy use.

The site and source EUI for this facility is calculated as follows. (See Table 5 for details):

$$Building\ Site\ EUI = \frac{(Electric\ Usage\ in\ kBtu + Gas\ Usage\ in\ kBtu)}{Building\ Square\ Footage}$$

$$Building\ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ X\ SS\ Ratio + Gas\ Usage\ in\ kBtu\ X\ SS\ Ratio)}{Building\ Square\ Footage}$$

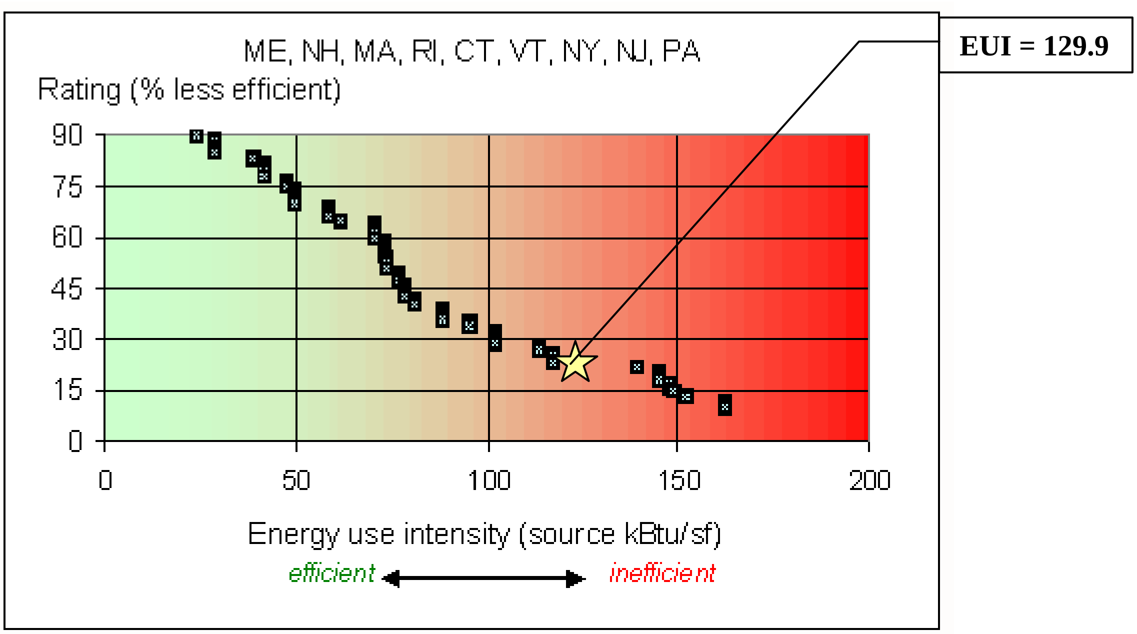
Table 5

Milton Avenue School EUI Calculations

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE RATIO	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu		kBtu
ELECTRIC	176,520.0			602,639	3.340	2,012,815
NATURAL GAS		27,878.6		2,787,862	1.047	2,918,891
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				3,390,501		4,931,707
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA	37,964	SQUARE FEET				
BUILDING SITE EUI	*89.31*	kBtu/SF/YR				
BUILDING SOURCE EUI	*129.90*	kBtu/SF/YR				

Table Figure 3 below depicts a national EUI grading for the source use of Elementary / Middle Schools.

Figure 3
Source Energy Use Intensity Distributions: Elementary/ Middle School



C. EPA Energy Benchmarking System

The United States Environmental Protection Agency (EPA) in an effort to promote energy management has created a system for benchmarking energy use amongst various end users. The benchmarking tool utilized for this analysis is entitled Portfolio Manager. The Portfolio Manager tool allows tracking and assessment of energy consumption via the template forms located on the ENERGY STAR website (www.energystar.gov). The importance of benchmarking for local government municipalities is becoming more important as utility costs continue to increase and emphasis is being placed on carbon reduction, greenhouse gas emissions and other environmental impacts.

Based on information gathered from the ENERGY STAR website, Government agencies spend more than $10 billion a year on energy to provide public services and meet constituent needs. Furthermore, energy use in commercial buildings and industrial facilities is responsible for more than 50 percent of U.S. carbon dioxide emissions. It is vital that local government municipalities assess facility energy usage, benchmark energy usage utilizing Portfolio Manager, set priorities and goals to lessen energy usage and move forward with priorities and goals.

In accordance with the Local Government Energy Audit Program, CEG has created an ENERGY STAR account for the municipality to access and monitoring the facility's yearly energy usage as it compares to facilities of similar type. The login page for the account can be accessed at the following web address; the username and password are also listed below:

https://www.energystar.gov/istar/pmpam/index.cfm?fuseaction=login.login

User Name: chathamsd
Password: lgeaceg2009

Security Question: What city were you born in?
Security Answer: "chatham"

The utility bills and other information gathered during the energy audit process are entered into the Portfolio Manager. The following is a summary of the results for the facility:

Table 6
ENERGY STAR Performance Rating

ENERGY STAR PERFORMANCE RATING		
FACILITY DESCRIPTION	**ENERGY PERFORMANCE RATING**	**NATIONAL AVERAGE**
Milton Avenue School	53	50

Refer to **Statement of Energy Performance Appendix** for the detailed energy summary.

V. FACILITY DESCRIPTION

The Milton Avenue School is a block with face brick constructed, two story facility comprised of classrooms, a library/ media center, offices, a gymnasium and boiler rooms. The original building was approximately 26,022 square feet and was built in 1948. An addition was built in 2001 that added approximately 11,940 square feet, bringing the building total to 37,964 square feet. The building operates for 40 hours during a typical week. There are different roof types on the building. The roof throughout is asphalt shingles on 15# felt on 4" nailable insulation on 3" structural metal deck. The flat portions are a cold process built up roofing system on uniform insulation. The windows in the original building are single pane. The windows in the 2001 addition are tempered, insulated glass with aluminum frame.

Heating

There are two (2) boiler plants at this facility. The first boiler room is located in the original building. There are four (4) natural gas fired, Fulton pulse boilers model PVLP-115 having 1,150,000 BTU/hr input and 978,000 BTU/hr maximum output, producing steam and have a combustion efficiency of 85%. These boilers serve the original building equipment via pipe tunnel. The original building equipment consists of classroom unit ventilators and fin tube radiation.

The boiler plant in the 2001 addition has one (1) H.B. Smith series 28A four (4) section boiler with a Power Flame burner model JR30A-12UHBS-4. The maximum natural gas input is 1,154,000 BTU/hr and a maximum output of 783,000 BTU/hr and a combustion efficiency of 78%. The HB Smith boiler serves the 2001 addition. There are two (2) TACO model 1600-028 in-line pumps in a lead/lag configuration serving as loop pumps and a TACO series 1600-155BF2 that serves as a recirculation pump. The boilers and pumps are eight years old and are in good condition.

There are three (3) Carrier series 48HJ Weather Maker packaged roof top units that provide heat for portions of the building. The units have natural gas heat inputs ranging from 72,000 BTU/hr to 125,000BTU/hr and have an AFUE of 81% to 82.9%. The units are located on the 2001 addition roof, serving the 2001 addition.

Cooling

There are three (3) Carrier series 48HJ Weather Maker packaged roof top units serving the 2001 addition as described in the heating section above. The units have cooling capacities from 4 to 7.5 nominal tons. There are eight (8) split systems having cooling capacities ranging from 0.75 to 4 tons. The split systems serve the 2001 addition and are in good condition.

Controls System

There are pneumatic controls serving the original school building. A Quincy air compressor that is approximately 3 years old provides air to the controls system. The system appears to be operational but is antiquated. There is an Automated Logic DDC system that controls the 2001 addition and allows read only status of the boilers.

Exhaust System

There are a couple of exhaust fans exhausting the bathroom areas. They are fractional horse power fan motors and are in fair condition.

Domestic Hot Water

There is a Rheem Fury model 22-50-3 domestic water heater having a 50 gallon tank, 50 MBH natural gas input. It serves the original building and is approximately 32 years old, is past its useful service life and is in poor condition.

There is a Rheem model G75-125 domestic water heater having a 75 gallon tank, 125 MBH natural gas input. It serves the 2001 addition and is approximately 8 years old and is in fair condition.

Lighting

The building is lit by varying types and sizes of light bulb types. The types used include the use of T-12 fluorescent, T-8 fluorescent, incandescent and compact fluorescent. The predominant lamps in the fluorescent light fixtures are 32 Watts and wattage for the incandescent lamp is 100 watts. The compact fluorescent lamp is 13 watts. The two (2) exit signs units that have (2) 15 watt incandescent lamps there are seventeen (17) exit signs that use LED technology and are 4 watts each.

VI. MAJOR EQUIPMENT LIST

The equipment list is considered major energy consuming equipment and through energy conservation measures could yield substantial energy savings. The list shows the major equipment in the facility and all pertinent information utilized in energy savings calculations. An approximate age was assigned to the equipment in some cases if a manufactures date was not shown on the equipment's nameplate. The ASHRAE service life for the equipment along with the remaining useful life is also shown in the Appendix.

Refer to the **Major Equipment List Appendix** for this facility.

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade – General

Description:

The lighting in the Milton Avenue School is primarily made up of fluorescent fixtures with T-8 lamps with electronic ballasts. There are a few T12 fluorescent fixtures in the boiler room and storage rooms. There is an incandescent lighting fixture in the Gym Office.

This ECM includes replacement of the existing fixtures containing T12 lamps and magnetic ballasts with fixtures containing T8 lamps and electronic ballasts. The new energy efficient, T8 fixtures will provide adequate lighting and will save the owner on electrical costs due to the better performance of the lamp and ballasts. This ECM will also provide maintenance savings through the reduced number of lamps replaced per year. The expected lamp life of a T8 lamp is approximately 30,000 burn-hours, in comparison to the existing T12 lamps which is approximately 20,000 burn-hours. The facility will need 33% less lamps replaced per year.

This ECM also includes replacement of all incandescent fixtures to compact fluorescent fixtures. The energy usage of an incandescent compared to a compact fluorescent approximately 3 to 4 times greater. In addition to the energy savings, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours.

Energy Savings Calculations:

The Investment Grade Lighting Audit appendix outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, the replacement of a T-12 fixture to a T-5 or T-8 fixture warrants the following incentive: T-5 or T-8 (1-2 lamp) = $10 per fixture; T-5 or T-8 (3-4 lamp) = $20 per fixture.

$$\text{Smart Start® } Incentive = (\#\, of\ 1-2\ lamp\ \ fixtures \times\ \$10) + (\#\, of\ 3-4\ lamp\ \ fixtures \times\ \$20)$$

$$\text{Smart Start® } Incentive = (3 \times\ \$20) = \underline{\$60}$$

There is no incentive available to replace an incandescent bulb with a CFL bulb. There is an incentive available to replace an entire fixture with a CFL fixture but is not necessary to incur the expense to replace the entire fixture.

Replacement and Maintenance Savings for fluorescent lamps are calculated as follows:

$$Savings = (reduction\ in\ lamps\ replaced\ \ per\ \ year) \times (repacment\ \$\ \ per\ lamp + Labor\ \$\ \ per\ lamp)$$
$$Savings = (3\ lamps\ \ per\ \ year) \times (\$2.00 + \$5.00) = \underline{\$}21$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$744
NJ Smart Start Equipment Incentive ($):	$60
Net Installation Cost ($):	$684
Maintenance Savings ($/Yr):	$21
Energy Savings ($/Yr):	$56
Total Yearly Savings ($/Yr):	$77
Estimated ECM Lifetime (Yr):	15
Simple Payback	8.9
Simple Lifetime ROI	68.5%
Simple Lifetime Maintenance Savings	$315
Simple Lifetime Savings	$1,152
Internal Rate of Return (IRR)	7%
Net Present Value (NPV)	$232.96

* ECM#1 Calculations DO NOT include lighting control changes implemented in ECM#2. If ECM#1 and #2 are implemented together the savings will be relatively lower than shown above.

ECM #2: Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. In many cases the lights are left on because of the inconvenience to manually switch lights off when a room is left or on when a room is first occupied. This is common in storage rooms that are occupied for only short periods and only a few times per day. In some instances lights are left on due to the misconception that it is better to keep the lights on rather than to continuously switch lights on and off. Although increased switching reduces lamp life, the energy savings outweigh the lamp replacement costs. The payback timeframe for when to turn the lights off is approximately two minutes. If the lights are off for at least a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is adequate to provide reduced lighting levels when full light output is not needed. Occupancy sensors detect motion and will switch the lights on when the room is occupied. Occupancy sensors can either be mounted in place of a current wall switch, or on the ceiling to cover large areas. Photocell control senses light levels and turn off or reduce lights when there is adequate daylight. Photocells are mostly used outside, but are becoming more popular in energy-efficient interior lighting designs as well.

ASHRAE Standard 90.1-2004, Appendix G is a reference standard for modeling building efficiency. The standard estimates that lighting controls provide a 10% reduction in lighting power usage for daytime occupancies in buildings over 5,000 SF, and 15% reduction in buildings under 5,000 SF. This ECM includes dual technology occupancy sensors in each classroom, private office, open office, conference room, restrooms, lunch room, boiler room, Library and.

The ECM includes replacement of standard wall switches with sensors wall switches for individual rooms, ceiling mount sensors for large office areas or restrooms, and photocell sensors for the rotunda sky-lit accent lights. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent. See the **Investment Grade Lighting Audit Appendix** for details.

The **Investment Grade Lighting Audit Appendix** of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by 10% for all areas that include occupancy sensor lighting controls and 20% for areas that include occupancy sensors as well as photocell daylight sensors.

Light Energy = 53,924 kWh/Yr. occupancy sensor controlled lighting

Energy Savings Calculations:

$$Energy\ Savings = 10\% \times Occuapancy\ Sensored\ Light\ Energy\ (kWh/Yr)$$

$$Energy\ Savings = 10\% \times 53{,}924\ (kWh) = 5{,}392\ (kWh)$$

$$Savings. = Energy\ Savings\ (kWh) \times Ave\ Elec\ Cost\left(\frac{\$}{kWh}\right)$$

$$Savings. = 5{,}392\ (kWh) \times 0.144\left(\frac{\$}{kWh}\right) = \$776$$

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is $160/unit including material and labor.

Installation Cost = $160 x 47 motion sensors = $7,520

From the NJ Smart Start appendix, the installation of a lighting control device warrants the following incentive: occupancy = $20 per sensor.

$$\text{Smart Start® } Incentive = (\#\ of\ \ wall\ mount\ devices \times\ \$\ 20) = (47 \times \$20)$$

$$\text{Smart Start® } Incentive = \$940\ Total$$

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$6,240
NJ Smart Start Equipment Incentive ($):	$940
Net Installation Cost ($):	$5,300
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$777
Total Yearly Savings ($/Yr):	$777
Estimated ECM Lifetime (Yr):	15
Simple Payback	6.8
Simple Lifetime ROI	119.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$11,648
Internal Rate of Return (IRR)	12%
Net Present Value (NPV)	$3,969.93

* ECM#2 Calculations <u>DO NOT</u> include lighting changes implemented in ECM#1. If ECM#1 and #2 are implemented together the savings will be relatively lower than shown above.

ECM #3: Install T-5 Lighting System in Gym

Description:

The Gym is currently lit via twelve (12) HID, 250 W Metal Halide fixtures that are mounted approximately 20'-0" above the finished floor. The lighting system is antiquated and the space would be better served with a more efficient, fluorescent lighting system. Studies have shown that metal halide lighting systems have a steep lumen depreciation rate (rate at which light is produced from fixture) which equates to approximately a 26% to 35% reduction in lighting output at 40% of the rated lamp life. In addition, the new fluorescent system will provide a better quality of light and save the Owner many dollars on replacement of the highly expensive metal halide lamps.

CEG recommends upgrading the lighting within the Gym to an energy-efficient T-5 lighting system that includes new lighting fixtures with high efficiency, electronic ballasts and T-5 high output (HO) lamps. The T-5 HO lamps are rated for 20,000 hours versus the 10,000 hours for the 250W Metal Halide lamps so there would be a savings in replacement cost and labor. In addition to the standard lighting features of the T-5 fixtures; a day-lighting option could be selected for the outside rows of light to take advantage of the natural daylight that provides light to the room during the day via the clerestory.

This measure replaces all the HID, 250 W Metal Halide fixtures in the Gym with a well-designed T-5 lighting system. Approximately twelve (12), 3-lamp T5HO high bay fixtures with reflectors and high-efficiency, electronic ballasts will be required in order to meet the mandated 50 foot-candle average within the Gym.

Energy Savings Calculations:

A detailed Investment Grade Lighting Audit can be found in **Investment Grade Lighting Audit Appendix – ECM#4** that outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, the replacement of a 250 W HID fixture to a T-5 or T-8 fixture warrants the following incentive: $50 per fixture.

$$\text{Smart Start® } Incentive = (\#\ of\ \ fixtures \times\ \$50) = (12 \times \$50) = \underline{\$600}$$

Maintenance savings are calculated based on the facility operational hours as indicated by the Owner. For the Gym, the estimated operational hours are 2,080 hours per year. Based on the lamp life comparison, there will be two (5) complete lamp replacements required for the metal halide system at the time when one (2) complete lamp replacement would be required for the fluorescent lighting system. Based on industry pricing, the lamp cost for a 250W metal halide lamp is approximately ±$25 per lamp and a T-5 54HO fluorescent lamp is approximately ±$5 per lamp. Therefore, the maintenance savings are calculated as follows:

$$Ma\,\text{int}\,eance\ Savings = (\#\ of\ \ MH\ \ lamps \times\ \ \$25\ \ per\ lamp) - (\#\ of\ \ T5HO\ lamps \times \$5\ \ per\ lamp)$$

$$Maint eance\ Savings = (12\ lamps \times\ \$25\ per\ lamp) - (36\ lamps \times \$5\ per\ lamp) = \underline{\$120}$$

= $120 / 25 years = $5/year average maintenance savings

It is pertinent to note, that installation labor was not included in the maintenance savings.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$3,600
NJ Smart Start Equipment Incentive ($):	$600
Net Installation Cost ($):	$3,000
Maintenance Savings ($/Yr):	$5
Energy Savings ($/Yr):	$395
Total Yearly Savings ($/Yr):	$400
Estimated ECM Lifetime (Yr):	25
Simple Payback	7.5
Simple Lifetime ROI	233.6%
Simple Lifetime Maintenance Savings	$125
Simple Lifetime Savings	$10,009
Internal Rate of Return (IRR)	13%
Net Present Value (NPV)	$3,971.70

ECM #4: Install LED Exit Signs

Description:

LED is an acronym for light-emitting-diode. LED's are small light sources that are readily associated with electronic equipment. LED exit signs have been manufactured in a variety of shapes and sizes. There are also retrofit kits that allow for simply modification of existing exit signs to accommodate LED technology. The benefits of LED technology are substantial. LED exit signs will last for 20-30 years without maintenance. This results in tremendous maintenance savings considering that incandescent or fluorescent lamps need to be replaced at a rate of 1-5 times per year. Lamp costs ($2-$7 each) and labor costs ($4-$10 per lamp) add up rapidly. Additionally, LED exit lights only uses 4 Watts. In comparison, conventional exit signs use 10-40 Watts. It is recommended that samples of the products be installed to confirm that they are compatible with the existing electrical system.

This ECM replaces all exit signs with incandescent lamps with new exit signs containing LED technology.

Energy Savings Calculations:

A detailed Investment Grade Lighting Audit can be found in **Investment Grade Lighting Audit Appendix – ECM#3** that outlines the proposed retrofits, costs, savings, and payback periods.

(30 watts-4 watts) x 1 kW/1000 watts x 8760 hrs/yr x 1 fixtures = 227.8 kWh/yr. saved

227.8 kWh/yr x $0.144/kWh = $33 / yr. saved

Maintenance savings = 1 fixtures x 2 bulbs/fixture x ($3/bulb + $4/bulb installation) = $14/yr

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, $20/LED Exit sign (≤75kW facility connected load) and $10/LED Exit sign (≥75kW facility connected load).

1 LED Exit signs x $10/ LED Exit sign = $10

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$56
NJ Smart Start Equipment Incentive ($):	$10
Net Installation Cost ($):	$46
Maintenance Savings ($/Yr):	$14
Energy Savings ($/Yr):	$33
Total Yearly Savings ($/Yr):	$47
Estimated ECM Lifetime (Yr):	25
Simple Payback	1.0
Simple Lifetime ROI	2443.5%
Simple Lifetime Maintenance Savings	$350
Simple Lifetime Savings	$1,170
Internal Rate of Return (IRR)	102%
Net Present Value (NPV)	$768.94

ECM #5: Domestic Water Heater Replacement

Description:

The existing Rheem model Fury 22-50-3 with a 50 gallon tank, 50,000 BTUH input natural gas heater with 80% thermal efficiency and a nameplate recovery rate of 42 gallon per hour.

This energy conservation measure will replace each of the existing water heater with a 96% thermal efficient Bradford White model EF-60T-125E-3N gas fired domestic hot water heater having 125 MBH input and 60-gallon storage capacity or equivalent.

Energy Savings Calculations:

Existing Natural Gas DW Heater (WH1)
Rated Capacity = 50 MBH input; 50 gallons storage
Combustion Efficiency = 80%
Age & Radiation Losses = 20%
Thermal Efficiency = 60%

Proposed Natural Gas-Fired, High-Efficiency DW Heater
Rated Capacity = 125 MBH input; 60 gallons storage
Thermal Efficiency = 96%
Radiation Losses = 0.5%
Net Efficiency = 95.5%

Operating Data for Domestic Water Heater

$$\text{Estimated Consumption} = \frac{50 MBHinput}{6{,}241 MBHbldginput} x 27{,}878.62 Therms / year = 223.35 Therms / year$$

Energy Savings = Old Water Heater Energy Input x ((New Water Heater Efficiency – Old Water Heater) / New Water Heater Efficiency))

$$\text{Energy Savings} = 223.35 \text{ Therms} \times \frac{(95.5\% - 60\%)}{(95.5\%)} = 83 \text{ Therms}$$

Average Cost of Natural Gas = $1.542/Therm

Yearly Savings = 83 Therm x $1.542/ Therm = $128/year

Cost of one (1) Commercial Domestic Water Heater and Installation = $7,070

Smart Start Incentive = $2.00/MBh x (60) /installed MBh = $120.

Simple Payback = $7070 / $128 = 55 years

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$7,070
NJ Smart Start Equipment Incentive ($):	$120
Net Installation Cost ($):	$6,950
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$128
Total Yearly Savings ($/Yr):	$128
Estimated ECM Lifetime (Yr):	12
Simple Payback	54.3
Simple Lifetime ROI	-77.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$1,536
Internal Rate of Return (IRR)	-18%
Net Present Value (NPV)	($5,675.89)

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

Globally, renewable energy has become a priority affecting international and domestic energy policy. The State of New Jersey has taken a proactive approach, and has recently adopted in its Energy Master Plan a goal of 30% renewable energy by 2020. To help reach this goal New Jersey created the Office of Clean Energy under the direction of the Board of Public Utilities and instituted a Renewable Energy Incentive Program to provide additional funding to private and public entities for installing qualified renewable technologies. A renewable energy source can greatly reduce a building's operating expenses while producing clean environmentally friendly energy. CEG has assessed the feasibility of installing renewable energy measures (REM) for the municipality utilizing renewable technologies and concluded that there is potential for solar energy generation. The solar photovoltaic system calculation summary will be concluded as **REM#1** within this report.

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which will be mounted on all south and southwestern facades of the building. Flat roof, as well as sloped areas can be utilized; flat areas will have the panels turned to an optimum solar absorbing angle. (A structural survey of the roof would be necessary before the installation of PV panels is considered). The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit is around $350, this value was used in our financial calculations. This equates to $0.35 per kWh generated.

CEG has reviewed the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 1,500 S.F. can be utilized for a PV system. A depiction of the area utilized is shown in **Renewable / Distributed Energy Measures Calculation Appendix**. Using this square footage it was determined that a system size of 21.16 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 25,952 KWh annually, reducing the overall utility bill by approximately 14.7% percent. A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix**. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

The proposed photovoltaic array layout is designed based on the specifications for the Sun Power SPR-230 panel. This panel has a "DC" rated full load output of 230 watts, and has a total panel conversion efficiency of 18%. Although panels rated at higher wattages are available through Sun Power and other various manufacturers, in general most manufacturers who produce commercially available solar panels produce a similar panel in the 200 to 250 watt range. This provides more manufacturer options to the public entity if they wish to pursue the proposed solar recommendation without losing significant system capacity.

The array system capacity was sized on available roof space on the existing facility. Estimated solar array generation was then calculated based on the National Renewable Energy Laboratory PVWatts Version 1.0 Calculator. In order to calculate the array generation an appropriate location with solar data on file must be selected. In addition the system DC rated kilowatt (kW) capacity must be inputted, a DC to AC de-rate factor, panel tilt angle, and array azimuth angle. The DC to AC de-rate factor is based on the panel nameplate DC rating, inverter and transformer efficiencies (95%), mismatch factor (98%), diodes and connections (100%), dc and ac wiring(98%, 99%), soiling, (95%), system availability (95%), shading (if applicable), and age(new/100%). The overall DC to AC de-rate factor has been calculated at an overall rating of 81%. The PVWatts Calculator program then calculates estimated system generation based on average monthly solar irradiance and user provided inputs. The monthly energy generation and offset electric costs from the PVWatts calculator is shown in the **Renewable/Distributed Energy Measures Calculation Appendix**.

The proposed solar array is qualified by the New Jersey Board of Public Utilities Net Metering Guidelines as a Class I Renewable Energy Source. These guidelines allow onsite customer generation using renewable energy sources such as solar and wind with a capacity of 2 megawatts (MW) or less. This limits a customer system design capacity to being a net user and not a net generator of electricity on an annual basis. Although these guidelines state that if a customer does net generate (produce more electricity than they use), the customer will be credited those kilowatt-hours generated to be carried over for future usage on a month to month basis. Then, on an annual basis if the customer is a net generator the customer will then be compensated by the utility the average annual PJM Grid LMP price per kilowatt-hour for the over generation. Due to the aforementioned legislation, the customer is at limited risk if they generate more than they use at times throughout the year. With the inefficiency of today's energy storage systems, such as batteries, the added cost of storage systems is not warranted and was not considered in the proposed design.

CEG has reviewed financing options for the owner. Two options were studied and they are as follows: Self-financed and direct purchase without finance. Self-finance was calculated with 95% of the total project cost financed at a 7% interest rate over 25 years. Direct purchase involves the local government paying for 100% of the total project cost upfront via one of the methods noted in the Installation Funding Options section below. Both of these calculations include a utility inflation rate as well as the degradation of the solar panels over time. Based on our calculations the following are the payback periods for the respective method of payment:

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM			
PAYMENT TYPE	**SIMPLE PAYBACK**	**SIMPLE ROI**	**INTERNAL RATE OF RETURN**
Self-Finance	14.85 Years	N/A	N/A
Direct Purchase	14.85 Years	68.3%	5%

*The solar energy measure is shown for reference in the executive summary Renewable Energy Measure (REM) table

In addition to the Solar Analysis, CEG also conducted a review of the applicability of wind energy for the facility. Wind energy production is another option available through the Renewable Energy Incentive Program. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. Based on CEG's review of the applicability of wind energy for the facility, it was determined that the average wind speed is not adequate, and the kilowatt demand for the building is below the threshold (200 kW) for purchase of a commercial wind turbine. Therefore, wind energy is not a viable option to implement.

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

Load Profile analysis was performed to determine the seasonal energy usage of the facility. Irregularities in the load profile will indicate potential problems within the facility. Consequently based on the profile a recommendation will be made to remedy the irregularity in energy usage. For this report, the facility's energy consumption data was gathered in table format and plotted in graph form to create the load profile. Refer to the Electric and Natural Gas Usage Profiles included within this report to reference the respective electricity and natural gas usage load profiles.

Electricity:

The Electric Usage Profile demonstrates a fairly flat load profile throughout the year. This is unusual for a school, because typically schools are closed in the summer. However the steady and elevated summer load profile (April – October), with a peak in October is supported by classrooms, library/media center, office, gymnasium and boiler rooms. The majority and elevated electric loads seen throughout the year are provided by cooling. Air-conditioning in this facility is provided by (3) three Carrier roof-top units serving the 2001 addition, with 4 – 7.5 tons of capacity. There are also (8) eight, split systems having cooling capacities ranging from .75 – 4 tons of capacity. Currently this facility's electric supply is provided by JCP&L (Jersey Central Power and Light). A flatter load profile of this type, will allow for more competitive energy prices when shopping for alternative energy suppliers.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical heating load profile. An increase in consumption is observed October through April during the standard heating season. Heating for this facility is provided by (2) two boiler plants. The first boiler is located in the original building and has (4) four pulse boilers producing steam. The boiler in the 2001 addition has (1) one H.B. Smith 4-section natural gas fired boiler. In addition there are (4) four Carrier packaged roof-top units, which are natural gas fired and serve the 2001 addition. Domestic hot water is supplied by a 50 Gallon Rheem, natural gas fired hot water heater in the original building. The 2001 addition has a 75 Gallon Rheem natural gas fired hot water heater. Natural gas Delivery-service is provided by Public Service Electric and Gas Company (PSE&G) on an LVG rate schedule. Commodity service is supplied by the Hess Corporation, the Third Party Supplier. This consistent load profile is beneficial when looking at supply options with new Third Party Suppliers.

Tariff:

Electricity:

This facility receives electrical service through Jersey Central Power & Light (JCP&L) on a GSS (General Service Secondary – 3 Phase) rate. Service classification GS is available for general service purposes on secondary voltages not included under Service Classifications RS, RT, RGT or GST. This facility's rate is a three phase service at secondary voltages. For electric supply (generation), the customer uses the service of a JCP&L. This facility uses the Delivery Service of the utility (JCP&L). The Delivery Service includes the following charges: Customer Charge, Supplemental Customer Charge, Distribution Charge (kW Demand), kWh Charge, Non-utility Generation Charge, TEFA, SBC, SCC, Standby Fee and RGGI. The Generation Service is provided by JCP&L under BGS (Basic Generation Service). BGS Energy and Reconciliation Charges are provided in Rider BGS-FP (fixed pricing) or BGS-CIEP (Commercial Industrial Energy Pricing). BGS also has a Transmission component to its charge.

Natural Gas:

This facility receives utility service through Public Service Electric and Gas Company (PSE&G). This facility utilizes the Delivery Service from PSE&G while receiving Commodity service from a Third Party Supplier (TPS), Hess Corporation.

LVG Rate: This utility tariff is for “firm” delivery service for general purposes. This rate schedule has a Delivery Charge, Balancing Charge, Societal Benefits Charge, Realignment Adjustment Charge, Margin Adjustment Charge, RGGI Charge and Customer Account Service Charge. The customer can elect to have the Commodity Charge serviced through the utility or by a Third Party Supplier (TPS). Note: Should the TPS not deliver, the customer may receive service from PSE&G under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service.

“Firm” delivery service defines the reliability of the transportation segment of the pricing. Much like the telecom industry, natural gas pipelines were un-bundled in the late 1990’s and the space was divided up and marketed into reliability of service. Firm Service is said to be the most reliable and last in the pecking order for interruption. This service should not be interrupted.
Commodity Charges: Customer may choose to receive gas supply from either: A TPS or PSE&G through its Basic Gas Supply Service default service. PSE&G may also supply Emergency Sales Service in certain instances. This is at a much higher than normal rate. It should be perceived as a penalty.

This facility utilizes the services of a Third Party Supplier, The Hess Corporation. The contract is administered by The Alliance for Competitive Service (ACES). ACES is the energy aggregation program of the New Jersey School Boards Association of School Administrator’s. The process was reviewed and approved by the New Jersey Department of Community Affairs.
Please see CEG recommendations below.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities. Good potential savings can be seen equally in the electric costs and the natural gas costs. The average price per kWh (kilowatt hour) for the High School based on a historical 1-year weighted average fixed price from the utility JCP&L is $.1415 / kWh (this is the fixed “price to compare” when shopping for energy procurement alternatives). The fixed weighted average price per decatherm for natural gas service in the High School, provided by the Hess Corporation (TPS) is $ 12.08 / dth (dth, is the common unit of measure). The natural gas prices are also the “prices to compare”.

The "price to compare" is the netted cost of the energy (including other costs), that the customer will use to compare to Third Party Supply sources when shopping for alternative suppliers. For electricity this cost would not include the utility transmission and distribution chargers. For natural gas the cost would not include the utility distribution charges and is said to be delivered to the utilities city-gate.

Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. Chatham School District could see improvement in its energy costs if it were to take advantage of these current market prices quickly, before energy prices increase. Based on electric supply from JCP&L and utilizing the historical consumption data provided (August 2008 through July 2009) and current electric rates, the school(s) could see an improvement in its electric costs of up to 25 % annually. (Note: Savings were calculated using Average Annual Consumption and a variance to a Fixed Average One-Year commodity contract). CEG recommends aggregating the entire electric load to gain the most optimal energy costs. CEG recommends advisement for alternative sourcing and supply of energy on a "managed approach".

CEG's second recommendation coincides with the natural gas costs. Based on the current alternative market pricing supplied by the Hess Corporation (ACES Agreement), CEG feels that School District could see an improvement of up to 33 % in its natural gas costs. CEG has experience with the mechanism for schools to buy energy in New Jersey. It is through the ACES Agreement (The Alliance for Competitive Energy Services) which is an energy aggregation program. From our experience, the basis price is the reason that the overall average price per dekatherm is ($12.08/dth). Therefore the average pricing formula supplied by Hess is 25 % above today's competitive market pricing. CEG recommends the school receive further advisement on these prices through an energy advisor. They should also consider procuring energy (natural gas) through an alternative supply source.

CEG also recommends scheduling a meeting with the current utility providers to review their utility charges and current tariff structures for electricity and natural gas. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), the municipality can learn more about the competitive supply process. The county can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu. They should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the information for ongoing demand-side management projects. Furthermore, special attention should be given to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with the utility representative. The School District should ask the utility representative about alternative billing options, such as consolidated billing when utilizing the service of a Third Party Supplier. Finally, if the supplier for energy (natural gas) is changed, closely monitor balancing, particularly when the contract is close to termination. This could be performed with the aid of an "energy advisor".

X. INSTALLATION FUNDING OPTIONS

CEG has reviewed various funding options for the facility owner to utilize in subsidizing the costs for installing the energy conservation measures noted within this report. Below are a few alternative funding methods:

i. *Energy Savings Improvement Program (ESIP)* – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and par for the costs using the value of energy savings that result from the improvements. The "Energy Savings Improvement Program (ESIP)" law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources.

ii. *Municipal Bonds* – Municipal bonds are a bond issued by a city or other local government, or their agencies. Potential issuers of municipal bonds include cities, counties, redevelopment agencies, school districts, publicly owned airports and seaports, and any other governmental entity (or group of governments) below the state level. Municipal bonds may be general obligations of the issuer or secured by specified revenues. Interest income received by holders of municipal bonds is often exempt from the federal income tax and from the income tax of the state in which they are issued, although municipal bonds issued for certain purposes may not be tax exempt.

iii. *Power Purchase Agreement* – Public Law 2008, Chapter 3 authorizes contractor of up to fifteen (15) years for contracts commonly known as "power purchase agreements." These are programs where the contracting unit (Owner) procures a contract for, in most cases, a third party to install, maintain, and own a renewable energy system. These renewable energy systems are typically solar panels, windmills or other systems that create renewable energy. In exchange for the third party's work of installing, maintaining and owning the renewable energy system, the contracting unit (Owner) agrees to purchase the power generated by the renewable energy system from the third party at agreed upon energy rates.

iv. *Pay For Performance* – The New Jersey Smart Start Pay for Performance program includes incentives based on savings resulted from implemented ECMs. The program is available for all buildings with average demand loads above 200 KW. The facility's participation in the program is assisted by an approved program partner. An "Energy Reduction Plan" is created with the facility and approved partner to shown at least 15% reduction in the building's current energy use. Multiple energy conservation measures implemented together are applicable toward the total savings of at least 15%. No more than 50% of the total energy savings can result from lighting upgrades / changes.

Total incentive is capped at 50% of the project cost. The program savings is broken down into three benchmarks; Energy Reduction Plan, Project Implementation, and

Measurement and Verification. Each step provides additional incentives as the energy reduction project continues. The benchmark incentives are as follows:

1. Energy Reduction Plan – Upon completion of an energy reduction plan by an approved program partner, the incentive will grant $0.10 per square foot between $5,000 and $50,000, and not to exceed 50% of the facility's annual energy expense. (Benchmark #1 is not provided in addition to the local government energy audit program incentive.)

2. Project Implementation – Upon installation of the recommended measures along with the "Substantial Completion Construction Report," the incentive will grant savings per KWH or Therm based on the program's rates. Minimum saving must be 15%. (Example $0.11 / kWh for 15% savings, $0.12/ kWh for 17% savings, … and $1.10 / Therm for 15% savings, $1.20 / Therm for 17% saving, …) Increased incentives result from projected savings above 15%.

3. Measurement and Verification – Upon verification 12 months after implementation of all recommended measures, that actual savings have been achieved, based on a completed verification report, the incentive will grant additional savings per kWh or Therm based on the program's rates. Minimum savings must be 15%. (Example $0.07 / kWh for 15% savings, $0.08/ kWh for 17% savings, … and $0.70 / Therm for 15% savings, $0.80 / Therm for 17% saving, …) Increased incentives result from verified savings above 15%.

CEG recommends the Owner review the use of the above-listed funding options in addition to utilizing their standard method of financing for facilities upgrades in order to fund the proposed energy conservation measures.

XI. ADDITIONAL RECOMMENDATIONS

The following recommendations include no cost/low cost measures, Operation & Maintenance (O&M) items, and water conservation measures with attractive paybacks. These measures are not eligible for the Smart Start Buildings incentives from the office of Clean Energy but save energy none the less.

A. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.

B. Maintain all weather stripping on windows and doors.

C. Clean all light fixtures to maximize light output.

D. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

E. Confirm that outside air economizers on the rooftop units are functioning properly to take advantage of free cooling and avoid excess outside air during occupied periods.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Milton Avenue School

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT.	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	Lighting Upgrade – General	$744	$0	$60	$684	$56	$21	$77	15	$837	$315	22.4%	8.9	7.36%	$232.96
ECM #2	Lightinf Controls	$6,240	$0	$940	$5,300	$777	$0	$777	15	$11,648	$0	119.8%	6.8	11.96%	$3,969.93
ECM #3	Lighting Upgrade - Gym	$3,600	$0	$600	$3,000	$395	$5	$400	25	$9,884	$125	229.5%	7.5	12.67%	$3,971.70
ECM #4	LED Exit Sign	$56	$0	$10	$46	$33	$14	$47	25	$820	$350	1682.6%	1.0	101.74%	$768.94
ECM #5	Domestic Water Heater Replacement	$7,070	$0	$120	$6,950	$128	$0	$128	12	$1,536	$0	-77.9%	54.3	-17.95%	($5,675.89)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	21.16 KW PV System	$190,440	$0	$0	$190,440	$3,737	$9,083	$12,820	25	$93,425	$227,075	-50.9%	14.9	4.48%	$32,796.55

Notes: 1) The variable Cn in the formulas for Internal Rate of Return and Net Present Value stands for the cash flow during each period.
2) The variable DR in the NPV equation stands for Discount Rate
3) For NPV and IRR calculations: From n=0 to N periods where N is the *lifetime of ECM* and Cn is the *cash flow during each period* .

Concord Engineering Group, Inc.

520 BURNT MILL ROAD
VOORHEES, NEW JERSEY 08043
PHONE: (856) 427-0200
FAX: (856) 427-6508

SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of January, 2009:

Electric Chillers

Water-Cooled Chillers	$12 - $170 per ton
Air-Cooled Chillers	$8 - $52 per ton

Gas Cooling

Gas Absorption Chillers	$185 - $400 per ton
Gas Engine-Driven Chillers	Calculated through custom measure path)

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	$73 - $93 per ton
Air-to-Air Heat Pumps	$73 - $92 per ton
Water-Source Heat Pumps	$81 per ton
Packaged Terminal AC & HP	$65 per ton
Central DX AC Systems	$40- $72 per ton
Dual Enthalpy Economizer Controls	$250

Ground Source Heat Pumps

Closed Loop & Open Loop	$370 per ton

Gas Heating

Gas Fired Boilers < 300 MBH	$300 per unit
Gas Fired Boilers ≥ 300 - 1500 MBH	$1.75 per MBH
Gas Fired Boilers ≥1500 - ≤ 4000 MBH	$1.00 per MBH
Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	$300 - $400 per unit

Variable Frequency Drives

Variable Air Volume	$65 - $155 per hp
Chilled-Water Pumps	$60 per hp
Compressors	$5,250 to $12,500 per drive

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons	$50 per unit
Gas-Fired Water Heaters >50 gallons	$1.00 - $2.00 per MBH
Gas-Fired Booster Water Heaters	$17 - $35 per MBH

Premium Motors

Three-Phase Motors	$45 - $700 per motor

Prescriptive Lighting

T-5 and T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 - $30 per fixture, (depending on quantity)
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start	$25 per fixture
LED Exit Signs	$10 - $20 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $284 per fixture

Lighting Controls – Occupancy Sensors

Wall Mounted	$20 per control
Remote Mounted	$35 per control
Daylight Dimmers	$25 per fixture
Occupancy Controlled hi-low Fluorescent Controls	$25 per fixture controlled

Lighting Controls – HID or Fluorescent Hi-Bay Controls

Occupancy hi-low	$75 per fixture controlled
Daylight Dimming	$75 per fixture controlled

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2004 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive

MAJOR EQUIPMENT LIST

Concord Engineering Group

Milton Avenue School

Boiler

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room		Fulton	1	PVPL-1150	103747	575-1150	489-978	84.5	NG	2	30	28	
Boiler Room		Fulton	1	PVPL-1150	103746	575-1150	489-978	84.5	NG	2	30	28	
Boiler Room		Fulton	1	PVPL-1150	103762	575-1150	489-978	84.5	NG	2	30	28	
Boiler Room		Fulton	1	PVPL-1150	103745	575-1150	489-978	84.5	NG	2	30	28	
SGI	2001 Addition	HB Smith	1	Series 28A-4	N2001-592	1154	783	86.2	NG	8	30	22	

Boiler - Burner

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
SGI	HB Smith	Power Flame	1	JR30-12UHBS-4	60146220	1154		NG	8	20	12	1/3 HP MOTOR

Boiler - Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	RPM	GPM	Ft. Hd	Frame Size	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	
Boiler Room	condensate		1			(2) 3/4							1989	10	(-10)	Past service life - should replace; no incentiveless than 1h
Boiler Room	condensate		1			(2) 1.5							2007	10	8	
SGI		TACO	2	1600-028									2000	10	1	
		TACO	1	1600 155 bf2	1610022								2001	10	2	

Domestic Hot Water Heater

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Input (MBh)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room		Rheem	1	Fury 22-50-3	RN 1077 304863	50	42	50		NG	32	10	(-22)	
		Rheem	1	G 75-125	URNG 1000GO1331	125	121.2	75			8	10	2	

DHW - Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	Volts	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room		Bell & Gosset	1	Series 100 AB	106192	12-Jan			1991	10	(-8)	Past service life - should replace; no incentiveless tha

Air Handling Units

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Cooling Coil	Cooling Eff. (EER)	Cooling Capacity	Heating Type	Input (MBh)	Output (MBh)	Heating Eff. (%)	Fuel	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Rooftop		Carrier	1	48HJD008---531HE	2500G34407	R-22				92/125	74.4/102.5	82%	NG	208-230	3		9	15	6	
Rooftop		Carrier	1	48HJE007---531--	0901G20357	R-22				82/115	66.4/93.2	81%	NG	208-230	3		8	15	7	
Rooftop		Carrier	1	48HJD005---531HE	0501G20161	R-22				50/72	41/59	82%	NG	208/230	3		8	15	7	

Split Systems and AC Condensers

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity Btu/h	Eff.	Refrigerant	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Rooftop		Mitsubishi	1	MU09TW	30 00041	9000		R-22	115	1		9	15	6	
Rooftop		Lennox	1	HS29-030-1P	5801E 66998	30000		R-22	208/230	1		2001	15	7	
Rooftop		Lennox	3	HS29-048-9Y	5801E 23684	48000		R-22	208/230	3		2001	15	7	
Rooftop		Lennox	2	HS29-024-IP	5801E 39741	24000		R-22	208/230	1		2001	15	7	
Rooftop		Lennox	1	HS29-042-94	5801E 40261	42000		R-22	208/230	3		2001	15	7	

Window AC Units

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity Btu/h	Eff.	Refrigerant	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	
Classrooms		Emerson Quiet Kool	2	18FD44	FE618831 1743	18000/17500		R-22	230/208	1	7.9/8.5	1993	15	(-1)	
Classrooms		Airtemp	1	B3D18E7A	LG423189 3195	18000/17500		R-22	230/208	1	7.9/8.5	1995	15	1	
Classrooms		Friedrich	1	KM18L30-B	LGDR12987	17800/17600		R-22	230/208	1	8.1/8.8	2007	15	13	
Classrooms		Samsung	1	AW075~~~~	P2EkC008~~~	17800/~~~		R-22	115	1	~~~	2002	15	8	
Classrooms		Frigideaire	7	FAS185J245	JK205243	18000/17800		R-22	230/208		8.5/9	2002	15	8	
Classrooms		Emerson Quiet Kool	1	10FT13	EE498 030 1393	10200		R-22	115		10.5	1993	15	(-1)	
Classrooms		Friedrich	1	KM18J30C-A	DDR04521	18000/17700		R-22	230/208	1	8.3/9.2	2004	15	10	

Air Compressor

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	Pressure	Capacity	Volts	Phase	FLA	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room	HVAC Controls	Quincey Climate Control	1	QC01508DOO118	5154823	(2) 2hp			200			8	15	7	

Heating and Ventilation Units

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Heating Coil	Capacity (Btu/h)	Fan HP	Fan RPM	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
		Herman Nelson	18													
		AAF	6										2001	15	7	

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Milton Avenue School

Building ID: 1830632
For 12-month Period Ending: August 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: September 22, 2009

Facility
Milton Avenue School
16 Milton Ave
Chatham, NJ 07928

Facility Owner
School District of the Chathams
58 Meyersville Road
Chatham, NJ 07928

Primary Contact for this Facility
Ralph Goodwin
58 Meyersville Road
Chatham, NJ 07928

Year Built: 1948
Gross Floor Area (ft²): 37,964

Energy Performance Rating[2] (1-100) 53

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	602,286
Natural Gas (kBtu)[4]	2,787,862
Total Energy (kBtu)	3,390,148
Energy Intensity[5]	
Site (kBtu/ft²/yr)	89
Source (kBtu/ft²/yr)	130
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	240
Electric Distribution Utility	
Jersey Central Power & Lt Co	
National Average Comparison	
National Average Site EUI	92
National Average Source EUI	134
% Difference from National Average Source EUI	-3%
Building Type	K-12 School

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Meets Industry Standards[6] **for Indoor Environmental Conditions:**

Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Certifying Professional
Raymond Johnson
520 South Burnt Mill Road
Voorhees, NJ 08043

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.
NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Milton Avenue School	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	K-12 School	Is this an accurate description of the space in question?		☐
Location	16 Milton Ave, Chatham, NJ 07928	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐

Milton Ave (K-12 School)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	37,964 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Open Weekends?	Yes	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	64	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	0	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	No	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	60 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	10 (Optional)	Is this school in operation for at least 8 months of the year?		☐

High School?	No	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Jersey Central Power & Lt Co

Fuel Type: Electricity		
Meter: Milton Ave Electric (kWh (thousand Watt-hours)) **Space(s):** Entire Facility **Generation Method:** Grid Purchase		
Start Date	**End Date**	**Energy Use (kWh (thousand Watt-hours))**
08/01/2009	08/31/2009	11,280.00
07/01/2009	07/31/2009	13,560.00
06/01/2009	06/30/2009	15,120.00
05/01/2009	05/31/2009	13,080.00
04/01/2009	04/30/2009	16,560.00
03/01/2009	03/31/2009	14,760.00
02/01/2009	02/28/2009	15,240.00
01/01/2009	01/31/2009	13,440.00
12/01/2008	12/31/2008	16,560.00
11/01/2008	11/30/2008	11,760.00
10/01/2008	10/31/2008	21,480.00
09/01/2008	09/30/2008	13,680.00
Milton Ave Electric Consumption (kWh (thousand Watt-hours))		**176,520.00**
Milton Ave Electric Consumption (kBtu (thousand Btu))		**602,286.24**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**602,286.24**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas		
Meter: Milton Ave Gas (therms) **Space(s):** Entire Facility		
Start Date	**End Date**	**Energy Use (therms)**
08/01/2009	08/31/2009	12.10
07/01/2009	07/31/2009	16.50
06/01/2009	06/30/2009	29.68
05/01/2009	05/31/2009	1,019.93
04/01/2009	04/30/2009	3,457.11
03/01/2009	03/31/2009	4,442.25
02/01/2009	02/28/2009	6,082.22
01/01/2009	01/31/2009	4,711.58
12/01/2008	12/31/2008	5,104.56
11/01/2008	11/30/2008	2,856.83

10/01/2008	10/31/2008	89.47
09/01/2008	09/30/2008	56.39
Milton Ave Gas Consumption (therms)		**27,878.62**
Milton Ave Gas Consumption (kBtu (thousand Btu))		**2,787,862.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**2,787,862.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

Additional Fuels	
Do the fuel consumption totals shown above represent the total energy use of this building? Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.	☐

On-Site Solar and Wind Energy	
Do the fuel consumption totals shown above include all on-site solar and/or wind power located at your facility? Please confirm that no on-site solar or wind installations have been omitted from this list. All on-site systems must be reported.	☐

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same as the PE that signed and stamped the SEP.)

Name: ____ Date: ____________

Signature: ____________________________________

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
Milton Avenue School
16 Milton Ave
Chatham, NJ 07928

Facility Owner
School District of the Chathams
58 Meyersville Road
Chatham, NJ 07928

Primary Contact for this Facility
Ralph Goodwin
58 Meyersville Road
Chatham, NJ 07928

General Information

Milton Avenue School	
Gross Floor Area Excluding Parking: (ft^2)	37,964
Year Built	1948
For 12-month Evaluation Period Ending Date:	August 31, 2009

Facility Space Use Summary

Milton Ave	
Space Type	K-12 School
Gross Floor Area(ft^2)	37,964
Open Weekends?	Yes
Number of PCs	64
Number of walk-in refrigeration/freezer units	0
Presence of cooking facilities	No
Percent Cooled	60
Percent Heated	100
Months°	10
High School?	No
School District°	Chatham

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 08/31/2009)	**Baseline** (Ending Date 08/31/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	53	53	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	89	89	72	N/A	92
Source (kBtu/ft^2)	130	130	105	N/A	134
Energy Cost					
$/year	$ 68,382.03	$ 68,382.03	$ 55,333.54	N/A	$ 70,755.87
$/$ft^2$/year	$ 1.80	$ 1.80	$ 1.46	N/A	$ 1.86
Greenhouse Gas Emissions					
$MtCO_2e$/year	240	240	194	N/A	248
$kgCO_2e/ft^2$/year	6	6	5	N/A	6

More than 50% of your building is defined as K-12 School. Please note that your rating accounts for all of the spaces listed. The National Average column presents energy performance data your building would have if your building had an average rating of 50.

Notes:
o - This attribute is optional.
d - A default value has been supplied by Portfolio Manager.

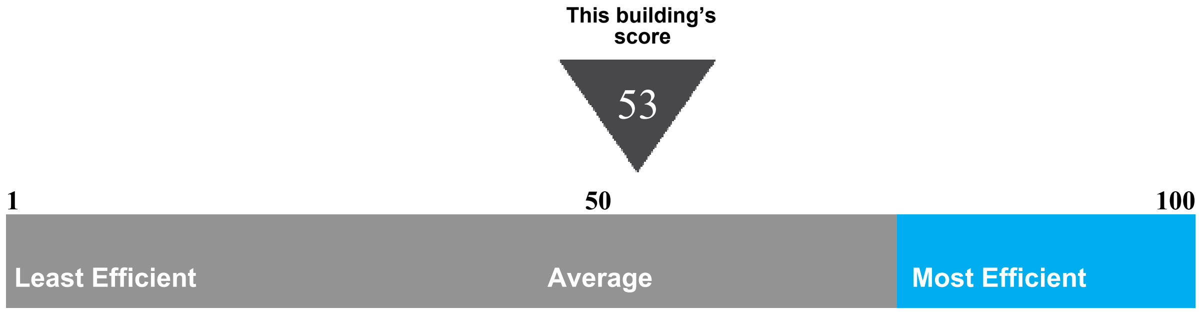
Statement of Energy Performance

2009

Milton Avenue School
16 Milton Ave
Chatham, NJ 07928

Portfolio Manager Building ID: 1830632

The energy use of this building has been measured and compared to other similar buildings using the Environmental Protection Agency's (EPA's) Energy Performance Scale of 1–100, with 1 being the least energy efficient and 100 the most energy efficient. For more information, visit energystar.gov/benchmark.



This building uses 130 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending August 2009

Buildings with a score of 75 or higher may qualify for EPA's ENERGY STAR.

I certify that the information contained within this statement is accurate and in accordance with U.S. Environmental Protection Agency's measurement standards, found at energystar.gov

Date of certification

EPA United States Environmental Protection Agency

Date Generated: 09/22/2009

CEG Job #: 9C09078
Project: School District of the Chathams
Address: 16 Milton Ave
Chatham, NJ
Building SF: 37,964

Milton Avenue School

KWH COST: **$0.144**

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
12	108	1880	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,308.5	$188.42	12	2	No Replacement	58	0.70	1308.48	$188.42	$0.00	$0.00	0.00	0	$0.00	0.00
12	109	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$208.47	12	2	No Replacement	58	0.70	1447.68	$208.47	$0.00	$0.00	0.00	0	$0.00	0.00
12	110	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$208.47	12	2	No Replacement	58	0.70	1447.68	$208.47	$0.00	$0.00	0.00	0	$0.00	0.00
6	Office	2080	4	1	T8 1x4 1 Lamp Electronic Ballast Surface Mounting Prismatic Lens	28	0.11	233.0	$33.55	4	1	No Replacement	28	0.11	232.96	$33.55	$0.00	$0.00	0.00	0	$0.00	0.00
8	Boiler Room	2080	11	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting No Lens	58	0.64	1,327.0	$191.09	11	2	No Replacement	58	0.64	1327.04	$191.09	$0.00	$0.00	0.00	0	$0.00	0.00
4	Boiler Room	2080	1	1	T12 1x2 1 Lamp Magnetic Ballast Surface Mounting No Lens	20	0.02	41.6	$5.99	1	1	No Replacement	20	0.02	41.6	$5.99	$0.00	$0.00	0.00	0	$0.00	0.00
11	Hallway	8760	25	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	1.45	12,702.0	$1,829.09	25	2	No Replacement	58	1.45	12702	$1,829.09	$0.00	$0.00	0.00	0	$0.00	0.00
11	Stairwell	8760	1	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.06	508.1	$73.16	1	2	No Replacement	58	0.06	508.08	$73.16	$0.00	$0.00	0.00	0	$0.00	0.00
12	Stairwell	8760	8	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.46	4,064.6	$585.31	8	2	No Replacement	58	0.46	4064.64	$585.31	$0.00	$0.00	0.00	0	$0.00	0.00
12	Bathroom	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	241.3	$34.74	2	2	No Replacement	58	0.12	241.28	$34.74	$0.00	$0.00	0.00	0	$0.00	0.00
5	**Storage**	**520**	**3**	**4**	**T12 1x8 4 Lamps Magnetic Ballast Pendant Mounting No Lens**	**316**	**0.95**	**493.0**	**$70.99**	**3**	**3**	**8' 3 Lamp T-8, no lens, Electronic Balast Cooper Metalux 8TDIM-332-UNV-EB82-U**	**177**	**0.53**	**276.12**	**$39.76**	**$246.00**	**$738.00**	**0.42**	**216.84**	**$31.22**	**23.63**
12	Office	2080	10	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.58	1,206.4	$173.72	10	2	No Replacement	58	0.58	1206.4	$173.72	$0.00	$0.00	0.00	0	$0.00	0.00
12	Storage	520	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.23	120.6	$17.37	4	2	No Replacement	58	0.23	120.64	$17.37	$0.00	$0.00	0.00	0	$0.00	0.00
14	107	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.66	1,364.5	$196.49	8	3	No Replacement	82	0.66	1364.48	$196.49	$0.00	$0.00	0.00	0	$0.00	0.00
12	Gym Office	2080	6	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.35	723.8	$104.23	6	2	No Replacement	58	0.35	723.84	$104.23	$0.00	$0.00	0.00	0	$0.00	0.00

18	**Gym Office**	**2080**	**1**	**1**	**Incandescent 100 w**	**100**	**0.10**	**208.0**	**$29.95**	**1**	**1**	**18 W CFL Lamp**	**18**	**0.02**	**37.44**	**$5.39**	**$5.75**	**$5.75**	**0.08**	**170.56**	**$24.56**	**0.23**
12	Bathroom	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	241.3	$34.74	2	2	No Replacement	58	0.12	241.28	$34.74	$0.00	$0.00	0.00	0	$0.00	0.00
12	106	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$208.47	12	2	No Replacement	58	0.70	1447.68	$208.47	$0.00	$0.00	0.00	0	$0.00	0.00
12	105	2080	6	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.35	723.8	$104.23	6	2	No Replacement	58	0.35	723.84	$104.23	$0.00	$0.00	0.00	0	$0.00	0.00
17	101	2080	12	1	T8 1x4 1 Lamp Electronic Ballast Surface Mounting Prismatic Lens	28	0.34	698.9	$100.64	12	1	No Replacement	28	0.34	698.88	$100.64	$0.00	$0.00	0.00	0	$0.00	0.00
12	101	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$17.37	1	2	No Replacement	58	0.06	120.64	$17.37	$0.00	$0.00	0.00	0	$0.00	0.00
12	101	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$17.37	1	2	No Replacement	58	0.06	120.64	$17.37	$0.00	$0.00	0.00	0	$0.00	0.00
13	102	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.98	2,046.7	$294.73	12	3	No Replacement	82	0.98	2046.72	$294.73	$0.00	$0.00	0.00	0	$0.00	0.00
12	102	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$17.37	1	2	No Replacement	58	0.06	120.64	$17.37	$0.00	$0.00	0.00	0	$0.00	0.00
12	Hallway	8760	6	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.35	3,048.5	$438.98	6	2	No Replacement	58	0.35	3048.48	$438.98	$0.00	$0.00	0.00	0	$0.00	0.00
13	104	2080	13	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.07	2,217.3	$319.29	13	3	No Replacement	82	1.07	2217.28	$319.29	$0.00	$0.00	0.00	0	$0.00	0.00
12	104	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	241.3	$34.74	2	2	No Replacement	58	0.12	241.28	$34.74	$0.00	$0.00	0.00	0	$0.00	0.00
13	103	2080	13	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.07	2,217.3	$319.29	13	3	No Replacement	82	1.07	2217.28	$319.29	$0.00	$0.00	0.00	0	$0.00	0.00
12	103	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	241.3	$34.74	2	2	No Replacement	58	0.12	241.28	$34.74	$0.00	$0.00	0.00	0	$0.00	0.00
12	Stairwell	8760	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	1,016.2	$146.33	2	2	No Replacement	58	0.12	1016.16	$146.33	$0.00	$0.00	0.00	0	$0.00	0.00
12	Stairwell	8760	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.23	2,032.3	$292.65	4	2	No Replacement	58	0.23	2032.32	$292.65	$0.00	$0.00	0.00	0	$0.00	0.00
12	Bathroom	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	241.3	$34.74	2	2	No Replacement	58	0.12	241.28	$34.74	$0.00	$0.00	0.00	0	$0.00	0.00
11	Hallway	8760	25	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	1.45	12,702.0	$1,829.09	25	2	No Replacement	58	1.45	12702	$1,829.09	$0.00	$0.00	0.00	0	$0.00	0.00

2	Hallway	8760	1	1	CFL 1 Lamp	28	0.03	245.3	$35.32	1	1	No Replacement	28	0.03	245.28	$35.32	$0.00	$0.00	0.00	0	$0.00	0.00
11	Hallway	8760	6	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.35	3,048.5	$438.98	6	2	No Replacement	58	0.35	3048.48	$438.98	$0.00	$0.00	0.00	0	$0.00	0.00
12	214	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$208.47	12	2	No Replacement	58	0.70	1447.68	$208.47	$0.00	$0.00	0.00	0	$0.00	0.00
12	213	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$208.47	12	2	No Replacement	58	0.70	1447.68	$208.47	$0.00	$0.00	0.00	0	$0.00	0.00
14	212	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.66	1,364.5	$196.49	8	3	No Replacement	82	0.66	1364.48	$196.49	$0.00	$0.00	0.00	0	$0.00	0.00
13	211	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.98	2,046.7	$294.73	12	3	No Replacement	82	0.98	2046.72	$294.73	$0.00	$0.00	0.00	0	$0.00	0.00
12	Hallway	8760	8	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.46	4,064.6	$585.31	8	2	No Replacement	58	0.46	4064.64	$585.31	$0.00	$0.00	0.00	0	$0.00	0.00
12	Stairwell	8760	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.23	2,032.3	$292.65	4	2	No Replacement	58	0.23	2032.32	$292.65	$0.00	$0.00	0.00	0	$0.00	0.00
11	Stairwell	8760	1	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.06	508.1	$73.16	1	2	No Replacement	58	0.06	508.08	$73.16	$0.00	$0.00	0.00	0	$0.00	0.00
8	Boiler Room	2080	3	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting No Lens	58	0.17	361.9	$52.12	3	2	No Replacement	58	0.17	361.92	$52.12	$0.00	$0.00	0.00	0	$0.00	0.00
13	204/205	2080	7	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.57	1,193.9	$171.92	7	3	No Replacement	82	0.57	1193.92	$171.92	$0.00	$0.00	0.00	0	$0.00	0.00
1	206	2080	18	2	T5 1x4 2 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Sylvania FP54/835/HO	54	0.97	2,021.8	$291.13	18	2	No Replacement	54	0.97	2021.76	$291.13	$0.00	$0.00	0.00	0	$0.00	0.00
7	Library	2080	45	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Direct/Indirect	58	2.61	5,428.8	$781.75	45	2	No Replacement	58	2.61	5428.8	$781.75	$0.00	$0.00	0.00	0	$0.00	0.00
13	203	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.49	1,023.4	$147.36	6	3	No Replacement	82	0.49	1023.36	$147.36	$0.00	$0.00	0.00	0	$0.00	0.00
13	Faculty Rm	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.49	1,023.4	$147.36	6	3	No Replacement	82	0.49	1023.36	$147.36	$0.00	$0.00	0.00	0	$0.00	0.00
12	Kitchen	2080	5	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.29	603.2	$86.86	5	2	No Replacement	58	0.29	603.2	$86.86	$0.00	$0.00	0.00	0	$0.00	0.00
12	Girls Room	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$17.37	1	2	No Replacement	58	0.06	120.64	$17.37	$0.00	$0.00	0.00	0	$0.00	0.00
12	Boys Room	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$17.37	1	2	No Replacement	58	0.06	120.64	$17.37	$0.00	$0.00	0.00	0	$0.00	0.00

12	207	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$208.47	12	2	No Replacement	58	0.70	1447.68	$208.47	$0.00	$0.00	0.00	0	$0.00	0.00
9	202	2080	12	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Prismatic Lens	58	0.70	1,447.7	$208.47	12	2	No Replacement	58	0.70	1447.68	$208.47	$0.00	$0.00	0.00	0	$0.00	0.00
12	208	2080	8	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.46	965.1	$138.98	8	2	No Replacement	58	0.46	965.12	$138.98	$0.00	$0.00	0.00	0	$0.00	0.00
12	Boys Room	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	241.3	$34.74	2	2	No Replacement	58	0.12	241.28	$34.74	$0.00	$0.00	0.00	0	$0.00	0.00
12	Girls Room	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$17.37	1	2	No Replacement	58	0.06	120.64	$17.37	$0.00	$0.00	0.00	0	$0.00	0.00
14	201	2080	4	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.33	682.2	$98.24	4	3	No Replacement	82	0.33	682.24	$98.24	$0.00	$0.00	0.00	0	$0.00	0.00
12	209	2080	8	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.46	965.1	$138.98	8	2	No Replacement	58	0.46	965.12	$138.98	$0.00	$0.00	0.00	0	$0.00	0.00
13	210	2080	13	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.07	2,217.3	$319.29	13	3	No Replacement	82	1.07	2217.28	$319.29	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		452	126			28.86	93,105.4	$13,407.18	452	125			28.361	92718.04	$13,351.40		$743.75	0.50	387.4	$55.79	13.33

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

CEG Job #: 9C09078
Project: School District of the Chathams
Address: 16 Milton Ave
Chatham, NJ
Building SF: 37,964

Milton Avenue School

KWH COST: **$0.144**

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
12	108	1880	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,308.5	$188.42	12	2	Dual Technology Occupancy Sensor	58	0.70	10%	1177.632	$169.58	$160.00	$160.00	0.00	130.848	$18.84	8.49
12	109	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$208.47	12	2	Dual Technology Occupancy Sensor	58	0.70	10%	1302.912	$187.62	$160.00	$160.00	0.00	144.768	$20.85	7.68
12	110	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$208.47	12	2	Dual Technology Occupancy Sensor	58	0.70	10%	1302.912	$187.62	$160.00	$160.00	0.00	144.768	$20.85	7.68
6	Office	2080	4	1	T8 1x4 1 Lamp Electronic Ballast Surface Mounting Prismatic Lens	28	0.11	233.0	$33.55	4	1	Dual Technology Occupancy Sensor	28	0.11	10%	209.664	$30.19	$160.00	$160.00	0.00	23.296	$3.35	47.70
8	Boiler Room	2080	11	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting No Lens	58	0.64	1,327.0	$191.09	11	2	Dual Technology Occupancy Sensor	58	0.64	10%	1194.336	$171.98	$160.00	$160.00	0.00	132.704	$19.11	8.37
4		2080	1	1	T12 1x2 1 Lamp Magnetic Ballast Surface Mounting No Lens	20	0.02	41.6	$5.99	1	1		20	0.02	10%	37.44	$5.39	$0.00	$0.00	0.00	4.16	$0.60	0.00
11	Hallway	8760	25	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	1.45	12,702.0	$1,829.09	25	2	None	58	1.45	0%	12702	$1,829.09	$0.00	$0.00	0.00	0	$0.00	0.00
11	Stairwell	8760	1	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.06	508.1	$73.16	1	2	None	58	0.06	0%	508.08	$73.16	$0.00	$0.00	0.00	0	$0.00	0.00
12	Stairwell	8760	8	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.46	4,064.6	$585.31	8	2	None	58	0.46	0%	4064.64	$585.31	$0.00	$0.00	0.00	0	$0.00	0.00
12	Bathroom	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	241.3	$34.74	2	2	Dual Technology Occupancy Sensor	58	0.12	10%	217.152	$31.27	$160.00	$160.00	0.00	24.128	$3.47	46.05
5	Storage	520	3	4	T12 1x8 4 Lamps Magnetic Ballast Pendant Mounting No Lens	316	0.95	493.0	$70.99	3	4	None	316	0.95	0%	492.96	$70.99	$0.00	$0.00	0.00	0	$0.00	0.00
3	Gym	2080	12	1	Metal Halide -High-Bay Fixture	292	3.50	7,288.3	$1,049.52	12	3	Dual Technology Occupancy Sensor	292	3.50	10%	6559.488	$944.57	$160.00	$160.00	0.00	728.832	$104.95	1.52
2		2080	2	1	CFL 1 Lamp	28	0.06	116.5	$16.77	2	1		28	0.06	10%	104.832	$15.10	$0.00	$0.00	0.00	11.648	$1.68	0.00
12	Office	2080	10	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.58	1,206.4	$173.72	10	2	Dual Technology Occupancy Sensor	58	0.58	10%	1085.76	$156.35	$160.00	$160.00	0.00	120.64	$17.37	9.21
12	Storage	520	4	2	T8 2x4 2 Lamps Electronic Ballast	58	0.23	120.6	$17.37	4	2	None	58	0.23	0%	120.64	$17.37	$0.00	$0.00	0.00	0	$0.00	0.00
14	107	2080	8	3	T8 2x4 3 Lamps Electronic Ballast	82	0.66	1,364.5	$196.49	8	3	Dual Technology Occupancy Sensor	82	0.66	10%	1228.032	$176.84	$160.00	$160.00	0.00	136.448	$19.65	8.14
12	Gym Office	2080	6	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.35	723.8	$104.23	6	2	Dual Technology Occupancy Sensor	58	0.35	10%	651.456	$93.81	$160.00	$160.00	0.00	72.384	$10.42	15.35
18		2080	1	1	Incandescent 100 w	100	0.10	208.0	$29.95	1	1		100	0.10	10%	187.2	$26.96	$0.00	$0.00	0.00	20.8	$3.00	0.00

12	Bathroom	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	241.3	$34.74	2	2	Dual Technology Occupancy Sensor	58	0.12	10%	217.152	$31.27	$160.00	$160.00	0.00	24.128	$3.47	46.05
12	106	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$208.47	12	2	Dual Technology Occupancy Sensor	58	0.70	10%	1302.912	$187.62	$160.00	$160.00	0.00	144.768	$20.85	7.68
12	105	2080	6	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.35	723.8	$104.23	6	2	Dual Technology Occupancy Sensor	58	0.35	10%	651.456	$93.81	$160.00	$160.00	0.00	72.384	$10.42	15.35
17	101	2080	12	1	T8 1x4 1 Lamp Electronic Ballast Surface Mounting Prismatic Lens	28	0.34	698.9	$100.64	12	1	Dual Technology Occupancy Sensor	28	0.34	10%	628.992	$90.57	$160.00	$160.00	0.00	69.888	$10.06	15.90
12		2080	1	2	T8 2x4 2 Lamps Electronic Ballast	58	0.06	120.6	$17.37	1	2		58	0.06	10%	108.576	$15.63	$0.00	$0.00	0.00	12.064	$1.74	0.00
12		2080	1	2	T8 2x4 2 Lamps Electronic Ballast	58	0.06	120.6	$17.37	1	2		58	0.06	10%	108.576	$15.63	$0.00	$0.00	0.00	12.064	$1.74	0.00
13	102	2080	12	3	T8 2x4 3 Lamps Electronic Ballast	82	0.98	2,046.7	$294.73	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$265.25	$160.00	$160.00	0.00	204.672	$29.47	5.43
12		2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$17.37	1	2		58	0.06	10%	108.576	$15.63	$0.00	$0.00	0.00	12.064	$1.74	0.00
12	Hallway	8760	6	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.35	3,048.5	$438.98	6	2	None	58	0.35	0%	3048.48	$438.98	$0.00	$0.00	0.00	0	$0.00	0.00
13	104	2080	13	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.07	2,217.3	$319.29	13	3	Dual Technology Occupancy Sensor	82	1.07	10%	1995.552	$287.36	$160.00	$160.00	0.00	221.728	$31.93	5.01
12		2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	241.3	$34.74	2	2		58	0.12	10%	217.152	$31.27	$0.00	$0.00	0.00	24.128	$3.47	0.00
13	103	2080	13	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.07	2,217.3	$319.29	13	3	Dual Technology Occupancy Sensor	82	1.07	10%	1995.552	$287.36	$160.00	$160.00	0.00	221.728	$31.93	5.01
12		2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	241.3	$34.74	2	2		58	0.12	10%	217.152	$31.27	$0.00	$0.00	0.00	24.128	$3.47	0.00
12	Stairwell	8760	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	1,016.2	$146.33	2	2	None	58	0.12	0%	1016.16	$146.33	$0.00	$0.00	0.00	0	$0.00	0.00
12	Stairwell	8760	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.23	2,032.3	$292.65	4	2	None	58	0.23	0%	2032.32	$292.65	$0.00	$0.00	0.00	0	$0.00	0.00
12	Bathroom	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	241.3	$34.74	2	2	Dual Technology Occupancy Sensor	58	0.12	10%	217.152	$31.27	$160.00	$160.00	0.00	24.128	$3.47	46.05
11	Hallway	8760	25	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	1.45	12,702.0	$1,829.09	25	2	None	58	1.45	0%	12702	$1,829.09	$0.00	$0.00	0.00	0	$0.00	0.00
2	Hallway	8760	1	1	CFL 1 Lamp	28	0.03	245.3	$35.32	1	1	None	28	0.03	0%	245.28	$35.32	$0.00	$0.00	0.00	0	$0.00	0.00
11	Hallway	8760	6	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.35	3,048.5	$438.98	6	2	None	58	0.35	0%	3048.48	$438.98	$0.00	$0.00	0.00	0	$0.00	0.00
12	214	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$208.47	12	2	Dual Technology Occupancy Sensor	58	0.70	10%	1302.912	$187.62	$160.00	$160.00	0.00	144.768	$20.85	7.68

12	213	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$208.47	12	2	Dual Technology Occupancy Sensor	58	0.70	10%	1302.912	$187.62	$160.00	$160.00	0.00	144.768	$20.85	7.68
14	212	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.66	1,364.5	$196.49	8	3	Dual Technology Occupancy Sensor	82	0.66	10%	1228.032	$176.84	$160.00	$160.00	0.00	136.448	$19.65	8.14
13	211	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.98	2,046.7	$294.73	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$265.25	$160.00	$160.00	0.00	204.672	$29.47	5.43
12	Hallway	8760	8	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.46	4,064.6	$585.31	8	2	None	58	0.46	0%	4064.64	$585.31	$0.00	$0.00	0.00	0	$0.00	0.00
12	Stairwell	8760	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.23	2,032.3	$292.65	4	2	None	58	0.23	0%	2032.32	$292.65	$0.00	$0.00	0.00	0	$0.00	0.00
11	Stairwell	8760	1	2	T8 1x4 2 Lamps Electronic Ballast Surface	58	0.06	508.1	$73.16	1	2	None	58	0.06	0%	508.08	$73.16	$0.00	$0.00	0.00	0	$0.00	0.00
8	Boiler Room	2080	3	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting No Lens	58	0.17	361.9	$52.12	3	2	Dual Technology Occupancy Sensor	58	0.17	10%	325.728	$46.90	$160.00	$160.00	0.00	36.192	$5.21	30.70
13	204/205	2080	7	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.57	1,193.9	$171.92	7	3	Dual Technology Occupancy Sensor	82	0.57	10%	1074.528	$154.73	$160.00	$160.00	0.00	119.392	$17.19	9.31
1	206	2080	18	2	T5 1x4 2 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Sylvania FP54/835/HO	54	0.97	2,021.8	$291.13	18	2	Dual Technology Occupancy Sensor	54	0.97	10%	1819.584	$262.02	$160.00	$160.00	0.00	202.176	$29.11	5.50
7	Library	2080	45	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Direct/Indirect	58	2.61	5,428.8	$781.75	45	2	Dual Technology Occupancy Sensor	58	2.61	10%	4885.92	$703.57	$160.00	$160.00	0.00	542.88	$78.17	2.05
13	203	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.49	1,023.4	$147.36	6	3	Dual Technology Occupancy Sensor	82	0.49	10%	921.024	$132.63	$160.00	$160.00	0.00	102.336	$14.74	10.86
13	Faculty Rm	2080	6	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.49	1,023.4	$147.36	6	3	Dual Technology Occupancy Sensor	82	0.49	10%	921.024	$132.63	$160.00	$160.00	0.00	102.336	$14.74	10.86
12	Kitchen	2080	5	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.29	603.2	$86.86	5	2	Dual Technology Occupancy Sensor	58	0.29	10%	542.88	$78.17	$160.00	$160.00	0.00	60.32	$8.69	18.42
12	Girls Room	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$17.37	1	2	Dual Technology Occupancy Sensor	58	0.06	10%	108.576	$15.63	$160.00	$160.00	0.00	12.064	$1.74	92.10
12	Boys Room	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$17.37	1	2	Dual Technology Occupancy Sensor	58	0.06	10%	108.576	$15.63	$160.00	$160.00	0.00	12.064	$1.74	92.10
12	207	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$208.47	12	2	Dual Technology Occupancy Sensor	58	0.70	10%	1302.912	$187.62	$160.00	$160.00	0.00	144.768	$20.85	7.68
9	202	2080	12	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Prismatic Lens	58	0.70	1,447.7	$208.47	12	2	Dual Technology Occupancy Sensor	58	0.70	10%	1302.912	$187.62	$160.00	$160.00	0.00	144.768	$20.85	7.68
12	208	2080	8	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.46	965.1	$138.98	8	2	Dual Technology Occupancy Sensor	58	0.46	10%	868.608	$125.08	$160.00	$160.00	0.00	96.512	$13.90	11.51

12	Boys Room	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.12	241.3	$34.74	2	2	Dual Technology Occupancy Sensor	58	0.12	10%	217.152	$31.27	$160.00	$160.00	0.00	24.128	$3.47	46.05
12	Girls Room	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting	58	0.06	120.6	$17.37	1	2	Dual Technology Occupancy Sensor	58	0.06	10%	108.576	$15.63	$160.00	$160.00	0.00	12.064	$1.74	92.10
14	201	2080	4	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting	82	0.33	682.2	$98.24	4	3	Dual Technology Occupancy Sensor	82	0.33	10%	614.016	$88.42	$160.00	$160.00	0.00	68.224	$9.82	16.29
12	209	2080	8	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.46	965.1	$138.98	8	2	Dual Technology Occupancy Sensor	58	0.46	10%	868.608	$125.08	$160.00	$160.00	0.00	96.512	$13.90	11.51
13	210	2080	13	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.07	2,217.3	$319.29	13	3	Dual Technology Occupancy Sensor	82	1.07	10%	1995.552	$287.36	$160.00	$160.00	0.00	221.728	$31.93	5.01
15	Throughout	8760	1	2	Exit Sign (2) 15 W incadescent	30	0.03	262.8	$37.84	1	0	None	30	0.03	0%	262.8	$37.84	$0.00	$0.00	0.00	0	$0.00	0.00
16	Throughout	8760	17	0	LED Exit Signs	4	0.07	595.7	$85.78	17	0	None	4	0.07	0%	595.68	$85.78	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		484	130			32.52	101,368.7	$14,597.10	484	130			32.518		95976.3	$13,820.59		$6,240.00	0.00	5392.4	$776.51	8.04

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

CEG Job #: 9C09078
Project: School District of the Chathams
Address: 16 Milton Ave
Chatham, NJ
Building SF: 37,964

Milton Avenue School

KWH COST: **$0.144**

ECM #3: Lighting Upgrade - Gym

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
3	Gym	2080	12	1	Metal Halide -High-Bay Fixture	292	3.50	7,288.3	$1,049.52	12	3	3-Lamp T-5 HO Cooper F-Bay	182	2.18	4542.72	$654.15	$300.00	$3,600.00	1.32	2745.6	$395.37	9.11
2	Gym	2080	2	1	CFL 1 Lamp	28	0.06	116.5	$16.77	2	1	No Replacement	28	0.06	116.48	$16.77	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		14	2			3.56	7,404.8	$1,066.29	14	4			2.24	4659.2	$670.92		$3,600.00	1.32	2745.6	$395.37	9.11

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

CEG Job #: 9C09078
Project: School District of the Chathams
Address: 16 Milton Ave
Chatham, NJ
Building SF: 37,964

Milton Avenue School

KWH COST: **$0.144**

ECM #4: LED Exit Sign

EXISTING LIGHTING										PROPOSED LIGHTING										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
15	**Throughout**	**8760**	**1**	**2**	**Exit Sign (2) 15 W incadescent**	**30**	**0.03**	**262.8**	**$37.84**	**1**	**0**	**Exit Sign - LED**	**4**	**0.00**	**35.04**	**$5.05**	**$56.00**	**$56.00**	**0.03**	**227.76**	**$32.80**	**1.71**
16	Throughout	8760	17	0	LED Exit Signs	4	0.07	595.7	$85.78	17	0	No Replacement	4	0.07	595.68	$85.78	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		18	2			0.10	858.5	$123.62	18	0			0.072	630.72	$90.82		$56.00	0.03	227.8	$32.80	1.71

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

Project Name: LGEA Solar PV Project - Milton Avenue School
Location: Chatham, NJ
Description: Photovoltaic System 95% Financing - 25 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 25 year
Total Construction Cost	$190,440
Annual kWh Production	25,952
Annual Energy Cost Reduction	$3,737
Annual SREC Revenue	$9,083
First Cost Premium	**$190,440**
Simple Payback:	**14.85** Years

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	95%
Financing Term (mths):	300	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.144**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	7.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$9,522	0	0	0	$0	0	0	(9,522)	0
1	$0	25,952	$3,737	$0	$9,083	$12,577	$2,768	($2,524)	($12,046)
2	$0	25,822	$3,849	$0	$9,038	$12,377	$2,968	($2,457)	($14,503)
3	$0	25,693	$3,965	$0	$8,993	$12,162	$3,182	($2,387)	($16,890)
4	$0	25,565	$4,084	$0	$8,948	$11,932	$3,412	($2,313)	($19,203)
5	$0	25,437	$4,206	$262	$8,903	$11,685	$3,659	($2,497)	($21,701)
6	$0	25,310	$4,332	$261	$8,858	$11,421	$3,924	($2,414)	($24,115)
7	$0	25,183	$4,462	$259	$8,814	$11,137	$4,207	($2,327)	($26,442)
8	$0	25,057	$4,596	$258	$8,770	$10,833	$4,511	($2,236)	($28,678)
9	$0	24,932	$4,734	$257	$8,726	$10,507	$4,837	($2,141)	($30,819)
10	$0	24,807	$4,876	$256	$8,683	$10,157	$5,187	($2,041)	($32,861)
11	$0	24,683	$5,022	$254	$8,639	$9,782	$5,562	($1,937)	($34,798)
12	$0	24,560	$5,173	$253	$8,596	$9,380	$5,964	($1,828)	($36,626)
13	$0	24,437	$5,328	$252	$8,553	$8,949	$6,395	($1,715)	($38,341)
14	$0	24,315	$5,488	$250	$8,510	$8,487	$6,858	($1,597)	($39,937)
15	$0	24,193	$5,653	$249	$8,468	$7,991	$7,353	($1,473)	($41,410)
16	$0	24,072	$5,822	$248	$8,425	$7,459	$7,885	($1,345)	($42,755)
17	$0	23,952	$5,997	$247	$8,383	$6,889	$8,455	($1,211)	($43,966)
18	$0	23,832	$6,177	$245	$8,341	$6,278	$9,066	($1,072)	($45,038)
19	$0	23,713	$6,362	$244	$8,300	$5,623	$9,722	($927)	($45,965)
20	$0	23,594	$6,553	$243	$8,258	$4,920	$10,424	($776)	($46,741)
21	$0	23,476	$6,750	$242	$8,217	$4,482	$9,583	$659	($46,082)
22	$0	23,359	$6,952	$241	$8,176	$3,622	$7,886	$3,379	($42,703)
23	$0	23,242	$7,161	$239	$8,135	$0	$0	$15,056	($27,647)
24	$0	23,126	$7,375	$238	$8,094	$0	$0	$15,231	($12,415)
25	$0	23,010	$7,597	$237	$8,054	$0	$0	$15,413	$2,998
	Totals:	495,110	$100,417	$4,038	$173,288	$190,544	$116,342	$133,811	($768,685)
				Net Present Value (NPV)				**($18,626)**	
				Internal Rate of Return (IRR)				**N/A**	

Project Name: LGEA Solar PV Project - Milton Avenue School
Location: Chatham, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$190,440
Annual kWh Production	25,952
Annual Energy Cost Reduction	$3,737
Annual SREC Revenue	$9,083
First Cost Premium	**$190,440**
Simple Payback:	**14.85** Years

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.144**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Cumulative Cash Flow
0	$190,440	0	0	0	$0	(190,440)	0
1	$0	25,952	$3,737	$0	$9,083	$12,820	($177,620)
2	$0	25,822	$3,849	$0	$9,038	$12,887	($164,733)
3	$0	25,693	$3,965	$0	$8,993	$12,957	($151,775)
4	$0	25,565	$4,084	$0	$8,948	$13,031	($138,744)
5	$0	25,437	$4,206	$262	$8,903	$12,847	($125,897)
6	$0	25,310	$4,332	$261	$8,858	$12,930	($112,967)
7	$0	25,183	$4,462	$259	$8,814	$13,017	($99,950)
8	$0	25,057	$4,596	$258	$8,770	$13,108	($86,842)
9	$0	24,932	$4,734	$257	$8,726	$13,203	($73,639)
10	$0	24,807	$4,876	$256	$8,683	$13,303	($60,336)
11	$0	24,683	$5,022	$254	$8,639	$13,407	($46,928)
12	$0	24,560	$5,173	$253	$8,596	$13,516	($33,412)
13	$0	24,437	$5,328	$252	$8,553	$13,629	($19,783)
14	$0	24,315	$5,488	$250	$8,510	$13,748	($6,035)
15	$0	24,193	$5,653	$249	$8,468	$13,871	$7,836
16	$0	24,072	$5,822	$248	$8,425	$14,000	$21,835
17	$0	23,952	$5,997	$247	$8,383	$14,133	$35,969
18	$0	23,832	$6,177	$245	$8,341	$14,273	$50,241
19	$0	23,713	$6,362	$244	$8,300	$14,417	$64,659
20	$0	23,594	$6,553	$243	$8,258	$14,568	$79,227
21	$1	23,476	$6,750	$242	$8,217	$14,725	$93,952
22	$2	23,359	$6,952	$241	$8,176	$14,887	$108,839
23	$3	23,242	$7,161	$239	$8,135	$15,056	$123,895
24	$4	23,126	$7,375	$238	$8,094	$15,231	$139,126
25	$5	23,010	$7,597	$237	$8,054	$15,413	$154,539
	Totals:	495,110	$100,417	$4,038	$173,288	$344,979	$269,667
				Net Present Value (NPV)		**$154,564**	
				Internal Rate of Return (IRR)		**5.0%**	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW_{DC}	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Milton Ave	1500	Sunpower SPR230	92	14.7	1,353	21.16	25,952	3,036	15.64

.= Proposed PV Layout

Notes:
1. Estimated kWH based on the National Renewable Energy Laboratory PVWatts Version 1 Calculator Program.

PVWatts Version 1 Input Screen

PV System Specifications:

DC Rating (kW):	21.16	Inputted From Roof Space Cell "G2" Total KW
DC to AC Derate Factor:	0.81	Inputted From Derate Factor Calculated Below in Cell "B37"
Array Type:	Fixed Tilt 1 - Axis Tracking 2 - Axis Tracking	There are 3 inputs for Array Type in all cases you should be using **Fixed Tilt** as the Selection
Fixed Tilt of Single Axis Tracking System:		
Array Tilt (degrees):	22	Based on Roof Type: For Flat Roof use 10 degrees, For Pitched Roof this is based on roof pitch.
Array Azimuth (degrees):	180	Based on Direction Array is Facing.

PV Watts Derate Factor for AC Power Rating at STC		
Component Derate Factors	PVWatts Default	Range
PV module nameplate DC rating	1.00	0.80–1.05
Inverter and transformer	0.95	0.88–0.96
Mismatch	0.98	0.97–0.995
Diodes and connections	1.00	0.99–0.997
DC wiring	0.98	0.97–0.99
AC wiring	0.99	0.98–0.993
1. Estimated kWH based on the National Renewable Energy Laboratory PVWatts Version 1 Calculator Program.	0.95	0.30–0.995
System availability	0.95	0.00–0.995
Shading	1.00	0.00–1.00
Sun-tracking	1.00	0.95–1.00
Age	1.00	0.70–1.00
Overall DC-to-AC derate factor	**0.81**	0.96001–0.09999

PVWatts * * * AC Energy & Cost Savings

Cautions for Interpreting the Results

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	21.2 kW
DC to AC Derate Factor:	0.810
AC Rating:	17.1 kW
Array Type:	Fixed Tilt
Array Tilt:	22.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	1.4 ¢/kWh

Results			
Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	2.85	1548	22.29
2	3.61	1770	25.49
3	4.39	2322	33.44
4	4.96	2440	35.14
5	5.68	2820	40.61
6	5.83	2722	39.20
7	5.71	2721	39.18
8	5.47	2580	37.15
9	4.94	2330	33.55
10	4.06	2039	29.36
11	2.74	1378	19.84
12	2.41	1282	18.46
Year	4.39	25952	373.71

Output Hourly Performance Data * Output Results as Text

About the Hourly Performance Data   Saving Text from a Browser

Run PVWATTS v.1 for another US location or an International location
Run PVWATTS v.2 (US only)

Please send questions and comments regarding PVWATTS to Webmaster

Return to RReDC home page (*http://rredc.nrel.gov*)

ENERGY AUDIT – FINAL REPORT

SCHOOL DISTRICT OF THE CHATHAMS
SOUTHERN BOULEVARD SCHOOL
192 SOUTHERN BOULEVARD
CHATHAM, NJ 07928

ATTN: RALPH GOODWIN
SCHOOL BUSINESS ADMINISTRATOR BOARD SECRETARY

CEG PROJECT NO. 9C09078

CONCORD ENGINEERING GROUP

520 SOUTH BURNT MILL ROAD
VOORHEES, NJ 08043
TELEPHONE: (856) 427-0200
FACSIMILE: (856) 427-6529
WWW.CEG-INC.NET

CONTACT: MICHAEL FISCHETTE, PRESIDENT
EMAIL: mfischette@ceg-inc.net

Table of Contents

REPORT DISCLAIMER

The information contained within this report, including any attachment(s), is intended solely for use by the named addressee(s). If you are not the intended recipient, or a person designated as responsible for delivering such messages to the intended recipient, you are not authorized to disclose, copy, distribute or retain this report, in whole or in part, without written authorization from Concord Engineering Group, Inc., 520 S. Burnt Mill Road, Voorhees, NJ 08043.

This report may contain proprietary, confidential or privileged information. If you have received this report in error, please notify the sender immediately. Thank you for your anticipated cooperation.

I. EXECUTIVE SUMMARY

This report presents the findings of an energy audit conducted for:

Southern Boulevard School
192 Southern Boulevard
Chatham, NJ 07928

Facility Contact Person: John Cataldo
Municipal Contact Person: Ralph Goodwin

This audit was performed in connection with the New Jersey Clean Energy Local Government Energy Audit Program. These energy audits are conducted to promote the office of Clean Energy's mission, which is to use innovation and technology to solve energy and environmental problems in a way that improves the State's economy. This can be achieved through the wiser and more efficient use of energy.

The annual energy costs at this facility are as follows:

Electricity	$68,813
Natural Gas	$56,600
Total	$125,413

The potential annual energy cost savings for each energy conservation measure (ECM) and renewable energy measure (REM) are shown below in Table 1. <u>Be aware that the ECM's are not additive because of the interrelation of some of the measures.</u> This audit is consistent with an ASHRAE level 2 audit. The cost and savings for each measure is ± 20%. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

Table 1
Financial Summary Table

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Lighting Upgrade - General	$2,050	$469	4.4	471.4%
ECM #2	Lighting Controls	$10,080	$1,545	6.5	130.0%
ECM #3	LED EXIT SIGNS	$414	$464	0.9	2703.3%
ECM #4	Lighting Upgrade - Gym	$4,500	$427	10.5	137.3%
ECM #5	Boiler Replacement – High Efficiency Upgrade	$185,250	$5,795	32.0	9.5%
ECM #6	Domestic Water Heater Replacement	$22,420	$351	63.9	-81.2%
ECM #7	High-Efficiency Split System Units	$21,103	$217	97.4	-84.6%
ECM #8	DDC System	$247,628	$9,631	25.7	-41.7%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	Solar PV Project	$1,374,480	$98,046	14.0	78.3%

Notes: A. Cost takes into consideration applicable NJ Smart StartTM incentives.
B. Savings takes into consideration applicable maintenance savings.

The estimated demand and energy savings for each ECM and REM is shown below in Table 2. The information in this table corresponds to the ECM's and REM in Table 1.

Table 2
Estimated Energy Savings Summary Table

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	Lighting Upgrade - General	1.4	2,844.9	0.0
ECM #2	Lighting Controls	0.0	9,366.4	0.0
ECM #3	LED EXIT SIGNS	0.2	2,049.8	0.0
ECM #4	Lighting Upgrade - Gym	1.2	2,545.9	0.0
ECM #5	Boiler Replacement – High Efficiency Upgrade	0.0	0.0	3,775
ECM #6	Domestic Water Heater Replacement	0.0	0.0	230.9
ECM #7	High-Efficiency Split System Units	0.0	1,313.0	0.0
ECM #8	DDC System	0.0	31,431.0	42,820.0

RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	Solar PV Project	152.7	190,380	0.0

Recommendation:

Concord Engineering Group (CEG) strongly recommends the implementation of all ECM's that provide a calculated simple payback at or under ten (10) years. The following Energy Conservation Measures are recommended for the Southern Boulevard School:

- **ECM #1:** Lighting Upgrade
- **ECM #2:** Install Lighting Controls
- **ECM #3:** LED Exit Signs
- **ECM #4:** Install T-5 Lighting in Gym

ECM #5 provides a payback within its lifetime. This system is past the ASHRAE recommended useful service life and will need to be replaced. The boiler can be replaced with more efficient equipment that will provide some energy savings and improve the schools carbon foot print.

Systems that have past their useful service life should be replaced such as the systems described in ECM#6 and 7. Although these ECMs will do not have a payback, they are systems that should be replaced and will save energy as summarized in Table 2 on page 5.

In addition to the ECMs, there are maintenance and operational measures that can provide significant energy savings and provide immediate benefit. The ECMs listed above represent investments that can be made to the facility which are justified by the savings seen overtime. However, the maintenance items and small operational improvements below are typically achievable with on site staff or maintenance contractors and in turn have the potential to provide substantial operational savings compared to the costs associated. The following are recommendations which should be considered a priority in achieving an energy efficient building:

1. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.
2. Maintain all weather stripping on entrance doors.
3. Clean all light fixtures to maximize light output.
4. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

Efficient HVAC equipment replacements are difficult to justify with the energy savings alone. The replacement of HVAC equipment such as the heating and ventilation units at Southern Boulevard School is typically initiated when the equipment stops working, surpasses the life expectancy, or maintenance requirements grow beyond the ability to continue to support it. When replacing the equipment becomes necessary, the additional cost to install high efficiency systems becomes a great value for the investment.

The existing facility does not qualify for the Pay for Performance Program because the average operating demand is below 200 KW.

II. INTRODUCTION

The Southern Boulevard School is a 61,907 square foot facility that includes classrooms, offices, Library/Media center, gymnasium, cafeteria, music rooms, Electric room and boiler rooms.

Electrical and natural gas utility information is collected and analyzed for one full year's energy use of the building. The utility information allows for analysis of the building's operational characteristics; calculate energy benchmarks for comparison to industry averages, estimated savings potential, and baseline usage/cost to monitor the effectiveness of implemented measures. A computer spreadsheet is used to calculate benchmarks and to graph utility information (see the utility profiles below).

The Energy Use Index (EUI) is established for the building. Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year (BTU/ft^2/yr), which is used to compare energy consumption to similar building types or to track consumption from year to year in the same building. The EUI is calculated by converting the annual consumption of all energy sources to BTU's and dividing by the area (gross square footage) of the building. Blueprints (where available) are utilized to verify the gross area of the facility. The EUI is a good indicator of the relative potential for energy savings. A low EUI indicates less potential for energy savings, while a high EUI indicates poor building performance therefore a high potential for energy savings.

Existing building architectural and engineering drawings (where available) are utilized for additional background information. The building envelope, lighting systems, HVAC equipment, and controls information gathered from building drawings allow for a more accurate and detailed review of the building. The information is compared to the energy usage profiles developed from utility data. Through the review of the architectural and engineering drawings a building profile can be defined that documents building age, type, usage, major energy consuming equipment or systems, etc.

The preliminary audit information is gathered in preparation for the site survey. The site survey provides critical information in deciphering where energy is spent and opportunities exist within a facility. The entire site is surveyed to inventory the following to gain an understanding of how each facility operates:

- Building envelope (roof, windows, etc.)
- Heating, ventilation, and air conditioning equipment (HVAC)
- Lighting systems and controls
- Facility-specific equipment

The building site visit is performed to survey all major building components and systems. The site visit includes detailed inspection of energy consuming components. Summary of building occupancy schedules, operating and maintenance practices, and energy management programs provided by the building manager are collected along with the system and components to determine a more accurate impact on energy consumption.

III. METHOD OF ANALYSIS

Post site visit work includes evaluation of the information gathered, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on HVAC, lighting and building envelope improvements. Data collected is processed using energy engineering calculations to anticipate energy usage for each of the proposed energy conservation measures (ECMs). The actual building's energy usage is entered directly from the utility bills provided by the owner. The anticipated energy usage is compared to the historical data to determine energy savings for the proposed ECMs.

It is pertinent to note, that the savings noted in this report are not additive. The savings for each recommendation is calculated as standalone energy conservation measures. Implementation of more than one ECM may in some cases affect the savings of each ECM. The savings may in some cases be relatively higher if an individual ECM is implemented in lieu of multiple recommended ECMs. For example implementing reduced operating schedules for inefficient lighting will result in a greater relative savings. Implementing reduced operating schedules for newly installed efficient lighting will result in a lower relative savings, because there is less energy to be saved. If multiple ECM's are recommended to be implemented, the combined savings is calculated and identified appropriately.

ECMs are determined by identifying the building's unique properties and deciphering the most beneficial energy saving measures available that meet the specific needs of the facility. The building construction type, function, operational schedule, existing conditions, and foreseen future plans are critical in the evaluation and final recommendations. Energy savings are calculated base on industry standard methods and engineering estimations. Energy consumption is calculated based on manufacturer's cataloged information when new equipment is proposed.

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers. The NJ SmartStart Building® program incentives savings (where applicable) are included for the appropriate ECM's and subtracted from the installed cost. Maintenance savings are calculated where applicable and added to the energy savings for each ECM. The costs and savings are applied and a simple payback and simple return on investment (ROI) is calculated. The simple payback is based on the years that it takes for the savings to pay back the net installation cost (Net Installation divided by Net Savings.) A simple return on investment is calculated as the percentage of the net installation cost that is saved in one year (Net Savings divided by Net Installation.)

A simple life-time calculation is shown for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The energy savings is extrapolated throughout the life-time of the ECM and the total energy savings is calculated as the total life-time savings.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

The energy usage for the facility has been tabulated and plotted in graph form as depicted within this section. Each energy source has been identified and monthly consumption and cost noted per the information provided by the Owner.

There are two electric services for the facility. The primary service is located at the Electric room room. The secondary service is located at the boiler room in the 1988 addition. The electric usage profile (below) represents the combined total actual electrical usage for the facility. Jersey Central Power and Light (JCP&L) provides electricity to the facility under their General Service Three-Phase rate structure, General Service Secondary Three-Phase rate structure. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile shows the actual natural gas energy usage for the facility. Public Service Electric and Gas (PSE&G) provides natural gas to the facility under the Basic General Supply Service- Large Volume Gas (LVG) rate structure. Hess Corporation is a third party supplier. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

The overall cost for utilities is calculated by dividing the total cost by the total usage. Based on the utility history provide, the average cost for utilities at this facility is as follows:

Description	Average
Electricity	16.5¢ / kWh
Natural Gas	$1.521 / Therm

Table 3
Electricity Billing Data

Electric Usage Summary

Utility Provider: JCP&L, General Service Secondary 3 phase

Meter: G28743023 Customer Number: 0801577897 0000554411

Meter: G16589718 Customer Number: 0801577897 0006106040

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Aug-08	33,760	159.2	$6,411
Sep-08	32,200	122.2	$5,168
Oct-08	35,480	118.6	$5,615
Nov-08	41,360	111.9	$6,554
Dec-08	37,720	115.7	$6,206
Jan-09	23,920	119.9	$4,248
Feb-09	39,240	117.2	$6,360
Mar-09	29,920	116.2	$4,980
Apr-09	36,120	145.7	$5,920
May-09	37,480	138.0	$6,107
Jun-09	37,400	138.5	$6,056
Jul-09	33,200	157.4	$5,188
Totals	**417,800**	**159.2 Max**	**$68,813**

AVERAGE DEMAND 130.0 KW average
AVERAGE RATE $0.165 $/kWh

Figure 1
Electricity Usage Profile

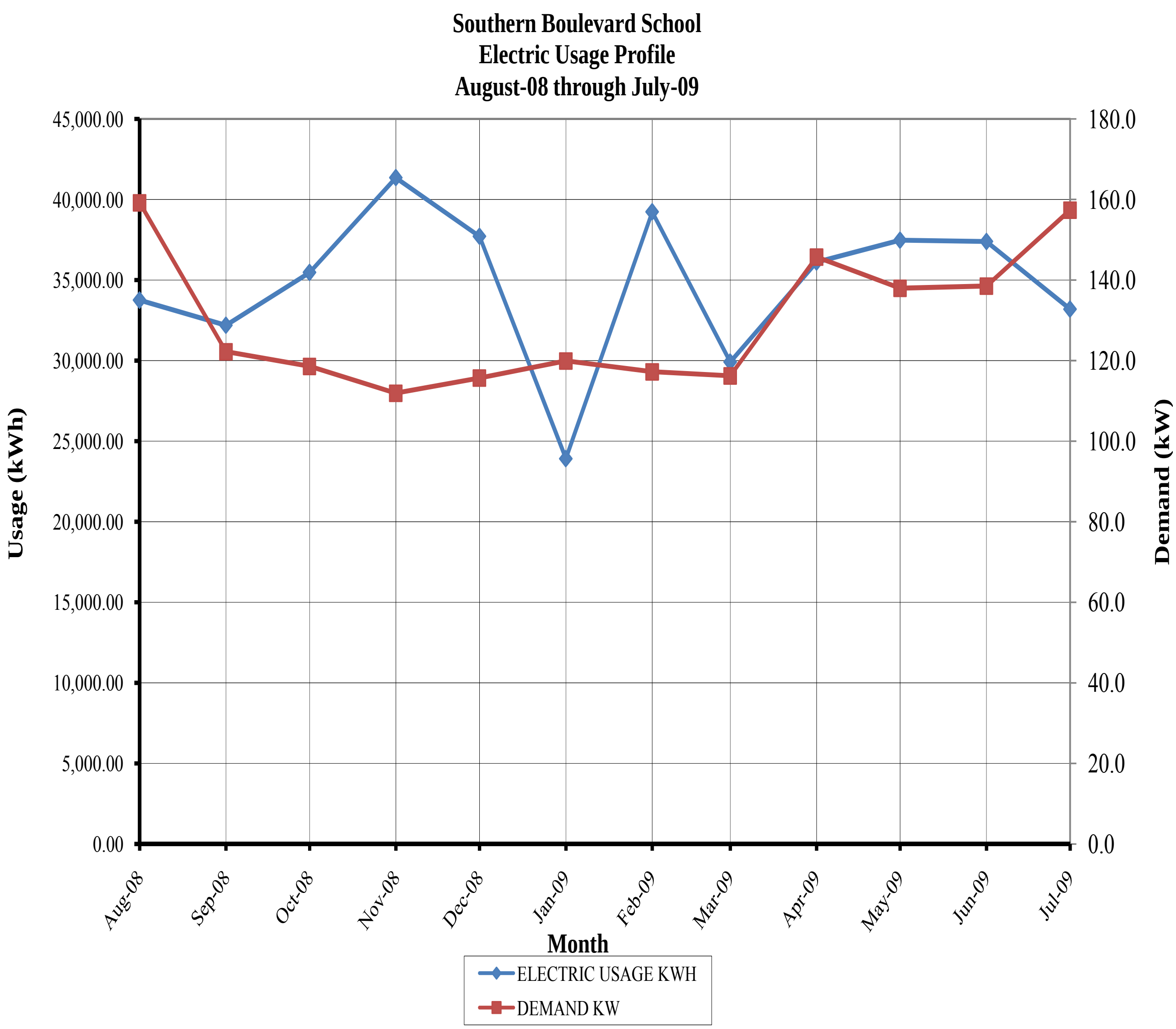


Table 4
Natural Gas Billing Data

Natural Gas Usage Summary

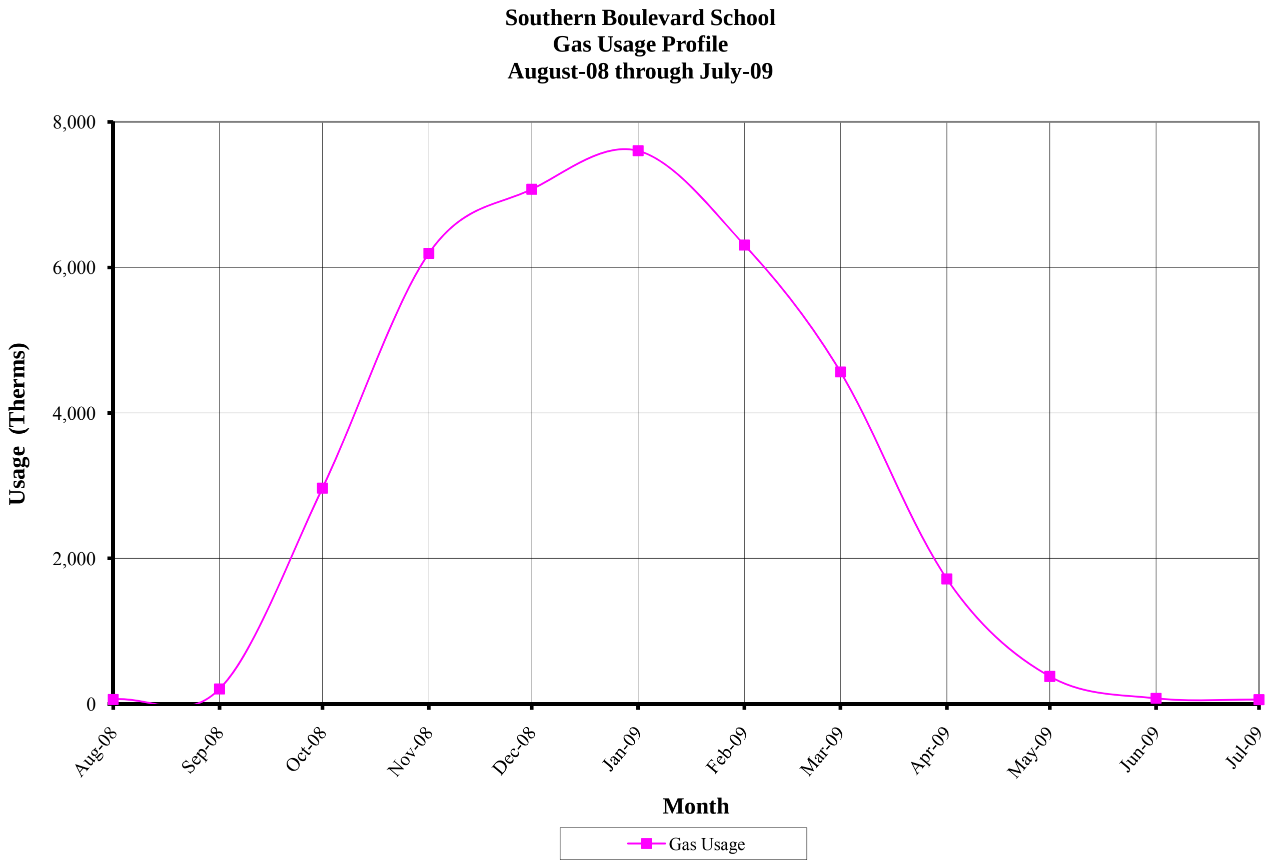
Utility Provider: PSE&G Combined (1874132, 1810551)
PoD ID: PG00001165 0698104556
Third Party Utility Provider: HESS

HESS Meters: 394872 / 394902, 394872 / 404582

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
Aug-08	64.94	$181.76
Sep-08	207.19	$368.93
Oct-08	2,968.93	$5,112.68
Nov-08	6,195.02	$9,562.44
Dec-08	7,074.66	$10,832.63
Jan-09	7,603.17	$11,599.91
Feb-09	6,307.56	$9,804.56
Mar-09	4,563.15	$6,004.71
Apr-09	1,719.89	$2,335.55
May-09	380.09	$593.24
Jun-09	78.18	$102.85
Jul-09	60.46	$100.92
TOTALS	**37,223.23**	**$56,600.18**

AVERAGE RATE: $1.521 $/THERM

Figure 2
Natural Gas Usage Profile



B. Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's annual energy utilization per square foot of building. This calculation is completed by converting all utility usage consumed by a building for one year, to British Thermal Units (BTU) and dividing this number by the building square footage. EUI is a good measure of a building's energy use and is utilized regularly for comparison of energy performance for similar building types. The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of Energy maintains a Benchmarking Building Energy Performance Program. The ORNL website determines how a building's energy use compares with similar facilities throughout the U.S. and in a specific region or state.

Source use differs from site usage when comparing a building's energy consumption with the national average. Site energy use is the energy consumed by the building at the building site only. Source energy use includes the site energy use as well as all of the losses to create and distribute the energy to the building. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses, which allows for a complete assessment of energy efficiency in a building. The type of utility purchased has a substantial impact on the source energy use of a building. The EPA has determined that source energy is the most comparable unit for evaluation purposes and overall global impact. Both the site and source EUI ratings for the building are provided to understand and compare the differences in energy use.

The site and source EUI for this facility is calculated as follows. (See Table 5 for details):

$$Building\ Site\ EUI = \frac{(Electric\ Usage\ in\ kBtu + Gas\ Usage\ in\ kBtu)}{Building\ Square\ Footage}$$

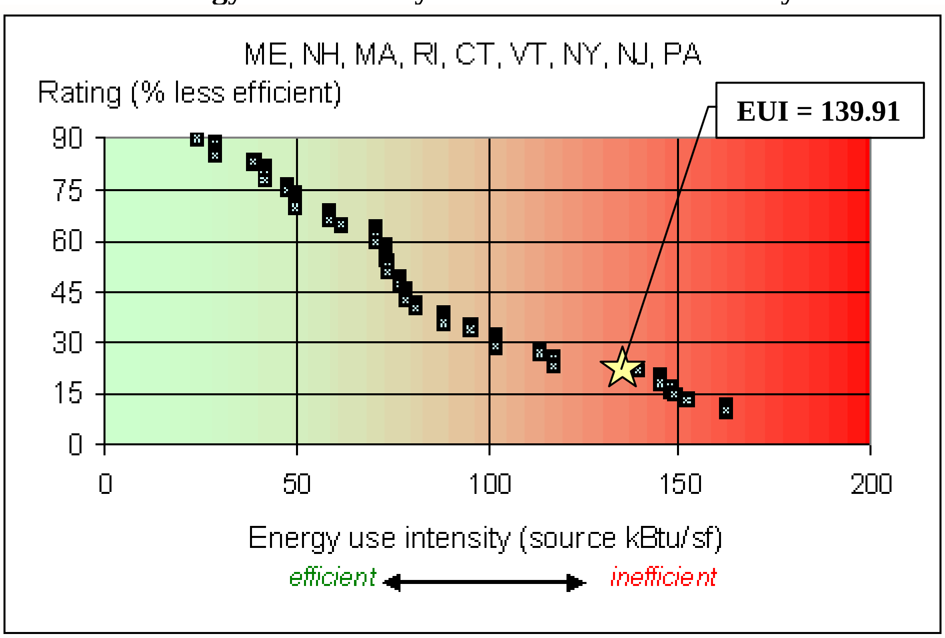
$$Building\ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ x\ SS\ Ratio + Gas\ Usage\ in\ kBtu\ x\ SS\ Ratio)}{Building\ Square\ Footage}$$

Table 5
Lafayette School EUI Calculations

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE RATIO	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu		kBtu
ELECTRIC	417,800.0			1,426,369	3.340	4,764,073
NATURAL GAS		37,223.2		3,722,323	1.047	3,897,272
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				5,148,692		8,661,345
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA	61,907	SQUARE FEET				
BUILDING SITE EUI	*83.17*	kBtu/SF/YR				
BUILDING SOURCE EUI	*139.91*	kBtu/SF/YR				

Figure 3 below depicts a national EUI grading for the source use of *Elementary School Buildings*.

Figure 3
Source Energy Use Intensity Distributions: Elementary Schools



C. EPA Energy Benchmarking System

The United States Environmental Protection Agency (EPA) in an effort to promote energy management has created a system for benchmarking energy use amongst various end users. The benchmarking tool utilized for this analysis is entitled Portfolio Manager. The Portfolio Manager tool allows tracking and assessment of energy consumption via the template forms located on the ENERGY STAR website (www.energystar.gov). The importance of benchmarking for local government municipalities is becoming more important as utility costs continue to increase and emphasis is being placed on carbon reduction, greenhouse gas emissions and other environmental impacts.

Based on information gathered from the ENERGY STAR website, Government agencies spend more than $10 billion a year on energy to provide public services and meet constituent needs. Furthermore, energy use in commercial buildings and industrial facilities is responsible for more than 50 percent of U.S. carbon dioxide emissions. It is vital that local government municipalities assess facility energy usage, benchmark energy usage utilizing Portfolio Manager, set priorities and goals to lessen energy usage and move forward with priorities and goals.

In accordance with the Local Government Energy Audit Program, CEG has created an ENERGY STAR account for the municipality to access and monitoring the facility's yearly energy usage as it compares to facilities of similar type. The following is the user name and password for this account:

https://www.energystar.gov/istar/pmpam/index.cfm?fuseaction=login.login

Username: chathamsd
Password: lgeaceg2009

Security Question: What city were you born in?
Security Answer: "chatham"

The utility bills and other information gathered during the energy audit process are entered into the Portfolio Manager. The following is a summary of the results for the facility:

Table 6
ENERGY STAR Performance Rating

FACILITY DESCRIPTION	ENERGY PERFORMANCE RATING	NATIONAL AVERAGE
Southern Boulevard School	36	50

Refer to the Statement of Energy Performance appendix for the detailed energy summary.

V. FACILITY DESCRIPTION

The original Southern Boulevard School building was built in 1955 and is a two-story with a basement, concrete with brick faced building. An addition of similar construction was built in 1964 making a total of approximately 54,320 square feet at that time. A gym addition was built in 1988 and boiler room built in 2001 that added approximately 7,587 square feet, bringing the building total to 61,907 square feet.

The facility currently houses the boiler rooms, electric room, cafeteria, offices, classrooms, gymnasium, restrooms, Library/Media center and music rooms. The building operates for 40 hours during a typical week. There is a built up roof on the original building. The 1988 addition has an EPDM roof membrane on 1.5” rigid insulation on 1.5” steel deck on steel beams. The windows are tempered, insulated glass with aluminum frame.

Heating System

There are two (2) boiler plants providing hot water for heating for this facility. The boiler plant in the original building consists of two (2) H.B. Smith, Mills 450-W-13 water boilers, each rated for 2,640,000 BTU/hr gross output and 2,295,700 BTU/hr net water output. Each boiler has a Power Flame model C2-GO-20B Natural Gas/oil burner with a maximum natural gas input rating of 3,080,000 BTU/hr. The boilers are 78.3% thermal efficient, operating in a lead/lag configuration. These pumps are approximately 8 years old and in good to fair condition.

The 2001 addition added a boiler plant and serves the 1988 addition. The boiler is a HB Smith model Series 28A-10 cast iron boiler, 3172 maximum MBH natural gas input and is 78.8% efficient. The boiler is eight years old and in good condition. There are two (2) 1.5 hp system pumps piped in parallel located in the 2001 addition boiler room and operating in a lead/lag configuration. The pumps are eight years old and are in fair condition.

There is one (1) heat and ventilation unit in the Basement Custodial room serving the Cafeteria. It appears (could not verify scheduled data) to be the original Nesbitt unit Type G, Size 1012L, 3600 CFM, 1.5 hp fan motor, 180 MBH hot water coil built in 1964 and is in poor condition.

The heating hot water serves twenty five (25) unit ventilators, nine (9) unit heaters and twenty nine (29) fin tube radiators in the original building and 1964 addition. The heating hot water serves three (3) cabinet unit heaters, two (2) heat and ventilation units, one (1) unit ventilator and two (2) fin tube radiators in the 1988 gym addition. The unit ventilators and unit heaters have fractional horse power fan motors and are in fair to poor condition. The two (2) heat and ventilation units serving the gym have a 1 hp and a 1.5 hp fan motor and are in fair condition.

Domestic Hot Water

There is an A.O. Smith model BT-80-112, 74 gallon capacity tank, natural gas, domestic water heater provides hot water for the original building. This unit has an natural gas input of 75,100 Btu/h, and a recovery rate of 72.82 gallons per hour, is 80% thermal efficient. The water heater was manufactured in 2005 and is in good condition.

There is a Rheem-Ruud Universal model G75-125, natural gas, domestic water heater provides hot water for the 1988 addition. This unit has an input of 125,000 Btu/h, 75 gallon tank and a recovery rate of 121.2 gallons per hour, is 80% thermal efficient. The water heater was manufactured in 2000 and is in fair condition.

There is a Ruud-Monel size 80-80, natural gas, domestic water heater provides hot water for the original building. This unit has an input of 95,200 Btu/h, 67 gallon tank and a recovery rate of 80 gallons per hour, is 80% thermal efficient. The water heater was manufactured in 1955 and is in poor condition.

Cooling System

The facility is cooled via four (4) split system air conditioning systems and forty two (42) window air conditioners. All cooling units are air cooled, direct expansion cooling. The split systems range from 3.5 to 7.5 nominal tons. The split systems range from eight (8) to fourteen (14) years old and range from good to fair condition. The window air conditioners range from one (1) to eight (8) years old and are in good condition.

Controls System

There are Johnson Controls pneumatic controls serving the original boiler room and original school building. A Quincy air compressor, approximately 3 years old, with (2) 2hp motors provides air to the controls system. The system operates on a hot water reset schedule as follows: 0°F Outside air temperature (OA): 200°F Leaving Water Temperature (LWT), 15°F Outside air temperature (OA): 175°F Leaving Water Temperature (LWT), 30°F Outside air temperature (OA): 150°F Leaving Water Temperature (LWT), 45°F Outside air temperature (OA): 125°F Leaving Water Temperature (LWT), 60°F Outside air temperature (OA): 100°F Leaving Water Temperature (LWT). The system appears to be operational but is antiquated.

Exhaust System

There are approximately twenty three (23) exhaust fans exhausting the toilet rooms, basement and gym. They are all fractional horse power fan.

Lighting

The building is lit by varying types and sizes of light bulb types. The types used include the use of T-12 fluorescent, T-8 fluorescent, incandescent and halogen. The lamp wattages range from 31 watts to 200 watts with the majority being fluorescent T8 light fixtures with 32 Watt lamps. The incandescent lamps range from 75 watts to 100 watts and the Halogen are 200 watts. There are twenty nine (29) LED exit signs and nine (9) incandescent lamp exit signs.

VI. MAJOR EQUIPMENT LIST

The equipment list is considered major energy consuming equipment and through energy conservation measures could yield substantial energy savings. The list shows the major equipment in the facility and all pertinent information utilized in energy savings calculations. An approximate age was assigned to the equipment in some cases if a manufactures date was not shown on the equipment's nameplate. The ASHRAE service life for the equipment along with the remaining useful life is also shown in the Appendix.

Refer to the **Major Equipment List Appendix** for this facility.

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade - General

Description: General

The lighting in the Southern Boulevard School is primarily made up of fluorescent fixtures with T-12 lamps and magnetic ballasts, T-8 lamps with electronic ballasts, incandescent lamps and halogen lamps. There is a closet, faculty room and a stairwell with incandescent lighting.

This ECM includes replacement of the existing fixtures containing T12 lamps and magnetic ballasts with fixtures containing T8 lamps and electronic ballasts. The new energy efficient, T8 fixtures will provide adequate lighting and will save the owner on electrical costs due to the better performance of the lamp and ballasts. This ECM will also provide maintenance savings through the reduced number of lamps replaced per year. The expected lamp life of a T8 lamp is approximately 30,000 burn-hours, in comparison to the existing T12 lamps which is approximately 20,000 burn-hours. The facility will need 33% less lamps replaced per year.

This ECM also includes replacement of all incandescent lamps to compact fluorescent lamps. The energy usage of an incandescent compared to a compact fluorescent approximately 3 to 4 times greater. In addition to the energy savings, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours.

Energy Savings Calculations:

The **Grade Lighting Audit ECM#1- General Appendix** outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, the replacement of a T-12 fixture to a T-5 or T-8 fixture warrants the following incentive: T-5 or T-8 (1-2 lamp) = \$25 per fixture; T-5 or T-8 (3-4 lamp) = \$30 per fixture.

$$\text{Smart Start® } Incentive = \left(\# \ of \ 1-2 \ lamp \ \ fixtures \times \ \$ \ 25\right) + \left(\# \ of \ 3-4 \ lamp \ \ fixtures \times \ \$ \ 30\right)$$
$$\text{Smart Start® } Incentive = \left(11 \times \ \$ \ 25\right) = \underline{\$275}$$

Replacement and Maintenance Savings are calculated as follows:

96T12: 11 fixtures x 2 lamps x (\$4.30/lamp+ \$5 labor/lamp) x 25 years x 2080 hrs/yr / 20,000 hours/lamp = \$531.96 lifetime cost

59T8: 22 lamps x (\$9.50/lamp+ \$5 labor/lamp) x 25 years x 2080 hrs/yr / 30,000 hours/lamp = \$552.93

Savings = T12 cost – T8 cost = $531.96 - $552.93 = (-$20.97) lifetime maintenance and cost savings (loss)

From the Smart Start Incentive appendix, there is no incentive for replacing incandescent lamps with compact fluorescent lamps. The incentive is only available if the entire light fixture is replaced. In most cases, the existing fixtures can be re-lamped by the facility's staff to obtain the energy savings without the expense of a new fixture and the involvement of an electrician to install a new fixture.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$2,325
NJ Smart Start Equipment Incentive ($):	$275
Net Installation Cost ($):	$2,050
Maintenance Savings ($/Yr):	($1)
Energy Savings ($/Yr):	$469
Total Yearly Savings ($/Yr):	$469
Estimated ECM Lifetime (Yr):	25
Simple Payback	4.4
Simple Lifetime ROI	471.4%
Simple Lifetime Maintenance Savings	($21)
Simple Lifetime Savings	$11,714
Internal Rate of Return (IRR)	23%
Net Present Value (NPV)	$6,109.36

* ECM#1 Calculations DO NOT include lighting control changes implemented in ECM#2. If ECM#1 and #2 are implemented together the savings will be relatively lower than shown above.

ECM #2: Install Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. There has been a belief that it is better to keep the lights on rather than to continuously switch them on and off. This on/off dilemma was studied, and it was determined that the best option is to turn the lights off whenever possible. Although this practice reduces the lamp life, the energy savings far outweigh the lamp replacement costs.

Lighting controls are available in many forms. Lighting controls can be as simplistic as an additional switch. Timeclocks are often used which allow the user to set an on/off schedule. Timeclocks range from a dial clock with on/off indicators to a small box the size of a thermostat with user programs for on/off schedule in digital format. Occupancy sensors detect motion and will switch the lights on when the room is occupied. They can either be mounted in place of the current wall switch, or they can be mounted on the ceiling to cover large areas. Lastly, photocells are a lighting control that sense light levels and will turn the lights off when there is adequate daylight. These are mostly used outside, but they are becoming much more popular in energy-efficient office designs as well.

To determine an estimated savings for lighting controls, we used ASHRAE 90.1-2004 (NJ Energy Code). Appendix G states that occupancy sensors have a 10% power adjustment factor for daytime occupancies for buildings over 5,000 SF. CEG recommends the installation of dual technology occupancy sensors in all classrooms, private offices, conference rooms, restrooms, lunch rooms, lounges, file rooms, etc.

Energy Savings Calculations:

The **Investment Grade Lighting Audit ECM#2- Lighting Controls Appendix** outlines the proposed retrofits, costs, savings, and payback periods. The hallways of the building is a 24/7 facility while the majority of the building is only occupied 40 hours a week and other areas are only a few hours a day. Ten percent of this value is the resultant energy savings due to installation of occupancy sensors and was calculated to be 9,366.4 kWh/year and $1,545/year.

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is $160/unit including material and labor. The SmartStart Buildings® incentive is $20 per control which equates to an installed cost of $140/unit. Total number of rooms to be retrofitted is 72. Total cost to install sensors is $140/ceiling unit x 72 units = $10,080.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$11,520
NJ Smart Start Equipment Incentive ($):	$1,440
Net Installation Cost ($):	$10,080
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,545
Total Yearly Savings ($/Yr):	$1,545
Estimated ECM Lifetime (Yr):	15
Simple Payback	6.5
Simple Lifetime ROI	130.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$23,182
Internal Rate of Return (IRR)	13%
Net Present Value (NPV)	$8,369.60

ECM #3: Install LED Exit Signs

Description:

LED is an acronym for light-emitting-diode. LED's are small light sources that are readily associated with electronic equipment. LED exit signs have been manufactured in a variety of shapes and sizes. There are also retrofit kits that allow for simply modification of existing exit signs to accommodate LED technology. The benefits of LED technology are substantial. LED exit signs will last for 20-30 years without maintenance. This results in tremendous maintenance savings considering that incandescent or fluorescent lamps need to be replaced at a rate of 1-5 times per year. Lamp costs ($2-$7 each) and labor costs ($4-$10 per lamp) add up rapidly. Additionally, LED exit lights only uses 4 Watts. In comparison, conventional exit signs use 10-40 Watts. It is recommended that samples of the products be installed to confirm that they are compatible with the existing electrical system.

This EM replaces all exit signs with incandescent lamps with new exit signs containing LED technology.

Energy Savings Calculations:

A detailed Investment Grade Lighting Audit can be found in **Investment Grade Lighting Audit Appendix – ECM#3** that outlines the proposed retrofits, costs, savings, and payback periods.

(30 watts-4 watts) x 1 kW/1000 watts x 8760 hrs/yr x 9 fixtures = 2,049.84 kWh/yr. saved

2,049.84 kWh/yr x $0.165/kWh = $338.22 / yr. saved

Maintenance savings = 9 fixtures x 2 bulbs/fixture x ($3/bulb + $4/bulb installation) = $126/yr

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, $20/LED Exit sign (≤75kW facility connected load) and $10/LED Exit sign (≥75kW facility connected load).

9 LED Exit signs x $10/ LED Exit sign = $90

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$504
NJ Smart Start Equipment Incentive ($):	$90
Net Installation Cost ($):	$414
Maintenance Savings ($/Yr):	$126
Energy Savings ($/Yr):	$338
Total Yearly Savings ($/Yr):	$464
Estimated ECM Lifetime (Yr):	25
Simple Payback	0.9
Simple Lifetime ROI	2703.3%
Simple Lifetime Maintenance Savings	$3,150
Simple Lifetime Savings	$11,606
Internal Rate of Return (IRR)	112%
Net Present Value (NPV)	$7,669.53

ECM #4: Install T-5 Lighting System in Gym

Description:

The Gym is currently lit via eighteen (18) HID, 250 W Metal Halide fixtures that are mounted approximately 20'-0" above the finished floor. The lighting system is antiquated and the space would be better served with a more efficient, fluorescent lighting system. Studies have shown that metal halide lighting systems have a steep lumen depreciation rate (rate at which light is produced from fixture) which equates to approximately a 26% to 35% reduction in lighting output at 40% of the rated lamp life. In addition, the new fluorescent system will provide a better quality of light and save the Owner many dollars on replacement of the highly expensive metal halide lamps.

CEG recommends upgrading the lighting within the Gym to an energy-efficient T-5 lighting system that includes new lighting fixtures with high efficiency, electronic ballasts and T-5 high output (HO) lamps. The T-5 HO lamps are rated for 20,000 hours versus the 10,000 hours for the 250W Metal Halide lamps so there would be a savings in replacement cost and labor. In addition to the standard lighting features of the T-5 fixtures; a day-lighting option could be selected for the outside rows of light to take advantage of the natural daylight that provides light to the room during the day via the clerestory.

This measure replaces all the HID, 250 W Metal Halide fixtures in the Gym with a well-designed T-5 lighting system. Approximately twenty (18), 3-lamp T5HO high bay fixtures with reflectors and high-efficiency, electronic ballasts will be required in order to meet the mandated 50 foot-candle average within the Gym.

Energy Savings Calculations:

A detailed **Grade Lighting Audit ECM#4- T-5 Lighting System in Gym Appendix** that outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, the replacement of a 250 W HID fixture to a T-5 or T-8 fixture warrants the following incentive: $50 per fixture.

$$\text{Smart Start® } Incentive = (\# \ of \ \ fixtures \times \ \$50) = (18 \times \$50) = \underline{\$900}$$

Maintenance savings are calculated based on the facility operational hours as indicated by the Owner. For the Gym, the estimated operational hours are 2,080 hours per year. Based on the lamp life comparison, there will be five (5) complete lamp replacements required for the metal halide system at the time when two (2) complete lamp replacement would be required for the fluorescent lighting system. Based on industry pricing, the lamp cost for a 250W metal halide lamp is approximately ±$25 per lamp and a T-5 54HO fluorescent lamp is approximately ±$5 per lamp. Therefore, the maintenance savings are calculated as follows:

$$Maint eance\ Savings = (\#\ of\ MH\ lamps \times \$25\ per\ lamp) - (\#\ of\ T5HO\ lamps \times \$5\ per\ lamp)$$

$$Maint eance\ Savings = (18\ lamps \times \$25\ per\ lamp) - (54\ lamps \times \$5\ per\ lamp) = \underline{\$180}$$

= $180 / 25 years = $7.20/year average maintenance savings

It is pertinent to note, that installation labor was not included in the maintenance savings.

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$5,400
NJ Smart Start Equipment Incentive ($):	$900
Net Installation Cost ($):	$4,500
Maintenance Savings ($/Yr):	$7
Energy Savings ($/Yr):	$420
Total Yearly Savings ($/Yr):	$427
Estimated ECM Lifetime (Yr):	25
Simple Payback	10.5
Simple Lifetime ROI	137.3%
Simple Lifetime Maintenance Savings	$180
Simple Lifetime Savings	$10,680
Internal Rate of Return (IRR)	8%
Net Present Value (NPV)	$2,938.90

ECM #5: Boiler Replacement – High Efficiency Upgrade

Description:

Heating is provided to the facility by two heating plants. The original basement heating plant, built in 1965 is outdated and can be more efficient. The newer heating plant, built in 2001 is adequately efficient and should remain in service.

In regards to the original plant, there are two (2) two H.B. Smith, Mills 450 series boiler, model 450-W-13, 3,370 MBH Natural Gas input each, natural gas burner water boilers, which have a combustion efficiency of 78.3% when new. These boilers are 9 years past its ASHRAE useful service life.

This energy conservation measure will replace the gas fired boilers serving the original facility. The calculation is based on the following equipment: Aerco, Benchmark BMK-3.0LN-2 condensing boiler or equivalent. The existing units will be replaced with high energy efficient units with capacities typical of the existing units.

Energy Savings Calculations:

Existing 2,640 MBH Gas Fired Boiler:

Rated Capacity = 5,280 MBh Input, 4,591.4 MBh Output (Natural Gas)

Combustion Efficiency = 78.3%
Age & Radiation Losses = 5%
Thermal Efficiency = 73.3%

Natural Gas Equipment List - Estimated Annual Usage per unit

Concord Engineering Group

Southern Boulevard

Manufacturer	Qty.	Model #	Serial #	Input (MBh)	% of Total Input	Estimated Annual Therms
H.B. SMITH	1	MILLS 450-W-13	41992H	3370	33.02%	12,289.47
H.B. SMITH	1	MILLS 450-W-13	781163 HI	3370	33.02%	12,289.47
H.B. SMITH	1	Series 28A-10	N2001-350	3172	31.08%	11,567.42
A.O. Smith	1	BT-80-112	L05M002900	75	0.74%	273.87
Rheem-Ruud	1	G75-125	URNG 1100G03000	125	1.22%	455.84
Ruud-Monel	1	Size 80-80		95.2	0.93%	347.17
			Total Input MBH	10,207	1.00	37,223.23
			Total Input Therms	102.1		
			Total Gas Consumption Therms / yr.	37223.23		

Replacement Gas Fired Boiler:

High-Efficiency Gas Fired Boiler

Rated Capacity = 6,000 MBh Input, 11,124 MBh maximum Output (Natural Gas)

Combustion Efficiency = 87.1%
Radiation Losses = 0.5%
Thermal Efficiency = 86.6%

Operating Data:

Heating Season Fuel Consumption = 24,579 Therms of natural (based on natural gas billing data and the square footage of the facility).

$$\textit{Heating Energy Savings} = \textit{Fuel Consumption} \times (\textit{New Furnace Efficiency} - \textit{Old Furnace Efficiency})$$

Heating Energy Savings = 24,579 Therms x ((86.6% - 73.3%) / (86.6%)) = 3,775 Therms

Total Heating Cost savings

Heating Energy Cost Savings = Annual Energy Savings x $/Therm

Heating Energy Cost Savings = (3,775 Therms) x $1.521/Therm = $5,742/ yr.

Installed cost of two (2) new BMK3.0 LN 460/4, IRI 3000MBH input gas fired boilers with one (1) BMS II sequencing panel, sensor kit and installation is $195,750.

Equipment Incentives:

Heating Smart Start Equipment Incentive = ($1.75/MBh) = (6,000 MBh) x $1.75 = $10,500

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$195,750
NJ Smart Start Equipment Incentive ($):	$10,500
Net Installation Cost ($):	$185,250
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$5,795
Total Yearly Savings ($/Yr):	$5,795
Estimated ECM Lifetime (Yr):	35
Simple Payback	32.0
Simple Lifetime ROI	9.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$202,825
Internal Rate of Return (IRR)	1%
Net Present Value (NPV)	($60,731.56)

ECM #6: Domestic Water Heater Replacement

Description:

There are three (3) existing domestic water heaters. The existing (WH-1) Ruud-Monel size 80-80 with a 67 gallon tank, 95,200 BTUH input natural gas heater with 80% thermal efficiency and a nameplate recovery rate of 80 gallon per hour. The existing domestic water heater (WH-2) is a Rheem-Ruud model G75-125 with a 75 gallon tank, 125,000 BTUH input natural gas heater with 80% thermal efficiency and a nameplate recovery rate of 121.2 gallon/hr. The other domestic water heater (WH-3) is an A.O Smith model BT-80-112 with a 74 gallon tank and 75,000 BTUH input natural gas heater with an 80% thermal efficiency and a nameplate recovery rate of 72.82 gallons per hour.

This energy conservation measure will replace each of the three (3) existing water heaters with a 96% thermal efficient Bradford White model EF-60T-125E-3N gas fired domestic hot water heater having 125 MBH input and 60-gallon storage capacity or equivalent.

Energy Savings Calculations:

<u>Existing Natural Gas DW Heater (WH1)</u>
Rated Capacity = 95.2 MBH input; 67 gallons storage
Combustion Efficiency = 80%
Age & Radiation Losses = 5%
Thermal Efficiency = 75%

<u>Existing Natural Gas DW Heater (WH2)</u>
Rated Capacity = 125 MBH input; 75 gallons storage
Combustion Efficiency = 80%
Age & Radiation Losses = 5%
Thermal Efficiency = 75%

<u>Existing Natural Gas DW Heater (WH2)</u>
Rated Capacity = 75 MBH input; 74 gallons storage
Combustion Efficiency = 80%
Age & Radiation Losses = 5%
Thermal Efficiency = 75%

<u>Proposed Natural Gas-Fired, High-Efficiency DW Heater (WH1), (WH2), and (WH3)</u>
Rated Capacity = 125 MBH input; 60 gallons storage
Thermal Efficiency = 96%
Radiation Losses = 0.5%
Net Efficiency = 95.5%

Natural Gas Equipment List - Estimated Annual Usage per unit

Concord Engineering Group

Southern Boulevard

Manufacturer	Qty.	Model #	Serial #	Input (MBh)	% of Total Input	Estimated Annual Therms
H.B. SMITH	1	MILLS 450-W-13	41992H	3370	**33.02%**	12,289.47
H.B. SMITH	1	MILLS 450-W-13	781163 HI	3370	**33.02%**	12,289.47
H.B. SMITH	1	Series 28A-10	N2001-350	3172	**31.08%**	11,567.42
A.O. Smith	1	BT-80-112	L05M002900	75	**0.74%**	**273.87**
Rheem-Ruud	1	G75-125	URNG 1100G03000	125	**1.22%**	**455.84**
Ruud-Monel	1	Size 80-80		95.2	**0.93%**	**347.17**
			Total Input MBH	**10,207**	**1.00**	**37,223.23**
			Total Input Therms	102.1		
			Total Gas Consumption Therms / yr.	37223.23		

Operating Data for Domestic Water Heater

$$\text{Estimated Consumption(WH1)} = \frac{95.2 MBHinput}{10{,}207 MBHbldginput} x37{,}223.23 Therms / year = 347.2 Therms / year$$

$$\text{Estimated Consumption(WH2)} = \frac{125 MBHinput}{10{,}207 MBHbldginput} x37{,}223.23 Therms / year = 455.8 Therms / year$$

$$\text{Estimated Consumption(WH3)} = \frac{75 MBHinput}{10{,}207 MBHbldginput} x37{,}223.23 Therms / year = 273.9 Therms / year$$

Energy Savings = Old Water Heater Energy Input x ((New Water Heater Efficiency – Old Water Heater) / New Water Heater Efficiency))

$$\text{Energy Savings (WH1)} = 347.2 \text{ Therms} \times \frac{(95.5\% - 75\%)}{(95.5\%)} = 74.2 \text{ Therms}$$

$$\text{Energy Savings (WH2)} = 455.8 \text{ Therms} \times \frac{(95.5\% - 75\%)}{(95.5\%)} = 97.9 \text{ Therms}$$

$$\text{Energy Savings (WH3)} = 273.9 \text{ Therms} \times \frac{(95.5\% - 75\%)}{(95.5\%)} = 58.8 \text{ Therms}$$

Total Energy Savings = (WH1) +(WH2) + (WH3)
= 74.2 Therms + 97.9 Therms + 58.8 Therms
= 230.9 Therms

Average Cost of Natural Gas = $1.521/Therm

Yearly Savings = 230.9 Therm x $1.521/ Therm = $351/year

Cost of (3) two Commercial Domestic Water Heater and Installation = $23,010

Simple Payback = $23,010 / $351 = 65.6 years

Smart Start Incentive = $2.00/MBh x (95.2+125+75) /installed MBh = $590.

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$23,010
NJ Smart Start Equipment Incentive ($):	$590
Net Installation Cost ($):	$22,420
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$351
Total Yearly Savings ($/Yr):	$351
Estimated ECM Lifetime (Yr):	12
Simple Payback	63.9
Simple Lifetime ROI	-81.2%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$4,212
Internal Rate of Return (IRR)	-19%
Net Present Value (NPV)	($18,926.14)

ECM #7: High-Efficiency Split System Units

Description:

There is one (1) indoor air handling unit and one (1) outdoor condensing unit that is near the end of it's expected service life of fifteen (15) years as outlined in Chapter 36 of the 2007 ASHRAE Applications Handbook. This split system was built in 1995 and is in fair condition. Due to escalating owning and maintenance costs, this unit can be replaced. The unit is 3,000 CFM (cubic feet per minute) capacity, 7.6 tons cooling.

This measure would replace the air handling and condensing unit with energy-efficient variable air volume air handler with DX cooling and hot water heating coil, variable air volume zone control dampers and an energy efficient condensing unit, by Trane or approved equivalent.

Energy Savings Calculations:

$$EnergySavings = \frac{[CoolingTons \times 12,000\,Btu/ton]}{[1000W/kW]} \times \left(\frac{1}{EER_{OLD}} - \frac{1}{EER_{NEW}}\right) \times Avg.LoadFactor \times Hrs.ofCooling$$

<u>Existing Trane 7.5-Ton CU</u>

Rated Capacity = 7.5 Tons per unit
Condenser Section Efficiency = 10.3 EER
Cooling Season Hrs. of Operation = 1,800 hrs/yr.

Average Cost of Electricity - $0.165/kWh

<u>Proposed High-Efficiency 7.5-Ton Condensing Unit</u>

Rated Capacity = 7.5 Tons per Unit
New Cooling Unit Efficiency = 11.5 EER

$$EnergySavings = \frac{[7.5Tons \times 12,000\,Btu/ton]}{[1000W/kW]} \times \left(\frac{1}{10.3} - \frac{1}{11.5}\right) \times 0.8 \times 1800 = 1,313\,kWh/yr \text{ per unit}$$

<u>Total Energy Cost Savings</u> = (1,313) kWh/yr. x $0.165/kWh = <u>$216.64</u> per year per unit

Installation costs for the 7.5 nominal Ton split system Air handling unit and condensing unit replacements with matching capacity are estimated at <u>$21,900</u>. It is pertinent to note that this estimate includes the demolition of the existing units.

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, the rooftop unit replacement falls under the category "Unitary HVAC" and warrants an incentive based on efficiency (EER) at a certain cooling tonnage.

$$\text{Smart Start® } Incentive\ (UnitaryHVAC / SplitSystems : 5.4 - 11.25\ Tons) = (Cooling\ Tons \times \quad Incentive)$$
$$= 1unit(7.5\ Tons \times \$73 / Ton) = \$547$$

$$\text{Smart Start® } Incentive\ DualEnthalpyEconomizerControls = \$250 \text{ x 1 units} = \$250$$

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$21,900
NJ Smart Start Equipment Incentive ($):	$797
Net Installation Cost ($):	$21,103
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$217
Total Yearly Savings ($/Yr):	$217
Estimated ECM Lifetime (Yr):	15
Simple Payback	97.4
Simple Lifetime ROI	-84.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$3,250
Internal Rate of Return (IRR)	-18%
Net Present Value (NPV)	($18,516.77)

ECM #8: DDC System – Southern Boulevard School

Description:

There is a Johnson Controls pneumatic controls system serving the original boiler room and original school building at the Southern Boulevard School. It appears to be original to the 1965 building. A Quincy air compressor, approximately 3 years old, with (2) 2hp motors provides air to the controls system. The system operates on a hot water reset schedule 0°F Outside air temperature (OA): 200°F Leaving Water Temperature (LWT), 15°F Outside air temperature (OA): 175°F Leaving Water Temperature (LWT), 30°F Outside air temperature (OA): 150°F Leaving Water Temperature (LWT), 45°F Outside air temperature (OA): 125°F Leaving Water Temperature (LWT), 60°F Outside air temperature (OA): 100°F Leaving Water Temperature (LWT). The system appears to be operational but is antiquated.

During initial discussions with the Owner it was noted that the hours of operation of the facility are generally 40 hours per week. Occasionally, there is additional after-hours usage during weeknights and weekends and thermostat adjustments are made by the person currently occupying the space instead on one general setpoint. This is a means for a cycling amongst different HVAC systems attempting to meet various setpoints throughout the year, independent of heating or cooling season. Therefore, a DDC system providing the Owner with full control over the HVAC equipment within the building appears to be an energy saving opportunity.

This ECM includes installing a Building Automation system with Direct Digital Controls (DDC) wired through an Ethernet backbone and front end controller within the Southern Boulevard School only. The system will include new thermostat controllers for all indoor air-handling systems and the rooftop units, in addition to each piece of equipment being wired back to a front end controller and computer interface. With the communication between the devices and the front end computer interface, the Owner will be able to take advantage of equipment scheduling for occupied and unoccupied periods based on the actual occupancy of the facility. Due to the fact that the Southern Boulevard School has diverse hours of occupancy, including evening and weekend hours, having supervisory control over all of the equipment makes sense. The DDC system will also aid in the response time to service / maintenance issues when the facility is not under normal maintenance supervision, i.e. after-hours.

The new DDC system has the potential to provide substantial savings by controlling the HVAC systems as a whole and provide operating schedules and features such as space averaging, night set-back, temperature override control, etc. The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings is based on the "Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways," document posted for public use April 2005. The study has found that commercial buildings have the potential to achieve significant energy savings through the use of building controls. The average energy savings are as follows based on the referenced report:

- Energy Management and Control System Savings: 5%-15%.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 10% of the total energy cost for the facility.

The cost of a full DDC system with new field devices, controllers, computer, software, programming, etc. is approximately $4.00 per SF in accordance with recent Contractor pricing for systems of this magnitude. Savings from the implementation of this ECM will be from the reduced energy consumption currently used by the HVAC system by proper control of schedule and temperatures via the DDC system.

Cost of complete DDC System = ($4.00/SF x 61,907 SF) = $247,628

Heating Season Heating Degree Days = 4,996 HDD
Average Cost of Gas = $1.521 / Therm

Cooling Season Full Load Cooling Hrs. = 1,129 hrs / yr
Average Cost of Electricity = $0.165/ kWh

Note: Degree Days and Full Load Hours referenced from ASHRAE Weather Data for Newark, NJ.

Energy Savings Calculations:

10% Savings on Heating Calculations

$$Heat\ Load = \frac{Heat\ Loss\left(\frac{Btu}{Hr\ SF}\right) \times Area\ (SF)}{1000\left(\frac{Btu}{kBtu}\right)}$$

$$Heat\ Load = \frac{50\left(\frac{Btu}{Hr\ SF}\right) \times 61{,}907\ (SF)}{1000\left(\frac{Btu}{kBtu}\right)} = 3095.3\left(\frac{kBtu}{Hr}\right)$$

$$Est\ Heat\ Cons. = \frac{Heat\ Load\left(\frac{kBtu}{Hr}\right) \times Heat\ Deg\ Days \times 24\ Hrs \times Correction\ Factor}{Design\ Temp\ Difference(^{\circ}F) \times Efficiency(\%) \times Fuel\ Heat\ Value\left(\frac{kBtu}{Therm}\right)}$$

$$Est\ Heat\ Cons. = \frac{3{,}095\left(\frac{kBtu}{Hr}\right) \times 4{,}996\ (HDD) \times 24\ Hrs \times 0.6}{65\ (^{\circ}F) \times 80\% \times 100\left(\frac{kBtu}{Therm}\right)} = 42{,}820(Therms)$$

$$Savings. = Heat\ Cons.(Therms) \times 10\%\ Savings \times Ave\ Gas\ Cost\left(\frac{\$}{Therm}\right)$$

$$Savings. = 42{,}820\ (Therms) \times 10\% \times 1.521\left(\frac{\$}{Therm}\right) = \underline{\$6{,}513}$$

<u>10% Savings on Cooling Calculations</u>**:**

$$Est\ Cool\ Cons. = \frac{Cool\ Load\ (Tons) \times 12{,}000\left(\frac{Btu}{Ton\ Hr}\right) \times Full\ Load\ Cooling\ Hrs.}{Ave\ Energy\ Efficiency\ Ratio\left(\frac{Btu}{Wh}\right) \times 1000\left(\frac{Wh}{kWh}\right)}$$

$$Est\ Cool\ Cons. = \frac{23.2\ (Tons) \times 12{,}000\left(\frac{Btu}{Ton\ Hr}\right) \times 1{,}129\ Hrs.}{10.0\left(\frac{Btu}{Wh}\right) \times 1000\left(\frac{Wh}{kWh}\right)} = 31{,}431(kWh)$$

$$Savings. = Cool\ Cons.(kWh) \times 10\%\ Savings \times Ave\ Elec\ Cost\left(\frac{\$}{kWh}\right)$$

$$Savings. = 31{,}431\ (kWh) \times 10\% \times 0.165\left(\frac{\$}{kWh}\right) = \underline{\$518}$$

Total Annual Energy Savings = \$6,513 + \$518 = <u>\$7,031</u> per year

It is pertinent to note that electric demand savings were unable to be estimated. Also, incentives for the installation of the DDC system are not currently available and maintenance savings could not be adequately calculated because information was not available to baseline the savings.

Estimated Maintenance Savings:

As stated before, a Johnson Controls electronic control system was installed in the 1995 addition but has since been ripped out and is now controlled manually. This ECM would eliminate the need to manually control this equipment and the savings is estimated as follows:

Maintenance Savings = 0.5 hrs/day x 5 days/week x 52 weeks/year x \$20/hour = \$2,600

Energy Savings Summary:

ECM #8 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$247,628
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$247,628
Maintenance Savings ($/Yr):	$2,600
Energy Savings ($/Yr):	$7,031
Total Yearly Savings ($/Yr):	$9,631
Estimated ECM Lifetime (Yr):	15
Simple Payback	25.7
Simple Lifetime ROI	-41.7%
Simple Lifetime Maintenance Savings	$39,000
Simple Lifetime Savings	$144,465
Internal Rate of Return (IRR)	-6%
Net Present Value (NPV)	($132,653.75)

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

Globally, renewable energy has become a priority affecting international and domestic energy policy. The State of New Jersey has taken a proactive approach, and has recently adopted in its Energy Master Plan a goal of 30% renewable energy by 2020. To help reach this goal New Jersey created the Office of Clean Energy under the direction of the Board of Public Utilities and instituted a Renewable Energy Incentive Program to provide additional funding to private and public entities for installing qualified renewable technologies. A renewable energy source can greatly reduce a building's operating expenses while producing clean environmentally friendly energy. CEG has assessed the feasibility of installing renewable energy technologies for Southern Boulevard School, and concluded that there is potential for solar energy generation.

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which will be mounted on all south and southwestern facades of the building. Flat roof, as well as sloped areas can be utilized; flat areas will have the panels turned to an optimum solar absorbing angle. (A structural survey of the roof would be necessary before the installation of PV panels is considered). The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit is around $350, this value was used in our financial calculations. This equates to $0.35 per kWh generated.

CEG has reviewed the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 9,755 S.F. can be utilized for a PV system. A depiction of the area utilized is shown in **Renewable / Distributed Energy Measures Calculation Appendix**. Using this square footage it was determined that a system size of 152.72 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 190,380 KWh annually, reducing the overall utility bill by approximately 45.5% percent. A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix**. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

The proposed photovoltaic array layout is designed based on the specifications for the Sun Power SPR-230 panel. This panel has a "DC" rated full load output of 230 watts, and has a total panel conversion efficiency of 18%. Although panels rated at higher wattages are available through Sun Power and other various manufacturers, in general most manufacturers who produce commercially available solar panels produce a similar panel in the 200 to 250 watt range. This provides more manufacturer options to the public entity if they wish to pursue the proposed solar recommendation without losing significant system capacity.

The array system capacity was sized on available roof space on the existing facility. Estimated solar array generation was then calculated based on the National Renewable Energy Laboratory PVWatts Version 1.0 Calculator. In order to calculate the array generation an appropriate location with solar data on file must be selected. In addition the system DC rated kilowatt (kW) capacity must be inputted, a DC to AC de-rate factor, panel tilt angle, and array azimuth angle. The DC to AC de-rate factor is based on the panel nameplate DC rating, inverter and transformer efficiencies (95%), mismatch factor (98%), diodes and connections (100%), dc and ac wiring(98%, 99%), soiling, (95%), system availability (95%), shading (if applicable), and age(new/100%). The overall DC to AC de-rate factor has been calculated at an overall rating of 81%. The PVWatts Calculator program then calculates estimated system generation based on average monthly solar irradiance and user provided inputs. The monthly energy generation and offset electric costs from the PVWatts calculator is shown in the **Renewable/Distributed Energy Measures Calculation Appendix**.

The proposed solar array is qualified by the New Jersey Board of Public Utilities Net Metering Guidelines as a Class I Renewable Energy Source. These guidelines allow onsite customer generation using renewable energy sources such as solar and wind with a capacity of 2 megawatts (MW) or less. This limits a customer system design capacity to being a net user and not a net generator of electricity on an annual basis. Although these guidelines state that if a customer does net generate (produce more electricity than they use), the customer will be credited those kilowatt-hours generated to be carried over for future usage on a month to month basis. Then, on an annual basis if the customer is a net generator the customer will then be compensated by the utility the average annual PJM Grid LMP price per kilowatt-hour for the over generation. Due to the aforementioned legislation, the customer is at limited risk if they generate more than they use at times throughout the year. With the inefficiency of today's energy storage systems, such as batteries, the added cost of storage systems is not warranted and was not considered in the proposed design.

CEG has reviewed financing options for the owner. Two options were studied and they are as follows: Self-financed and direct purchase without finance. Self-finance was calculated with 95% of the total project cost financed at a 7% interest rate over 25 years. Direct purchase involves the local government paying for 100% of the total project cost upfront via one of the methods noted in the Installation Funding Options section below. Both of these calculations include a utility inflation rate as well as the degradation of the solar panels over time. Based on our calculations the following are the payback periods for the respective method of payment:

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM			
PAYMENT TYPE	**SIMPLE PAYBACK**	**SIMPLE ROI**	**INTERNAL RATE OF RETURN**
Self-Finance	14 Years	78.3%	3.7%
Direct Purchase	14 Years	78.3%	5.7%

*The solar energy measure is shown for reference in the executive summary REM table

The resultant Internal Rate of Return indicates that if the Owner was able to "Direct Purchase" the solar project, the project would be slightly more beneficial to the Owner.

In addition to the Solar Analysis, CEG also conducted a review of the applicability of wind energy for the facility. Wind energy production is another option available through the Renewable Energy Incentive Program. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. Based on CEG's review of the applicability of wind energy for the facility, it was determined that the average wind speed is not adequate for purchase of a commercial wind turbine. Therefore, wind energy is not a viable option to implement.

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

Load Profile analysis was performed to determine the seasonal energy usage of the facility. Irregularities in the load profile will indicate potential problems within the facility. Consequently based on the profile a recommendation will be made to remedy the irregularity in energy usage. For this report, the facility's energy consumption data was gathered in table format and plotted in graph form to create the load profile. Refer to the Electric and Natural Gas Usage Profiles included within this report to reference the respective electricity and natural gas usage load profiles.

Electricity:

The Electric Usage Profile demonstrates a fairly flat load profile throughout the year, with the exception of a sharp drop-off in January 2009. But for this exception the balance of the year is quite steady in consumption. The steady load in the summer suggests activities and use of the building during this time. Again, this is a multi-function facility with boiler rooms, electric room, cafeteria, offices classrooms, gymnasium, restrooms, library/media center, and music rooms. The steady summer time consumption is suggestive of cooling (air conditioner) load. In this facility air-conditioning is provided via (4) four split systems and (42) forty two window units. The split systems range from 3.5 – 7.5 nominal tons of capacity. This is unusual for a school, because typically schools are closed in the summer. However the steady and elevated summer load profile (March – October), with a unique peak in November, is supported by the amount of multi-use rooms in this facility. Currently this facility's electric supply is provided by JCP&L (Jersey Central Power and Light). CEG will provide options for this under the Recommendations section. A flatter load profile of this type, will allow for more competitive energy prices when shopping for alternative energy suppliers.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical heating load profile. An increase in consumption is observed September through March during the standard heating season. Heating for this facility is provided by (2) two boiler plants which provide hot water for heating. The boiler plant consists of (2) two H.B. Smith Mills hot water boilers serviced by natural gas. The 2001 addition has a H.B Smith boiler that serves the 1988 building. There is (1) one heat and ventilation unit in the custodial room serving the cafeteria. The heating hot water serves (25) twenty five unit ventilators, (9) nine unit heaters and (29) twenty nine fin tube radiators in the original building. The heating hot water serves (3) three cabinet unit heaters, (2) two heat and ventilation units, (1) one unit ventilator and (2) two fin tube radiators in the 1988 gym addition.

Domestic Hot Water: The original building has a 75 gallon natural gas fired A.O. Smith hot water heater. The 1988 addition has a Rheem Ruud 75 gallon natural gas fired water heater. The original building has a Ruud Monel, 67 gallon natural gas fired hot water heater.

Natural gas Delivery-service is provided by Public Service Electric and Gas Company (PSE&G) on an LVG rate schedule. Commodity service is supplied by the Hess Corporation, the Third Party

Supplier. This consistent load profile is beneficial when looking at supply options with a new Third Party Supplier.

Tariff:

Electricity:

This facility receives electrical service through Jersey Central Power & Light (JCP&L) on a GSS (General Service Secondary – 3 Phase) rate. Service classification GS is available for general service purposes on secondary voltages not included under Service Classifications RS, RT, RGT or GST. This facility's rate is a three phase service at secondary voltages. For electric supply (generation), the customer uses the service of a JCP&L. This facility uses the Delivery Service of the utility (JCP&L). The Delivery Service includes the following charges: Customer Charge, Supplemental Customer Charge, Distribution Charge (kW Demand), kWh Charge, Non-utility Generation Charge, TEFA, SBC, SCC, Standby Fee and RGGI. The Generation Service is provided by JCP&L under BGS (Basic Generation Service). BGS Energy and Reconciliation Charges are provided in Rider BGS-FP (fixed pricing) or BGS-CIEP (Commercial Industrial Energy Pricing). BGS also has a Transmission component to its charge.

Natural Gas:

This facility receives utility service through Public Service Electric and Gas Company (PSE&G). This facility utilizes the Delivery Service from PSE&G while receiving Commodity service from a Third Party Supplier (TPS), Hess Corporation.

LVG Rate: This utility tariff is for "firm" delivery service for general purposes. This rate schedule has a Delivery Charge, Balancing Charge, Societal Benefits Charge, Realignment Adjustment Charge, Margin Adjustment Charge, RGGI Charge and Customer Account Service Charge. The customer can elect to have the Commodity Charge serviced through the utility or by a Third Party Supplier (TPS). Note: Should the TPS not deliver, the customer may receive service from PSE&G under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service.

"Firm" delivery service defines the reliability of the transportation segment of the pricing. Much like the telecom industry, natural gas pipelines were un-bundled in the late 1990's and the space was divided up and marketed into reliability of service. Firm Service is said to be the most reliable and last in the pecking order for interruption. This service should not be interrupted.

Commodity Charges: Customer may choose to receive gas supply from either: A TPS or PSE&G through its Basic Gas Supply Service default service. PSE&G may also supply Emergency Sales Service in certain instances. This is at a much higher than normal rate. It should be perceived as a penalty.

This facility utilizes the services of a Third Party Supplier, The Hess Corporation. The contract is administered by The Alliance for Competitive Service (ACES). ACES is the energy aggregation program of the New Jersey School Boards Association of School Administrator's. The process was reviewed and approved by the New Jersey Department of Community Affairs.

Please see CEG recommendations below.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities. Good potential savings can be seen equally in the electric costs and the natural gas costs. The average price per kWh (kilowatt hour) for the High School based on a historical 1-year weighted average fixed price from the utility JCP&L is $.1415 / kWh (this is the fixed "price to compare" when shopping for energy procurement alternatives). The fixed weighted average price per decatherm for natural gas service in the High School, provided by the Hess Corporation (TPS) is $ 12.08 / dth (dth, is the common unit of measure). The natural gas prices are also the "prices to compare".

The "price to compare" is the netted cost of the energy (including other costs), that the customer will use to compare to Third Party Supply sources when shopping for alternative suppliers. For electricity this cost would not include the utility transmission and distribution chargers. For natural gas the cost would not include the utility distribution charges and is said to be delivered to the utilities city-gate.

Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. Chatham School District could see improvement in its energy costs if it were to take advantage of these current market prices quickly, before energy prices increase. Based on electric supply from JCP&L and utilizing the historical consumption data provided (August 2008 through July 2009) and current electric rates, the school(s) could see an improvement in its electric costs of up to 25 % annually. (Note: Savings were calculated using Average Annual Consumption and a variance to a Fixed Average One-Year commodity contract). CEG recommends aggregating the entire electric load to gain the most optimal energy costs. CEG recommends advisement for alternative sourcing and supply of energy on a "managed approach".
CEG's second recommendation coincides with the natural gas costs. Based on the current alternative market pricing supplied by the Hess Corporation (ACES Agreement), CEG feels that School District could see an improvement of up to 33 % in its natural gas costs. CEG has experience with the mechanism for schools to buy energy in New Jersey. It is through the ACES Agreement (The Alliance for Competitive Energy Services) which is an energy aggregation program. From our experience, the basis price is the reason that the overall average price per dekatherm is ($12.08/dth). Therefore the average pricing formula supplied by Hess is 25 % above today's competitive market pricing. CEG recommends the school receive further advisement on these prices through an energy advisor. They should also consider procuring energy (natural gas) through an alternative supply source.

CEG also recommends scheduling a meeting with the current utility providers to review their utility charges and current tariff structures for electricity and natural gas. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), the municipality can learn more about the competitive supply process. The county can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu. They should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the information for ongoing demand-side management projects. Furthermore, special attention should be given to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with the utility representative. The School District should ask the utility representative about alternative billing options, such as consolidated billing when utilizing the service of a Third Party Supplier. Finally, if the supplier for energy (natural gas) is changed, closely monitor balancing, particularly when the contract is close to termination. This could be performed with the aid of an "energy advisor".

X. INSTALLATION FUNDING OPTIONS

CEG has reviewed various funding options for the Owner to utilize in subsidizing the costs for installing the energy conservation measures noted within this report. Below are a few alternative funding methods:

i. *Energy Savings Improvement Program (ESIP)* – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and par for the costs using the value of energy savings that result from the improvements. The “Energy Savings Improvement Program (ESIP)” law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources.

ii. *Municipal Bonds* – Municipal bonds are a bond issued by a city or other local government, or their agencies. Potential issuers of municipal bonds include cities, counties, redevelopment agencies, school districts, publicly owned airports and seaports, and any other governmental entity (or group of governments) below the state level. Municipal bonds may be general obligations of the issuer or secured by specified revenues. Interest income received by holders of municipal bonds is often exempt from the federal income tax and from the income tax of the state in which they are issued, although municipal bonds issued for certain purposes may not be tax exempt.

iii. *Power Purchase Agreement* – Public Law 2008, Chapter 3 authorizes contractor of up to fifteen (15) years for contracts commonly known as “power purchase agreements.” These are programs where the contracting unit (Owner) procures a contract for, in most cases, a third party to install, maintain, and own a renewable energy system. These renewable energy systems are typically solar panels, windmills or other systems that create renewable energy. In exchange for the third party’s work of installing, maintaining and owning the renewable energy system, the contracting unit (Owner) agrees to purchase the power generated by the renewable energy system from the third party at agreed upon energy rates.

iv. *Pay For Performance* – The New Jersey Smart Start Pay for Performance program includes incentives based on savings resulted from implemented ECMs. The program is available for all buildings with average demand loads above 200 KW. The facility’s participation in the program is assisted by an approved program partner. An “Energy Reduction Plan” is created with the facility and approved partner to shown at least 15% reduction in the building’s current energy use. Multiple energy conservation measures implemented together are applicable toward the total savings of at least 15%. No more than 50% of the total energy savings can result from lighting upgrades / changes.

Total incentive is capped at 50% of the project cost. The program savings is broken down into three benchmarks; Energy Reduction Plan, Project Implementation, and Measurement and Verification. Each step provides additional incentives as the energy reduction project continues. The benchmark incentives are as follows:

1. Energy Reduction Plan – Upon completion of an energy reduction plan by an approved program partner, the incentive will grant $0.10 per square foot between $5,000 and $50,000, and not to exceed 50% of the facility's annual energy expense. (Benchmark #1 is not provided in addition to the local government energy audit program incentive.)

2. Project Implementation – Upon installation of the recommended measures along with the "Substantial Completion Construction Report," the incentive will grant savings per KWH or Therm based on the program's rates. Minimum saving must be 15%. (Example $0.11 / kWh for 15% savings, $0.12/ kWh for 17% savings, … and $1.10 / Therm for 15% savings, $1.20 / Therm for 17% saving, …) Increased incentives result from projected savings above 15%.

3. Measurement and Verification – Upon verification 12 months after implementation of all recommended measures, that actual savings have been achieved, based on a completed verification report, the incentive will grant additional savings per kWh or Therm based on the program's rates. Minimum savings must be 15%. (Example $0.07 / kWh for 15% savings, $0.08/ kWh for 17% savings, … and $0.70 / Therm for 15% savings, $0.80 / Therm for 17% saving, …) Increased incentives result from verified savings above 15%.

CEG recommends the Owner review the use of the above-listed funding options in addition to utilizing their standard method of financing for facilities upgrades in order to fund the proposed energy conservation measures.

XI. ADDITIONAL RECOMMENDATIONS

The following recommendations include no cost/low cost measures, Operation & Maintenance (O&M) items, and water conservation measures with attractive paybacks. These measures are not eligible for the Smart Start Buildings incentives from the office of Clean Energy but save energy none the less.

A. Chemically clean the condenser and evaporator coils in the window AC units periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%. The 3-step process includes cleaning of the coils, rinsing and a micro biocide treatment. Thoroughly cleaned coils are not as susceptible to re-fouling so they stay clean longer, reducing the cleaning cycle frequency

B. Maintain all weather stripping on windows and doors.

C. Repair/replace damaged or missing ductwork insulation in the ceiling spaces.

D. Provide more frequent air filter changes to decrease overall fan horsepower requirements and maintain better IAQ.

E. Recalibrate existing zone thermostats.

F. Clean all fixtures to maximize light output.

G. Feel for air drafts around electrical outlets. Inexpensive pads are available, as are plugs for unused sockets.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Southern Boulevard School

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT.	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	Lighting Upgrade - General	$2,325	$0	$275	$2,050	$469	($1)	$469	25	$11,714	-$21	471.4%	4.4	22.72%	$6,109.36
ECM #2	Lighting Controls	$11,520	$0	$1,440	$10,080	$1,545	$0	$1,545	15	$23,182	$0	130.0%	6.5	12.82%	$8,369.60
ECM #3	LED EXIT SIGNS	$504	$0	$90	$414	$338	$126	$464	25	$11,606	$3,150	2703.3%	0.9	112.13%	$7,669.53
ECM #4	Lighting Upgrade - Gym	$5,400	$0	$900	$4,500	$420	$7	$427	25	$10,680	$180	137.3%	10.5	8.16%	$2,938.90
ECM #5	Boiler Replacement – High Efficiency Upgrade	$195,750	$0	$10,500	$185,250	$5,795	$0	$5,795	35	$202,825	$0	9.5%	32.0	0.51%	($60,731.56)
ECM #6	Domestic Water Heater Replacement	$23,010	$0	$590	$22,420	$351	$0	$351	12	$4,212	$0	-81.2%	63.9	-19.46%	($18,926.14)
ECM #7	High-Efficiency Split System Units	$21,900	$0	$797	$21,103	$217	$0	$217	15	$3,250	$0	-84.6%	97.4	-17.56%	($18,516.77)
ECM #8	DDC System	$247,628	$0	$0	$247,628	$7,031	$2,600	$9,631	15	$144,465	$39,000	-41.7%	25.7	-6.09%	($132,653.75)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	Solar PV Project	$1,374,480	$0	$0	$1,374,480	$31,413	$66,633	$98,046	25	$2,451,150	$1,665,825	78.3%	14.0	5.05%	$332,809.48

Notes: 1) The variable Cn in the formulas for Internal Rate of Return and Net Present Value stands for the cash flow during each period.
2) The variable DR in the NPV equation stands for Discount Rate
3) For NPV and IRR calculations: From n=0 to N periods where N is the *lifetime of ECM* and Cn is the *cash flow during each period*.

Concord Engineering Group, Inc.

520 BURNT MILL ROAD
VOORHEES, NEW JERSEY 08043
PHONE: (856) 427-0200
FAX: (856) 427-6508

SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of January, 2009:

Electric Chillers

Water-Cooled Chillers	$12 - $170 per ton
Air-Cooled Chillers	$8 - $52 per ton

Gas Cooling

Gas Absorption Chillers	$185 - $400 per ton
Gas Engine-Driven Chillers	Calculated through custom measure path)

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	$73 - $93 per ton
Air-to-Air Heat Pumps	$73 - $92 per ton
Water-Source Heat Pumps	$81 per ton
Packaged Terminal AC & HP	$65 per ton
Central DX AC Systems	$40- $72 per ton
Dual Enthalpy Economizer Controls	$250

Ground Source Heat Pumps

Closed Loop & Open Loop	$370 per ton

Gas Heating

Gas Fired Boilers < 300 MBH	$300 per unit
Gas Fired Boilers ≥ 300 - 1500 MBH	$1.75 per MBH
Gas Fired Boilers ≥1500 - ≤ 4000 MBH	$1.00 per MBH
Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	$300 - $400 per unit

Variable Frequency Drives

Variable Air Volume	$65 - $155 per hp
Chilled-Water Pumps	$60 per hp
Compressors	$5,250 to $12,500 per drive

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons	$50 per unit
Gas-Fired Water Heaters >50 gallons	$1.00 - $2.00 per MBH
Gas-Fired Booster Water Heaters	$17 - $35 per MBH

Premium Motors

Three-Phase Motors	$45 - $700 per motor

Prescriptive Lighting

T-5 and T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 - $30 per fixture, (depending on quantity)
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start	$25 per fixture
LED Exit Signs	$10 - $20 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $284 per fixture

Lighting Controls – Occupancy Sensors

Wall Mounted	$20 per control
Remote Mounted	$35 per control
Daylight Dimmers	$25 per fixture
Occupancy Controlled hi-low Fluorescent Controls	$25 per fixture controlled

Lighting Controls – HID or Fluorescent Hi-Bay Controls

Occupancy hi-low	$75 per fixture controlled
Daylight Dimming	$75 per fixture controlled

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2004 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive

MAJOR EQUIPMENT LIST

Concord Engineering Group

Southern Boulevard School

Boiler

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Basement	Orig., 1988 Add.	H.B. SMITH	1	MILLS 450-W-13	41992H	3370	2640	78.3%	Natural Gas	44	35	(-9)	
Basement	Orig., 1988 Add.	H.B. SMITH	1	MILLS 450-W-13	781163 HI	3370	2640	78.3%	Natural Gas	44	35	(-9)	
2001 Addition	2001 Addition	H.B. SMITH	1	Series 28A-10	N2001-350	3172	2498	78.8%	Natural Gas	8	35	27	

Boiler - Burner

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Basement	Orig., 1988 Add.	Power Flame	1	C2-GO-20B	78130449	3080	78.3	NG/ Oil	31	20	(-11)	
Basement	Orig., 1988 Add.	Power Flame	1	C2-GO-20B		3080	78.3	NG/ Oil	31	20	(-11)	
2001 Addition	Smith Series 28A		1	HG-35-S-2	40446-1		78.8%	NG	8	20	12	

Boiler - Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	RPM	GPM	Ft. Hd	Frame Size	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	
Basement	Orig., 1988 Add.	Weinman Pump Co.	2	2K B 2G	152662-1	7.5	1750	156	55	215T	208-220/240		44	20	(-24)	Base mounted
Basement	Orig., 1988 Add.	Armstrong	2	H-54BF	8906	0.75							10	10	0	in-line
2001 Boiler Rm	Smith Series 28A	Taco	2	1619C3N3U									8	10	2	in-line

Domestic Hot Water Heater

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Input (MBh)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Basemant	Orig., 1988 Add.	Ruud-Monel	1	Size 80-80		95.2	80	67	80	NG	54	12	(-42)	
Basemant	Orig., 1988 Add.	Rheem-Ruud	1	G75-125	URNG 1100G03000	125	121.2	75	80	NG	9	12	3	
Basemant	Orig., 1988 Add.	A.O. Smith	1	BT-80-112	L05M002900	75	72.82	74	80	NG	4	12	8	

DHW - Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	Volts	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Basement	Orig., 1988 Add.	TACO	1	007-BF5		1/25			2000	10	1	ciculator

Air Handling Units

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Cooling Coil	Cooling Eff. (EER)	Cooling Capacity (MBH)	Heating Type	Input (MBh)	Output (MBh)	Heating Eff. (%)	Fuel	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Basement	Music Room	Am. Std. Trane	1	TWE090300BV		DX R-22	10.3	92000						208-2320	3		1995	15	1	Mates with outdoor CU at Grade.

Split Systems and AC Condensers

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity Btu/h	Eff.	Refrigerant	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Rooftop		Fedders	2	C1048BBD3V	AS298427006X			R-22	208/230	3		2004			
Rooftop		Lennox	1	HS29-060-94	5801D31759			R-22	208/230	1					
Rooftop		Lennox	1	HS29-042-94	5801E 40263			R-22	208/230	3					
Rooftop		Heat Controller	1	SMA18SA-1		18000		R-410A	208/230	1					
Grade	Music Room/Basement	Am. Std. Trane	1	TT090A300CB	K2945P1AH	90000	10.3	R-22	208-230	3		1995	15	1	

Window AC Units

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity Btu/h	Eff.	Refrigerant	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Classrooms		Airtemp	1	CSM12E25	LZ177856 3138	12500		R-22	115	1	12				
Classrooms		Friedrich	3	KS15J10-A	LDFR20065	14500	10.8	R-22	115	1	12	2004			
Classrooms		Airtemp	1	B3D18E7A	KH192168 2906	18000/17500		R-22	230/208	1	7.9/8.5				
Classrooms		Air Exchanger	1	ASM12E25	KZ138371-2998	12500		R-22	115	1	12				
Classrooms		Airtemp	1	CSL19E75	MZ 265839 3438	18500		R-22	230/208	1	11/11.5				
Classrooms		Friedrich	8	KM18L30-C	LHM2001301	17800/17600	10	R-22	230/208	1	8.1/8.8	2008			
Classrooms		Friedrich	1	KM18J30C-A	LDDR04574	18000/17700		R-22	230/208	1	8.3/9.2	2004			
Classrooms		White-Westinghouse	2	WAS185F2A1	JK70312501	18000/17600		R-22	230/208	1	8.5/9				
Classrooms		Fridgidaire Gallery	3	FAS22512A2	JK10900033	22000		R-22	208/230	1		2001			
Classrooms		Fridgidaire Gallery	1	FAL125J1A3	JK0157099	12000	9.5	R-22	115	1		2000			
		Quasar	1	HQ2102GH	1409500310	10000	9.5	R-22	115	1					
		Emerson Quiet Cool	1	12DD40		18000/17500	10		208/230	1					
Classrooms		Friedrich	3	KM18L30-A	LEERG2601	17800/17600		R-22	230/208	1		2005			
		Friedrich	1	KS15L10-B	LGAR02392	14500	10.8	R-22	115	1	12	2007			
		Friedrich	1	KM18L30-B	LGER00206	17800/17600	10	R-22	208/230	1		2007			

Air Compressor

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	Pressure	Capacity	Volts	Phase	FLA	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Basement	Original Bldg	Quincy	1			(2) 2 hp motor			200	3					

Heating and Ventilation Units

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Heating Coil	Cooling Capacity (Btu/h)	Fan HP	Fan RPM	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Classrooms	Classrooms	AAF	2	U.AZO.4.024.C.G.65.Z.19.AL.22.G.W.B.1	280202000	HW, 1 Row	24,000 BTU	0.33		208	1		7			DX Cooling

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Southern Blvd School

Building ID: 1830643
For 12-month Period Ending: July 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: October 15, 2009

Facility
Southern Blvd School
192 Southern Blvd
Chatham, NJ 07928

Facility Owner
School District of the Chathams
58 Meyersville Road
Chatham, NJ 07928

Primary Contact for this Facility
Ralph Goodwin
58 Meyersville Road
Chatham, NJ 07928

Year Built: 1955
Gross Floor Area (ft²): 61,907

Energy Performance Rating[2] (1-100) 36

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	1,425,534
Natural Gas (kBtu)[4]	3,722,324
Total Energy (kBtu)	5,147,858

Energy Intensity[5]	
Site (kBtu/ft²/yr)	83
Source (kBtu/ft²/yr)	140

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	415

Electric Distribution Utility
Jersey Central Power & Lt Co

National Average Comparison	
National Average Site EUI	73
National Average Source EUI	124
% Difference from National Average Source EUI	13%
Building Type	K-12 School

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Meets Industry Standards[6] for Indoor Environmental Conditions:

Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Certifying Professional
Raymond Johnson
520 South Burnt Mill Road
Voorhees, NJ 08043

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.
NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Southern Blvd School	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	K-12 School	Is this an accurate description of the space in question?		☐
Location	192 Southern Blvd, Chatham, NJ 07928	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐

Southern Blvd School (K-12 School)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	61,907 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Open Weekends?	No	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	108	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	0	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	Yes	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	60 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	90 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	10 (Optional)	Is this school in operation for at least 8 months of the year?		☐

High School?	No	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Jersey Central Power & Lt Co

Fuel Type: Electricity

Meter: G28743023 JCP&L (kWh (thousand Watt-hours))
Space(s): Entire Facility
Generation Method: Grid Purchase

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
07/01/2009	07/31/2009	18,800.00
06/01/2009	06/30/2009	21,920.00
05/01/2009	05/31/2009	23,320.00
04/01/2009	04/30/2009	24,720.00
03/01/2009	03/31/2009	18,880.00
02/01/2009	02/28/2009	26,400.00
01/01/2009	01/31/2009	16,240.00
12/01/2008	12/31/2008	24,400.00
11/01/2008	11/30/2008	27,440.00
10/01/2008	10/31/2008	21,920.00
09/01/2008	09/30/2008	20,560.00
08/01/2008	08/31/2008	19,840.00
G28743023 JCP&L Consumption (kWh (thousand Watt-hours))		**264,440.00**
G28743023 JCP&L Consumption (kBtu (thousand Btu))		**902,269.28**

Meter: G16589718 JCP&L (kWh (thousand Watt-hours))
Space(s): Entire Facility
Generation Method: Grid Purchase

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
07/01/2009	07/31/2009	14,400.00
06/01/2009	06/30/2009	15,480.00
05/01/2009	05/31/2009	14,160.00
04/01/2009	04/30/2009	11,400.00
03/01/2009	03/31/2009	11,040.00
02/01/2009	02/28/2009	12,840.00
01/01/2009	01/31/2009	7,680.00
12/01/2008	12/31/2008	13,320.00
11/01/2008	11/30/2008	13,920.00
10/01/2008	10/31/2008	13,560.00
09/01/2008	09/30/2008	11,640.00
08/01/2008	08/31/2008	13,920.00
G16589718 JCP&L Consumption (kWh (thousand Watt-hours))		**153,360.00**

G16589718 JCP&L Consumption (kBtu (thousand Btu))	**523,264.32**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))	**1,425,533.60**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?	☐

Fuel Type: Natural Gas

Meter: 1874132, 1810551 PSE&G (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
07/01/2009	07/31/2009	60.46
06/01/2009	06/30/2009	78.18
05/01/2009	05/31/2009	380.09
04/01/2009	04/30/2009	1,719.89
03/01/2009	03/31/2009	4,563.15
02/01/2009	02/28/2009	6,307.56
01/01/2009	01/31/2009	7,603.17
12/01/2008	12/31/2008	7,074.66
11/01/2008	11/30/2008	6,195.02
10/01/2008	10/31/2008	2,968.93
09/01/2008	09/30/2008	207.19
08/01/2008	08/31/2008	64.94
1874132, 1810551 PSE&G Consumption (therms)		**37,223.24**
1874132, 1810551 PSE&G Consumption (kBtu (thousand Btu))		**3,722,324.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**3,722,324.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

Additional Fuels

Do the fuel consumption totals shown above represent the total energy use of this building? Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.	☐

On-Site Solar and Wind Energy

Do the fuel consumption totals shown above include all on-site solar and/or wind power located at your facility? Please confirm that no on-site solar or wind installations have been omitted from this list. All on-site systems must be reported.	☐

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same as the PE that signed and stamped the SEP.)

Name: ____ Date: _____________

Signature: ______________________________________

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
Southern Blvd School
192 Southern Blvd
Chatham, NJ 07928

Facility Owner
School District of the Chathams
58 Meyersville Road
Chatham, NJ 07928

Primary Contact for this Facility
Ralph Goodwin
58 Meyersville Road
Chatham, NJ 07928

General Information

Southern Blvd School	
Gross Floor Area Excluding Parking: (ft^2)	61,907
Year Built	1955
For 12-month Evaluation Period Ending Date:	July 31, 2009

Facility Space Use Summary

Southern Blvd School	
Space Type	K-12 School
Gross Floor Area(ft^2)	61,907
Open Weekends?	No
Number of PCs	108
Number of walk-in refrigeration/freezer units	0
Presence of cooking facilities	Yes
Percent Cooled	60
Percent Heated	90
Months°	10
High School?	No
School District°	Chatham

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 07/31/2009)	**Baseline** (Ending Date 07/31/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	36	36	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	83	83	57	N/A	73
Source (kBtu/ft^2)	140	140	97	N/A	124
Energy Cost					
$/year	$ 80,971.99	$ 80,971.99	$ 55,945.17	N/A	$ 71,545.55
$/ft^2/year	$ 1.31	$ 1.31	$ 0.91	N/A	$ 1.16
Greenhouse Gas Emissions					
$MtCO_2e$/year	415	415	287	N/A	367
$kgCO_2e/ft^2$/year	7	7	5	N/A	6

More than 50% of your building is defined as K-12 School. Please note that your rating accounts for all of the spaces listed. The National Average column presents energy performance data your building would have if your building had an average rating of 50.

Notes:
o - This attribute is optional.
d - A default value has been supplied by Portfolio Manager.

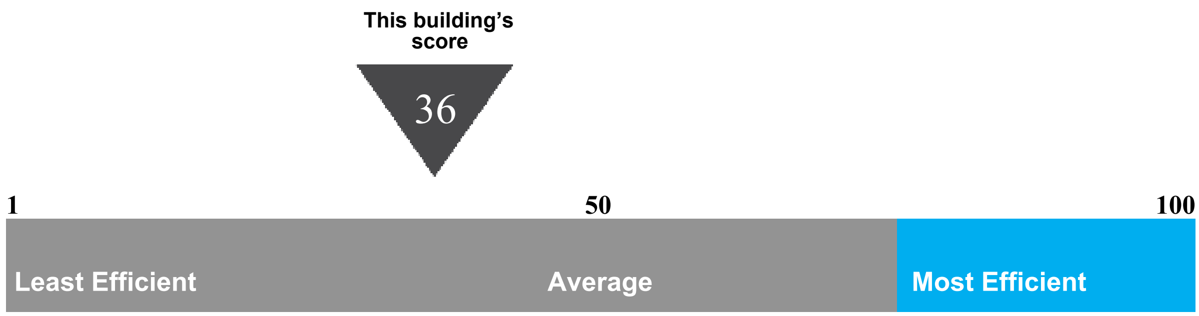
Statement of Energy Performance

2009

Southern Blvd School
192 Southern Blvd
Chatham, NJ 07928

Portfolio Manager Building ID: 1830643

The energy use of this building has been measured and compared to other similar buildings using the Environmental Protection Agency's (EPA's) Energy Performance Scale of 1–100, with 1 being the least energy efficient and 100 the most energy efficient. For more information, visit energystar.gov/benchmark.



This building uses 140 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending July 2009

Buildings with a score of 75 or higher may qualify for EPA's ENERGY STAR.

I certify that the information contained within this statement is accurate and in accordance with U.S. Environmental Protection Agency's measurement standards, found at energystar.gov

Date of certification

EPA United States Environmental Protection Agency

Date Generated: 10/15/2009

CEG Job #: 9C09078
Project: School District of the Chathams
Address: 192 Southern Blvd
Chatham, NJ
Building SF: 61,907

Southern Boulevard School

KWH COS **$0.165**

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										**PROPOSED LIGHTING**									**SAVINGS**			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost INSTALLED	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
10	Closet	260	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.17	45.2	$7.46	3	2	No Change	58	0.17	45.24	$7.46	$0.00	$0.00	0.00	0	$0.00	0.00
20	122	2080	14	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	58	0.81	1,689.0	$278.68	14	2	No Change	58	0.81	1688.96	$278.68	$0.00	$0.00	0.00	0	$0.00	0.00
12	122	2080	5	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Parabolic Lens	82	0.41	852.8	$140.71	5	3	No Change	82	0.41	852.8	$140.71	$0.00	$0.00	0.00	0	$0.00	0.00
8	125	2080	3	3	T8 2x2 3 U-Tube Lamps Electronic Ballast Recessed Mouting Prismatic Lens	108	0.32	673.9	$111.20	3	3	No Change	108	0.32	673.92	$111.20	$0.00	$0.00	0.00	0	$0.00	0.00
12	125	2080	14	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Parabolic Lens	82	1.15	2,387.8	$393.99	14	3	No Change	82	1.15	2387.84	$393.99	$0.00	$0.00	0.00	0	$0.00	0.00
10	125	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.12	241.3	$39.81	2	2	No Change	58	0.12	241.28	$39.81	$0.00	$0.00	0.00	0	$0.00	0.00
17	Gym	2080	18	1	Halogen 1 Lamp Magnetic Ballast Surface Mounting	200	3.60	7,488.0	$1,235.52	18	1	No Change	200	3.60	7488	$1,235.52	$0.00	$0.00	0.00	0	$0.00	0.00
1	106	2080	20	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.56	1,164.8	$192.19	20	1	No Change	28	0.56	1164.8	$192.19	$0.00	$0.00	0.00	0	$0.00	0.00
7	106	2080	2	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mouting Prismatic Lens	73	0.15	303.7	$50.11	2	2	No Change	73	0.15	303.68	$50.11	$0.00	$0.00	0.00	0	$0.00	0.00
1	105	2080	18	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.50	1,048.3	$172.97	18	1	No Change	28	0.50	1048.32	$172.97	$0.00	$0.00	0.00	0	$0.00	0.00
1	104	2080	18	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.50	1,048.3	$172.97	18	1	No Change	28	0.50	1048.32	$172.97	$0.00	$0.00	0.00	0	$0.00	0.00
1	103	2080	18	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.50	1,048.3	$172.97	18	1	No Change	28	0.50	1048.32	$172.97	$0.00	$0.00	0.00	0	$0.00	0.00
1	102	2080	14	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.39	815.4	$134.53	14	1	No Change	28	0.39	815.36	$134.53	$0.00	$0.00	0.00	0	$0.00	0.00
1	101	2080	14	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.39	815.4	$134.53	14	1	No Change	28	0.39	815.36	$134.53	$0.00	$0.00	0.00	0	$0.00	0.00

10	Faculty Rm	2080	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.23	482.6	$79.62	4	2	No Change	58	0.23	482.56	$79.62	$0.00	$0.00	0.00	0	$0.00	0.00
23	Faculty Rm	2080	1	1	Incadescent 100 watt	100	0.10	208.0	$34.32	1	0	Eiko-30w mini sprial	30	0.03	62.4	$10.30	$6.00	$6.00	0.07	145.6	$24.02	0.25
2	Faculty Rm	2080	1	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Prismatic Lens	58	0.06	120.6	$19.91	1	2	No Change	58	0.06	120.64	$19.91	$0.00	$0.00	0.00	0	$0.00	0.00
3	Faculty Rm	2080	4	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Parabolic Lens	58	0.23	482.6	$79.62	4	2	No Change	58	0.23	482.56	$79.62	$0.00	$0.00	0.00	0	$0.00	0.00
10	Nurse	2080	8	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.46	965.1	$159.24	8	2	No Change	58	0.46	965.12	$159.24	$0.00	$0.00	0.00	0	$0.00	0.00
2	Nurse	2080	1	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Prismatic Lens	58	0.06	120.6	$19.91	1	2	No Change	58	0.06	120.64	$19.91	$0.00	$0.00	0.00	0	$0.00	0.00
7	Nurse	2080	1	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mouting Prismatic Lens	73	0.07	151.8	$25.05	1	2	No Change	73	0.07	151.84	$25.05	$0.00	$0.00	0.00	0	$0.00	0.00
14	Bathroom	2080	1	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	0.11	226.7	$37.41	1	4	No Change	109	0.11	226.72	$37.41	$0.00	$0.00	0.00	0	$0.00	0.00
10	Closet	260	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.06	15.1	$2.49	1	2	No Change	58	0.06	15.08	$2.49	$0.00	$0.00	0.00	0	$0.00	0.00
23	Closet	260	1	1	Incadescent 100 watt	100	0.10	26.0	$4.29	1	0	Eiko-30w mini sprial	30	0.03	7.8	$1.29	$6.00	$6.00	0.07	18.2	$3.00	2.00
15	100	2080	12	6	T8 2x4 6 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	167	2.00	4,168.3	$687.77	12	6	No Change	167	2.00	4168.32	$687.77	$0.00	$0.00	0.00	0	$0.00	0.00
10	Office	2080	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.17	361.9	$59.72	3	2	No Change	58	0.17	361.92	$59.72	$0.00	$0.00	0.00	0	$0.00	0.00
3	Office	2080	1	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Parabolic Lens	58	0.06	120.6	$19.91	1	2	No Change	58	0.06	120.64	$19.91	$0.00	$0.00	0.00	0	$0.00	0.00
14	Bathroom	2080	2	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	0.22	453.4	$74.82	2	4	No Change	109	0.22	453.44	$74.82	$0.00	$0.00	0.00	0	$0.00	0.00
13	Bathroom	2080	1	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.08	170.6	$28.14	1	3	No Change	82	0.08	170.56	$28.14	$0.00	$0.00	0.00	0	$0.00	0.00
13	208	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	No Change	82	0.98	2046.72	$337.71	$0.00	$0.00	0.00	0	$0.00	0.00
14	Bathroom	2080	2	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	0.22	453.4	$74.82	2	4	No Change	109	0.22	453.44	$74.82	$0.00	$0.00	0.00	0	$0.00	0.00

13	Art Room	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	No Change	82	0.98	2046.72	$337.71	$0.00	$0.00	0.00	0	$0.00	0.00
11	Art Room	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Surface Mouted Prismatic Lens	58	0.06	120.6	$19.91	1	2	No Change	58	0.06	120.64	$19.91	$0.00	$0.00	0.00	0	$0.00	0.00
13	201	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	No Change	82	0.98	2046.72	$337.71	$0.00	$0.00	0.00	0	$0.00	0.00
13	202	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	No Change	82	0.98	2046.72	$337.71	$0.00	$0.00	0.00	0	$0.00	0.00
14	203	2080	12	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	1.31	2,720.6	$448.91	12	4	No Change	109	1.31	2720.64	$448.91	$0.00	$0.00	0.00	0	$0.00	0.00
13	204	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	No Change	82	0.98	2046.72	$337.71	$0.00	$0.00	0.00	0	$0.00	0.00
22	Stairwell	2080	1	1	Incadescent 75 watt	75	0.08	156.0	$25.74	1	0	Eiko-25w mini sprial	25	0.03	52	$8.58	$5.75	$5.75	0.05	104	$17.16	0.34
2	Stairwell	2080	5	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Prismatic Lens	58	0.29	603.2	$99.53	5	2	No Change	58	0.29	603.2	$99.53	$0.00	$0.00	0.00	0	$0.00	0.00
13	Hallway	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.66	1,364.5	$225.14	8	3	No Change	82	0.66	1364.48	$225.14	$0.00	$0.00	0.00	0	$0.00	0.00
10	Hallway	2080	6	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.35	723.8	$119.43	6	2	No Change	58	0.35	723.84	$119.43	$0.00	$0.00	0.00	0	$0.00	0.00
2	Stairwell	2080	5	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Prismatic Lens	58	0.29	603.2	$99.53	5	2	No Change	58	0.29	603.2	$99.53	$0.00	$0.00	0.00	0	$0.00	0.00
10	45	2080	7	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.41	844.5	$139.34	7	2	No Change	58	0.41	844.48	$139.34	$0.00	$0.00	0.00	0	$0.00	0.00
14	Hallway	2080	19	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	2.07	4,307.7	$710.77	19	4	No Change	109	2.07	4307.68	$710.77	$0.00	$0.00	0.00	0	$0.00	0.00
16	Hallway	2080	2	6	T8 4x4 6 Lamps Electronic Ballast Recessed Mouting Parabolic Lens	164	0.33	682.2	$112.57	2	6	No Change	164	0.33	682.24	$112.57	$0.00	$0.00	0.00	0	$0.00	0.00
8	Hallway	2080	5	3	T8 2x2 3 U-Tube Lamps Electronic Ballast Recessed Mouting Prismatic Lens	108	0.54	1,123.2	$185.33	5	3	No Change	108	0.54	1123.2	$185.33	$0.00	$0.00	0.00	0	$0.00	0.00
4	Cafeteria	2080	36	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mouting Parabolic Lens	58	2.09	4,343.0	$716.60	36	2	No Change	58	2.09	4343.04	$716.60	$0.00	$0.00	0.00	0	$0.00	0.00
6	Cafeteria	2080	6	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mouting No Lens	58	0.35	723.8	$119.43	6	2	No Change	58	0.35	723.84	$119.43	$0.00	$0.00	0.00	0	$0.00	0.00

5	Cafeteria	2080	6	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mouting Prismatic Lens	58	0.35	723.8	$119.43	6	2	No Change	58	0.35	723.84	$119.43	$0.00	$0.00	0.00	0	$0.00	0.00
18	Electric Rm	2080	1	2	T12 1x8 2 Lamps Magnetic Ballast Pendant Mouting No Lens	210	0.21	436.8	$72.07	1	2	8' 2-Lamp T-8 Cooper Metalux, Electronic Ballast M/N 8TDIM-232-UNV-EB81-U	118	0.12	245.44	$40.50	$207.00	$207.00	0.09	191.36	$31.57	6.56
22	Electric Rm	2080	4	1	Incadescent 75 watt	75	0.30	624.0	$102.96	4	0	Eiko-25w mini sprial	25	0.10	208	$34.32	$5.75	$23.00	0.20	416	$68.64	0.34
14	Music Rm	2080	17	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	1.85	3,854.2	$635.95	17	4	No Change	109	1.85	3854.24	$635.95	$0.00	$0.00	0.00	0	$0.00	0.00
14	Basement Rms	2080	2	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	0.22	453.4	$74.82	2	4	No Change	109	0.22	453.44	$74.82	$0.00	$0.00	0.00	0	$0.00	0.00
14	Basement Rms	2080	10	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	1.09	2,267.2	$374.09	10	4	No Change	109	1.09	2267.2	$374.09	$0.00	$0.00	0.00	0	$0.00	0.00
26	Basement Rms	2080	6	2	T8 1x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.35	723.8	$119.43	6	2	No Change	58	0.35	723.84	$119.43	$0.00	$0.00	0.00	0	$0.00	0.00
10	Basement Rms	2080	7	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.41	844.5	$139.34	7	2	No Change	58	0.41	844.48	$139.34	$0.00	$0.00	0.00	0	$0.00	0.00
21	Basement Rms	2080	1	1	Incadescent 40 watt	40	0.04	83.2	$13.73	1	0	Eiko-13w mini sprial	13	0.01	27.04	$4.46	$7.19	$7.19	0.03	56.16	$9.27	0.78
10	Bathroom	2080	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.23	482.6	$79.62	4	2	No Change	58	0.23	482.56	$79.62	$0.00	$0.00	0.00	0	$0.00	0.00
10	Exit Stairs	2080	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.23	482.6	$79.62	4	2	No Change	58	0.23	482.56	$79.62	$0.00	$0.00	0.00	0	$0.00	0.00
9	Library	2080	41	3	T8 2x2 3 U-Tube Lamps Electronic Ballast Recessed Mouting Parabolic Lens	108	4.43	9,210.2	$1,519.69	41	3	No Change	108	4.43	9210.24	$1,519.69	$0.00	$0.00	0.00	0	$0.00	0.00
20	Library	2080	16	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	58	0.93	1,930.2	$318.49	16	2	No Change	58	0.93	1930.24	$318.49	$0.00	$0.00	0.00	0	$0.00	0.00
12	Library	2080	3	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Parabolic Lens	82	0.25	511.7	$84.43	3	3	No Change	82	0.25	511.68	$84.43	$0.00	$0.00	0.00	0	$0.00	0.00
12	124	2080	14	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Parabolic Lens	82	1.15	2,387.8	$393.99	14	3	No Change	82	1.15	2387.84	$393.99	$0.00	$0.00	0.00	0	$0.00	0.00
9	124	2080	4	3	T8 2x2 3 U-Tube Lamps Electronic Ballast Recessed Mouting Parabolic Lens	108	0.43	898.6	$148.26	4	3	No Change	108	0.43	898.56	$148.26	$0.00	$0.00	0.00	0	$0.00	0.00
10	Storage	260	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.06	15.1	$2.49	1	2	No Change	58	0.06	15.08	$2.49	$0.00	$0.00	0.00	0	$0.00	0.00

10	Bathroom	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.06	120.6	$19.91	1	2	No Change	58	0.06	120.64	$19.91	$0.00	$0.00	0.00	0	$0.00	0.00
14	Boys Room	2080	2	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	0.22	453.4	$74.82	2	4	No Change	109	0.22	453.44	$74.82	$0.00	$0.00	0.00	0	$0.00	0.00
7	Boys Room	2080	1	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mouting Prismatic Lens	73	0.07	151.8	$25.05	1	2	No Change	73	0.07	151.84	$25.05	$0.00	$0.00	0.00	0	$0.00	0.00
14	Girls Room	2080	2	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	0.22	453.4	$74.82	2	4	No Change	109	0.22	453.44	$74.82	$0.00	$0.00	0.00	0	$0.00	0.00
7	Girls Room	2080	1	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mouting Prismatic Lens	73	0.07	151.8	$25.05	1	2	No Change	73	0.07	151.84	$25.05	$0.00	$0.00	0.00	0	$0.00	0.00
1	107	2080	20	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.56	1,164.8	$192.19	20	1	No Change	28	0.56	1164.8	$192.19	$0.00	$0.00	0.00	0	$0.00	0.00
7	107	2080	2	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mouting Prismatic Lens	73	0.15	303.7	$50.11	2	2	No Change	73	0.15	303.68	$50.11	$0.00	$0.00	0.00	0	$0.00	0.00
1	108	2080	18	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.50	1,048.3	$172.97	18	1	No Change	28	0.50	1048.32	$172.97	$0.00	$0.00	0.00	0	$0.00	0.00
1	108	2080	18	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.50	1,048.3	$172.97	18	1	No Change	28	0.50	1048.32	$172.97	$0.00	$0.00	0.00	0	$0.00	0.00
2	Boys Room	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Prismatic Lens	58	0.12	241.3	$39.81	2	2	No Change	58	0.12	241.28	$39.81	$0.00	$0.00	0.00	0	$0.00	0.00
1	109	2080	14	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.39	815.4	$134.53	14	1	No Change	28	0.39	815.36	$134.53	$0.00	$0.00	0.00	0	$0.00	0.00
1	110	2080	14	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.39	815.4	$134.53	14	1	No Change	28	0.39	815.36	$134.53	$0.00	$0.00	0.00	0	$0.00	0.00
13	111	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	No Change	82	0.98	2046.72	$337.71	$0.00	$0.00	0.00	0	$0.00	0.00
13	112	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	No Change	82	0.98	2046.72	$337.71	$0.00	$0.00	0.00	0	$0.00	0.00
13	206	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	No Change	82	0.98	2046.72	$337.71	$0.00	$0.00	0.00	0	$0.00	0.00
13	207	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	No Change	82	0.98	2046.72	$337.71	$0.00	$0.00	0.00	0	$0.00	0.00
10	Boys Room	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.12	241.3	$39.81	2	2	No Change	58	0.12	241.28	$39.81	$0.00	$0.00	0.00	0	$0.00	0.00

13	205	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	No Change	82	0.98	2046.72	$337.71	$0.00	$0.00	0.00	0	$0.00	0.00
2	Stairwell	2080	5	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Prismatic Lens	58	0.29	603.2	$99.53	5	2	No Change	58	0.29	603.2	$99.53	$0.00	$0.00	0.00	0	$0.00	0.00
2	Stairwell	2080	5	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Prismatic Lens	58	0.29	603.2	$99.53	5	2	No Change	58	0.29	603.2	$99.53	$0.00	$0.00	0.00	0	$0.00	0.00
9	Staff Bathroom	2080	1	3	T8 2x2 3 U-Tube Lamps Electronic Ballast Recessed Mouting Parabolic Lens	108	0.11	224.6	$37.07	1	3	No Change	108	0.11	224.64	$37.07	$0.00	$0.00	0.00	0	$0.00	0.00
13	Staff Bathroom	2080	2	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.16	341.1	$56.28	2	3	No Change	82	0.16	341.12	$56.28	$0.00	$0.00	0.00	0	$0.00	0.00
18	Gym Office	2080	8	2	T12 1x8 2 Lamps Magnetic Ballast Pendant Mouting No Lens	210	1.68	3,494.4	$576.58	8	2	8' 2-Lamp T-8 Cooper Metalux, Electronic Ballast M/N 8TDIM-232-UNV-EB81-U	118	0.94	1963.52	$323.98	$207.00	$1,656.00	0.74	1530.88	$252.60	6.56
19	Storage	2080	2	2	T12 1x8 2 Lamps Magnetic Ballast Surface Mounting Prismatic Lens	210	0.42	873.6	$144.14	2	2	8' 2-Lamp T-8 Cooper Metalux, Electronic Ballast M/N 8TDIM-232-UNV-EB81-U	118	0.24	490.88	$81.00	$207.00	$414.00	0.18	382.72	$63.15	6.56
	Totals		701	211			51.31	106,012.9	$17,492.13	701	206			49.88	103168	$17,022.72		$2,324.94	1.43	2844.9	$469.41	4.95

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

CEG Job #: 9C09078
Project: School District of the Chathams
Address: 192 Southern Blvd
Chatham, NJ
Building SF: 61,907

Southern Boulevard School

KWH COST: **$0.165**

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
10	Closet	260	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.17	45.2	$7.46	3	2	None	58	0.17	0%	45.24	$7.46	$0.00	$0.00	0.00	0	$0.00	0.00
20	122	2080	14	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	58	0.81	1,689.0	$278.68	14	2	Dual Technology Occupancy Sensor	58	0.81	10%	1520.064	$250.81	$160.00	$160.00	0.00	168.896	$27.87	5.74
12	122	2080	5	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Parabolic Lens	82	0.41	852.8	$140.71	5	3	Dual Technology Occupancy Sensor	82	0.41	10%	767.52	$126.64	$160.00	$160.00	0.00	85.28	$14.07	11.37
8	125	2080	3	3	T8 2x2 3 U-Tube Lamps Electronic Ballast Recessed Mouting Prismatic Lens	108	0.32	673.9	$111.20	3	3	Dual Technology Occupancy Sensor	108	0.32	10%	606.528	$100.08	$160.00	$160.00	0.00	67.392	$11.12	14.39
12	125	2080	14	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Parabolic Lens	82	1.15	2,387.8	$393.99	14	3	Dual Technology Occupancy Sensor	82	1.15	10%	2149.056	$354.59	$160.00	$160.00	0.00	238.784	$39.40	4.06
10	125	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.12	241.3	$39.81	2	2	Dual Technology Occupancy Sensor	58	0.12	10%	217.152	$35.83	$160.00	$160.00	0.00	24.128	$3.98	40.19
17	Gym	2080	18	1	Halogen 1 Lamp Magnetic Ballast Surface Mounting	200	3.60	7,488.0	$1,235.52	18	1	Dual Technology Occupancy Sensor	200	3.60	10%	6739.2	$1,111.97	$160.00	$160.00	0.00	748.8	$123.55	1.30
1	106	2080	20	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.56	1,164.8	$192.19	20	1	Dual Technology Occupancy Sensor	28	0.56	10%	1048.32	$172.97	$160.00	$160.00	0.00	116.48	$19.22	8.33
7	106	2080	2	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mouting Prismatic Lens	73	0.15	303.7	$50.11	2	2	Dual Technology Occupancy Sensor	73	0.15	10%	273.312	$45.10	$160.00	$160.00	0.00	30.368	$5.01	31.93
1	105	2080	18	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.50	1,048.3	$172.97	18	1	Dual Technology Occupancy Sensor	28	0.50	10%	943.488	$155.68	$160.00	$160.00	0.00	104.832	$17.30	9.25
1	104	2080	18	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.50	1,048.3	$172.97	18	1	Dual Technology Occupancy Sensor	28	0.50	10%	943.488	$155.68	$160.00	$160.00	0.00	104.832	$17.30	9.25
1	103	2080	18	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.50	1,048.3	$172.97	18	1	Dual Technology Occupancy Sensor	28	0.50	10%	943.488	$155.68	$160.00	$160.00	0.00	104.832	$17.30	9.25
1	102	2080	14	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.39	815.4	$134.53	14	1	Dual Technology Occupancy Sensor	28	0.39	10%	733.824	$121.08	$160.00	$160.00	0.00	81.536	$13.45	11.89
1	101	2080	14	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.39	815.4	$134.53	14	1	Dual Technology Occupancy Sensor	28	0.39	10%	733.824	$121.08	$160.00	$160.00	0.00	81.536	$13.45	11.89

10	Faculty Rm	2080	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.23	482.6	$79.62	4	2	Dual Technology Occupancy Sensor	58	0.23	10%	434.304	$71.66	$160.00	$160.00	0.00	48.256	$7.96	20.09
23	Faculty Rm	2080	1	1	Incadescent 100 watt	100	0.10	208.0	$34.32	1	0	Dual Technology Occupancy Sensor	100	0.10	10%	187.2	$30.89	$160.00	$160.00	0.00	20.8	$3.43	46.62
2	Faculty Rm	2080	1	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Prismatic Lens	58	0.06	120.6	$19.91	1	2	Dual Technology Occupancy Sensor	58	0.06	10%	108.576	$17.92	$160.00	$160.00	0.00	12.064	$1.99	80.38
3	Faculty Rm	2080	4	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Parabolic Lens	58	0.23	482.6	$79.62	4	2	Dual Technology Occupancy Sensor	58	0.23	10%	434.304	$71.66	$160.00	$160.00	0.00	48.256	$7.96	20.09
10	Nurse	2080	8	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.46	965.1	$159.24	8	2	Dual Technology Occupancy Sensor	58	0.46	10%	868.608	$143.32	$160.00	$160.00	0.00	96.512	$15.92	10.05
2	Nurse	2080	1	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Prismatic Lens	58	0.06	120.6	$19.91	1	2	Dual Technology Occupancy Sensor	58	0.06	10%	108.576	$17.92	$160.00	$160.00	0.00	12.064	$1.99	80.38
7	Nurse	2080	1	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mouting Prismatic Lens	73	0.07	151.8	$25.05	1	2	Dual Technology Occupancy Sensor	73	0.07	10%	136.656	$22.55	$160.00	$160.00	0.00	15.184	$2.51	63.86
14	Bathroom	2080	1	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	0.11	226.7	$37.41	1	4	Dual Technology Occupancy Sensor	109	0.11	10%	204.048	$33.67	$160.00	$160.00	0.00	22.672	$3.74	42.77
10	Closet	260	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.06	15.1	$2.49	1	2	None	58	0.06	0%	15.08	$2.49	$0.00	$0.00	0.00	0	$0.00	0.00
23	Closet	260	1	1	Incadescent 100 watt	100	0.10	26.0	$4.29	1	0	None	100	0.10	0%	26	$4.29	$0.00	$0.00	0.00	0	$0.00	0.00
15	100	2080	12	6	T8 2x4 6 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	167	2.00	4,168.3	$687.77	12	6	Dual Technology Occupancy Sensor	167	2.00	10%	3751.488	$619.00	$160.00	$160.00	0.00	416.832	$68.78	2.33
10	Office	2080	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.17	361.9	$59.72	3	2	Dual Technology Occupancy Sensor	58	0.17	10%	325.728	$53.75	$160.00	$160.00	0.00	36.192	$5.97	26.79
3	Office	2080	1	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Parabolic Lens	58	0.06	120.6	$19.91	1	2	Dual Technology Occupancy Sensor	58	0.06	10%	108.576	$17.92	$160.00	$160.00	0.00	12.064	$1.99	80.38
14	Bathroom	2080	2	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	0.22	453.4	$74.82	2	4	Dual Technology Occupancy Sensor	109	0.22	10%	408.096	$67.34	$160.00	$160.00	0.00	45.344	$7.48	21.39
13	Bathroom	2080	1	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.08	170.6	$28.14	1	3	Dual Technology Occupancy Sensor	82	0.08	10%	153.504	$25.33	$160.00	$160.00	0.00	17.056	$2.81	56.85
13	208	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$303.94	$160.00	$160.00	0.00	204.672	$33.77	4.74
14	Bathroom	2080	2	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	0.22	453.4	$74.82	2	4	Dual Technology Occupancy Sensor	109	0.22	10%	408.096	$67.34	$160.00	$160.00	0.00	45.344	$7.48	21.39
13	Art Room	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$303.94	$160.00	$160.00	0.00	204.672	$33.77	4.74

11	Art Room	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Surface Mouted Prismatic Lens	58	0.06	120.6	$19.91	1	2	Dual Technology Occupancy Sensor	58	0.06	10%	108.576	$17.92	$160.00	$160.00	0.00	12.064	$1.99	80.38
13	201	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$303.94	$160.00	$160.00	0.00	204.672	$33.77	4.74
13	202	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$303.94	$160.00	$160.00	0.00	204.672	$33.77	4.74
14	203	2080	12	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	1.31	2,720.6	$448.91	12	4	Dual Technology Occupancy Sensor	109	1.31	10%	2448.576	$404.02	$160.00	$160.00	0.00	272.064	$44.89	3.56
13	204	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$303.94	$160.00	$160.00	0.00	204.672	$33.77	4.74
22	Stairwell	2080	1	1	Incadescent 75 watt	75	0.08	156.0	$25.74	1	0	None	75	0.08	0%	156	$25.74	$0.00	$0.00	0.00	0	$0.00	0.00
2	Stairwell	2080	5	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Prismatic Lens	58	0.29	603.2	$99.53	5	2	None	58	0.29	0%	603.2	$99.53	$0.00	$0.00	0.00	0	$0.00	0.00
13	Hallway	2080	8	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.66	1,364.5	$225.14	8	3	None	82	0.66	0%	1364.48	$225.14	$0.00	$0.00	0.00	0	$0.00	0.00
10	Hallway	2080	6	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.35	723.8	$119.43	6	2	None	58	0.35	0%	723.84	$119.43	$0.00	$0.00	0.00	0	$0.00	0.00
2	Stairwell	2080	5	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Prismatic Lens	58	0.29	603.2	$99.53	5	2	None	58	0.29	0%	603.2	$99.53	$0.00	$0.00	0.00	0	$0.00	0.00
10	45	2080	7	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.41	844.5	$139.34	7	2	Dual Technology Occupancy Sensor	58	0.41	10%	760.032	$125.41	$160.00	$160.00	0.00	84.448	$13.93	11.48
14	Hallway	2080	19	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	2.07	4,307.7	$710.77	19	4	None	109	2.07	0%	4307.68	$710.77	$0.00	$0.00	0.00	0	$0.00	0.00
16	Hallway	2080	2	6	T8 4x4 6 Lamps Electronic Ballast Recessed Mouting Parabolic Lens	164	0.33	682.2	$112.57	2	6	None	164	0.33	0%	682.24	$112.57	$0.00	$0.00	0.00	0	$0.00	0.00
8	Hallway	2080	5	3	T8 2x2 3 U-Tube Lamps Electronic Ballast Recessed Mouting Prismatic Lens	108	0.54	1,123.2	$185.33	5	3	None	108	0.54	0%	1123.2	$185.33	$0.00	$0.00	0.00	0	$0.00	0.00
4	Cafeteria	2080	36	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mouting Parabolic Lens	58	2.09	4,343.0	$716.60	36	2	Dual Technology Occupancy Sensor	58	2.09	10%	3908.736	$644.94	$160.00	$160.00	0.00	434.304	$71.66	2.23
6	Cafeteria	2080	6	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mouting No Lens	58	0.35	723.8	$119.43	6	2	Dual Technology Occupancy Sensor	58	0.35	10%	651.456	$107.49	$160.00	$160.00	0.00	72.384	$11.94	13.40
5	Cafeteria	2080	6	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mouting Prismatic Lens	58	0.35	723.8	$119.43	6	2	Dual Technology Occupancy Sensor	58	0.35	10%	651.456	$107.49	$160.00	$160.00	0.00	72.384	$11.94	13.40
18	Electric Rm	2080	1	2	T12 1x8 2 Lamps Magnetic Ballast Pendant Mouting No Lens	210	0.21	436.8	$72.07	1	2	Dual Technology Occupancy Sensor	210	0.21	10%	393.12	$64.86	$160.00	$160.00	0.00	43.68	$7.21	22.20

22	Electric Rm	2080	4	1	Incadescent 75 watt	75	0.30	624.0	$102.96	4	0	Dual Technology Occupancy Sensor	75	0.30	10%	561.6	$92.66	$160.00	$160.00	0.00	62.4	$10.30	15.54
14	Music Rm	2080	17	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	1.85	3,854.2	$635.95	17	4	Dual Technology Occupancy Sensor	109	1.85	10%	3468.816	$572.35	$160.00	$160.00	0.00	385.424	$63.59	2.52
14	Basement Rms	2080	2	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	0.22	453.4	$74.82	2	4	Dual Technology Occupancy Sensor	109	0.22	10%	408.096	$67.34	$160.00	$160.00	0.00	45.344	$7.48	21.39
14	Basement Rms	2080	10	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	1.09	2,267.2	$374.09	10	4	Dual Technology Occupancy Sensor	109	1.09	10%	2040.48	$336.68	$160.00	$160.00	0.00	226.72	$37.41	4.28
26	Basement Rms	2080	6	2	T8 1x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.35	723.8	$119.43	6	2	Dual Technology Occupancy Sensor	58	0.35	10%	651.456	$107.49	$160.00	$160.00	0.00	72.384	$11.94	13.40
10	Basement Rms	2080	7	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.41	844.5	$139.34	7	2	Dual Technology Occupancy Sensor	58	0.41	10%	760.032	$125.41	$160.00	$160.00	0.00	84.448	$13.93	11.48
21	Basement Rms	2080	1	1	Incadescent 40 watt	40	0.04	83.2	$13.73	1	0	Dual Technology Occupancy Sensor	40	0.04	10%	74.88	$12.36	$160.00	$160.00	0.00	8.32	$1.37	116.55
10	Bathroom	2080	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.23	482.6	$79.62	4	2	Dual Technology Occupancy Sensor	58	0.23	10%	434.304	$71.66	$160.00	$160.00	0.00	48.256	$7.96	20.09
10	Exit Stairs	2080	4	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.23	482.6	$79.62	4	2	None	58	0.23	0%	482.56	$79.62	$0.00	$0.00	0.00	0	$0.00	0.00
9	Library	2080	41	3	T8 2x2 3 U-Tube Lamps Electronic Ballast Recessed Mouting Parabolic Lens	108	4.43	9,210.2	$1,519.69	41	3	Dual Technology Occupancy Sensor	108	4.43	10%	8289.216	$1,367.72	$160.00	$160.00	0.00	921.024	$151.97	1.05
20	Library	2080	16	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Direct/Indirect Lens	58	0.93	1,930.2	$318.49	16	2	Dual Technology Occupancy Sensor	58	0.93	10%	1737.216	$286.64	$160.00	$160.00	0.00	193.024	$31.85	5.02
12	Library	2080	3	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Parabolic Lens	82	0.25	511.7	$84.43	3	3	Dual Technology Occupancy Sensor	82	0.25	10%	460.512	$75.98	$160.00	$160.00	0.00	51.168	$8.44	18.95
12	124	2080	14	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Parabolic Lens	82	1.15	2,387.8	$393.99	14	3	Dual Technology Occupancy Sensor	82	1.15	10%	2149.056	$354.59	$160.00	$160.00	0.00	238.784	$39.40	4.06
9	124	2080	4	3	T8 2x2 3 U-Tube Lamps Electronic Ballast Recessed Mouting Parabolic Lens	108	0.43	898.6	$148.26	4	3	Dual Technology Occupancy Sensor	108	0.43	10%	808.704	$133.44	$160.00	$160.00	0.00	89.856	$14.83	10.79
10	Storage	260	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.06	15.1	$2.49	1	2	None	58	0.06	0%	15.08	$2.49	$0.00	$0.00	0.00	0	$0.00	0.00
10	Bathroom	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.06	120.6	$19.91	1	2	None	58	0.06	0%	120.64	$19.91	$0.00	$0.00	0.00	0	$0.00	0.00
14	Boys Room	2080	2	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	0.22	453.4	$74.82	2	4	Dual Technology Occupancy Sensor	109	0.22	10%	408.096	$67.34	$160.00	$160.00	0.00	45.344	$7.48	21.39
7	Boys Room	2080	1	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mouting Prismatic Lens	73	0.07	151.8	$25.05	1	2	Dual Technology Occupancy Sensor	73	0.07	10%	136.656	$22.55	$160.00	$160.00	0.00	15.184	$2.51	63.86
14	Girls Room	2080	2	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	109	0.22	453.4	$74.82	2	4	Dual Technology Occupancy Sensor	109	0.22	10%	408.096	$67.34	$160.00	$160.00	0.00	45.344	$7.48	21.39
7	Girls Room	2080	1	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mouting Prismatic Lens	73	0.07	151.8	$25.05	1	2	Dual Technology Occupancy Sensor	73	0.07	10%	136.656	$22.55	$160.00	$160.00	0.00	15.184	$2.51	63.86

1	107	2080	20	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.56	1,164.8	$192.19	20	1	Dual Technology Occupancy Sensor	28	0.56	10%	1048.32	$172.97	$160.00	$160.00	0.00	116.48	$19.22	8.33
7	107	2080	2	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mouting Prismatic Lens	73	0.15	303.7	$50.11	2	2	Dual Technology Occupancy Sensor	73	0.15	10%	273.312	$45.10	$160.00	$160.00	0.00	30.368	$5.01	31.93

1	108	2080	18	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.50	1,048.3	$172.97	18	1	Dual Technology Occupancy Sensor	28	0.50	10%	943.488	$155.68	$160.00	$160.00	0.00	104.832	$17.30	9.25
1	108	2080	18	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.50	1,048.3	$172.97	18	1	Dual Technology Occupancy Sensor	28	0.50	10%	943.488	$155.68	$160.00	$160.00	0.00	104.832	$17.30	9.25
2	Boys Room	2080	2	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Prismatic Lens	58	0.12	241.3	$39.81	2	2	Dual Technology Occupancy Sensor	58	0.12	10%	217.152	$35.83	$160.00	$160.00	0.00	24.128	$3.98	40.19
1	109	2080	14	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.39	815.4	$134.53	14	1	Dual Technology Occupancy Sensor	28	0.39	10%	733.824	$121.08	$160.00	$160.00	0.00	81.536	$13.45	11.89
1	110	2080	14	1	T8 1x4 1 Lamp Electronic Ballast Pendant Mounting Prismatic Lens	28	0.39	815.4	$134.53	14	1	Dual Technology Occupancy Sensor	28	0.39	10%	733.824	$121.08	$160.00	$160.00	0.00	81.536	$13.45	11.89
13	111	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$303.94	$160.00	$160.00	0.00	204.672	$33.77	4.74
13	112	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$303.94	$160.00	$160.00	0.00	204.672	$33.77	4.74
13	206	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$303.94	$160.00	$160.00	0.00	204.672	$33.77	4.74
13	207	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$303.94	$160.00	$160.00	0.00	204.672	$33.77	4.74
10	Boys Room	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	58	0.12	241.3	$39.81	2	2	Dual Technology Occupancy Sensor	58	0.12	10%	217.152	$35.83	$160.00	$160.00	0.00	24.128	$3.98	40.19
13	205	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.98	2,046.7	$337.71	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$303.94	$160.00	$160.00	0.00	204.672	$33.77	4.74
2	Stairwell	2080	5	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Prismatic Lens	58	0.29	603.2	$99.53	5	2	None	58	0.29	0%	603.2	$99.53	$0.00	$0.00	0.00	0	$0.00	0.00
2	Stairwell	2080	5	2	T8 1x4 2 Lamps Electronic Ballast Surface Mouting Prismatic Lens	58	0.29	603.2	$99.53	5	2	None	58	0.29	0%	603.2	$99.53	$0.00	$0.00	0.00	0	$0.00	0.00
9	Staff Bathroom	2080	1	3	T8 2x2 3 U-Tube Lamps Electronic Ballast Recessed Mouting Parabolic Lens	108	0.11	224.6	$37.07	1	3	Dual Technology Occupancy Sensor	108	0.11	10%	202.176	$33.36	$160.00	$160.00	0.00	22.464	$3.71	43.17
13	Staff Bathroom	2080	2	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mouting Prismatic Lens	82	0.16	341.1	$56.28	2	3	Dual Technology Occupancy Sensor	82	0.16	10%	307.008	$50.66	$160.00	$160.00	0.00	34.112	$5.63	28.43
18	Gym Office	2080	8	2	T12 1x8 2 Lamps Magnetic Ballast Pendant Mouting No Lens	210	1.68	3,494.4	$576.58	8	2	Dual Technology Occupancy Sensor	210	1.68	10%	3144.96	$518.92	$160.00	$160.00	0.00	349.44	$57.66	2.78
19	Storage	2080	2	2	T12 1x8 2 Lamps Magnetic Ballast Surface Mounting Prismatic Lens	210	0.42	873.6	$144.14	2	2	None	210	0.42	0%	873.6	$144.14	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		701	211			51.31	106,012.9	$17,492.13	701	206			51.309		96646.47	$15,946.67		$11,520.00	0.00	9366.4	$1,545.46	7.45

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives

CEG Job #: 9C09078
Project: School District of the Chathams
Address: 192 Southern Blvd
Chatham, NJ
Building SF: 61,907

Southern Boulevard School

KWH COST **$0.165**

ECM #3: LED EXIT SIGNS

EXISTING LIGHTING										**PROPOSED LIGHTING**										**SAVINGS**			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost INSTALLED	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
24	Throughout	8760	28	0	LED Exit Signs	4	0.11	981.1	$161.88	28	0	No Change	4	0.11	981.12	$161.88	$0.00	$0.00	0.00	0	$0.00	0.00
25	Throughout	8760	9	0	INC Exit Signs	30	0.27	2,365.2	$390.26	9	0	Exit Sign - LED	4	0.04	315.36	$52.03	$56.00	$504.00	0.23	2049.84	$338.22	1.49
	Totals		37	0			0.38	3,346.3	$552.14	37	0			0.148	1296.48	$213.92		$504.00	0.23	2049.8	$338.22	1.49

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentive

CEG Job #: 9C09078
Project: School District of the Chathams
Address: 192 Southern Blvd
Chatham, NJ
Building SF: 61,907

Southern Boulevard School

KWH COST **$0.165**

ECM #4: Lighting Upgrade - GYM

EXISTING LIGHTING										**PROPOSED LIGHTING**										**SAVINGS**			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost INSTALLED	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
17	Gym	2080	18	1	Halogen 1 Lamp Magnetic Ballast Surface Mounting	250	4.50	9,360.0	$1,544.40	18	3	3-Lamp T-5 HO Cooper F-Bay	182	3.28	6814.08	$1,124.32	$300.00	$5,400.00	1.22	2545.92	$420.08	12.85
	Totals		18	1			4.50	9,360.0	$1,544.40	18	3			3.276	6814.08	$1,124.32		$5,400.00	1.22	2545.9	$420.08	12.85

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentive

Project Name: LGEA Solar PV Project - Southern Boulevard School
Location: Chatham, NJ
Description: Photovoltaic System 95% Financing - 25 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 25 year
Total Construction Cost	$1,374,480
Annual kWh Production	190,380
Annual Energy Cost Reduction	$31,413
Annual SREC Revenue	$66,633
First Cost Premium	**$1,374,480**
Simple Payback:	**14.02** Years

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	95%
Financing Term (mths):	300	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.165**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	7.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$68,724	0	0	0	$0	0	0	(68,724)	0
1	$0	190,380	$31,413	$0	$66,633	$90,770	$19,976	($12,700)	($81,424)
2	$0	189,428	$32,355	$0	$66,300	$89,326	$21,420	($12,091)	($93,515)
3	$0	188,481	$33,326	$0	$65,968	$87,778	$22,968	($11,452)	($104,967)
4	$0	187,539	$34,326	$0	$65,638	$86,117	$24,628	($10,782)	($115,748)
5	$0	186,601	$35,355	$1,922	$65,310	$84,337	$26,409	($12,002)	($127,750)
6	$0	185,668	$36,416	$1,912	$64,984	$82,428	$28,318	($11,258)	($139,009)
7	$0	184,740	$37,508	$1,903	$64,659	$80,381	$30,365	($10,481)	($149,490)
8	$0	183,816	$38,634	$1,893	$64,336	$78,186	$32,560	($9,670)	($159,160)
9	$0	182,897	$39,793	$1,884	$64,014	$75,832	$34,914	($8,823)	($167,983)
10	$0	181,982	$40,986	$1,874	$63,694	$73,308	$37,438	($7,940)	($175,923)
11	$0	181,072	$42,216	$1,865	$63,375	$70,601	$40,144	($7,019)	($182,942)
12	$0	180,167	$43,483	$1,856	$63,058	$67,699	$43,046	($6,060)	($189,003)
13	$0	179,266	$44,787	$1,846	$62,743	$64,588	$46,158	($5,062)	($194,065)
14	$0	178,370	$46,131	$1,837	$62,429	$61,251	$49,495	($4,023)	($198,088)
15	$0	177,478	$47,515	$1,828	$62,117	$57,673	$53,073	($2,942)	($201,030)
16	$0	176,591	$48,940	$1,819	$61,807	$53,836	$56,910	($1,818)	($202,848)
17	$0	175,708	$50,408	$1,810	$61,498	$49,722	$61,023	($650)	($203,497)
18	$0	174,829	$51,920	$1,801	$61,190	$45,311	$65,435	$564	($202,933)
19	$0	173,955	$53,478	$1,792	$60,884	$40,581	$70,165	$1,825	($201,109)
20	$0	173,085	$55,082	$1,783	$60,580	$35,508	$75,237	$3,134	($197,975)
21	$0	172,220	$56,735	$1,774	$60,277	$32,351	$69,166	$13,721	($184,254)
22	$0	171,359	$58,437	$1,765	$59,976	$26,142	$56,917	$33,588	($150,666)
23	$0	170,502	$60,190	$1,756	$59,676	$0	$0	$118,109	($32,556)
24	$0	169,649	$61,996	$1,747	$59,377	$0	$0	$119,626	$87,069
25	$0	168,801	$63,856	$1,739	$59,080	$0	$0	$121,197	$208,266
	Totals:	4,484,582	$1,145,284	$38,406	1,569,604	$1,433,725	$965,766	276,990	($3,360,600)
				Net Present Value (NPV)				**($64,739)**	
				Internal Rate of Return (IRR)				**3.7%**	

Project Name: LGEA Solar PV Project - Southern Boulevard School
Location: Chatham, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

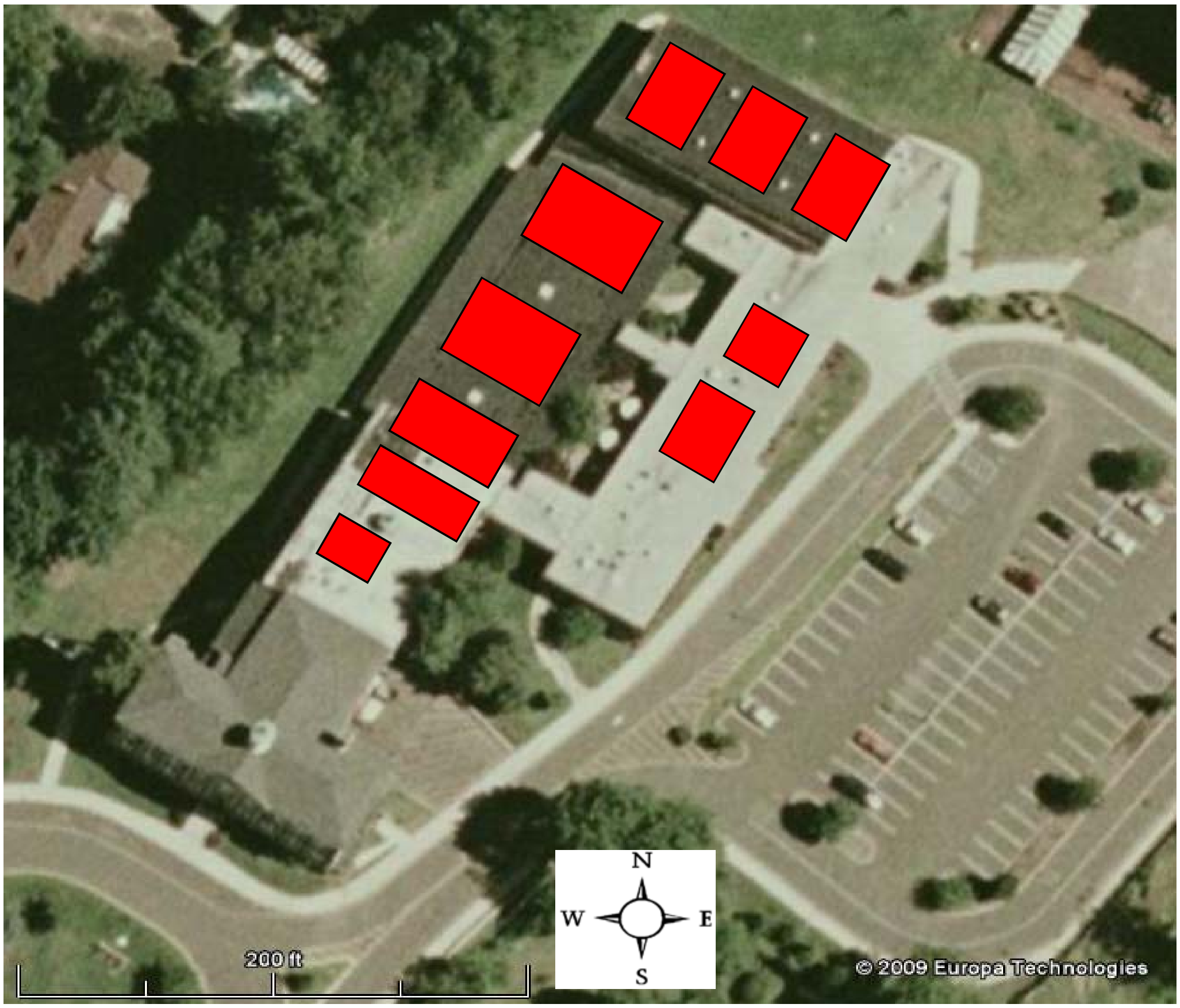
	Photovoltaic System - Direct Purchase
Total Construction Cost	$1,374,480
Annual kWh Production	190,380
Annual Energy Cost Reduction	$31,413
Annual SREC Revenue	$66,633
First Cost Premium	**$1,374,480**
Simple Payback:	**14.02** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.165**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Cumulative Cash Flow
0	$1,374,480	0	0	0	$0	(1,374,480)	0
1	$0	190,380	$31,413	$0	$66,633	$98,046	($1,276,434)
2	$0	189,428	$32,355	$0	$66,300	$98,655	($1,177,779)
3	$0	188,481	$33,326	$0	$65,968	$99,294	($1,078,485)
4	$0	187,539	$34,326	$0	$65,638	$99,964	($978,521)
5	$0	186,601	$35,355	$1,922	$65,310	$98,744	($879,778)
6	$0	185,668	$36,416	$1,912	$64,984	$99,487	($780,290)
7	$0	184,740	$37,508	$1,903	$64,659	$100,264	($680,026)
8	$0	183,816	$38,634	$1,893	$64,336	$101,076	($578,950)
9	$0	182,897	$39,793	$1,884	$64,014	$101,923	($477,027)
10	$0	181,982	$40,986	$1,874	$63,694	$102,806	($374,222)
11	$0	181,072	$42,216	$1,865	$63,375	$103,726	($270,495)
12	$0	180,167	$43,483	$1,856	$63,058	$104,685	($165,810)
13	$0	179,266	$44,787	$1,846	$62,743	$105,684	($60,126)
14	$0	178,370	$46,131	$1,837	$62,429	$106,723	$46,597
15	$0	177,478	$47,515	$1,828	$62,117	$107,804	$154,400
16	$0	176,591	$48,940	$1,819	$61,807	$108,928	$263,328
17	$0	175,708	$50,408	$1,810	$61,498	$110,096	$373,424
18	$0	174,829	$51,920	$1,801	$61,190	$111,310	$484,734
19	$0	173,955	$53,478	$1,792	$60,884	$112,571	$597,304
20	$0	173,085	$55,082	$1,783	$60,580	$113,879	$711,184
21	$1	172,220	$56,735	$1,774	$60,277	$115,238	$826,422
22	$2	171,359	$58,437	$1,765	$59,976	$116,647	$943,069
23	$3	170,502	$60,190	$1,756	$59,676	$118,109	$1,061,179
24	$4	169,649	$61,996	$1,747	$59,377	$119,626	$1,180,804
25	$5	168,801	$63,856	$1,739	$59,080	$121,197	$1,302,001
	Totals:	4,484,582	1,145,284	38,406	1,569,604	2,676,481	(833,499)
			Net Present Value (NPV)			**$1,302,026**	
			Internal Rate of Return (IRR)			**5.7%**	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Southern Boulevard School	9755	Sunpower SPR230	664	14.7	9,764	152.72	190,380	21,912	15.64



.= Proposed PV Layout

Notes:

1. Estimated kWH based on the National Renewable Energy Laboratory PVWatts Version 1 Calculator Program.

PVWatts Version 1 Input Screen

PV System Specifications:

DC Rating (kW):	152.72	Inputted From Roof Space Cell "G2" Total KW
DC to AC Derate Factor:	0.81	Inputted From Derate Factor Calculated Below in Cell "B37"
Array Type:	Fixed Tilt 1 - Axis Tracking 2 - Axis Tracking	There are 3 inputs for Array Type in all cases you should be using **Fixed Tilt** as the Selection
Fixed Tilt of Single Axis Tracking System:		
Array Tilt (degrees):	10	Based on Roof Type: For Flat Roof use 10 degrees, For Pitched Roof this is based on roof pitch.
Array Azimuth (degrees):	180	Based on Direction Array is Facing.

PV Watts Derate Factor for AC Power Rating at STC		
Component Derate Factors	PVWatts Default	Range
PV module nameplate DC rating	1.00	0.80–1.05
Inverter and transformer	0.95	0.88–0.96
Mismatch	0.98	0.97–0.995
Diodes and connections	1.00	0.99–0.997
DC wiring	0.98	0.97–0.99
AC wiring	0.99	0.98–0.993
1. Estimated kWH based on the National Renewable Energy Laboratory PVWatts Version 1 Calculator Program.	0.95	0.30–0.995
System availability	0.95	0.00–0.995
Shading	1.00	0.00–1.00
Sun-tracking	1.00	0.95–1.00
Age	1.00	0.70–1.00
Overall DC-to-AC derate factor	**0.81**	0.96001–0.09999

Click on **Calculate** if default values are acceptable, or after selecting your system specifications. Click on **Help** for information about system specifications. To use a DC to AC derate factor other than the default, click on **Derate Factor Help** for information.

Station Identification:

WBAN Number:	14734
City:	Newark
State:	New_Jersey

PV System Specifications:

DC Rating (kW):	152.72	
DC to AC Derate Factor:	.81	DERATE FACTOR HELP
Array Type:	Fixed Tilt	

Fixed Tilt or 1-Axis Tracking System:

Array Tilt (degrees):	40.73	(Default = Latitude)
Array Azimuth (degrees):	180.0	(Default = South)

Energy Data:

Cost of Electricity (cents/kWh): 0.165

Calculate | HELP | Reset Form

Return to RREDC Home Page (*http://rredc.nrel.gov/*)

PVWatts *** **AC Energy & Cost Savings**

Cautions for Interpreting the Results

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	152.7 kW
DC to AC Derate Factor:	0.810
AC Rating:	123.7 kW
Array Type:	Fixed Tilt
Array Tilt:	40.7°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	0.2 ¢/kWh

Results

Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	3.36	13323	21.98
2	4.05	14380	23.73
3	4.58	17437	28.77
4	4.84	17048	28.13
5	5.30	18788	31.00
6	5.32	17732	29.26
7	5.27	17907	29.55
8	5.25	17712	29.22
9	5.06	17174	28.34
10	4.46	16177	26.69
11	3.15	11554	19.06
12	2.87	11147	18.39
Year	4.46	190380	314.13

Output Hourly Performance Data * Output Results as Text

About the Hourly Performance Data   Saving Text from a Browser

Run PVWATTS v.1 for another US location or an International location
Run PVWATTS v.2 (US only)

Please send questions and comments regarding PVWATTS to Webmaster

RReDC Return to RReDC home page (*http://rredc.nrel.gov*)

ENERGY AUDIT – FINAL REPORT

SCHOOL DISTRICT OF THE CHATHAMS
WASHINGTON AVENUE SCHOOL

102 WASHINGTON AVENUE
CHATHAM, NJ 07928
ATTN: RALPH GOODWIN
SCHOOL BUSINESS ADMINISTRATOR BOARD SECRETARY

CEG PROJECT NO. 9C09078

CONCORD ENGINEERING GROUP

520 SOUTH BURNT MILL ROAD
VOORHEES, NJ 08043
TELEPHONE: (856) 427-0200
FACSIMILE: (856) 427-6529
WWW.CEG-INC.NET

CONTACT: MICHAEL FISCHETTE, PRESIDENT
EMAIL: mfischette@ceg-inc.net

Table of Contents

REPORT DISCLAIMER

The information contained within this report, including any attachment(s), is intended solely for use by the named addressee(s). If you are not the intended recipient, or a person designated as responsible for delivering such messages to the intended recipient, you are not authorized to disclose, copy, distribute or retain this report, in whole or in part, without written authorization from Concord Engineering Group, Inc., 520 S. Burnt Mill Road, Voorhees, NJ 08043.

This report may contain proprietary, confidential or privileged information. If you have received this report in error, please notify the sender immediately. Thank you for your anticipated cooperation.

I. EXECUTIVE SUMMARY

This report presents the findings of an energy audit conducted for:

Washington Avenue School
102 Washington Avenue
Chatham, NJ 07928

Facility Contact Person: John Cataldo
Municipal Contact Person: Ralph Goodwin

This audit was performed in connection with the New Jersey Clean Energy Local Government Energy Audit Program. These energy audits are conducted to promote the office of Clean Energy's mission, which is to use innovation and technology to solve energy and environmental problems in a way that improves the State's economy. This can be achieved through the wiser and more efficient use of energy.

The annual energy costs at this facility are as follows:

Electricity	$55,510
Natural Gas	$51,573
Total	$107,083

The potential annual energy cost savings for each energy conservation measure (ECM) and renewable energy measure (REM) are shown below in Table 1. Be aware that the ECM's are not additive because of the interrelation of some of the measures. This audit is consistent with an ASHRAE level 2 audit. The cost and savings for each measure is ± 20%. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

Table 1
Financial Summary Table

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Lighting Upgrade - General	$49	$158	0.3	4735.2%
ECM #2	Lighting Controls	$5,880	$1,567	3.8	299.6%
ECM #3	Install NEMA Premium Efficient Pump Motor	$5,012	$214	23.4	-57.3%
ECM #4	DDC System	$131,514	$7,156	18.4	-18.4%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	Solar PV Project	$1,039,972	$26,040	39.9	-37.4%

Notes: A. Cost takes into consideration applicable NJ Smart StartTM incentives.
B. Savings takes into consideration applicable maintenance savings.

The estimated demand and energy savings for each ECM and REM is shown below in Table 2. The information in this table corresponds to the ECM's and REM in Table 1.

Table 2
Estimated Energy Savings Summary Table

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	Lighting Upgrade - General	0.5	918.3	-
ECM #2	Lighting Controls	0.0	9,108.1	-
ECM #3	Install NEMA Premium Efficient Pump Motor	0.3	1,244.1	-
ECM #4	DDC System	-	-	2,995.2
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	Solar PV Project	121.4	151,393.0	-

Recommendation:

Concord Engineering Group (CEG) strongly recommends the implementation of all ECM's that provide a calculated simple payback at or under ten (10) years. The following Energy Conservation Measures are recommended for the Washington Avenue School:

- **ECM #1:** Lighting Upgrade
- **ECM #2:** Install Lighting Controls

Equipment that has past its useful service life should be replaced such as the equipment described in ECM#3. Although this ECM will not have a payback in less than 10 years, this equipment should be replaced and will save energy as summarized above in Table 2 on page 5.

In addition to the ECMs, there are maintenance and operational measures that can provide significant energy savings and provide immediate benefit. The ECMs listed above represent investments that can be made to the facility which are justified by the savings seen overtime. However, the maintenance items and small operational improvements below are typically achievable with on site staff or maintenance contractors and in turn have the potential to provide substantial operational savings compared to the costs associated. The following are recommendations which should be considered a priority in achieving an energy efficient building:

1. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.
2. Maintain all weather stripping on entrance doors.
3. Clean all light fixtures to maximize light output.
4. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

Efficient HVAC equipment replacements are difficult to justify with the energy savings alone. The replacement of HVAC equipment such as the heating and ventilation units at Washington Avenue School is typically initiated when the equipment stops working, surpasses the life expectancy, or maintenance requirements grow beyond the ability to continue to support it. When replacing the equipment becomes necessary, the additional cost to install high efficiency systems becomes a great value for the investment.

The existing facility does not qualify for the Pay for Performance Program because the average operating demand is below 200 KW.

II. INTRODUCTION

The Washington Avenue School is a 43,838 square foot facility that includes restrooms, classrooms, offices, Library, gymnasium, multi-purpose room, art room and boiler room.

Electrical and natural gas utility information is collected and analyzed for one full year's energy use of the building. The utility information allows for analysis of the building's operational characteristics; calculate energy benchmarks for comparison to industry averages, estimated savings potential, and baseline usage/cost to monitor the effectiveness of implemented measures. A computer spreadsheet is used to calculate benchmarks and to graph utility information (see the utility profiles below).

The Energy Use Index (EUI) is established for the building. Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year ($BTU/ft^2/yr$), which is used to compare energy consumption to similar building types or to track consumption from year to year in the same building. The EUI is calculated by converting the annual consumption of all energy sources to BTU's and dividing by the area (gross square footage) of the building. Blueprints (where available) are utilized to verify the gross area of the facility. The EUI is a good indicator of the relative potential for energy savings. A low EUI indicates less potential for energy savings, while a high EUI indicates poor building performance therefore a high potential for energy savings.

Existing building architectural and engineering drawings (where available) are utilized for additional background information. The building envelope, lighting systems, HVAC equipment, and controls information gathered from building drawings allow for a more accurate and detailed review of the building. The information is compared to the energy usage profiles developed from utility data. Through the review of the architectural and engineering drawings a building profile can be defined that documents building age, type, usage, major energy consuming equipment or systems, etc.

The preliminary audit information is gathered in preparation for the site survey. The site survey provides critical information in deciphering where energy is spent and opportunities exist within a facility. The entire site is surveyed to inventory the following to gain an understanding of how each facility operates:

- Building envelope (roof, windows, etc.)
- Heating, ventilation, and air conditioning equipment (HVAC)
- Lighting systems and controls
- Facility-specific equipment

The building site visit is performed to survey all major building components and systems. The site visit includes detailed inspection of energy consuming components. Summary of building occupancy schedules, operating and maintenance practices, and energy management programs provided by the building manager are collected along with the system and components to determine a more accurate impact on energy consumption.

III. METHOD OF ANALYSIS

Post site visit work includes evaluation of the information gathered, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on HVAC, lighting and building envelope improvements. Data collected is processed using energy engineering calculations to anticipate energy usage for each of the proposed energy conservation measures (ECMs). The actual building's energy usage is entered directly from the utility bills provided by the owner. The anticipated energy usage is compared to the historical data to determine energy savings for the proposed ECMs.

It is pertinent to note, that the savings noted in this report are not additive. The savings for each recommendation is calculated as standalone energy conservation measures. Implementation of more than one ECM may in some cases affect the savings of each ECM. The savings may in some cases be relatively higher if an individual ECM is implemented in lieu of multiple recommended ECMs. For example implementing reduced operating schedules for inefficient lighting will result in a greater relative savings. Implementing reduced operating schedules for newly installed efficient lighting will result in a lower relative savings, because there is less energy to be saved. If multiple ECM's are recommended to be implemented, the combined savings is calculated and identified appropriately.

ECMs are determined by identifying the building's unique properties and deciphering the most beneficial energy saving measures available that meet the specific needs of the facility. The building construction type, function, operational schedule, existing conditions, and foreseen future plans are critical in the evaluation and final recommendations. Energy savings are calculated base on industry standard methods and engineering estimations. Energy consumption is calculated based on manufacturer's cataloged information when new equipment is proposed.

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers. The NJ SmartStart Building® program incentives savings (where applicable) are included for the appropriate ECM's and subtracted from the installed cost. Maintenance savings are calculated where applicable and added to the energy savings for each ECM. The costs and savings are applied and a simple payback and simple return on investment (ROI) is calculated. The simple payback is based on the years that it takes for the savings to pay back the net installation cost (Net Installation divided by Net Savings.) A simple return on investment is calculated as the percentage of the net installation cost that is saved in one year (Net Savings divided by Net Installation.)

A simple life-time calculation is shown for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The energy savings is extrapolated throughout the life-time of the ECM and the total energy savings is calculated as the total life-time savings.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

The energy usage for the facility has been tabulated and plotted in graph form as depicted within this section. Each energy source has been identified and monthly consumption and cost noted per the information provided by the Owner.

There is one (1) electric service for the facility. The primary service is located just outside of the boiler room. The electric usage profile (below) represents the actual electrical usage for the facility. Jersey Central Power and Light (JCP&L) provides electricity to the facility under their General Service Three-Phase rate structure. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile shows the actual natural gas energy usage for the facility. Public Service Electric and Gas (PSE&G) provides natural gas to the facility under the Basic General Supply Service- Large Volume Gas (LVG) rate structure. Hess Corporation is a third party supplier. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

The overall cost for utilities is calculated by dividing the total cost by the total usage. Based on the utility history provide, the average cost for utilities at this facility is as follows:

Description	Average
Electricity	17.2¢ / kWh
Natural Gas	$1.521 / Therm

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: JCP&L
Rate: JC_GS3_01F
Meter No: G28890566
Customer ID No: 0801577897 0000426058
Third Party Utility Provider: N/A
TPS Meter / Acct No: N/A

MONTH OF USE	CONSUMPTION (KWH)	DEMAND (KW)	TOTAL BILL
Aug-08	25,120	175.9	$5,186
Sep-08	27,760	152.1	$4,757
Oct-08	29,120	117.4	$4,734
Nov-08	29,600	100.8	$4,774
Dec-08	26,720	99.0	$4,503
Jan-09	28,320	95.2	$4,728
Feb-09	26,720	98.7	$4,472
Mar-09	27,200	112.2	$4,570
Apr-09	28,720	146.7	$4,861
May-09	26,160	144.9	$4,526
Jun-09	23,600	143.0	$4,191
Jul-09	24,360	127.7	$4,207
Totals	**323,400**	**175.9 Max**	**$55,510**

AVERAGE DEMAND **126.1 KW average**
AVERAGE RATE **$0.172** **$/kWh**

Figure 1
Electricity Usage Profile

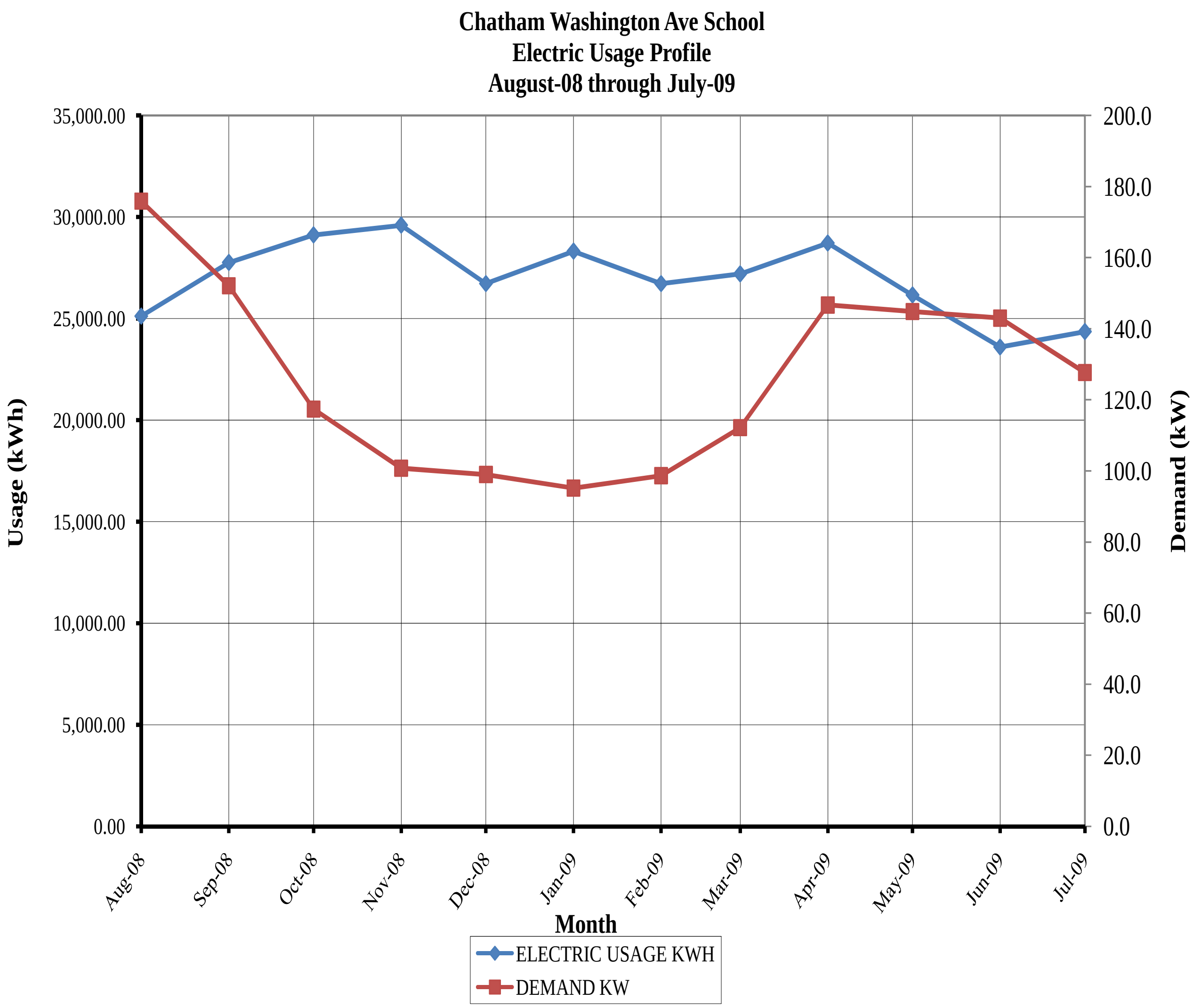


Table 4
Natural Gas Billing Data

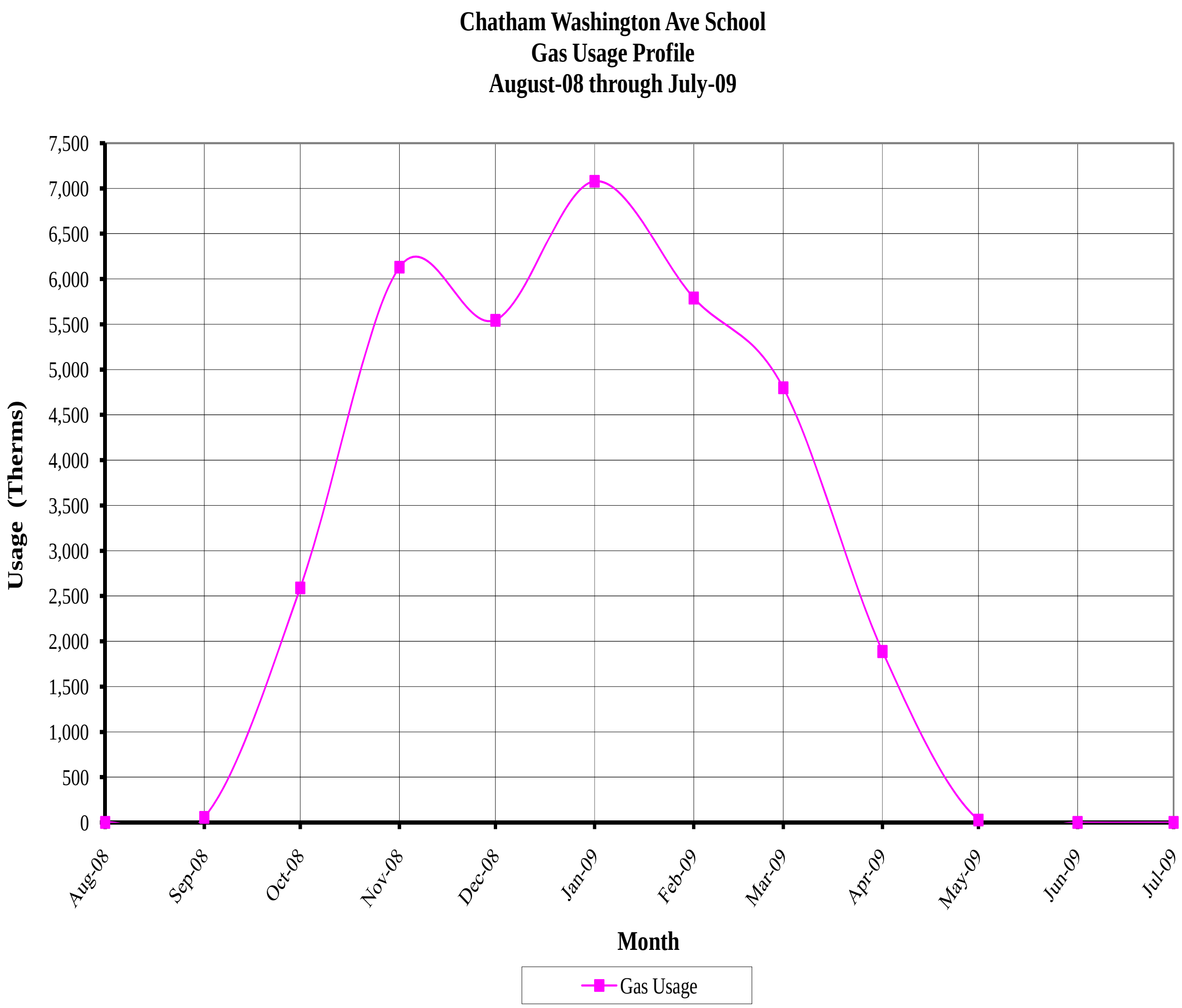
GAS USAGE SUMMARY

Utility Provider:	PSE&G
Rate:	LVG
Meter No:	3274106 and 2808799
Point of Delivery ID:	PG000010675177904612
Third Party Utility Provider:	Hess Corporation
TPS Meter No:	394872/394904

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
Aug-08	2.21	$94.93
Sep-08	56.33	$167.31
Oct-08	2,589.80	$4,537.44
Nov-08	6,130.77	$9,417.96
Dec-08	5,546.09	$8,443.61
Jan-09	7,078.64	$10,757.21
Feb-09	5,791.06	$8,972.05
Mar-09	4,800.21	$6,310.74
Apr-09	1,888.02	$2,552.74
May-09	28.58	$131.30
Jun-09	1.10	$93.84
Jul-09	0.00	$93.72
TOTALS	**33,912.81**	**$51,572.85**

AVERAGE RATE: **$1.521** **$/THERM**

Figure 2
Natural Gas Usage Profile



B. Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's annual energy utilization per square foot of building. This calculation is completed by converting all utility usage consumed by a building for one year, to British Thermal Units (BTU) and dividing this number by the building square footage. EUI is a good measure of a building's energy use and is utilized regularly for comparison of energy performance for similar building types. The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of Energy maintains a Benchmarking Building Energy Performance Program. The ORNL website determines how a building's energy use compares with similar facilities throughout the U.S. and in a specific region or state.

Source use differs from site usage when comparing a building's energy consumption with the national average. Site energy use is the energy consumed by the building at the building site only. Source energy use includes the site energy use as well as all of the losses to create and distribute the energy to the building. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses, which allows for a complete assessment of energy efficiency in a building. The type of utility purchased has a substantial impact on the source energy use of a building. The EPA has determined that source energy is the most comparable unit for evaluation purposes and overall global impact. Both the site and source EUI ratings for the building are provided to understand and compare the differences in energy use.

The site and source EUI for this facility is calculated as follows. (See Table 5 for details):

$$Building\ Site\ EUI = \frac{(Electric\ Usage\ in\ kBtu + Gas\ Usage\ in\ kBtu)}{Building\ Square\ Footage}$$

$$Building\ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ x\ SS\ Ratio + Gas\ Usage\ in\ kBtu\ x\ SS\ Ratio)}{Building\ Square\ Footage}$$

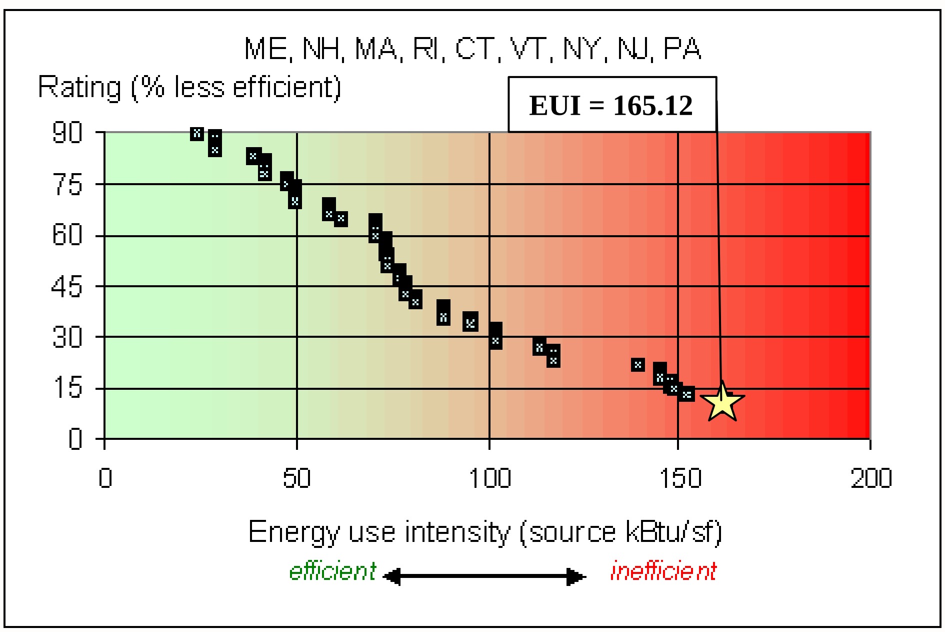
Table 5
Washington Avenue School EUI Calculations

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE RATIO	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu		kBtu
ELECTRIC	323,400.0			1,104,088	3.340	3,687,653
NATURAL GAS		33,912.8		3,391,281	1.047	3,550,671
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				4,495,368		7,238,323

*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.

BUILDING AREA	43,838	SQUARE FEET
BUILDING SITE EUI	*102.55*	kBtu/SF/YR
BUILDING SOURCE EUI	*165.12*	kBtu/SF/YR

Figure 3
Source Energy Use Intensity Distributions: Elementary Schools



C. EPA Energy Benchmarking System

The United States Environmental Protection Agency (EPA) in an effort to promote energy management has created a system for benchmarking energy use amongst various end users. The benchmarking tool utilized for this analysis is entitled Portfolio Manager. The Portfolio Manager tool allows tracking and assessment of energy consumption via the template forms located on the ENERGY STAR website (www.energystar.gov). The importance of benchmarking for local government municipalities is becoming more important as utility costs continue to increase and emphasis is being placed on carbon reduction, greenhouse gas emissions and other environmental impacts.

Based on information gathered from the ENERGY STAR website, Government agencies spend more than $10 billion a year on energy to provide public services and meet constituent needs. Furthermore, energy use in commercial buildings and industrial facilities is responsible for more than 50 percent of U.S. carbon dioxide emissions. It is vital that local government municipalities assess facility energy usage, benchmark energy usage utilizing Portfolio Manager, set priorities and goals to lessen energy usage and move forward with priorities and goals.

In accordance with the Local Government Energy Audit Program, CEG has created an ENERGY STAR account for the municipality to access and monitoring the facility's yearly energy usage as it compares to facilities of similar type. The following is the user name and password for this account:

https://www.energystar.gov/istar/pmpam/index.cfm?fuseaction=login.login

Username: chathamsd
Password: lgeaceg2009

Security Question: What city were you born in?
Security Answer: "chatham"

The utility bills and other information gathered during the energy audit process are entered into the Portfolio Manager. The following is a summary of the results for the facility:

Table 6
ENERGY STAR Performance Rating

FACILITY DESCRIPTION	ENERGY PERFORMANCE RATING	NATIONAL AVERAGE
Washington Avenue School	11	50

Refer to the Statement of Energy Performance appendix for the detailed energy summary.

V. FACILITY DESCRIPTION

The original Washington Avenue School building was built in 1952. The original school is a one-story block and brick faced building, and is 23,318 square feet. An addition of similar construction was built in 1996 and in 2006 that added approximately 20,520 square feet, bringing the building total to 43,838 square feet.

The facility currently houses the rest rooms, classrooms, offices, Library, gymnasium, multi-purpose room, art room and boiler room. The building operates for 40 hours during a typical week. There is a asphalt rolled roof on the 2006 addition. The original building and the 1996 addition has an EPDM roof membrane roof. The windows in the original 1952 building are single pane wire glass. The windows in the 1996 and 2006 additions are tempered, insulated glass with aluminum frame.

Heating System

The boiler plant consists of five (5) Fulton Pulse model PVLP 1150 steam boilers, each rated for 1,150,000 BTU/hr max input and 978,000 BTU/hr net maximum output. Each boiler has a maximum natural gas input rating of 1,150,000 BTU/hr. The boilers are 84.4% thermal efficient. The steam is piped via pipe tunnel to the existing building classroom unit ventilators. A portion of the steam is diverted to a heat exchanger to generate heating hot water. The heating hot water is pumped to unit heaters, fin tube radiation, classroom units and unit ventilators in the 2006 addition. The 5 hp in-line pumps operate in a lead/lag configuration. These pumps are approximately 3 years old and in good condition.

There are three (3) roof top units with natural gas heat serving the 2006 addition. The heating input ranges from 55.9 MBH to 631.8 MBH. These units are three (3) years old and are in good condition.

Domestic Hot Water

There is a Rheem Fury model 82V52-2 electric, domestic water heater provides hot water for the 2006 addition. This unit has an input of 4,500 watts, 50 gallon tank and a recovery rate of 18.6 gallons per hour at 100°F rise and a .91 energy factor. The water heater was manufactured in 2007 and is in good condition.

There is a Paterson-Kelley steam to hot water generator. An Armstrong model S-25 circulator pump is used. The hot water generator and pump are two (2) years old and in good condition.

Cooling System

The facility is cooled via eleven (11) split system air conditioning systems and eighteen (18) window air conditioners and three (3) roof top units. All cooling units are air cooled, direct expansion cooling. The split systems range from 1.5 to 4 nominal tons. The split systems range from five (5) to fourteen (14) years old and range from good to fair condition. The window air conditioners range from four (4) to nine (9) years old and are in good condition. The three (3) packaged roof top units are 2, 2.5 and 40 nominal tons cooling with gas heat exchangers as listed above in the heating section, are three (3) years old and in good condition.

Controls System

There are pneumatic controls serving the original school building. The system appears to be operational but is antiquated. The 2006 addition has Automated Logic DDC controls. The boilers are monitored through the DDC contols.

Exhaust System

There are five (5) fractional horse power exhaust fans exhausting the toilet rooms and gym in the 2006 addition.

Lighting

The building is lit by varying types and sizes of light bulb types. The types used include the use of T-8 fluorescent, incandescent and compact fluorescent. The lamp wattages range from 26 watts to 200 watts with the majority being fluorescent T8 light fixtures with 32 Watt lamps. The incandescent lamps range from 90 watts to 200 watts. There are seventeen (17) LED exit signs.

VI. MAJOR EQUIPMENT LIST

The equipment list is considered major energy consuming equipment and through energy conservation measures could yield substantial energy savings. The list shows the major equipment in the facility and all pertinent information utilized in energy savings calculations. An approximate age was assigned to the equipment in some cases if a manufactures date was not shown on the equipment's nameplate. The ASHRAE service life for the equipment along with the remaining useful life is also shown in the Appendix.

Refer to the **Major Equipment List Appendix** for this facility.

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade - General

Description: General

The lighting in the Washington Avenue School is primarily made up of fluorescent fixtures with T-8 lamps with electronic ballasts, incandescent lamps and compact fluorescent lamps. There are a few closets, room 14, Library with incandescent lighting and Faculty room and hallway with compact fluorescent fixtures.

This ECM includes replacement of all incandescent lamps to compact fluorescent lamps. The energy usage of an incandescent compared to a compact fluorescent approximately 3 to 4 times greater. In addition to the energy savings, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours.

Energy Savings Calculations:

The **Grade Lighting Audit ECM#1- General Appendix** outlines the proposed retrofits, costs, savings, and payback periods.

From the Smart **Start Incentive Appendix**, there is no incentive for replacing incandescent lamps with compact fluorescent lamps. The incentive is only available if the entire light fixture is replaced. In most cases, the existing fixtures can be re-lamped by the facility's staff to obtain the energy savings without the expense of a new fixture and the involvement of an electrician to install a new fixture.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$49
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$49
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$158
Total Yearly Savings ($/Yr):	$158
Estimated ECM Lifetime (Yr):	15
Simple Payback	0.3
Simple Lifetime ROI	4735.2%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$2,369
Internal Rate of Return (IRR)	322%
Net Present Value (NPV)	$1,836.60

* ECM#1 Calculations DO NOT include lighting control changes implemented in ECM#2. If ECM#1 and #2 are implemented together the savings will be relatively lower than shown above.

ECM #2: Install Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. There has been a belief that it is better to keep the lights on rather than to continuously switch them on and off. This on/off dilemma was studied, and it was determined that the best option is to turn the lights off whenever possible. Although this practice reduces the lamp life, the energy savings far outweigh the lamp replacement costs.

Lighting controls are available in many forms. Lighting controls can be as simplistic as an additional switch. Timeclocks are often used which allow the user to set an on/off schedule. Timeclocks range from a dial clock with on/off indicators to a small box the size of a thermostat with user programs for on/off schedule in digital format. Occupancy sensors detect motion and will switch the lights on when the room is occupied. They can either be mounted in place of the current wall switch, or they can be mounted on the ceiling to cover large areas. Lastly, photocells are a lighting control that sense light levels and will turn the lights off when there is adequate daylight. These are mostly used outside, but they are becoming much more popular in energy-efficient office designs as well.

To determine an estimated savings for lighting controls, we used ASHRAE 90.1-2004 (NJ Energy Code). Appendix G states that occupancy sensors have a 10% power adjustment factor for daytime occupancies for buildings over 5,000 SF. CEG recommends the installation of dual technology occupancy sensors in all classrooms, private offices, conference rooms, restrooms, lunch rooms, storage rooms, lounges, file rooms, gym, etc.

Energy Savings Calculations:

The **Investment Grade Lighting Audit ECM#2- Lighting Controls Appendix** outlines the proposed retrofits, costs, savings, and payback periods. The hallways of the building is a 24/7 facility while the majority of the building is only occupied 40 hours a week and other areas are only a few hours a day. Ten percent of this value is the resultant energy savings due to installation of occupancy sensors and was calculated to be 6,046.6 kWh/year and $1,040/year.

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is $160/unit including material and labor. The SmartStart Buildings® incentive is $20 per control which equates to an installed cost of $140/unit. Total number of rooms to be retrofitted is 34. Total cost to install sensors is $140/ceiling unit x 42 units = $5,880.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$6,720
NJ Smart Start Equipment Incentive ($):	$840
Net Installation Cost ($):	$5,880
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,567
Total Yearly Savings ($/Yr):	$1,567
Estimated ECM Lifetime (Yr):	15
Simple Payback	3.8
Simple Lifetime ROI	299.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$23,499
Internal Rate of Return (IRR)	26%
Net Present Value (NPV)	$12,821.97

ECM #3: Install NEMA Premium Efficient Pump Motor

Description:

Replacing the old system booster pump motor with new efficient motor is a simple change that can provide substantial savings.

Existing electric motors equal to or greater than one horsepower ranged from 78 to 93% efficient. The improved efficiency of the NEMA premium efficient motors is primarily due to better designs with use of better materials to reduce losses. Surprisingly, the electricity used to power a motor represents 95 % of its total lifetime operating cost. Because many motors operate 40-80 hours per week, even small increases in efficiency can yield substantial energy and dollar savings.

This energy conservation measure would replace all motors equal to or greater than 1 HP with NEMA Premium® Efficient Motors. NEMA Premium® is the most efficient motor designation in the marketplace today. Using MotorMaster+, Version 4, the energy & cost savings were calculated for the fan/pump motors in this facility that are greater than or equal to 1 HP.

Energy Savings Calculations:

Existing: A 1.5 HP system circulation pump motor with the following characteristics:
Existing Motor Efficiency = 78%
Annual Hours of Operations = 4500 (Average)
1 HP = 0.746 Watt
Load Factor = 75%
Cost of electricity = $0.172 / kWh

Existing 1.5HP Motor Operating Cost =
{0.746 Watt/HP x Motor HP x Load Factor x Hours of Operation x Cost of Electricity] ÷ Motor Efficiency
= [0.746 x 1.5 x 0.75 x 4,500 x 0.172] ÷ 0.78 = $833 / Year

New NEMA Premium Motor Efficiency = 88.9%

New NEMA Premium Efficiency 5HP Motor Operating Cost =
{0.746 x 5 x 0.75 x 4,500 x 0.172} ÷ 0.889 = $731 / Year

Savings = $833 - $731 = $102 / Year x 2 motors = $204 / Year

Installed Cost of a 1.5 HP NEMA Premium® Efficiency Motor = $1,234 minus the SmartStart Building® incentive for a 1.5hp ($50/motor) is $1,189 or $2,368 for two (2) motors.

Simple Payback = $2,368 / $204 = 11.6 Years

kWh saved = $204 / $0.172/kWh = 1186 kWh
kW saved = 593 kWh / 4,500 hrs./yr. = 0.26 Kw

Existing: A 5 HP system circulation pump motor with the following characteristics:
Existing Motor Efficiency = 90%
Annual Hours of Operations = 4500 (Average)
1 HP = 0.746 Watt
Load Factor = 75%
Cost of electricity = $0.172 / kWh

Existing 1.5HP Motor Operating Cost =
{0.746 Watt/HP x Motor HP x Load Factor x Hours of Operation x Cost of Electricity] ÷ Motor Efficiency
= [0.746 x 5 x 0.75 x 4,500 x 0.172] ÷ 0.90 = $2,406 / Year

New NEMA Premium Motor Efficiency = 90.2%

New NEMA Premium Efficiency 5HP Motor Operating Cost =
{0.746 x 5 x 0.75 x 4,500 x 0.172} ÷ 0.902 = $2401 / Year

Savings = $2,406 - $2,401 = $5 / Year x 2 motors = $10 / Year

Installed Cost of a 5 HP NEMA Premium® Efficiency Motor = $1,382 minus the SmartStart Building® incentive for a 5hp ($60/motor) is $1,322 or $2,644 for two (2) motors.

Simple Payback = $2,644 / $10 = 264.4 Years

kWh saved = $10 / $0.172/kWh = 58.1 kWh
kW saved = 58.1 kWh / 4,500 hrs./yr. = 0.01 kW

The following table outlines the motor replacement plan for this facility:

MOTOR REPLACEMENT PLAN

MOTOR HP	QTY	ENCLOSURE TYPE	NUMBER OF POLES	INSTALLED COST ** PER MOTOR	TOTAL COST	TOTAL SAVINGS	SIMPLE PAYBACK	SIMPLE RETURN ON INVESTMENT
5	2	TEFC	4-Pole	$1,322	$2,644	$10	264.4	0.4%
1.5	2	TEFC	4-Pole	$1,184	$2,368	$204	11.6	8.6%
				Totals:	*$5,012*	*$214*	*23.4*	*4.3 %*

**** Net Cost after the SmartStart Buildings® incentive is applied.**

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$5,232
NJ Smart Start Equipment Incentive ($):	$220
Net Installation Cost ($):	$5,012
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$214
Total Yearly Savings ($/Yr):	$214
Estimated ECM Lifetime (Yr):	10
Simple Payback	23.4
Simple Lifetime ROI	-57.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$2,140
Internal Rate of Return (IRR)	-13%
Net Present Value (NPV)	($3,186.54)

ECM #4: DDC System – Washington Avenue School

Description:

The current HVAC systems within the Washington Avenue School are controlled via two types of systems. The original building has pneumatic thermostats. An Automated Logic Direct Digital Control (DDC) system is serving the new classrooms in the 2006 addition and can monitor the boilers. The DDC system is not a web based system. Thermostats are 2-stage for a day/night (occupied/unoccupied) function by means if a mechanical time clock. During initial discussions with the Owner it was noted that the hours of operation of the facility are generally 40 hours per week. Occasionally, there are additional after-hour usage during weeknights and weekends and thermostat adjustments are made by the person currently occupying the space instead on one general setpoint. This is a means for a cycling amongst different HVAC systems attempting to meet various setpoints throughout the year, independent of heating or cooling season. Therefore, a DDC system providing the Owner with full control over the HVAC equipment within the building appears to be an energy saving opportunity.

This ECM includes installing a Building Automation system with Direct Digital Controls (DDC) wired through an Ethernet backbone and front end controller within the Washington Avenue School only. The system will include new thermostat controllers for all indoor air-handling systems and the rooftop units, in addition to each piece of equipment being wired back to a front end controller and computer interface. With the communication between the devices and the front end computer interface, the Owner will be able to take advantage of equipment scheduling for occupied and unoccupied periods based on the actual occupancy of the facility. Due to the fact that the Washington Avenue School has diverse hours of occupancy, including evening and weekend hours, having supervisory control over all of the equipment makes sense. The DDC system will also aid in the response time to service / maintenance issues when the facility is not under normal maintenance supervision, i.e. after-hours.

The new DDC system has the potential to provide substantial savings by controlling the HVAC systems as a whole and provide operating schedules and features such as space averaging, night set-back, temperature override control, etc. The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings is based on the "Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways," document posted for public use April 2005. The study has found that commercial buildings have the potential to achieve significant energy savings through the use of building controls. The average energy savings are as follows based on the referenced report:

- Energy Management and Control System Savings: 5%-15%.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 10% of the total energy cost for the facility.

The cost of a full DDC system with new field devices, controllers, computer, software, programming, etc. is approximately $4.00 per SF in accordance with recent Contractor pricing for systems of this magnitude. Savings from the implementation of this ECM will be from the reduced energy consumption currently used by the HVAC system by proper control of schedule and temperatures via the DDC system.

Cost of complete DDC System = ($3.00/SF x 43,838 SF) = $131,514

Heating Season Heating Degree Days = 4,996 HDD
Average Cost of Gas = $1.521 / Therm

Cooling Season Full Load Cooling Hrs. = 1,129 hrs / yr
Average Cost of Electricity = $0.172/ kWh

Note: Degree Days and Full Load Hours referenced from ASHRAE Weather Data for Newark, NJ.

Energy Savings Calculations:

10% Savings on Heating Calculations

$$Heat\ Load = \frac{Heat\ Loss\left(\frac{Btu}{Hr\ SF}\right)\times Area\ (SF)}{1000\left(\frac{Btu}{kBtu}\right)}$$

$$Heat\ Load = \frac{50\left(\frac{Btu}{Hr\ SF}\right)\times 43{,}838\ (SF)}{1000\left(\frac{Btu}{kBtu}\right)} = 2{,}192\left(\frac{kBtu}{Hr}\right)$$

$$Est\ Heat\ Cons. = \frac{Heat\ Load\left(\frac{kBtu}{Hr}\right)\times Heat\ Deg\ Days\times 24\ Hrs\times Correction\ Factor}{Design\ Temp\ Difference(^\circ F)\times Efficiency(\%)\times Fuel\ Heat\ Value\left(\frac{kBtu}{Therm}\right)}$$

$$Est\ Heat\ Cons. = \frac{2{,}192\left(\frac{kBtu}{Hr}\right)\times 4{,}996\ (HDD)\times 24\ Hrs\times 0.6}{65\ (^\circ F)\times 81\%\times 100\left(\frac{kBtu}{Therm}\right)} = 29{,}952(Therms)$$

$$Savings. = Heat\ Cons.(Therms)\times 10\%\ Savings\times Ave\ Gas\ Cost\left(\frac{\$}{Therm}\right)$$

$$Savings. = 29{,}952\ (Therms)\times 10\%\times 1.521\left(\frac{\$}{Therm}\right) = \underline{\$4{,}556}$$

10% Savings on Cooling Calculations**:**

Cooling equipment that would be served by the DDC system is already connected to the DDC system and would not materialize into any further savings.

Total Annual Energy Savings = $4,556 + $0 = $4,556 per year

It is pertinent to note that electric demand savings were unable to be estimated. Also, incentives for the installation of the DDC system are not currently available and maintenance savings could not be adequately calculated because information was not available to baseline the savings.

Estimated Maintenance Savings:

This ECM would eliminate the need to manually control this equipment and the savings is estimated as follows:

Maintenance Savings = 0.5 hrs/day x 5 days/week x 52 weeks/year x $20/hour = $2,600

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$131,514
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$131,514
Maintenance Savings ($/Yr):	$2,600
Energy Savings ($/Yr):	$4,556
Total Yearly Savings ($/Yr):	$7,156
Estimated ECM Lifetime (Yr):	15
Simple Payback	18.4
Simple Lifetime ROI	-18.4%
Simple Lifetime Maintenance Savings	$39,000
Simple Lifetime Savings	$107,340
Internal Rate of Return (IRR)	-2%
Net Present Value (NPV)	($46,086.14)

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

Globally, renewable energy has become a priority affecting international and domestic energy policy. The State of New Jersey has taken a proactive approach, and has recently adopted in its Energy Master Plan a goal of 30% renewable energy by 2020. To help reach this goal New Jersey created the Office of Clean Energy under the direction of the Board of Public Utilities and instituted a Renewable Energy Incentive Program to provide additional funding to private and public entities for installing qualified renewable technologies. A renewable energy source can greatly reduce a building's operating expenses while producing clean environmentally friendly energy. CEG has assessed the feasibility of installing renewable energy measures (REM) for the municipality utilizing renewable technologies and concluded that there is potential for solar energy generation. The solar photovoltaic system calculation summary will be concluded as **REM#1** within this report.

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which will be mounted on all south and southwestern facades of the building. Flat roof, as well as sloped areas can be utilized; flat areas will have the panels turned to an optimum solar absorbing angle. (A structural survey of the roof would be necessary before the installation of PV panels is considered). The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit is around $350, this value was used in our financial calculations. This equates to $0.35 per kWh generated.

CEG has reviewed the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 7,764 S.F. can be utilized for a PV system. A depiction of the area utilized is shown in Renewable / Distributed Energy Measures Calculation Appendix. Using this square footage it was determined that a system size of 121.44 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 151,393 KWh annually, reducing the overall utility bill by approximately 46.8% percent. A detailed financial analysis can be found in the Renewable / Distributed Energy Measures Calculation appendix. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

The proposed photovoltaic array layout is designed based on the specifications for the Sun Power SPR-230 panel. This panel has a "DC" rated full load output of 230 watts, and has a total panel conversion efficiency of 18%. Although panels rated at higher wattages are available through Sun Power and other various manufacturers, in general most manufacturers who produce commercially available solar panels produce a similar panel in the 200 to 250 watt range. This provides more manufacturer options to the public entity if they wish to pursue the proposed solar recommendation without losing significant system capacity.

The array system capacity was sized on available roof space on the existing facility. Estimated solar array generation was then calculated based on the National Renewable Energy Laboratory PVWatts Version 1.0 Calculator. In order to calculate the array generation an appropriate location with solar data on file must be selected. In addition the system DC rated kilowatt (kW) capacity must be inputted, a DC to AC de-rate factor, panel tilt angle, and array azimuth angle. The DC to AC derate factor is based on the panel nameplate DC rating, inverter and transformer efficiencies (95%), mismatch factor (98%), diodes and connections (100%), dc and ac wiring(98%, 99%), soiling, (95%), system availability (95%), shading (if applicable), and age(new/100%). The overall DC to AC de-rate factor has been calculated at an overall rating of 81%. The PVWatts Calculator program then calculates estimated system generation based on average monthly solar irradiance and user provided inputs. The monthly energy generation and offset electric costs from the PVWatts calculator is shown in the **Renewable/Distributed Energy Measures Calculation Appendix**.

The proposed solar array is qualified by the New Jersey Board of Public Utilities Net Metering Guidelines as a Class I Renewable Energy Source. These guidelines allow onsite customer generation using renewable energy sources such as solar and wind with a capacity of 2 megawatts (MW) or less. This limits a customer system design capacity to being a net user and not a net generator of electricity on an annual basis. Although these guidelines state that if a customer does net generate (produce more electricity than they use), the customer will be credited those kilowatt-hours generated to be carried over for future usage on a month to month basis. Then, on an annual basis if the customer is a net generator the customer will then be compensated by the utility the average annual PJM Grid LMP price per kilowatt-hour for the over generation. Due to the aforementioned legislation, the customer is at limited risk if they generate more than they use at times throughout the year. With the inefficiency of today's energy storage systems, such as batteries, the added cost of storage systems is not warranted and was not considered in the proposed design.

CEG has reviewed financing options for the owner. Two options were studied and they are as follows: Self-financed and direct purchase without finance. Self-finance was calculated with 95% of the total project cost financed at a 7% interest rate over 25 years. Direct purchase involves the local government paying for 100% of the total project cost upfront via one of the methods noted in the Installation Funding Options section below. Both of these calculations include a utility inflation rate as well as the degradation of the solar panels over time. Based on our calculations the following are the payback periods for the respective method of payment:

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM			
PAYMENT TYPE	**SIMPLE PAYBACK**	**SIMPLE ROI**	**INTERNAL RATE OF RETURN**
Self-Finance	13.8 Years	-37.4%	4.6%
Direct Purchase	13.8 Years	-37.4%	5.9%

*The solar energy measure is shown for reference in the executive summary REM table

The resultant Internal Rate of Return indicates that if the Owner was able to "Direct Purchase" the solar project, the project would be slightly more beneficial to the Owner.

In addition to the Solar Analysis, CEG also conducted a review of the applicability of wind energy for the facility. Wind energy production is another option available through the Renewable Energy Incentive Program. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. Based on CEG's review of the applicability of wind energy for the facility, it was determined that the average wind speed is not adequate for purchase of a commercial wind turbine. Therefore, wind energy is not a viable option to implement.

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

Load Profile analysis was performed to determine the seasonal energy usage of the facility. Irregularities in the load profile will indicate potential problems within the facility. Consequently based on the profile a recommendation will be made to remedy the irregularity in energy usage. For this report, the facility's energy consumption data was gathered in table format and plotted in graph form to create the load profile. Refer to the Electric and Natural Gas Usage Profiles included within this report to reference the respective electricity and natural gas usage load profiles.

Electricity:

The Electric Usage Profile demonstrates a very flat load profile throughout the year. A load profile of this consistency is not standard when compared to school profiles. In this case there is a steady electric consumption throughout the year, which represents elevated activity in this facility especially in the summer. This active facility has the following types of rooms: restrooms, classrooms, offices, library, gymnasium, multi-purpose room, art room and boiler room. The steady summer load profile is supported by steady cooling (air-conditioning) load. Cooling in this facility is provided by (11) eleven split system air conditioning systems and (18) eighteen window units and (3) three rooftop units. The capacity of the split system units ranges from 1.5 – 4 tons. The three packaged air conditioning units range in capacity from 2.5 – 40 ton of capacity.

In addition, domestic hot water is supplied by a Rheem Fury electric hot water heater that provides hot water for the 2006 addition. There is a Paterson-Kelley steam to hot water generator present. An Armstrong circulating pump is used.

Currently this facility's electric supply is provided by JCP&L (Jersey Central Power and Light). CEG will provide options for this under the Recommendations section. A flatter load profile of this type, will allow for more competitive energy prices when shopping for alternative energy suppliers.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical heating load profile. An increase in consumption is observed September through April during the standard heating season. Heating in this facility is sourced from a boiler plant. This plant consists of (5) five Fulton Pulse steam boilers. The boilers are sourced with natural gas and a portion of the steam is diverted to a heat exchanger to generate hot water. The heating hot water is pumped to unit heaters, fin tube radiation, classroom units and ventilators in the 2006 addition. There are (3) three natural gas sourced roof-top units that serve the 2006 addition. Natural gas Delivery-service is provided by Public Service Electric and Gas Company (PSE&G) on an LVG rate schedule. Commodity service is supplied by the Hess Corporation, the Third Party Supplier. This consistent load profile is beneficial when looking at supply options with a new Third Party Supplier.

Tariff:

Electricity:

This facility receives electrical service through Jersey Central Power & Light (JCP&L) on a GSS (General Service Secondary – 3 Phase) rate. Service classification GS is available for general service purposes on secondary voltages not included under Service Classifications RS, RT, RGT or GST. This facility's rate is a three phase service at secondary voltages. For electric supply (generation), the customer uses the service of a JCP&L. This facility uses the Delivery Service of the utility (JCP&L). The Delivery Service includes the following charges: Customer Charge, Supplemental Customer Charge, Distribution Charge (kW Demand), kWh Charge, Non-utility Generation Charge, TEFA, SBC, SCC, Standby Fee and RGGI. The Generation Service is provided by JCP&L under BGS (Basic Generation Service). BGS Energy and Reconciliation Charges are provided in Rider BGS-FP (fixed pricing) or BGS-CIEP (Commercial Industrial Energy Pricing). BGS also has a Transmission component to its charge.

Natural Gas:

This facility receives utility service through Public Service Electric and Gas Company (PSE&G). This facility utilizes the Delivery Service from PSE&G while receiving Commodity service from a Third Party Supplier (TPS), Hess Corporation.

LVG Rate: This utility tariff is for "firm" delivery service for general purposes. This rate schedule has a Delivery Charge, Balancing Charge, Societal Benefits Charge, Realignment Adjustment Charge, Margin Adjustment Charge, RGGI Charge and Customer Account Service Charge. The customer can elect to have the Commodity Charge serviced through the utility or by a Third Party Supplier (TPS). Note: Should the TPS not deliver, the customer may receive service from PSE&G under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service.

"Firm" delivery service defines the reliability of the transportation segment of the pricing. Much like the telecom industry, natural gas pipelines were un-bundled in the late 1990's and the space was divided up and marketed into reliability of service. Firm Service is said to be the most reliable and last in the pecking order for interruption. This service should not be interrupted.

Commodity Charges: Customer may choose to receive gas supply from either: A TPS or PSE&G through its Basic Gas Supply Service default service. PSE&G may also supply Emergency Sales Service in certain instances. This is at a much higher than normal rate. It should be perceived as a penalty.

This facility utilizes the services of a Third Party Supplier, The Hess Corporation. The contract is administered by The Alliance for Competitive Service (ACES). ACES is the energy aggregation program of the New Jersey School Boards Association of School Administrator's. The process was reviewed and approved by the New Jersey Department of Community Affairs.
Please see CEG recommendations below.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities. Good potential savings can be seen equally in the electric costs and the natural gas costs. The average price per kWh (kilowatt hour) for the High School based on a historical 1-year weighted average fixed price from the utility JCP&L is $.1415 / kWh (this is the fixed "price to compare" when shopping for energy procurement alternatives). The fixed weighted average price per decatherm for natural gas service in the High School, provided by the Hess Corporation (TPS) is $ 12.08 / dth (dth, is the common unit of measure). The natural gas prices are also the "prices to compare".

The "price to compare" is the netted cost of the energy (including other costs), that the customer will use to compare to Third Party Supply sources when shopping for alternative suppliers. For electricity this cost would not include the utility transmission and distribution chargers. For natural gas the cost would not include the utility distribution charges and is said to be delivered to the utilities city-gate.

Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. Chatham School District could see improvement in its energy costs if it were to take advantage of these current market prices quickly, before energy prices increase. Based on electric supply from JCP&L and utilizing the historical consumption data provided (August 2008 through July 2009) and current electric rates, the school(s) could see an improvement in its electric costs of up to 25 % annually. (Note: Savings were calculated using Average Annual Consumption and a variance to a Fixed Average One-Year commodity contract). CEG recommends aggregating the entire electric load to gain the most optimal energy costs. CEG recommends advisement for alternative sourcing and supply of energy on a "managed approach".
CEG's second recommendation coincides with the natural gas costs. Based on the current alternative market pricing supplied by the Hess Corporation (ACES Agreement), CEG feels that School District could see an improvement of up to 33 % in its natural gas costs. CEG has experience with the mechanism for schools to buy energy in New Jersey. It is through the ACES Agreement (The Alliance for Competitive Energy Services) which is an energy aggregation program. From our experience, the basis price is the reason that the overall average price per dekatherm is ($12.08/dth). Therefore the average pricing formula supplied by Hess is 25 % above today's competitive market pricing. CEG recommends the school receive further advisement on these prices through an energy advisor. They should also consider procuring energy (natural gas) through an alternative supply source.

CEG also recommends scheduling a meeting with the current utility providers to review their utility charges and current tariff structures for electricity and natural gas. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), the municipality can learn more about the competitive supply process. The county can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu. They should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the information for ongoing demand-side management projects. Furthermore, special attention should be given to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with the utility representative. The School District should ask the utility representative about alternative billing options, such as consolidated billing when utilizing the service of a Third Party Supplier. Finally, if the supplier for energy (natural gas) is changed, closely monitor balancing, particularly when the contract is close to termination. This could be performed with the aid of an "energy advisor".

X. INSTALLATION FUNDING OPTIONS

CEG has reviewed various funding options for the Owner to utilize in subsidizing the costs for installing the energy conservation measures noted within this report. Below are a few alternative funding methods:

i. *Energy Savings Improvement Program (ESIP)* – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and par for the costs using the value of energy savings that result from the improvements. The "Energy Savings Improvement Program (ESIP)" law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources.

ii. *Municipal Bonds* – Municipal bonds are a bond issued by a city or other local government, or their agencies. Potential issuers of municipal bonds include cities, counties, redevelopment agencies, school districts, publicly owned airports and seaports, and any other governmental entity (or group of governments) below the state level. Municipal bonds may be general obligations of the issuer or secured by specified revenues. Interest income received by holders of municipal bonds is often exempt from the federal income tax and from the income tax of the state in which they are issued, although municipal bonds issued for certain purposes may not be tax exempt.

iii. *Power Purchase Agreement* – Public Law 2008, Chapter 3 authorizes contractor of up to fifteen (15) years for contracts commonly known as "power purchase agreements." These are programs where the contracting unit (Owner) procures a contract for, in most cases, a third party to install, maintain, and own a renewable energy system. These renewable energy systems are typically solar panels, windmills or other systems that create renewable energy. In exchange for the third party's work of installing, maintaining and owning the renewable energy system, the contracting unit (Owner) agrees to purchase the power generated by the renewable energy system from the third party at agreed upon energy rates.

iv. *Pay For Performance* – The New Jersey Smart Start Pay for Performance program includes incentives based on savings resulted from implemented ECMs. The program is available for all buildings with average demand loads above 200 KW. The facility's participation in the program is assisted by an approved program partner. An "Energy Reduction Plan" is created with the facility and approved partner to shown at least 15% reduction in the building's current energy use. Multiple energy conservation measures implemented together are applicable toward the total savings of at least 15%. No more than 50% of the total energy savings can result from lighting upgrades / changes.

   Total incentive is capped at 50% of the project cost. The program savings is broken down into three benchmarks; Energy Reduction Plan, Project Implementation, and Measurement and Verification. Each step provides additional incentives as the energy reduction project continues. The benchmark incentives are as follows:

1. Energy Reduction Plan – Upon completion of an energy reduction plan by an approved program partner, the incentive will grant $0.10 per square foot between $5,000 and $50,000, and not to exceed 50% of the facility's annual energy expense. (Benchmark #1 is not provided in addition to the local government energy audit program incentive.)

2. Project Implementation – Upon installation of the recommended measures along with the "Substantial Completion Construction Report," the incentive will grant savings per KWH or Therm based on the program's rates. Minimum saving must be 15%. (Example $0.11 / kWh for 15% savings, $0.12/ kWh for 17% savings, … and $1.10 / Therm for 15% savings, $1.20 / Therm for 17% saving, …) Increased incentives result from projected savings above 15%.

3. Measurement and Verification – Upon verification 12 months after implementation of all recommended measures, that actual savings have been achieved, based on a completed verification report, the incentive will grant additional savings per kWh or Therm based on the program's rates. Minimum savings must be 15%. (Example $0.07 / kWh for 15% savings, $0.08/ kWh for 17% savings, … and $0.70 / Therm for 15% savings, $0.80 / Therm for 17% saving, …) Increased incentives result from verified savings above 15%.

CEG recommends the Owner review the use of the above-listed funding options in addition to utilizing their standard method of financing for facilities upgrades in order to fund the proposed energy conservation measures.

XI. ADDITIONAL RECOMMENDATIONS

The following recommendations include no cost/low cost measures, Operation & Maintenance (O&M) items, and water conservation measures with attractive paybacks. These measures are not eligible for the Smart Start Buildings incentives from the office of Clean Energy but save energy none the less.

A. Chemically clean the condenser and evaporator coils in the window AC units periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%. The 3-step process includes cleaning of the coils, rinsing and a micro biocide treatment. Thoroughly cleaned coils are not as susceptible to re-fouling so they stay clean longer, reducing the cleaning cycle frequency

B. Maintain all weather stripping on windows and doors.

C. Repair/replace damaged or missing ductwork insulation in the ceiling spaces.

D. Provide more frequent air filter changes to decrease overall fan horsepower requirements and maintain better IAQ.

E. Recalibrate existing zone thermostats.

F. Clean all fixtures to maximize light output.

G. Feel for air drafts around electrical outlets. Inexpensive pads are available, as are plugs for unused sockets.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Washington Avenue School

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT.	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	Lighting Upgrade - General	$49	$0	$0	$49	$158	$0	$158	15	$2,369	$0	4735.2%	0.3	322.35%	$1,836.60
ECM #2	Lighting Controls	$6,720	$0	$840	$5,880	$1,567	$0	$1,567	15	$23,499	$0	299.6%	3.8	25.79%	$12,821.97
ECM #3	Install NEMA Premium Efficient Pump Motor	$5,232	$0	$220	$5,012	$214	$0	$214	10	$2,140	$0	-57.3%	23.4	-13.08%	($3,186.54)
ECM #4	DDC System	$131,514	$0	$0	$131,514	$4,556	$2,600	$7,156	15	$107,340	$39,000	-18.4%	18.4	-2.44%	($46,086.14)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	Solar PV Project	$1,092,960	$0	$52,988	$1,039,972	$26,040	$0	$26,040	25	$651,000	$0	-37.4%	39.9	-3.32%	($586,533.63)

Notes: 1) The variable Cn in the formulas for Internal Rate of Return and Net Present Value stands for the cash flow during each period.
2) The variable DR in the NPV equation stands for Discount Rate
3) For NPV and IRR calculations: From n=0 to N periods where N is the *lifetime of ECM* and Cn is the *cash flow during each period*.

Concord Engineering Group, Inc.

520 BURNT MILL ROAD
VOORHEES, NEW JERSEY 08043
PHONE: (856) 427-0200
FAX: (856) 427-6508

SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of January, 2009:

Electric Chillers

Water-Cooled Chillers	$12 - $170 per ton
Air-Cooled Chillers	$8 - $52 per ton

Gas Cooling

Gas Absorption Chillers	$185 - $400 per ton
Gas Engine-Driven Chillers	Calculated through custom measure path)

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	$73 - $93 per ton
Air-to-Air Heat Pumps	$73 - $92 per ton
Water-Source Heat Pumps	$81 per ton
Packaged Terminal AC & HP	$65 per ton
Central DX AC Systems	$40- $72 per ton
Dual Enthalpy Economizer Controls	$250

Ground Source Heat Pumps

Closed Loop & Open Loop	$370 per ton

Gas Heating

Gas Fired Boilers < 300 MBH	$300 per unit
Gas Fired Boilers ≥ 300 - 1500 MBH	$1.75 per MBH
Gas Fired Boilers ≥1500 - ≤ 4000 MBH	$1.00 per MBH
Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	$300 - $400 per unit

Variable Frequency Drives

Variable Air Volume	$65 - $155 per hp
Chilled-Water Pumps	$60 per hp
Compressors	$5,250 to $12,500 per drive

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons	$50 per unit
Gas-Fired Water Heaters >50 gallons	$1.00 - $2.00 per MBH
Gas-Fired Booster Water Heaters	$17 - $35 per MBH

Premium Motors

Three-Phase Motors	$45 - $700 per motor

Prescriptive Lighting

T-5 and T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 - $30 per fixture, (depending on quantity)
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start	$25 per fixture
LED Exit Signs	$10 - $20 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $284 per fixture

Lighting Controls – Occupancy Sensors

Wall Mounted	$20 per control
Remote Mounted	$35 per control
Daylight Dimmers	$25 per fixture
Occupancy Controlled hi-low Fluorescent Controls	$25 per fixture controlled

Lighting Controls – HID or Fluorescent Hi-Bay Controls

Occupancy hi-low	$75 per fixture controlled
Daylight Dimming	$75 per fixture controlled

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2004 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive

MAJOR EQUIPMENT LIST

Concord Engineering Group

Washington Avenue School

Boiler

Location	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Rm	Fulton	1	PVLP 1150	103768	575-1150	489-978	84.4	NG	2	30	28	
Boiler Rm	Fulton	1	PVLP 1150	103766	575-1150	489-978	84.4	NG	2	30	28	
Boiler Rm	Fulton	1	PVLP 1150	103788	575-1150	489-978	84.4	NG	2	30	28	
Boiler Rm	Fulton	1	PVLP 1150	103785	575-1150	489-978	84.4	NG	2	30	28	
Boiler Rm	Fulton	1	PVLP 1150	103767	575-1150	489-978	84.4	NG	2	30	28	

Boiler - Pumps

Location	Manufacturer	Qty.	Model #	Serial #	HP	RPM	GPM	Ft. Hd	Frame Size	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	
Boiler Room	Baldor	2	EJMM3218T	36G687T832	5	1750				230/460	3	22	10	(-12)	
Boiler Room	Emerson	2	P55BLZ-696	132-066	0.5	1725				200	3	13	10	(-3)	
	Bell & Gosset	2	Series 90 1-1/2A 5.625	1634799 B29	1.5	1800	20	30				17	10	(-7)	

Domestic Hot Water Heater

Location	Manufacturer	Qty	Model #	Serial #	Input (MBh)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room	Rheem	1	82V52-2	RH0707245625	4500 W	67	50	.91 Energy Factor	Electric	2	12	10	

DHW - Pumps

Location	Manufacturer	Qty.	Model #	Serial #	HP	Volts	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
	Armstrong	1	S-25	AB/B-1				2007	10	8	
	Taco	1	AC25F	1615B3E2	5			2007	10	8	

Air Handling Units

Location	Manufacturer	Qty	Model #	Serial #	Cooling Coil	Cooling Eff. (EER)	Cooling Capacity (Tons)	Heating Type	Input (MBh)	Output (MBh)	Heating Eff. (%)	Fuel	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Rooftop	Aaon	1	RM-A01-9-0-BA01-319	200612-AMGA29800	R-410A		1		69	56	81%	NG	208	1		3	15	12	
Rooftop	Aaon	1	RN-040-8-0-BB04-3B9	200612-BNGV02423	R-410A				780	632	81%	NG	208	3		3	15	12	
Rooftop	Aaon	1	RM-A02-9-0BA01-319	200612-AMGB29801	R-410A		2		69	56	81%	NG	208	1		3	15	12	

Split Systems and AC Condensers

Location	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity (Btu/h)	Eff.	Refrigerant	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Rooftop	Lennox	2	HS29-048-94	5801A 50930	48000		R-22	208/230	3		8	15	7	
Rooftop	Lennox	1	AC13-030-230-02	5806H65900	30000		R-22	208/230	1		3	15	12	
Rooftop	Lennox	1	HS20-036-134	5807B56170	36000		R-22	208/230	3		2	15	13	
Rooftop	Trane XE1200	1	TTP024C100AZ	L015KB9FF	24000	12 Seer	R-22	200/230	1		Jan-96	15	2	
Rooftop	Trane	1	TTA042D300B0	Z09445W3F	42000		R-22	200/230	3		Mar-01	15	7	
Rooftop	Trane XE1200	1	TTP018C100AZ	K304RXCFF	18000	12 Seer	R-22	200/230	1		Jul-95	15	1	
Rooftop	Fedders	1	C1048BBD3V	HS354553 224X	48000	10 SEER	R-22	208/230	1		2004	15	10	
Rooftop	EMI	1	No Info								5	15	10	
Rooftop	York	2	H2RD024S06B	W0N6295122	24000		R-22	208	1					

Window AC Units

Location	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity (Btu/h)	Eff.	Refrigerant	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Classrooms	Friedrich	2	KM18L30-A	LEBR01200	17800/17600	10	R-22	197	1		2005	15	11	
Classrooms	Emerson Quiet Coo	4	180044-E		18000/17500			230/208			5	15	10	
Classrooms	Friedrich	6	KM18J30C-A	LDDR03791	18000/17700		R-22	230/208	1		2004	15	10	
Classrooms	Frididaire	1	FAS185J2A1				R-22	230/208	1		Jun-00	15	6	
Classrooms	Westinghouse	1	WAS18JH2A1				R-22	230/208	1		5	15	10	
Classrooms	Airedale	4	CMX4-208	S321500303155006-1471			R-22	208/230	3		5	15	10	
Classrooms	Friedrich	3	KS15J10-A	LCAR06056	14500	10.9	R-22	115	1		2003	15	9	

Heating and Ventilation Units

Location	Manufacturer	Qty.	Model #	Serial #	Heating Coil	Capacity (Btu/h)	Fan HP	Fan RPM	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
	Herman Nelson	12										2			

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Washington Avenue School

Building ID: 1830654
For 12-month Period Ending: July 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: October 15, 2009

Facility
Washington Avenue School
102 Washington Ave
Chatham, NJ 07928

Facility Owner
School District of the Chathams
58 Meyersville Road
Chatham, NJ 07928

Primary Contact for this Facility
Ralph Goodwin
58 Meyersville Road
Chatham, NJ 07928

Year Built: 1952
Gross Floor Area (ft²): 43,838

Energy Performance Rating[2] (1-100) 11

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	1,103,441
Natural Gas (kBtu)[4]	3,391,281
Total Energy (kBtu)	4,494,722
Energy Intensity[5]	
Site (kBtu/ft²/yr)	103
Source (kBtu/ft²/yr)	165
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	348
Electric Distribution Utility	
Jersey Central Power & Lt Co	
National Average Comparison	
National Average Site EUI	68
National Average Source EUI	110
% Difference from National Average Source EUI	50%
Building Type	K-12 School

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Meets Industry Standards[6] for Indoor Environmental Conditions:

Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Certifying Professional
Raymond Johnson
520 South Burnt Mill Road
Voorhees, NJ 08043

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.
NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Washington Avenue School	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	K-12 School	Is this an accurate description of the space in question?		☐
Location	102 Washington Ave, Chatham, NJ 07928	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐

Washington Ave School (K-12 School)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	43,838 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Open Weekends?	No	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	73	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	0	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	No	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	70 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	90 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	10 (Optional)	Is this school in operation for at least 8 months of the year?		☐

High School?	No	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Jersey Central Power & Lt Co

Fuel Type: Electricity

Meter: G28890566 JCP&L (kWh (thousand Watt-hours))
Space(s): Entire Facility
Generation Method: Grid Purchase

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
07/01/2009	07/31/2009	24,360.00
06/01/2009	06/30/2009	23,600.00
05/01/2009	05/31/2009	26,160.00
04/01/2009	04/30/2009	28,720.00
03/01/2009	03/31/2009	27,200.00
02/01/2009	02/28/2009	26,720.00
01/01/2009	01/31/2009	28,320.00
12/01/2008	12/31/2008	26,720.00
11/01/2008	11/30/2008	29,600.00
10/01/2008	10/31/2008	29,120.00
09/01/2008	09/30/2008	27,760.00
08/01/2008	08/31/2008	25,120.00
G28890566 JCP&L Consumption (kWh (thousand Watt-hours))		**323,400.00**
G28890566 JCP&L Consumption (kBtu (thousand Btu))		**1,103,440.80**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**1,103,440.80**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

Meter: 3274106 PSE&G (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
07/01/2009	07/31/2009	0.00
06/01/2009	06/30/2009	0.00
05/01/2009	05/31/2009	0.00
04/01/2009	04/30/2009	0.00
03/01/2009	03/31/2009	0.00
02/01/2009	02/28/2009	5,791.06
01/01/2009	01/31/2009	7,078.64
12/01/2008	12/31/2008	5,546.09
11/01/2008	11/30/2008	6,130.77
10/01/2008	10/31/2008	2,589.80

09/01/2008	09/30/2008	56.33
08/01/2008	08/31/2008	2.21
3274106 PSE&G Consumption (therms)		**27,194.90**
3274106 PSE&G Consumption (kBtu (thousand Btu))		**2,719,490.00**
Meter: 2808799 PSE&G (therms) **Space(s):** Entire Facility		
Start Date	**End Date**	**Energy Use (therms)**
07/01/2009	07/31/2009	0.00
06/01/2009	06/30/2009	1.10
05/01/2009	05/31/2009	28.58
04/01/2009	04/30/2009	1,888.02
03/01/2009	03/31/2009	4,800.21
02/01/2009	02/28/2009	0.00
01/01/2009	01/31/2009	0.00
12/01/2008	12/31/2008	0.00
11/01/2008	11/30/2008	0.00
10/01/2008	10/31/2008	0.00
09/01/2008	09/30/2008	0.00
08/01/2008	08/31/2008	0.00
2808799 PSE&G Consumption (therms)		**6,717.91**
2808799 PSE&G Consumption (kBtu (thousand Btu))		**671,791.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**3,391,281.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

Additional Fuels	
Do the fuel consumption totals shown above represent the total energy use of this building? Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.	☐

On-Site Solar and Wind Energy	
Do the fuel consumption totals shown above include all on-site solar and/or wind power located at your facility? Please confirm that no on-site solar or wind installations have been omitted from this list. All on-site systems must be reported.	☐

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same as the PE that signed and stamped the SEP.)

Name: ____ Date: _____________

Signature: ______________________________________

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
Washington Avenue School
102 Washington Ave
Chatham, NJ 07928

Facility Owner
School District of the Chathams
58 Meyersville Road
Chatham, NJ 07928

Primary Contact for this Facility
Ralph Goodwin
58 Meyersville Road
Chatham, NJ 07928

General Information

Washington Avenue School	
Gross Floor Area Excluding Parking: (ft^2)	43,838
Year Built	1952
For 12-month Evaluation Period Ending Date:	July 31, 2009

Facility Space Use Summary

Washington Ave School	
Space Type	K-12 School
Gross Floor Area(ft^2)	43,838
Open Weekends?	No
Number of PCs	73
Number of walk-in refrigeration/freezer units	0
Presence of cooking facilities	No
Percent Cooled	70
Percent Heated	90
Months[o]	10
High School?	No
School District[o]	Rutherford

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 07/31/2009)	**Baseline** (Ending Date 07/31/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	11	11	75	N/A	50
Energy Intensity					
Site (kBtu/ft2)	103	103	53	N/A	68
Source (kBtu/ft2)	165	165	86	N/A	110
Energy Cost					
$/year	$ 62,401.40	$ 62,401.40	$ 32,524.44	N/A	$ 41,592.82
$/ft2/year	$ 1.42	$ 1.42	$ 0.74	N/A	$ 0.95
Greenhouse Gas Emissions					
$MtCO_2e$/year	348	348	181	N/A	232
$kgCO_2e/ft^2$/year	8	8	4	N/A	5

More than 50% of your building is defined as K-12 School. Please note that your rating accounts for all of the spaces listed. The National Average column presents energy performance data your building would have if your building had an average rating of 50.

Notes:
o - This attribute is optional.
d - A default value has been supplied by Portfolio Manager.

Statement of Energy Performance

2009

Washington Avenue School
102 Washington Ave
Chatham, NJ 07928

Portfolio Manager Building ID: 1830654

The energy use of this building has been measured and compared to other similar buildings using the Environmental Protection Agency's (EPA's) Energy Performance Scale of 1–100, with 1 being the least energy efficient and 100 the most energy efficient. For more information, visit energystar.gov/benchmark.

This building's score

11

1	50	100
Least Efficient	Average	Most Efficient

This building uses 165 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending July 2009

Buildings with a score of 75 or higher may qualify for EPA's ENERGY STAR.

I certify that the information contained within this statement is accurate and in accordance with U.S. Environmental Protection Agency's measurement standards, found at energystar.gov

Date of certification

EPA United States Environmental Protection Agency

Date Generated: 10/15/2009

CEG Job #: 9C09078
Project: School District of the Chathams
Address: 102 Washington Ave
Chatham, NJ
Building SF: 43,838

Washington Avenue School

KWH COST: **$0.172**

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
18	3	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$352.04	12	3	No Change	82	0.98	2046.72	$352.04	$0.00	$0.00	0.00	0	$0.00	0.00
14	Closet	520	1	1	Incadescent 100 Watt	100	0.10	52.0	$8.94	1	1	26 W CFL Lamp	26	0.03	13.52	$2.33	$5.75	$5.75	0.07	38.48	$6.62	0.87
18	2	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$352.04	12	8	No Change	82	0.98	2046.72	$352.04	$0.00	$0.00	0.00	0	$0.00	0.00
3	Restrooms	2080	4	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.23	482.6	$83.00	4	3	No Change	58	0.23	482.56	$83.00	$0.00	$0.00	0.00	0	$0.00	0.00
18	1	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$352.04	12	3	No Change	82	0.98	2046.72	$352.04	$0.00	$0.00	0.00	0	$0.00	0.00
18	6	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$352.04	12	0	No Change	82	0.98	2046.72	$352.04	$0.00	$0.00	0.00	0	$0.00	0.00
10	5	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$249.00	12	2	No Change	58	0.70	1447.68	$249.00	$0.00	$0.00	0.00	0	$0.00	0.00
11	SG1	2080	9	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.74	1,535.0	$264.03	9	3	No Change	82	0.74	1535.04	$264.03	$0.00	$0.00	0.00	0	$0.00	0.00
10	4	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$249.00	12	3	No Change	58	0.70	1447.68	$249.00	$0.00	$0.00	0.00	0	$0.00	0.00
12		2080	1	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.11	226.7	$39.00	1	2	No Change	109	0.11	226.72	$39.00	$0.00	$0.00	0.00	0	$0.00	0.00
11	Faculty Rm	2080	4	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting	82	0.33	682.2	$117.35	4	2	No Change	82	0.33	682.24	$117.35	$0.00	$0.00	0.00	0	$0.00	0.00
16		2080	2	2	CFL 2 High Hat Lamps Electronic Ballast Recessed Mounting No Cover	28	0.06	116.5	$20.03	2	0	No Change	28	0.06	116.48	$20.03	$0.00	$0.00	0.00	0	$0.00	0.00
11	24	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.98	2,046.7	$352.04	12	0	No Change	82	0.98	2046.72	$352.04	$0.00	$0.00	0.00	0	$0.00	0.00
11	22	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.98	2,046.7	$352.04	12	0	No Change	82	0.98	2046.72	$352.04	$0.00	$0.00	0.00	0	$0.00	0.00
11	21	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.98	2,046.7	$352.04	12	0	No Change	82	0.98	2046.72	$352.04	$0.00	$0.00	0.00	0	$0.00	0.00

11	Closet	520	3	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.25	127.9	$22.00	3	0	No Change	82	0.25	127.92	$22.00	$0.00	$0.00	0.00	0	$0.00	0.00
11	20	2080	14	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.15	2,387.8	$410.71	14	0	No Change	82	1.15	2387.84	$410.71	$0.00	$0.00	0.00	0	$0.00	0.00
7		2080	1	3	T8 2x2 3 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	108	0.11	224.6	$38.64	1	0	No Change	108	0.11	224.64	$38.64	$0.00	$0.00	0.00	0	$0.00	0.00
18	17	2080	19	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	1.56	3,240.6	$557.39	19	0	No Change	82	1.56	3240.64	$557.39	$0.00	$0.00	0.00	0	$0.00	0.00
5		2080	1	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	73	0.07	151.8	$26.12	1	0	No Change	73	0.07	151.84	$26.12	$0.00	$0.00	0.00	0	$0.00	0.00
18	18	2080	15	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	1.23	2,558.4	$440.04	15	0	No Change	82	1.23	2558.4	$440.04	$0.00	$0.00	0.00	0	$0.00	0.00
5		2080	1	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	73	0.07	151.8	$26.12	1	0	No Change	73	0.07	151.84	$26.12	$0.00	$0.00	0.00	0	$0.00	0.00
5	Bathrooms	2080	2	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	73	0.15	303.7	$52.23	2	0	No Change	73	0.15	303.68	$52.23	$0.00	$0.00	0.00	0	$0.00	0.00
10	Faculty Rm	2080	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.17	361.9	$62.25	3	0	No Change	58	0.17	361.92	$62.25	$0.00	$0.00	0.00	0	$0.00	0.00
18	Special Services	2080	3	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.25	511.7	$88.01	3	0	No Change	82	0.25	511.68	$88.01	$0.00	$0.00	0.00	0	$0.00	0.00

10	14	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$249.00	12	0	No Change	58	0.70	1447.68	$249.00	$0.00	$0.00	0.00	0	$0.00	0.00
15		2080	1	1	Incadescent 200 Watt	200	0.20	416.0	$71.55	1	0	65 W CFL Lamp	65	0.07	135.2	$23.25	$20.25	$20.25	0.14	280.8	$48.30	0.42
10	Library	2080	31	2	T8 2x4 2 Lamps Electronic Ballast	58	1.80	3,739.8	$643.25	31	0	No Change	58	1.80	3739.84	$643.25	$0.00	$0.00	0.00	0	$0.00	0.00
9		2080	10	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	58	0.58	1,206.4	$207.50	10	0	No Change	58	0.58	1206.4	$207.50	$0.00	$0.00	0.00	0	$0.00	0.00
1		2080	23	1	T8 1x4 1 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	28	0.64	1,339.5	$230.40	23	0	No Change	28	0.64	1339.52	$230.40	$0.00	$0.00	0.00	0	$0.00	0.00
5		2080	6	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	73	0.44	911.0	$156.70	6	0	No Change	73	0.44	911.04	$156.70	$0.00	$0.00	0.00	0	$0.00	0.00
13		2080	4	1	Incadescent 90 Watt	90	0.36	748.8	$128.79	4	0	18 W CFL Lamp	18	0.07	149.76	$25.76	$5.75	$23.00	0.29	599.04	$103.03	0.22
11	19	2080	15	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.23	2,558.4	$440.04	15	0	No Change	82	1.23	2558.4	$440.04	$0.00	$0.00	0.00	0	$0.00	0.00
5		2080	1	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	73	0.07	151.8	$26.12	1	0	No Change	73	0.07	151.84	$26.12	$0.00	$0.00	0.00	0	$0.00	0.00
10	13	2080	7	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.41	844.5	$145.25	7	0	No Change	58	0.41	844.48	$145.25	$0.00	$0.00	0.00	0	$0.00	0.00
10	Restroom	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting	58	0.06	120.6	$20.75	1	0	No Change	58	0.06	120.64	$20.75	$0.00	$0.00	0.00	0	$0.00	0.00
18	7	2080	12	3	T8 2x4 3 Lamps Electronic Ballast	82	0.98	2,046.7	$352.04	12	0	No Change	82	0.98	2046.72	$352.04	$0.00	$0.00	0.00	0	$0.00	0.00
18	8	2080	12	3	T8 2x4 3 Lamps Electronic Ballast	82	0.98	2,046.7	$352.04	12	0	No Change	82	0.98	2046.72	$352.04	$0.00	$0.00	0.00	0	$0.00	0.00
10	Storage	2080	3	2	T8 2x4 2 Lamps Electronic Ballast	58	0.17	361.9	$62.25	3	0	No Change	58	0.17	361.92	$62.25	$0.00	$0.00	0.00	0	$0.00	0.00
10	Hallway	8760	34	2	T8 2x4 2 Lamps Electronic Ballast	58	1.97	17,274.7	$2,971.25	34	0	No Change	58	1.97	17274.72	$2,971.25	$0.00	$0.00	0.00	0	$0.00	0.00
5		8760	4	2	T8 2x2 2 U-Tube Lamps Electronic Ballast	73	0.29	2,557.9	$439.96	4	0	No Change	73	0.29	2557.92	$439.96	$0.00	$0.00	0.00	0	$0.00	0.00
6		8760	19	3	T8 2x2 3 Twin Tube Lamps Electronic	40	0.76	6,657.6	$1,145.11	19	0	No Change	40	0.76	6657.6	$1,145.11	$0.00	$0.00	0.00	0	$0.00	0.00
16		8760	5	2	CFL 2 High Hat Lamps Electronic Ballast	28	0.14	1,226.4	$210.94	5	0	No Change	28	0.14	1226.4	$210.94	$0.00	$0.00	0.00	0	$0.00	0.00
5		8760	17	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	73	1.24	10,871.2	$1,869.84	17	0	No Change	73	1.24	10871.16	$1,869.84	$0.00	$0.00	0.00	0	$0.00	0.00
8	Boiler Room	2080	2	2	T8 2x4 2 Lamps Electronic Ballast	58	0.12	241.3	$41.50	2	0	No Change	58	0.12	241.28	$41.50	$0.00	$0.00	0.00	0	$0.00	0.00
2		2080	3	2	T8 1x4 2 Lamps Electronic Ballast	58	0.17	361.9	$62.25	3	0	No Change	58	0.17	361.92	$62.25	$0.00	$0.00	0.00	0	$0.00	0.00
10	Bathrooms	2080	1	2	T8 2x4 2 Lamps Electronic Ballast	58	0.06	120.6	$20.75	1	0	No Change	58	0.06	120.64	$20.75	$0.00	$0.00	0.00	0	$0.00	0.00
18	11	2080	12	3	T8 2x4 3 Lamps Electronic Ballast	82	0.98	2,046.7	$352.04	12	0	No Change	82	0.98	2046.72	$352.04	$0.00	$0.00	0.00	0	$0.00	0.00
18	10	2080	12	3	T8 2x4 3 Lamps Electronic Ballast	82	0.98	2,046.7	$352.04	12	0	No Change	82	0.98	2046.72	$352.04	$0.00	$0.00	0.00	0	$0.00	0.00

18	12	2080	12	3	T8 2x4 3 Lamps Electronic Ballast	82	0.98	2,046.7	$352.04	12	0	No Change	82	0.98	2046.72	$352.04	$0.00	$0.00	0.00	0	$0.00	0.00
18	9	2080	12	3	T8 2x4 3 Lamps Electronic Ballast	82	0.98	2,046.7	$352.04	12	0	No Change	82	0.98	2046.72	$352.04	$0.00	$0.00	0.00	0	$0.00	0.00
2	Storage	2080	6	2	T8 1x4 2 Lamps Electronic Ballast	58	0.35	723.8	$124.50	6	0	No Change	58	0.35	723.84	$124.50	$0.00	$0.00	0.00	0	$0.00	0.00
19	Gym	2080	18	2	T8 2x2 2 U-Tube Lamps Electronic Ballast	73	1.31	2,733.1	$470.10	18	0	No Change	73	1.31	2733.12	$470.10	$0.00	$0.00	0.00	0	$0.00	0.00
3	Office	2080	19	2	T8 1x4 2 Lamps Electronic Ballast	58	1.10	2,292.2	$394.25	19	0	No Change	58	1.10	2292.16	$394.25	$0.00	$0.00	0.00	0	$0.00	0.00
10		2080	20	2	T8 2x4 2 Lamps Electronic Ballast	58	1.16	2,412.8	$415.00	20	0	No Change	58	1.16	2412.8	$415.00	$0.00	$0.00	0.00	0	$0.00	0.00
10	Principal	2080	21	2	T8 2x4 2 Lamps Electronic Ballast	58	1.22	2,533.4	$435.75	21	0	No Change	58	1.22	2533.44	$435.75	$0.00	$0.00	0.00	0	$0.00	0.00
3		2080	22	2	T8 1x4 2 Lamps Electronic Ballast	58	1.28	2,654.1	$456.50	22	0	No Change	58	1.28	2654.08	$456.50	$0.00	$0.00	0.00	0	$0.00	0.00
5	Boys	2080	23	2	T8 2x2 2 U-Tube Lamps Electronic Ballast	73	1.68	3,492.3	$600.68	23	0	No Change	73	1.68	3492.32	$600.68	$0.00	$0.00	0.00	0	$0.00	0.00
5	Girls	2080	24	2	T8 2x2 2 U-Tube Lamps Electronic Ballast	73	1.75	3,644.2	$626.80	24	0	No Change	73	1.75	3644.16	$626.80	$0.00	$0.00	0.00	0	$0.00	0.00
20	Gym 2006 Addition	2080	25	8	8 26w CFL Lamps Electronic Ballast	208	5.20	10,816.0	$1,860.35	25	0	No Change	208	5.20	10816	$1,860.35	$0.00	$0.00	0.00	0	$0.00	0.00
7	Gym Office	2080	26	3	T8 2x2 3 U-Tube Lamps Electronic Ballast	108	2.81	5,840.6	$1,004.59	26	0	No Change	108	2.81	5840.64	$1,004.59	$0.00	$0.00	0.00	0	$0.00	0.00
22	New Hallway	2080	27	3	2'x2' 3-Lamp 40w Biax, Center Mount Split	102	2.75	5,728.3	$985.27	27	0	No Change	102	2.75	5728.32	$985.27	$0.00	$0.00	0.00	0	$0.00	0.00
10	Closet	520	28	2	T8 2x4 2 Lamps Electronic Ballast	58	1.62	844.5	$145.25	28	0	No Change	58	1.62	844.48	$145.25	$0.00	$0.00	0.00	0	$0.00	0.00
21	Closet	520	29	2	Compact Fluorescent High Hat - 2 lamp	56	1.62	844.5	$145.25	29	0	No Change	56	1.62	844.48	$145.25	$0.00	$0.00	0.00	0	$0.00	0.00
23	Throughout	8760	17	0	Exit Sign - LED	4	0.07	595.7	$102.46	17		No Change	4	0.07	595.68	$102.46	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		767	157			56.1	140,931.9	$24,240.28	767	30			55.6	140,013.6	$24,082.33		$49.00	0.5	918.3	$157.95	0.31

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

CEG Job #: 9C09078
Project: School District of the Chathams
Address: 102 Washington Ave
Chatham, NJ
Building SF: 43,838

Washington Avenue School

KWH COST: **$0.172**

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
18	3	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$352.04	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$316.83	$160.00	$160.00	0.00	204.672	$35.20	4.54
14	Closet	520	1	1	Incadescent 100 Watt	100	0.10	52.0	$8.94	1	1	None	100	0.10	0%	52	$8.94	$0.00	$0.00	0.00	0	$0.00	0.00
18	2	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$352.04	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$316.83	$160.00	$160.00	0.00	204.672	$35.20	4.54
3	Restrooms	2080	4	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	0.23	482.6	$83.00	4	2	Dual Technology Occupancy Sensor	58	0.23	10%	434.304	$74.70	$160.00	$160.00	0.00	48.256	$8.30	19.28
18	1	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$352.04	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$316.83	$160.00	$160.00	0.00	204.672	$35.20	4.54
18	6	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$352.04	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$316.83	$160.00	$160.00	0.00	204.672	$35.20	4.54
10	5	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$249.00	12	2	Dual Technology Occupancy Sensor	58	0.70	10%	1302.912	$224.10	$160.00	$160.00	0.00	144.768	$24.90	6.43
11	SG1	2080	9	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting	82	0.74	1,535.0	$264.03	9	3	Dual Technology Occupancy Sensor	82	0.74	10%	1381.536	$237.62	$160.00	$160.00	0.00	153.504	$26.40	6.06
10	4	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$249.00	12	2	Dual Technology Occupancy Sensor	58	0.70	10%	1302.912	$224.10	$160.00	$160.00	0.00	144.768	$24.90	6.43
12		2080	1	4	T8 2x4 4 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	109	0.11	226.7	$39.00	1	4		109	0.11	10%	204.048	$35.10	$160.00	$160.00	0.00	22.672	$3.90	
11	Faculty Rm	2080	4	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting	82	0.33	682.2	$117.35	4	3	Dual Technology Occupancy Sensor	82	0.33	10%	614.016	$105.61	$0.00	$0.00	0.00	68.224	$11.73	9.07
16		2080	2	2	CFL 2 High Hat Lamps Electronic Ballast	28	0.06	116.5	$20.03	2	2		28	0.06	10%	104.832	$18.03	$0.00	$0.00	0.00	11.648	$2.00	
11	24	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.98	2,046.7	$352.04	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$316.83	$160.00	$160.00	0.00	204.672	$35.20	4.54
11	22	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	0.98	2,046.7	$352.04	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$316.83	$160.00	$160.00	0.00	204.672	$35.20	4.54
11	21	2080	12	3	T8 2x4 3 Lamps Electronic Ballast	82	0.98	2,046.7	$352.04	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$316.83	$160.00	$160.00	0.00	204.672	$35.20	4.54
11	Closet	520	3	3	T8 2x4 3 Lamps Electronic Ballast	82	0.25	127.9	$22.00	3	3	None	82	0.25	0%	127.92	$22.00	$0.00	$0.00	0.00	0	$0.00	0.00

11	20	2080	14	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.15	2,387.8	$410.71	14	3	Dual Technology Occupancy Sensor	82	1.15	10%	2149.056	$369.64	$160.00	$160.00	0.00	238.784	$41.07	3.56
7		2080	1	3	T8 2x2 3 U-Tube Lamps Electronic Ballast	108	0.11	224.6	$38.64	1	3		108	0.11	10%	202.176	$34.77	$0.00	$0.00	0.00	22.464	$3.86	
18	17	2080	19	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	1.56	3,240.6	$557.39	19	3	Dual Technology Occupancy Sensor	82	1.56	10%	2916.576	$501.65	$160.00	$160.00	0.00	324.064	$55.74	2.74
5		2080	1	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	73	0.07	151.8	$26.12	1	2		73	0.07	10%	136.656	$23.50	$0.00	$0.00	0.00	15.184	$2.61	
18	18	2080	15	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	1.23	2,558.4	$440.04	15	3	Dual Technology Occupancy Sensor	82	1.23	10%	2302.56	$396.04	$160.00	$160.00	0.00	255.84	$44.00	3.43
5		2080	1	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	73	0.07	151.8	$26.12	1	2		73	0.07	10%	136.656	$23.50	$0.00	$0.00	0.00	15.184	$2.61	
5	Bathrooms	2080	2	2	T8 2x2 2 U-Tube Lamps Electronic Ballast	73	0.15	303.7	$52.23	2	2	Dual Technology Occupancy Sensor	73	0.15	10%	273.312	$47.01	$160.00	$160.00	0.00	30.368	$5.22	30.63
10	Faculty Rm	2080	3	2	T8 2x4 2 Lamps Electronic Ballast	58	0.17	361.9	$62.25	3	2	Dual Technology Occupancy Sensor	58	0.17	10%	325.728	$56.03	$160.00	$160.00	0.00	36.192	$6.23	25.70
18	Special Services	2080	3	3	T8 2x4 3 Lamps Electronic Ballast	82	0.25	511.7	$88.01	3	3	Dual Technology Occupancy Sensor	82	0.25	10%	460.512	$79.21	$160.00	$160.00	0.00	51.168	$8.80	18.18
10	14	2080	12	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.70	1,447.7	$249.00	12	2	Dual Technology Occupancy Sensor	58	0.70	10%	1302.912	$224.10	$160.00	$160.00	0.00	144.768	$24.90	4.99
15		2080	1	1	Incadescent 200 Watt	200	0.20	416.0	$71.55	1	1		200	0.20	10%	374.4	$64.40	$0.00	$0.00	0.00	41.6	$7.16	
10	Library	2080	31	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.80	3,739.8	$643.25	31	2	Dual Technology Occupancy Sensor	58	1.80	10%	3365.856	$578.93	$160.00	$160.00	0.00	373.984	$64.33	1.17
9		2080	10	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	58	0.58	1,206.4	$207.50	10	2		58	0.58	10%	1085.76	$186.75	$0.00	$0.00	0.00	120.64	$20.75	
1		2080	23	1	T8 1x4 1 Lamps Electronic Ballast Pendant Mounting Parabolic Lens	28	0.64	1,339.5	$230.40	23	1		28	0.64	10%	1205.568	$207.36	$0.00	$0.00	0.00	133.952	$23.04	
5		2080	6	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	73	0.44	911.0	$156.70	6	2		73	0.44	10%	819.936	$141.03	$0.00	$0.00	0.00	91.104	$15.67	
13		2080	4	1	Incadescent 90 Watt	90	0.36	748.8	$128.79	4	1		90	0.36	10%	673.92	$115.91	$0.00	$0.00	0.00	74.88	$12.88	
11	19	2080	15	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Parabolic Lens	82	1.23	2,558.4	$440.04	15	3	Dual Technology Occupancy Sensor	82	1.23	10%	2302.56	$396.04	$160.00	$160.00	0.00	255.84	$44.00	3.43
5		2080	1	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	73	0.07	151.8	$26.12	1	2		73	0.07	10%	136.656	$23.50	$0.00	$0.00	0.00	15.184	$2.61	
10	13	2080	7	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.41	844.5	$145.25	7	2	Dual Technology Occupancy Sensor	58	0.41	10%	760.032	$130.73	$160.00	$160.00	0.00	84.448	$14.53	11.02

10	Restroom	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting	58	0.06	120.6	$20.75	1	2	Dual Technology Occupancy Sensor	58	0.06	10%	108.576	$18.68	$160.00	$160.00	0.00	12.064	$2.08	77.11
18	7	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$352.04	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$316.83	$160.00	$160.00	0.00	204.672	$35.20	4.54
18	8	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$352.04	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$316.83	$160.00	$160.00	0.00	204.672	$35.20	4.54
10	Storage	2080	3	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.17	361.9	$62.25	3	2	Dual Technology Occupancy Sensor	58	0.17	10%	325.728	$56.03	$160.00	$160.00	0.00	36.192	$6.23	25.70
10	Hallway	8760	34	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.97	17,274.7	$2,971.25	34	2	None	58	1.97	0%	17274.72	$2,971.25	$0.00	$0.00	0.00	0	$0.00	0.00
5		8760	4	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	73	0.29	2,557.9	$439.96	4	2		73	0.29	0%	2557.92	$439.96	$0.00	$0.00	0.00	0	$0.00	
6		8760	19	3	T8 2x2 3 Twin Tube Lamps Electronic Ballast Recessed Mounting Direct/Indirect Lens	40	0.76	6,657.6	$1,145.11	19	3		40	0.76	0%	6657.6	$1,145.11	$0.00	$0.00	0.00	0	$0.00	
16		8760	5	2	CFL 2 High Hat Lamps Electronic Ballast Recessed Mounting No Cover	28	0.14	1,226.4	$210.94	5	2		28	0.14	0%	1226.4	$210.94	$0.00	$0.00	0.00	0	$0.00	
5		8760	17	2	T8 2x2 2 U-Tube Lamps Electronic Ballast	73	1.24	10,871.2	$1,869.84	17	2		73	1.24	0%	10871.16	$1,869.84	$0.00	$0.00	0.00	0	$0.00	
8	Boiler Room	2080	2	2	T8 2x4 2 Lamps Electronic Ballast Pendant Mounting Prismatic Lens	58	0.12	241.3	$41.50	2	2	Dual Technology Occupancy Sensor	58	0.12	10%	217.152	$37.35	$160.00	$160.00	0.00	24.128	$4.15	15.42
2		2080	3	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Prismatic Lens	58	0.17	361.9	$62.25	3	2		58	0.17	10%	325.728	$56.03	$0.00	$0.00	0.00	36.192	$6.23	
10	Bathrooms	2080	1	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	0.06	120.6	$20.75	1	2	Dual Technology Occupancy Sensor	58	0.06	10%	108.576	$18.68	$160.00	$160.00	0.00	12.064	$2.08	77.11
18	11	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$352.04	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$316.83	$160.00	$160.00	0.00	204.672	$35.20	4.54
18	10	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$352.04	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$316.83	$160.00	$160.00	0.00	204.672	$35.20	4.54
18	12	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$352.04	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$316.83	$160.00	$160.00	0.00	204.672	$35.20	4.54
18	9	2080	12	3	T8 2x4 3 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	82	0.98	2,046.7	$352.04	12	3	Dual Technology Occupancy Sensor	82	0.98	10%	1842.048	$316.83	$160.00	$160.00	0.00	204.672	$35.20	4.54
2	Storage	2080	6	2	T8 1x4 2 Lamps Electronic Ballast Pendant Mounting Prismatic Lens	58	0.35	723.8	$124.50	6	2	Dual Technology Occupancy Sensor	58	0.35	10%	651.456	$112.05	$160.00	$160.00	0.00	72.384	$12.45	12.85
19	Gym	2080	18	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mounting Prismatic Lens	73	1.31	2,733.1	$470.10	18	2	Dual Technology Occupancy Sensor	73	1.31	10%	2459.808	$423.09	$160.00	$160.00	0.00	273.312	$47.01	3.40

3	Office	2080	19	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	1.10	2,292.2	$394.25	19	2	Dual Technology Occupancy Sensor	58	1.10	10%	2062.944	$354.83	$160.00	$160.00	0.00	229.216	$39.43	1.98
10		2080	20	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.16	2,412.8	$415.00	20	2		58	1.16	10%	2171.52	$373.50	$0.00	$0.00	0.00	241.28	$41.50	
10	Principal	2080	21	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.22	2,533.4	$435.75	21	2	Dual Technology Occupancy Sensor	58	1.22	10%	2280.096	$392.18	$160.00	$160.00	0.00	253.344	$43.58	1.79
3		2080	22	2	T8 1x4 2 Lamps Electronic Ballast Surface Mounting Prismatic Lens	58	1.28	2,654.1	$456.50	22	2		58	1.28	10%	2388.672	$410.85	$0.00	$0.00	0.00	265.408	$45.65	
5	Boys	2080	23	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	73	1.68	3,492.3	$600.68	23	2	Dual Technology Occupancy Sensor	73	1.68	10%	3143.088	$540.61	$160.00	$160.00	0.00	349.232	$60.07	2.66
5	Girls	2080	24	2	T8 2x2 2 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	73	1.75	3,644.2	$626.80	24	2	Dual Technology Occupancy Sensor	73	1.75	10%	3279.744	$564.12	$160.00	$160.00	0.00	364.416	$62.68	2.55
20	Gym 2006 Addition	2080	25	2	CFL 2 High Hat Lamps Electronic Ballast Recessed Mounting No Cover	56	1.40	2,912.0	$500.86	25	2	Dual Technology Occupancy Sensor	56	1.40	10%	2620.8	$450.78	$160.00	$160.00	0.00	291.2	$50.09	3.19
7	Gym Office	2080	26	3	T8 2x2 3 U-Tube Lamps Electronic Ballast Recessed Mounting Parabolic Lens	108	2.81	5,840.6	$1,004.59	26	3	Dual Technology Occupancy Sensor	108	2.81	10%	5256.576	$904.13	$160.00	$160.00	0.00	584.064	$100.46	1.59
22	New Hallway	2080	27	2	CFL 2 High Hat Lamps Electronic Ballast Recessed Mounting No Cover	56	1.51	3,145.0	$540.93	27	2	Dual Technology Occupancy Sensor	56	1.51	10%	2830.464	$486.84	$160.00	$160.00	0.00	314.496	$54.09	2.96
10	Closet	520	28	2	T8 2x4 2 Lamps Electronic Ballast Recessed Mounting Prismatic Lens	58	1.62	844.5	$145.25	28	2	Dual Technology Occupancy Sensor	58	1.62	10%	760.032	$130.73	$160.00	$160.00	0.00	84.448	$14.53	5.51
21		520	29	2	CFL 2 High Hat Lamps Electronic Ballast Recessed Mounting No Cover	56	1.62	844.5	$145.25	29	2		56	1.62	10%	760.032	$130.73	$0.00	$0.00	0.00	84.448	$14.53	
	Totals		750	150			50.976	129,848.8	$22,334.00	750	150			50.976		120,740.7	$20,767.41		$6,720.00	0	9,108.1	$1,566.60	4.29

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

Project Name: LGEA Solar PV Project - Washington Ave School
Location: Chatham, NJ
Description: Photovoltaic System 95% Financing - 25 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 25 year
Total Construction Cost	$1,092,960
Annual kWh Production	151,393
Annual Energy Cost Reduction	$26,040
Annual SREC Revenue	$52,988
First Cost Premium	**$1,092,960**
Simple Payback:	**13.83** Years

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	95%
Financing Term (mths):	300	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.172**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	7.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$54,648	0	0	0	$0	0	0	(54,648)	0
1	$0	151,393	$26,040	$0	$52,988	$72,179	$15,884	($9,036)	($63,684)
2	$0	150,636	$26,821	$0	$52,723	$71,030	$17,033	($8,519)	($72,203)
3	$0	149,883	$27,625	$0	$52,459	$69,799	$18,264	($7,978)	($80,182)
4	$0	149,133	$28,454	$0	$52,197	$68,479	$19,584	($7,412)	($87,594)
5	$0	148,388	$29,308	$1,528	$51,936	$67,063	$21,000	($8,348)	($95,941)
6	$0	147,646	$30,187	$1,521	$51,676	$65,545	$22,518	($7,721)	($103,662)
7	$0	146,908	$31,093	$1,513	$51,418	$63,917	$24,146	($7,066)	($110,728)
8	$0	146,173	$32,025	$1,506	$51,161	$62,172	$25,891	($6,382)	($117,110)
9	$0	145,442	$32,986	$1,498	$50,905	$60,300	$27,763	($5,670)	($122,780)
10	$0	144,715	$33,976	$1,491	$50,650	$58,293	$29,770	($4,927)	($127,708)
11	$0	143,991	$34,995	$1,483	$50,397	$56,141	$31,922	($4,154)	($131,862)
12	$0	143,271	$36,045	$1,476	$50,145	$53,833	$34,230	($3,349)	($135,210)
13	$0	142,555	$37,126	$1,468	$49,894	$51,359	$36,704	($2,511)	($137,721)
14	$0	141,842	$38,240	$1,461	$49,645	$48,706	$39,357	($1,639)	($139,360)
15	$0	141,133	$39,387	$1,454	$49,397	$45,860	$42,203	($733)	($140,093)
16	$0	140,427	$40,569	$1,446	$49,150	$42,810	$45,253	$209	($139,883)
17	$0	139,725	$41,786	$1,439	$48,904	$39,538	$48,525	$1,188	($138,696)
18	$0	139,027	$43,039	$1,432	$48,659	$36,030	$52,033	$2,204	($136,492)
19	$0	138,332	$44,331	$1,425	$48,416	$32,269	$55,794	$3,259	($133,233)
20	$0	137,640	$45,661	$1,418	$48,174	$28,236	$59,827	$4,354	($128,879)
21	$0	136,952	$47,030	$1,411	$47,933	$25,725	$55,000	$12,829	($116,050)
22	$0	136,267	$48,441	$1,404	$47,693	$20,787	$45,260	$28,684	($87,366)
23	$0	135,586	$49,895	$1,397	$47,455	$0	$0	$95,953	$8,587
24	$0	134,908	$51,391	$1,390	$47,218	$0	$0	$97,220	$105,806
25	$0	134,233	$52,933	$1,383	$46,982	$0	$0	$98,532	$204,338
	Totals:	3,566,206	949,385	30,541	1,248,172	1,140,070	767,959	258,986	(2,227,704)
			Net Present Value (NPV)				**($37,224)**		
			Internal Rate of Return (IRR)				**4.6%**		

Project Name: LGEA Solar PV Project - Washington Ave School
Location: Chatham, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

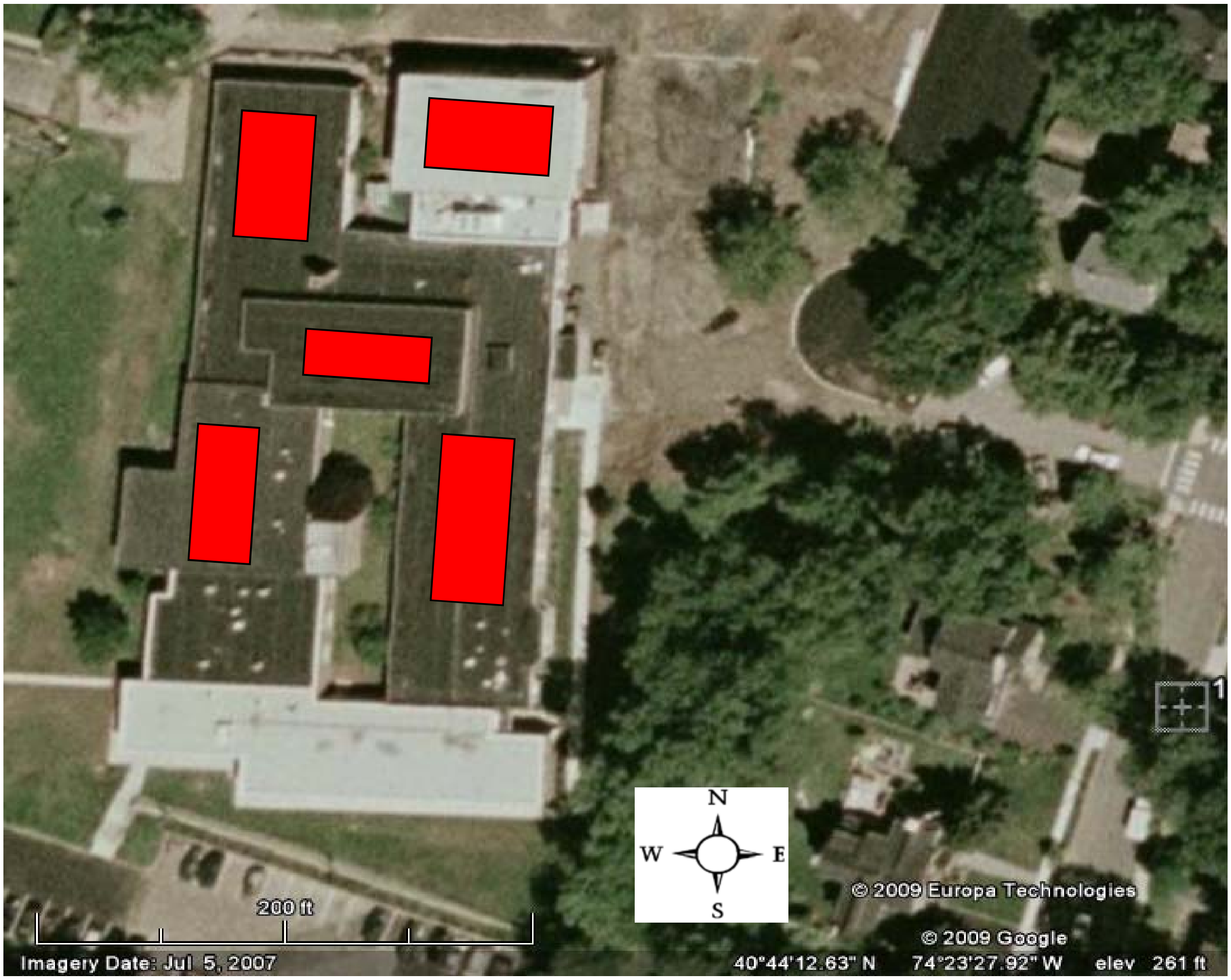
	Photovoltaic System - Direct Purchase
Total Construction Cost	$1,092,960
Annual kWh Production	151,393
Annual Energy Cost Reduction	$26,040
Annual SREC Revenue	$52,988
First Cost Premium	**$1,092,960**
Simple Payback:	**13.83** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.172**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Cumulative Cash Flow
0	$1,092,960	0	0	0	$0	(1,092,960)	0
1	$0	151,393	$26,040	$0	$52,988	$79,027	($1,013,933)
2	$0	150,636	$26,821	$0	$52,723	$79,543	($934,389)
3	$0	149,883	$27,625	$0	$52,459	$80,084	($854,305)
4	$0	149,133	$28,454	$0	$52,197	$80,651	($773,654)
5	$0	148,388	$29,308	$1,528	$51,936	$79,715	($693,939)
6	$0	147,646	$30,187	$1,521	$51,676	$80,342	($613,597)
7	$0	146,908	$31,093	$1,513	$51,418	$80,997	($532,600)
8	$0	146,173	$32,025	$1,506	$51,161	$81,680	($450,919)
9	$0	145,442	$32,986	$1,498	$50,905	$82,393	($368,526)
10	$0	144,715	$33,976	$1,491	$50,650	$83,135	($285,391)
11	$0	143,991	$34,995	$1,483	$50,397	$83,909	($201,482)
12	$0	143,271	$36,045	$1,476	$50,145	$84,714	($116,768)
13	$0	142,555	$37,126	$1,468	$49,894	$85,552	($31,215)
14	$0	141,842	$38,240	$1,461	$49,645	$86,424	$55,208
15	$0	141,133	$39,387	$1,454	$49,397	$87,330	$142,539
16	$0	140,427	$40,569	$1,446	$49,150	$88,272	$230,811
17	$0	139,725	$41,786	$1,439	$48,904	$89,251	$320,061
18	$0	139,027	$43,039	$1,432	$48,659	$90,267	$410,328
19	$0	138,332	$44,331	$1,425	$48,416	$91,322	$501,650
20	$0	137,640	$45,661	$1,418	$48,174	$92,417	$594,067
21	$1	136,952	$47,030	$1,411	$47,933	$93,553	$687,620
22	$2	136,267	$48,441	$1,404	$47,693	$94,731	$782,351
23	$3	135,586	$49,895	$1,397	$47,455	$95,953	$878,304
24	$4	134,908	$51,391	$1,390	$47,218	$97,220	$975,523
25	$5	134,233	$52,933	$1,383	$46,982	$98,532	$1,074,056
	Totals:	3,566,206	949,385	30,541	1,248,172	2,167,016	(218,202)
				Net Present Value (NPV)		**$1,074,081**	
				Internal Rate of Return (IRR)		**5.9%**	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Washington Avenue	7750	Sunpower SPR230	528	14.7	7,764	121.44	151,393	17,424	15.64



.= Proposed PV Layout

Notes:

1. Estimated kWH based on the National Renewable Energy Laboratory PVWatts Version 1 Calculator Program.

PVWatts Version 1 Input Screen

PV System Specifications:

DC Rating (kW):	121.44	Inputted From Roof Space Cell "G2" Total KW
DC to AC Derate Factor:	0.81	Inputted From Derate Factor Calculated Below in Cell "B37"
Array Type:	Fixed Tilt 1 - Axis Tracking 2 - Axis Tracking	There are 3 inputs for Array Type in all cases you should be using **Fixed Tilt** as the Selection
Fixed Tilt of Single Axis Tracking System:		
Array Tilt (degrees):	10	Based on Roof Type: For Flat Roof use 10 degrees, For Pitched Roof this is based on roof pitch.
Array Azimuth (degrees):	180	Based on Direction Array is Facing.

PV Watts Derate Factor for AC Power Rating at STC		
Component Derate Factors	PVWatts Default	Range
PV module nameplate DC rating	1.00	0.80–1.05
Inverter and transformer	0.95	0.88–0.96
Mismatch	0.98	0.97–0.995
Diodes and connections	1.00	0.99–0.997
DC wiring	0.98	0.97–0.99
AC wiring	0.99	0.98–0.993
1. Estimated kWH based on the National Renewable Energy Laboratory PVWatts Version 1 Calculator Program.	0.95	0.30–0.995
System availability	0.95	0.00–0.995
Shading	1.00	0.00–1.00
Sun-tracking	1.00	0.95–1.00
Age	1.00	0.70–1.00
Overall DC-to-AC derate factor	**0.81**	0.96001–0.09999

Click on **Calculate** if default values are acceptable, or after selecting your system specifications. Click on **Help** for information about system specifications. To use a DC to AC derate factor other than the default, click on **Derate Factor Help** for information.

Station Identification:

WBAN Number:	14734
City:	Newark
State:	New_Jersey

PV System Specifications:

DC Rating (kW):	121.44	
DC to AC Derate Factor:	.81	DERATE FACTOR HELP
Array Type:	Fixed Tilt	

Fixed Tilt or 1-Axis Tracking System:

Array Tilt (degrees):	40.7	(Default = Latitude)
Array Azimuth (degrees):	180.0	(Default = South)

Energy Data:

Cost of Electricity (cents/kWh): .172

Calculate | HELP | Reset Form

PVWatts *** AC Energy & Cost Savings

Cautions for Interpreting the Results

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	121.4 kW
DC to AC Derate Factor:	0.810
AC Rating:	98.4 kW
Array Type:	Fixed Tilt
Array Tilt:	40.7°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	0.2 ¢/kWh

Results			
Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	3.36	10592	18.22
2	4.05	11434	19.67
3	4.58	13866	23.85
4	4.84	13558	23.32
5	5.30	14943	25.70
6	5.33	14103	24.26
7	5.27	14242	24.50
8	5.25	14087	24.23
9	5.06	13657	23.49
10	4.46	12862	22.12
11	3.15	9186	15.80
12	2.87	8862	15.24
Year	4.46	151393	260.40

Output Hourly Performance Data * Output Results as Text

About the Hourly Performance Data

Saving Text from a Browser

Run PVWATTS v.1 for another US location or an International location
Run PVWATTS v.2 (US only)

Please send questions and comments regarding PVWATTS to Webmaster

Return to RReDC home page (*http://rredc.nrel.gov*)

APPENDIX 2 ECM CALCULATIONS

This Page Intentionally Left Blank

Chathams School District
Exhibit D
ECM 1A - Lighting Upgrades
Lighting Upgrade and Heating Penalty

ECM DESCRIPTION

Retrofit existing lighting fixtures with new energy efficient lighting fixtures, install motion sensors and implement daylight harvesting in selected areas

DATA / ASSUMPTIONS

* Heating Season	20	Weeks
** Fraction of heat to be made-up	40.0%	
Heating Hours (Weather Data)	3,948	Hours

** Fraction of the Year Representing the Cooling Season Liberal estimate of the heating season, as there are times during the year when the building is neither heated nor cooled.
*** Fraction of the Lighting Reduction that Has to Be Made Up by Heating a portion of the lighting heat is released at night plus interior zones will have limited heating loads

MEASUREMENT AND VERIFICATION

Option
A - The
Engine

COMMISSIONING

Confirm lighting operation and occupancy sensors functions

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) =	0%
Safety Factor (Thermal) =	0%

Relatively high safety factor is used for this ECM because of direct measurements are proven over the time and savings are stipulated

Chathams School District
Exhibit D
ECM 1A - Lighting Upgrades
Lighting Upgrade and Heating Penalty

CALCULATIONS

Detailed energy savings calculations are in the line-by-line calculation sheet

*Inputs are blue

Building	Lighting Savings (kWh)	Lighting Savings (kW)	Lighting Hours Check (hrs)
Chatham High School	344,469	152.80	2,254
Chatham Middle School	248,665	108.77	2,286
Lafayette School	125,332	52.45	2,390
Milton Avenue School	69,367	27.79	2,496
Southern Boulevard School	108,575	45.61	2,381
Washington Avenue School	76,262	31.45	2,425
Totals	972,671	419	

CALCULATIONS

	Chatham High School	Chatham Middle School	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School
Lighting Derate	0%	0%	0%	0%	0%	0%
Lighting Savings	344,469	248,665	125,332	69,367	108,575	76,262
kW Savings	153	109	52	28	46	31
Heating Season	20	20	20	20	20	20
** % of Heating Season	38%	38%	38%	38%	38%	38%
***Fraction of Heat to be Made-up	40%	40%	40%	40%	40%	40%
****Annual Equivalent of Lighting kWh Saved in Therms	11,753	8,484	4,276	2,367	3,705	2,602
Current Boiler Efficiency	80.0%	87.0%	90.0%	78.0%	76.3%	77.9%
Heating Penalty (Therms)	(2,260)	(1,500)	(731)	(467)	(747)	(514)

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Chatham High School	c wing tech room	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	c wing cust st	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	c wing Electric mech rm	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	48	15.00	720.00	1497.60	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1697.28	0.82
Chatham High School	c wing faculty womens br	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	c wing faculty womens br	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	1872.00	2	15.00	30.00	56.16	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	18.72	0.01
Chatham High School	c wing faculty mens br	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	c wing faculty mens br	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	1872.00	2	15.00	30.00	56.16	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	18.72	0.01
Chatham High School	c wing hall	2080.00	35	128.00	4480.00	9318.40	4.48	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	140	15.00	2100.00	4368.00	2.10	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	4950.40	2.38
Chatham High School	c wing hall	2080.00	4	36.00	144.00	299.52	0.14	2 - 18 WATT QUAD-PIN CFL	2080.00	8	15.00	120.00	249.60	0.12	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	49.92	0.02
Chatham High School	c wing womens br	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	c wing mens br	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	c wing hall br area	2080.00	2	36.00	72.00	149.76	0.07	2 - 18 WATT QUAD-PIN CFL	2080.00	4	15.00	60.00	124.80	0.06	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	24.96	0.01
Chatham High School	c205	2080.00	25	96.00	2400.00	4992.00	2.40	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	75	15.00	1125.00	2106.00	1.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2886.00	1.28
Chatham High School	c205 st	520.00	2	96.00	192.00	99.84	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	468.00	6	15.00	90.00	42.12	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	57.72	0.10
Chatham High School	c204	2080.00	25	96.00	2400.00	4992.00	2.40	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	75	15.00	1125.00	2106.00	1.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2886.00	1.28
Chatham High School	c204 prep	2080.00	3	96.00	288.00	599.04	0.29	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	9	15.00	135.00	252.72	0.13	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	346.32	0.15
Chatham High School	c science office	2080.00	8	96.00	768.00	1597.44	0.77	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	24	15.00	360.00	673.92	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	923.52	0.41
Chatham High School	c203	2080.00	25	96.00	2400.00	4992.00	2.40	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	75	15.00	1125.00	2106.00	1.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2886.00	1.28
Chatham High School	c203 prep	2080.00	6	96.00	576.00	1198.08	0.58	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	18	15.00	270.00	505.44	0.27	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	692.64	0.31
Chatham High School	c203 chem st	520.00	4	96.00	384.00	199.68	0.38	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	468.00	12	15.00	180.00	84.24	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	115.44	0.20
Chatham High School	c202	2080.00	25	96.00	2400.00	4992.00	2.40	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	75	15.00	1125.00	2106.00	1.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2886.00	1.28
Chatham High School	c202 prep	2080.00	5	96.00	480.00	998.40	0.48	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	15	15.00	225.00	421.20	0.22	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	577.20	0.26
Chatham High School	c202 prep EM	2080.00	1	96.00	96.00	199.68	0.10	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	3	22.00	66.00	123.55	0.07	4 FOOT 22W NWM BALLAST READY LED TUBE	76.13	0.03
Chatham High School	c202 chem st	520.00	4	96.00	384.00	199.68	0.38	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	468.00	12	15.00	180.00	84.24	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	115.44	0.20
Chatham High School	c200	2080.00	25	96.00	2400.00	4992.00	2.40	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	75	15.00	1125.00	2106.00	1.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2886.00	1.28
Chatham High School	c201	2080.00	25	96.00	2400.00	4992.00	2.40	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	75	15.00	1125.00	2106.00	1.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2886.00	1.28
Chatham High School	c201 flower rm	2080.00	8	221.00	1768.00	3677.44	1.77	8' FIXTURE, 3-F96/T12/ 60 WATT LAMPS, STANDARD MAGNETIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2329.60	1.05
Chatham High School	fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	8	0.00	0.00	0.00	0.00	TANDEM VAPOR TIGHT THREE LIGHT 8'	0.00	0.00
Chatham High School	display case	2080.00	2	32.00	64.00	133.12	0.06	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham High School	stair B	2080.00	10	128.00	1280.00	2662.40	1.28	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	40	15.00	600.00	1248.00	0.60	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1414.40	0.68
Chatham High School	stair b	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham High School	main entry	2080.00	3	60.00	180.00	374.40	0.18	A LAMP 60 WATT INCANDESCENT	2080.00	3	18.00	54.00	112.32	0.05	CREE 100W EQUIVALENT BULB DIMMABLE	262.08	0.13
Chatham High School	main entry ext	4380.00	3	60.00	180.00	788.40	0.18	A LAMP 60 WATT INCANDESCENT	4380.00	3	18.00	54.00	236.52	0.05	CREE 100W EQUIVALENT BULB DIMMABLE	551.88	0.13
Chatham High School	c 1st fl hall	2080.00	41	128.00	5248.00	10915.84	5.25	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	164	15.00	2460.00	5116.80	2.46	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	5799.04	2.79
Chatham High School	c 1st fl near door 21	2080.00	8	128.00	1024.00	2129.92	1.02	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	32	15.00	480.00	998.40	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1131.52	0.54
Chatham High School	stair a	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham High School	stair a	2080.00	8	128.00	1024.00	2129.92	1.02	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	32	15.00	480.00	998.40	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1131.52	0.54
Chatham High School	boiler rm	2080.00	9	64.00	576.00	1198.08	0.58	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	18	15.00	270.00	561.60	0.27	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	636.48	0.31
Chatham High School	gym	2080.00	20	336.00	6720.00	13977.60	6.72	8-42 WATT CFL HIGHBAY	1872.00	20	160.00	3200.00	5990.40	3.20	HH HIGHBAY,160W,18,000 LM,40K,120-277V, 0-10V DIMMING,15 AMP 120V TWIST LOCK PLUG (REFLECTOR NOT INCLUDED)	7987.20	3.52
Chatham High School	weight room	2080.00	10	336.00	3360.00	6988.80	3.36	8-42 WATT CFL HIGHBAY	1872.00	10	160.00	1600.00	2995.20	1.60	HH HIGHBAY,160W,18,000 LM,40K,120-277V, 0-10V DIMMING,15 AMP 120V TWIST LOCK PLUG (REFLECTOR NOT INCLUDED)	3993.60	1.76
Chatham High School	c hall	2080.00	4	36.00	144.00	299.52	0.14	2 - 18 WATT QUAD-PIN CFL	2080.00	8	16.00	128.00	266.24	0.13	DOWNLIGHT RETROFIT 6", 16W, HIGH CRI, 120V, 2700K, DIM - ENERGY STAR	33.28	0.02
Chatham High School	c137	2080.00	25	96.00	2400.00	4992.00	2.40	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	75	15.00	1125.00	2106.00	1.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2886.00	1.28

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Chatham High School	c137 prep	2080.00	6	96.00	576.00	1198.08	0.58	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	18	15.00	270.00	505.44	0.27	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	692.64	0.31
Chatham High School	c137 chem st	2080.00	4	96.00	384.00	798.72	0.38	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	c139	2080.00	25	96.00	2400.00	4992.00	2.40	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	75	15.00	1125.00	2106.00	1.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2886.00	1.28
Chatham High School	c143	2080.00	25	96.00	2400.00	4992.00	2.40	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	75	15.00	1125.00	2106.00	1.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2886.00	1.28
Chatham High School	c141	2080.00	25	96.00	2400.00	4992.00	2.40	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	75	15.00	1125.00	2106.00	1.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2886.00	1.28
Chatham High School	c141 rm	2080.00	6	96.00	576.00	1198.08	0.58	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	18	15.00	270.00	561.60	0.27	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	636.48	0.31
Chatham High School	c140	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Chatham High School	c mens br 1st fl	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	c womens br 1st fl	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	c br hall	2080.00	2	36.00	72.00	149.76	0.07	2 - 18 WATT QUAD-PIN CFL	2080.00	4	16.00	64.00	133.12	0.06	DOWNLIGHT RETROFIT 6", 16W, HIGH CRI, 120V, 2700K, DIM - ENERGY STAR	16.64	0.01
Chatham High School	c 138	2080.00	25	96.00	2400.00	4992.00	2.40	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	75	15.00	1125.00	2106.00	1.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2886.00	1.28
Chatham High School	c 138 prep	2080.00	6	96.00	576.00	1198.08	0.58	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	18	15.00	270.00	505.44	0.27	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	692.64	0.31
Chatham High School	c 138 chem st	2080.00	4	96.00	384.00	798.72	0.38	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	12	15.00	180.00	374.40	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	424.32	0.20
Chatham High School	c136	2080.00	25	96.00	2400.00	4992.00	2.40	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	75	15.00	1125.00	2106.00	1.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2886.00	1.28
Chatham High School	c womens fac br	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	1872.00	2	16.00	32.00	59.90	0.03	DOWNLIGHT RETROFIT 6", 16W, HIGH CRI, 120V, 2700K, DIM - ENERGY STAR	14.98	0.00
Chatham High School	c womens fac br	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	c mens fac br	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	1872.00	2	16.00	32.00	59.90	0.03	DOWNLIGHT RETROFIT 6", 16W, HIGH CRI, 120V, 2700K, DIM - ENERGY STAR	14.98	0.00
Chatham High School	c mens fac br	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	c 1st flo st	520.00	4	60.00	240.00	124.80	0.24	A LAMP 60 WATT INCANDESCENT	520.00	4	18.00	72.00	37.44	0.07	CREE 100W EQUIVALENT BULB DIMMABLE	87.36	0.17
Chatham High School	c 1st fl electr rm	520.00	4	64.00	256.00	133.12	0.26	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	8	15.00	120.00	62.40	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.14
Chatham High School	hall to main gym	2080.00	9	128.00	1152.00	2396.16	1.15	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham High School	hall to main gym	2080.00	4	64.00	256.00	532.48	0.26	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Chatham High School	main hall gym	2080.00	26	62.00	1612.00	3352.96	1.61	2-2X2-31W-FB031/841-4 PIN UTUBE	2080.00	26	35.00	910.00	1892.80	0.91	ZR22, 35 WATT, 3200LM, 4000K, 0-10V DIMMING	1460.16	0.70
Chatham High School	main gym	2080.00	4	336.00	1344.00	2795.52	1.34	8-42 WATT CFL HIGHBAY	1872.00	4	160.00	640.00	1198.08	0.64	HH HIGHBAY,160W,18,000 LM,40K,120-277V, 0-10V DIMMING,15 AMP 120V TWIST LOCK PLUG (REFLECTOR NOT INCLUDED)	1597.44	0.70
Chatham High School	main gym	2080.00	24	226.00	5424.00	11281.92	5.42	4' FIXTURE, 4-F54/T5/HO/LAMPS, ELECTRONIC BALLAST	1872.00	144	18.00	2592.00	4852.22	2.59	G3 HP 4 FOOT 18W 5000K MILKY LENS SEP LED TUBE - DLC LISTED	6429.70	2.83
Chatham High School	main gym fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	24	0.00	0.00	0.00	0.00	6 LAMP LINEAR HIGHBAY WITH WIRE GUARD	0.00	0.00
Chatham High School	hall near main gym	2080.00	7	128.00	896.00	1863.68	0.90	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	28	15.00	420.00	873.60	0.42	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	990.08	0.48
Chatham High School	main hall gym	2080.00	2	32.00	64.00	133.12	0.06	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham High School	gym equipment rm	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham High School	cafe hall	2080.00	4	64.00	256.00	532.48	0.26	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Chatham High School	chem st	520.00	1	60.00	60.00	31.20	0.06	A LAMP 60 WATT INCANDESCENT	520.00	1	18.00	18.00	9.36	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	21.84	0.04
Chatham High School	hall cafe	2080.00	1	60.00	60.00	124.80	0.06	A LAMP 60 WATT INCANDESCENT	2080.00	1	18.00	18.00	37.44	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	87.36	0.04
Chatham High School	kitchen freezer	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham High School	freezer	2080.00	1	60.00	60.00	124.80	0.06	A LAMP 60 WATT INCANDESCENT	2080.00	1	18.00	18.00	37.44	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	87.36	0.04
Chatham High School	kitchen st	520.00	1	64.00	64.00	33.28	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	2	15.00	30.00	15.60	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	17.68	0.03
Chatham High School	cafe mgr	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham High School	kitchen	2080.00	22	64.00	1408.00	2928.64	1.41	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	44	15.00	660.00	1235.52	0.66	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1693.12	0.75
Chatham High School	kitchen fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	22	0.00	0.00	0.00	0.00	4FT 2 LAMP INDUSTRIAL HOOD	0.00	0.00
Chatham High School	wash area	2080.00	4	64.00	256.00	532.48	0.26	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Chatham High School	fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	4	0.00	0.00	0.00	0.00	4FT 2 LAMP INDUSTRIAL HOOD	0.00	0.00
Chatham High School	kitchen st	520.00	6	64.00	384.00	199.68	0.38	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	12	15.00	180.00	93.60	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	106.08	0.20
Chatham High School	girls locker hall	2080.00	7	64.00	448.00	931.84	0.45	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	14	15.00	210.00	436.80	0.21	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	495.04	0.24
Chatham High School	display case	2080.00	16	35.00	560.00	1164.80	0.56	35 WATT MR 16 INCANDESCENT 12V - RECESSED FIXTURE	2080.00	16	7.00	112.00	232.96	0.11	MR16, GU5.3 BASE, 7W, 12V, 36°, 2700K, HIGH CRI, DIM - ENERGY STAR	931.84	0.45
Chatham High School	cafe hall	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham High School	cafe garbage	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Chatham High School	cyber center	2080.00	8	128.00	1024.00	2129.92	1.02	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	32	15.00	480.00	898.56	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1231.36	0.54
Chatham High School	cyber center	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	4	15.00	60.00	112.32	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	153.92	0.07
Chatham High School	cafeteria	2080.00	32	128.00	4096.00	8519.68	4.10	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	128	15.00	1920.00	3594.24	1.92	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	4925.44	2.18
Chatham High School	cafeteria	2080.00	5	65.00	325.00	676.00	0.33	PAR 30 FLOOD 65 WATT	2080.00	5	14.00	70.00	145.60	0.07	PAR30, E26 BASE, 14 WATT, 120V 25°, 2700K, DIMMABLE - ENERGY STAR	530.40	0.26
Chatham High School	main office	2080.00	9	128.00	1152.00	2396.16	1.15	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Chatham High School	a104-114 hall	2080.00	17	128.00	2176.00	4526.08	2.18	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	68	15.00	1020.00	2121.60	1.02	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2404.48	1.16
Chatham High School	a113 hall	2080.00	9	128.00	1152.00	2396.16	1.15	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham High School	a hall near world langauge	2080.00	13	128.00	1664.00	3461.12	1.66	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	52	15.00	780.00	1622.40	0.78	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1838.72	0.88
Chatham High School	stair c hall	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	48	15.00	720.00	1497.60	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1697.28	0.82
Chatham High School	b 154 hall	2080.00	8	36.00	288.00	599.04	0.29	2 - 18 WATT QUAD-PIN CFL	2080.00	8	16.00	128.00	266.24	0.13	DOWNLIGHT RETROFIT 6", 16W, HIGH CRI, 120V, 2700K, DIM - ENERGY STAR	332.80	0.16
Chatham High School	c hall	2080.00	7	36.00	252.00	524.16	0.25	2 - 18 WATT QUAD-PIN CFL	2080.00	7	16.00	112.00	232.96	0.11	DOWNLIGHT RETROFIT 6", 16W, HIGH CRI, 120V, 2700K, DIM - ENERGY STAR	291.20	0.14
Chatham High School	hall to c area	2080.00	8	128.00	1024.00	2129.92	1.02	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	32	15.00	480.00	998.40	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1131.52	0.54
Chatham High School	a123-133 hall	2080.00	16	128.00	2048.00	4259.84	2.05	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	64	15.00	960.00	1996.80	0.96	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2263.04	1.09
Chatham High School	main office walls	2080.00	7	64.00	448.00	931.84	0.45	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	14	15.00	210.00	436.80	0.21	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	495.04	0.24
Chatham High School	main office kitchen	2080.00	1	59.00	59.00	122.72	0.06	*8' FIXTURE, 1-F96/T8/ 59 WATT LAMP, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	60.32	0.03
Chatham High School	kitchen fixture	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	4FT WRAP AROUND 2 LAMP	0.00	0.00
Chatham High School	main office kitchen	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Chatham High School	communications	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham High School	assitant principal	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	8	15.00	120.00	224.64	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.14
Chatham High School	principal	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	women br	2080.00	1	64.00	64.00	133.12	0.06	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	3	9.00	27.00	56.16	0.03	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.04
Chatham High School	womens br kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Chatham High School	mens br	2080.00	1	64.00	64.00	133.12	0.06	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	3	9.00	27.00	56.16	0.03	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.04
Chatham High School	men br kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Chatham High School	chapman office	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	8	15.00	120.00	224.64	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.14
Chatham High School	malea office	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	8	15.00	120.00	224.64	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.14
Chatham High School	counseling	2080.00	14	96.00	1344.00	2795.52	1.34	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	42	15.00	630.00	1179.36	0.63	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1616.16	0.71
Chatham High School	patterson office	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	8	15.00	120.00	224.64	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.14
Chatham High School	newcombe office	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	8	15.00	120.00	224.64	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.14
Chatham High School	murphy office	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	8	15.00	120.00	224.64	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.14
Chatham High School	kool-behr office	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	8	15.00	120.00	224.64	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.14
Chatham High School	tully-cano office	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	8	15.00	120.00	224.64	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.14
Chatham High School	tully cano br	2080.00	1	60.00	60.00	124.80	0.06	A LAMP 60 WATT INCANDESCENT	2080.00	1	18.00	18.00	37.44	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	87.36	0.04
Chatham High School	barbato office	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	8	15.00	120.00	224.64	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.14
Chatham High School	office	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	8	15.00	120.00	224.64	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.14
Chatham High School	main hall cust cl	520.00	1	60.00	60.00	31.20	0.06	A LAMP 60 WATT INCANDESCENT	520.00	1	18.00	18.00	9.36	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	21.84	0.04
Chatham High School	men br	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	girls br	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	hall	4380.00	3	64.00	192.00	840.96	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	4380.00	6	22.00	132.00	578.16	0.13	4 FOOT 22W NWM BALLAST READY LED TUBE	262.80	0.06
Chatham High School	stairs to L wing	2080.00	4	32.00	128.00	266.24	0.13	1 - 32 WATT CFL	2080.00	4	18.00	72.00	149.76	0.07	CREE 100W EQUIVALENT BULB DIMMABLE	116.48	0.06
Chatham High School	L wing hall	2080.00	1	128.00	128.00	266.24	0.13	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham High School	L wing hall	2080.00	6	128.00	768.00	1597.44	0.77	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	24	15.00	360.00	748.80	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	848.64	0.41
Chatham High School	L wing hall	2080.00	3	96.00	288.00	599.04	0.29	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	9	15.00	135.00	280.80	0.13	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	318.24	0.15
Chatham High School	L wing hall	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	6	15.00	90.00	187.20	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	212.16	0.10

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Chatham High School	L 10	2080.00	28	64.00	1792.00	3727.36	1.79	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	56	15.00	840.00	1572.48	0.84	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2154.88	0.95
Chatham High School	L12	2080.00	33	64.00	2112.00	4392.96	2.11	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	66	15.00	990.00	1853.28	0.99	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2539.68	1.12
Chatham High School	L12 office	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	4	15.00	60.00	112.32	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	153.92	0.07
Chatham High School	L 14	2080.00	38	64.00	2432.00	5058.56	2.43	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	76	15.00	1140.00	2134.08	1.14	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2924.48	1.29
Chatham High School	L 14 kiln	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Chatham High School	L 14 office	2080.00	6	64.00	384.00	798.72	0.38	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	L 14 hall	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham High School	L maint shop	2080.00	6	64.00	384.00	798.72	0.38	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	12	15.00	180.00	374.40	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	424.32	0.20
Chatham High School	L11	2080.00	25	96.00	2400.00	4992.00	2.40	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	75	15.00	1125.00	2106.00	1.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2886.00	1.28
Chatham High School	L womens br	2080.00	4	64.00	256.00	532.48	0.26	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	12	9.00	108.00	224.64	0.11	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.15
Chatham High School	L womens br kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	4	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Chatham High School	L cust closet	520.00	1	32.00	32.00	16.64	0.03	1 - 32 WATT CFL	520.00	1	18.00	18.00	9.36	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	7.28	0.01
Chatham High School	L mens br	2080.00	4	64.00	256.00	532.48	0.26	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	12	9.00	108.00	224.64	0.11	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.15
Chatham High School	L mens br kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	4	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Chatham High School	L 13	2080.00	12	32.00	384.00	798.72	0.38	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	L 13	2080.00	3	34.00	102.00	212.16	0.10	*2' FIXTURE, 2-F17/T8/STD LAMPS, ELECTRONIC BALLAST	1872.00	6	9.00	54.00	101.09	0.05	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	111.07	0.05
Chatham High School	L 15	2080.00	17	32.00	544.00	1131.52	0.54	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	1872.00	17	15.00	255.00	477.36	0.25	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	654.16	0.29
Chatham High School	L 15	2080.00	3	34.00	102.00	212.16	0.10	*2' FIXTURE, 2-F17/T8/STD LAMPS, ELECTRONIC BALLAST	1872.00	6	9.00	54.00	101.09	0.05	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	111.07	0.05
Chatham High School	b150-158 hall	2080.00	27	128.00	3456.00	7188.48	3.46	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	108	15.00	1620.00	3369.60	1.62	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	3818.88	1.84
Chatham High School	B hall	2080.00	3	60.00	180.00	374.40	0.18	A LAMP 60 WATT INCANDESCENT	2080.00	3	18.00	54.00	112.32	0.05	CREE 100W EQUIVALENT BULB DIMMABLE	262.08	0.13
Chatham High School	B 158	2080.00	10	96.00	960.00	1996.80	0.96	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	30	15.00	450.00	842.40	0.45	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1154.40	0.51
Chatham High School	B 158 em	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	6	22.00	132.00	274.56	0.13	4 FOOT 22W NWM BALLAST READY LED TUBE	124.80	0.06
Chatham High School	B 158	2080.00	9	36.00	324.00	673.92	0.32	2 - 18 WATT DUAL-PIN CFL	2080.00	9	15.00	135.00	280.80	0.13	HELEN LAMP, HORIZONTAL, 1-13 WATT G24D SERIES 2 PIN LED REPLACEMENT BULB - 3500K	393.12	0.19
Chatham High School	B 156	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Chatham High School	B 156 em	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	6	22.00	132.00	274.56	0.13	4 FOOT 22W NWM BALLAST READY LED TUBE	124.80	0.06
Chatham High School	B 157	2080.00	13	128.00	1664.00	3461.12	1.66	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	52	15.00	780.00	1460.16	0.78	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2000.96	0.88
Chatham High School	B 155	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Chatham High School	B 154	2080.00	13	96.00	1248.00	2595.84	1.25	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	39	15.00	585.00	1095.12	0.58	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1500.72	0.66
Chatham High School	B 154 EM	2080.00	1	96.00	96.00	199.68	0.10	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	3	22.00	66.00	137.28	0.07	4 FOOT 22W NWM BALLAST READY LED TUBE	62.40	0.03
Chatham High School	B 152	2080.00	5	96.00	480.00	998.40	0.48	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	15	15.00	225.00	421.20	0.22	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	577.20	0.26
Chatham High School	B 152 EM	2080.00	1	96.00	96.00	199.68	0.10	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	3	22.00	66.00	137.28	0.07	4 FOOT 22W NWM BALLAST READY LED TUBE	62.40	0.03
Chatham High School	B 151	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Chatham High School	B men br	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	1	16.00	16.00	33.28	0.02	DOWNLIGHT RETROFIT 6", 16W, HIGH CRI, 120V, 2700K, DIM - ENERGY STAR	41.60	0.02
Chatham High School	B men br	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	12	15.00	180.00	374.40	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	424.32	0.20
Chatham High School	B women br	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	1	16.00	16.00	33.28	0.02	DOWNLIGHT RETROFIT 6", 16W, HIGH CRI, 120V, 2700K, DIM - ENERGY STAR	41.60	0.02
Chatham High School	B womens br	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	12	15.00	180.00	374.40	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	424.32	0.20
Chatham High School	B hall br	2080.00	2	36.00	72.00	149.76	0.07	2 - 18 WATT QUAD-PIN CFL	2080.00	2	16.00	32.00	66.56	0.03	DOWNLIGHT RETROFIT 6", 16W, HIGH CRI, 120V, 2700K, DIM - ENERGY STAR	83.20	0.04
Chatham High School	B exit stairs	2080.00	5	64.00	320.00	665.60	0.32	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	10	15.00	150.00	312.00	0.15	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	353.60	0.17
Chatham High School	B mech rm	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	6	15.00	90.00	187.20	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	212.16	0.10
Chatham High School	fixtures	2080.00	0	0.00	0.00	0.00	0.00	0 - N/A	2080.00	3	0.00	0.00	0.00	0.00	4FT 2 LAMP INDUSTRIAL HOOD	0.00	0.00
Chatham High School	B auto main	2080.00	14	32.00	448.00	931.84	0.45	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	1872.00	14	15.00	210.00	393.12	0.21	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	538.72	0.24
Chatham High School	B Main auto	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	8	15.00	120.00	224.64	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.14
Chatham High School	B Main auto	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Chatham High School	Main Br	2080.00	1	96.00	96.00	199.68	0.10	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	3	15.00	45.00	84.24	0.04	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	115.44	0.05
Chatham High School	Maint BR	2080.00	3	60.00	180.00	374.40	0.18	A LAMP 60 WATT INCANDESCENT	2080.00	3	18.00	54.00	112.32	0.05	CREE 100W EQUIVALENT BULB DIMMABLE	262.08	0.13
Chatham High School	Maint wash area	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham High School	Maint break rm	2080.00	6	96.00	576.00	1198.08	0.58	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	18	15.00	270.00	561.60	0.27	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	636.48	0.31
Chatham High School	Maint office	2080.00	4	96.00	384.00	798.72	0.38	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	12	15.00	180.00	374.40	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	424.32	0.20
Chatham High School	Maint shop	2080.00	2	118.00	236.00	490.88	0.24	*8' FIXTURE, 2-F96/T8/ 59 WATT LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	241.28	0.12
Chatham High School	fixture	2080.00	0	0.00	0.00	0.00	0.00	0 - N/A	2080.00	2	0.00	0.00	0.00	0.00	4FT WRAP AROUND 4 LAMP	0.00	0.00
Chatham High School	Maint st	520.00	2	64.00	128.00	66.56	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	4	15.00	60.00	31.20	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	35.36	0.07
Chatham High School	Maint office	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham High School	Maint shop	2080.00	3	190.00	570.00	1185.60	0.57	METAL HALIDE, 1-150 WATT LAMP	2080.00	12	15.00	180.00	374.40	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	811.20	0.39
Chatham High School	fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	3	0.00	0.00	0.00	0.00	4FT WRAP AROUND 4 LAMP	0.00	0.00
Chatham High School	Hall to mens br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham High School	fixture	2080.00	0	0.00	0.00	0.00	0.00	0 - N/A	2080.00	1	0.00	0.00	0.00	0.00	4FT 2 LAMP INDUSTRIAL HOOD	0.00	0.00
Chatham High School	B Math office	2080.00	13	96.00	1248.00	2595.84	1.25	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	39	15.00	585.00	1095.12	0.58	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1500.72	0.66
Chatham High School	B math office EM	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	22.00	132.00	247.10	0.13	4 FOOT 22W NWM BALLAST READY LED TUBE	152.26	0.06
Chatham High School	B 160	2080.00	15	96.00	1440.00	2995.20	1.44	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	45	15.00	675.00	1263.60	0.67	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1731.60	0.77
Chatham High School	B 160	2080.00	1	64.00	64.00	133.12	0.06	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	1872.00	3	9.00	27.00	50.54	0.03	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	82.58	0.04
Chatham High School	B 160 kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Chatham High School	B world language	2080.00	8	96.00	768.00	1597.44	0.77	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	24	15.00	360.00	673.92	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	923.52	0.41
Chatham High School	B 161	2080.00	10	96.00	960.00	1996.80	0.96	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	30	15.00	450.00	842.40	0.45	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1154.40	0.51
Chatham High School	B 164	2080.00	16	96.00	1536.00	3194.88	1.54	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Chatham High School	B 163	2080.00	8	96.00	768.00	1597.44	0.77	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	24	15.00	360.00	673.92	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	923.52	0.41
Chatham High School	B 166	2080.00	20	64.00	1280.00	2662.40	1.28	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	40	15.00	600.00	1123.20	0.60	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1539.20	0.68
Chatham High School	B 167	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Chatham High School	B 168	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Chatham High School	B 169	2080.00	20	64.00	1280.00	2662.40	1.28	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	40	15.00	600.00	1123.20	0.60	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1539.20	0.68
Chatham High School	B hall down	2080.00	1	125.00	125.00	260.00	0.13	HIGH PRESSURE SODIUM, 1-125 WATT LAMP	2080.00	1	19.00	19.00	39.52	0.02	PAR38, E26 BASE, 19 WATT, 120V 40°, 2700K, DIMMABLE - ENERGY STAR	220.48	0.11
Chatham High School	B hall	2080.00	7	128.00	896.00	1863.68	0.90	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	28	15.00	420.00	873.60	0.42	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	990.08	0.48
Chatham High School	B hall em	2080.00	1	128.00	128.00	266.24	0.13	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	22.00	88.00	183.04	0.09	4 FOOT 22W NWM BALLAST READY LED TUBE	83.20	0.04
Chatham High School	Auditorium hall	2080.00	10	32.00	320.00	665.60	0.32	1 - 32 WATT CFL	2080.00	10	18.00	180.00	374.40	0.18	CREE 100W EQUIVALENT BULB DIMMABLE	291.20	0.14
Chatham High School	Auditorium hall	2080.00	14	90.00	1260.00	2620.80	1.26	PAR 38 FLOOD 90 WATT	2080.00	14	19.00	266.00	553.28	0.27	PAR38, E26 BASE, 19 WATT, 120V 40°, 2700K, DIMMABLE - ENERGY STAR	2067.52	0.99
Chatham High School	Auditorium hall	2080.00	5	32.00	160.00	332.80	0.16	1 - 32 WATT CFL	2080.00	5	18.00	90.00	187.20	0.09	CREE 100W EQUIVALENT BULB DIMMABLE	145.60	0.07
Chatham High School	Auditorium Hall	2080.00	19	90.00	1710.00	3556.80	1.71	PAR 38 FLOOD 90 WATT	2080.00	19	19.00	361.00	750.88	0.36	PAR38, E26 BASE, 19 WATT, 120V 40°, 2700K, DIMMABLE - ENERGY STAR	2805.92	1.35
Chatham High School	Auditorium hall	2080.00	10	90.00	900.00	1872.00	0.90	PAR 38 FLOOD 90 WATT	2080.00	10	19.00	190.00	395.20	0.19	PAR38, E26 BASE, 19 WATT, 120V 40°, 2700K, DIMMABLE - ENERGY STAR	1476.80	0.71
Chatham High School	Auditorium hall	2080.00	13	60.00	780.00	1622.40	0.78	A LAMP 60 WATT INCANDESCENT	2080.00	13	18.00	234.00	486.72	0.23	CREE 100W EQUIVALENT BULB DIMMABLE	1135.68	0.55
Chatham High School	polan office	2080.00	5	64.00	320.00	665.60	0.32	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	10	15.00	150.00	280.80	0.15	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	384.80	0.17
Chatham High School	polan office	2080.00	5	64.00	320.00	665.60	0.32	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	10	15.00	150.00	280.80	0.15	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	384.80	0.17
Chatham High School	Aud hall	2080.00	13	90.00	1170.00	2433.60	1.17	PAR 38 FLOOD 90 WATT	2080.00	13	19.00	247.00	513.76	0.25	PAR38, E26 BASE, 19 WATT, 120V 40°, 2700K, DIMMABLE - ENERGY STAR	1919.84	0.92
Chatham High School	Aud hall	2080.00	3	90.00	270.00	561.60	0.27	PAR 38 FLOOD 90 WATT	2080.00	3	19.00	57.00	118.56	0.06	PAR38, E26 BASE, 19 WATT, 120V 40°, 2700K, DIMMABLE - ENERGY STAR	443.04	0.21
Chatham High School	Aud mens br	2080.00	6	64.00	384.00	798.72	0.38	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	Aud mens br	2080.00	1	60.00	60.00	124.80	0.06	A LAMP 60 WATT INCANDESCENT	1872.00	1	18.00	18.00	33.70	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	91.10	0.04
Chatham High School	Auditorium	2080.00	96	90.00	8640.00	17971.20	8.64	PAR 38 FLOOD 90 WATT	2080.00	96	19.00	1824.00	3793.92	1.82	PAR38, E26 BASE, 19 WATT, 120V 25°, 2700K, DIMMABLE - ENERGY STAR	14177.28	6.82
Chatham High School	Aud control booth	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	6	15.00	90.00	187.20	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	212.16	0.10
Chatham High School	Auditorium	2080.00	4	60.00	240.00	499.20	0.24	A LAMP 60 WATT INCANDESCENT	2080.00	4	9.50	38.00	79.04	0.04	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	420.16	0.20
Chatham High School	Stage	2080.00	2	118.00	236.00	490.88	0.24	*8' FIXTURE, 2-F96/T8/ 59 WATT LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	366.08	0.18
Chatham High School	stage fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	4	0.00	0.00	0.00	0.00	BEGHELLI BS100 4FT 2 LAMP VAPOR TIGHT	0.00	0.00

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Chatham High School	light storage	2080.00	5	125.00	625.00	1300.00	0.63	HIGH PRESSURE SODIUM, 1-125 WATT LAMP	2080.00	20	15.00	300.00	624.00	0.30	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	676.00	0.33
Chatham High School	fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	5	0.00	0.00	0.00	0.00	4FT WRAP AROUND 4 LAMP	0.00	0.00
Chatham High School	B aud hall	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	6	15.00	90.00	187.20	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	212.16	0.10
Chatham High School	B lower hall	2080.00	7	96.00	672.00	1397.76	0.67	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	21	15.00	315.00	655.20	0.31	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	742.56	0.36
Chatham High School	B lower hall EM	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	6	22.00	132.00	274.56	0.13	4 FOOT 22W NWM BALLAST READY LED TUBE	124.80	0.06
Chatham High School	B 170	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Chatham High School	B 171	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Chatham High School	B 172	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Chatham High School	B 173	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Chatham High School	Aud hall	2080.00	1	128.00	128.00	266.24	0.13	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham High School	Aud hall EM	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	22.00	176.00	366.08	0.18	4 FOOT 22W NWM BALLAST READY LED TUBE	166.40	0.08
Chatham High School	Aud woodshop	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	48	15.00	720.00	1497.60	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1697.28	0.82
Chatham High School	M womens br em	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	22.00	44.00	82.37	0.04	4 FOOT 22W NWM BALLAST READY LED TUBE	50.75	0.02
Chatham High School	M mens br em	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	22.00	44.00	82.37	0.04	4 FOOT 22W NWM BALLAST READY LED TUBE	50.75	0.02
Chatham High School	M hall	2080.00	17	128.00	2176.00	4526.08	2.18	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	68	15.00	1020.00	2121.60	1.02	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2404.48	1.16
Chatham High School	M 19	2080.00	3	96.00	288.00	599.04	0.29	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	9	15.00	135.00	252.72	0.13	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	346.32	0.15
Chatham High School	M 19 em	2080.00	1	96.00	96.00	199.68	0.10	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	3	22.00	66.00	123.55	0.07	4 FOOT 22W NWM BALLAST READY LED TUBE	76.13	0.03
Chatham High School	M band rm	2080.00	45	132.00	5940.00	12355.20	5.94	2' 4-F40T8, BIAX ELECTRONIC BALLAST -	1872.00	45	35.00	1575.00	2948.40	1.57	ZR22, 35 WATT, 3200LM, 4000K, 0-10V DIMMING	9406.80	4.37
Chatham High School	M band rm EM	2080.00	11	132.00	1452.00	3020.16	1.45	2' 4-F40T8, BIAX ELECTRONIC BALLAST -	1872.00	11	35.00	385.00	720.72	0.38	ZR22, 35 WATT, 3200LM, 4000K, 0-10V DIMMING , EMERGENCY	2299.44	1.07
Chatham High School	M band rm	2080.00	1	64.00	64.00	133.12	0.06	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	1872.00	3	9.00	27.00	50.54	0.03	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	82.58	0.04
Chatham High School	M band rm kit	2080.00	0	0.00	0.00	0.00	0.00	0 - N/A	2080.00	3	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Chatham High School	M music office	2080.00	8	96.00	768.00	1597.44	0.77	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	24	15.00	360.00	673.92	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	923.52	0.41
Chatham High School	M Uniform st	520.00	8	128.00	1024.00	532.48	1.02	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	32	15.00	480.00	249.60	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.54
Chatham High School	M band st	520.00	5	96.00	480.00	249.60	0.48	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	15	15.00	225.00	117.00	0.22	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	132.60	0.26
Chatham High School	M band st EM	2080.00	1	96.00	96.00	199.68	0.10	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	3	22.00	66.00	137.28	0.07	4 FOOT 22W NWM BALLAST READY LED TUBE	62.40	0.03
Chatham High School	M 20	2080.00	4	96.00	384.00	798.72	0.38	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	M 18	2080.00	1	96.00	96.00	199.68	0.10	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	3	15.00	45.00	84.24	0.04	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	115.44	0.05
Chatham High School	social studies office	2080.00	14	64.00	896.00	1863.68	0.90	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	28	15.00	420.00	786.24	0.42	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1077.44	0.48
Chatham High School	A113	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Chatham High School	A114	2080.00	8	128.00	1024.00	2129.92	1.02	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	32	15.00	480.00	898.56	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1231.36	0.54
Chatham High School	A114	2080.00	4	64.00	256.00	532.48	0.26	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	1872.00	12	9.00	108.00	202.18	0.11	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	330.30	0.15
Chatham High School	A114 kit	2080.00	0	0.00	0.00	0.00	0.00	0 - N/A	2080.00	4	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Chatham High School	A115	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Chatham High School	A114B	2080.00	4	128.00	512.00	1064.96	0.51	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	16	15.00	240.00	449.28	0.24	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	615.68	0.27
Chatham High School	a114b em	2080.00	1	128.00	128.00	266.24	0.13	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	4	22.00	88.00	164.74	0.09	4 FOOT 22W NWM BALLAST READY LED TUBE	101.50	0.04
Chatham High School	a116	2080.00	45	64.00	2880.00	5990.40	2.88	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	90	15.00	1350.00	2527.20	1.35	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	3463.20	1.53
Chatham High School	a116 office	2080.00	4	64.00	256.00	532.48	0.26	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	8	15.00	120.00	224.64	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.14
Chatham High School	a117	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Chatham High School	a119	2080.00	11	128.00	1408.00	2928.64	1.41	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	44	15.00	660.00	1235.52	0.66	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1693.12	0.75
Chatham High School	a120	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Chatham High School	a120 romero	2080.00	4	128.00	512.00	1064.96	0.51	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	16	15.00	240.00	449.28	0.24	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	615.68	0.27
Chatham High School	a120 office	2080.00	6	128.00	768.00	1597.44	0.77	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	24	15.00	360.00	673.92	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	923.52	0.41

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Chatham High School	a121 cst	2080.00	4	96.00	384.00	798.72	0.38	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	a121 cont	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Chatham High School	a121 cubby	2080.00	1	17.00	17.00	35.36	0.02	*2' FIXTURE, 1-F17/T8/STD LAMPS, ELECTRONIC BALLAST	1872.00	1	9.00	9.00	16.85	0.01	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	18.51	0.01
Chatham High School	a121 calle	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Chatham High School	a121 camaano	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Chatham High School	a121 delvalle	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Chatham High School	A electric rm	2080.00	2	32.00	64.00	133.12	0.06	1 - 32 WATT CFL	1872.00	2	18.00	36.00	67.39	0.04	CREE 100W EQUIVALENT BULB DIMMABLE	65.73	0.03
Chatham High School	A tech office	2080.00	3	96.00	288.00	599.04	0.29	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	9	15.00	135.00	252.72	0.13	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	346.32	0.15
Chatham High School	a123	2080.00	9	128.00	1152.00	2396.16	1.15	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Chatham High School	A Ath Dir kitchen	2080.00	1	32.00	32.00	66.56	0.03	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	1872.00	1	15.00	15.00	28.08	0.01	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	38.48	0.02
Chatham High School	A 125	2080.00	9	128.00	1152.00	2396.16	1.15	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Chatham High School	A 124	2080.00	9	128.00	1152.00	2396.16	1.15	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Chatham High School	A 127	2080.00	9	128.00	1152.00	2396.16	1.15	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Chatham High School	A 126	2080.00	9	128.00	1152.00	2396.16	1.15	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Chatham High School	A 128	2080.00	9	128.00	1152.00	2396.16	1.15	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Chatham High School	A 129	2080.00	15	128.00	1920.00	3993.60	1.92	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	60	15.00	900.00	1684.80	0.90	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2308.80	1.02
Chatham High School	ext entry	4380.00	1	295.00	295.00	1292.10	0.30	METAL HALIDE, 1-250 WATT LAMP	4380.00	1	62.00	62.00	271.56	0.06	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	1020.54	0.23
Chatham High School	ext road/pkg lights	4380.00	14	295.00	4130.00	18089.40	4.13	HIGH PRESSURE SODIUM, 1-250 WATT LAMP	4380.00	14	78.00	1092.00	4782.96	1.09	AREA LIGHT POST TOP 78W COOL LED TYPE V CLEAR LENS BZ - DLC LISTED	13306.44	3.04
Chatham High School	Doors: 3,26,27	4380.00	4	60.00	240.00	1051.20	0.24	A LAMP 60 WATT INCANDESCENT	4380.00	4	18.00	72.00	315.36	0.07	CREE 100W EQUIVALENT BULB DIMMABLE	735.84	0.17
Chatham High School	maintenance entry	4380.00	2	295.00	590.00	2584.20	0.59	METAL HALIDE, 1-250 WATT LAMP	4380.00	2	62.00	124.00	543.12	0.12	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	2041.08	0.47
Chatham High School	door 24	4380.00	2	295.00	590.00	2584.20	0.59	METAL HALIDE, 1-250 WATT LAMP	4380.00	2	62.00	124.00	543.12	0.12	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	2041.08	0.47
Chatham High School	door 22	4380.00	1	295.00	295.00	1292.10	0.30	METAL HALIDE, 1-250 WATT LAMP	4380.00	1	62.00	62.00	271.56	0.06	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	1020.54	0.23
Chatham High School	door 20 area	4380.00	8	190.00	1520.00	6657.60	1.52	METAL HALIDE, 1-150 WATT LAMP	4380.00	8	26.00	208.00	911.04	0.21	SLIM 26W COOL LED 120V TO 277V WALLMOUNT BRONZE - DLC LISTED	5746.56	1.31
Chatham High School	A 130	2080.00	9	128.00	1152.00	2396.16	1.15	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Chatham High School	A131	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Chatham High School	A 132	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Chatham High School	A 133	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Chatham High School	A134	2080.00	18	64.00	1152.00	2396.16	1.15	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Chatham High School	A134	2080.00	3	96.00	288.00	599.04	0.29	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	9	15.00	135.00	252.72	0.13	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	346.32	0.15
Chatham High School	A134 em	2080.00	1	96.00	96.00	199.68	0.10	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	3	22.00	66.00	123.55	0.07	4 FOOT 22W NWM BALLAST READY LED TUBE	76.13	0.03
Chatham High School	library office	2080.00	5	96.00	480.00	998.40	0.48	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	15	15.00	225.00	421.20	0.22	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	577.20	0.26
Chatham High School	library office em	2080.00	1	96.00	96.00	199.68	0.10	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	3	22.00	66.00	123.55	0.07	4 FOOT 22W NWM BALLAST READY LED TUBE	76.13	0.03
Chatham High School	library	2080.00	52	132.00	6864.00	14277.12	6.86	2' 4-F40T8, BIAX ELECTRONIC BALLAST -	1872.00	52	35.00	1820.00	3407.04	1.82	ZR22, 35 WATT, 3200LM, 4000K, 0-10V DIMMING	10870.08	5.04
Chatham High School	library em	2080.00	13	132.00	1716.00	3569.28	1.72	2' 4-F40T8, BIAX ELECTRONIC BALLAST -	1872.00	13	35.00	455.00	851.76	0.45	ZR22, 35 WATT, 3200LM, 4000K, 0-10V DIMMING , EMERGENCY	2717.52	1.26
Chatham High School	library	2080.00	113	96.00	10848.00	22563.84	10.85	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	339	15.00	5085.00	9519.12	5.08	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	13044.72	5.76
Chatham High School	library em	2080.00	14	96.00	1344.00	2795.52	1.34	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	42	22.00	924.00	1729.73	0.92	4 FOOT 22W NWM BALLAST READY LED TUBE	1065.79	0.42
Chatham High School	library	2080.00	34	36.00	1224.00	2545.92	1.22	2 - 18 WATT QUAD-PIN CFL	1872.00	68	15.00	1020.00	1909.44	1.02	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	636.48	0.20
Chatham High School	library st	520.00	20	60.00	1200.00	624.00	1.20	4' FIXTURE, 2-F34/T12 LAMPS, ELECTRONIC BALLAST	520.00	40	15.00	600.00	312.00	0.60	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	312.00	0.60
Chatham High School	library st	520.00	1	32.00	32.00	16.64	0.03	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	520.00	1	15.00	15.00	7.80	0.01	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	8.84	0.02
Chatham High School	library st	520.00	2	60.00	120.00	62.40	0.12	A LAMP 60 WATT INCANDESCENT	520.00	2	18.00	36.00	18.72	0.04	CREE 100W EQUIVALENT BULB DIMMABLE	43.68	0.08
Chatham High School	library server rm	520.00	2	64.00	128.00	66.56	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	4	15.00	60.00	31.20	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	35.36	0.07
Chatham High School	library office	2080.00	6	96.00	576.00	1198.08	0.58	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	18	15.00	270.00	505.44	0.27	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	692.64	0.31
Chatham High School	library office em	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	22.00	132.00	247.10	0.13	4 FOOT 22W NWM BALLAST READY LED TUBE	152.26	0.06

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Chatham High School	library display	2080.00	4	32.00	128.00	266.24	0.13	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham High School	A faculty BR's	2080.00	4	60.00	240.00	499.20	0.24	A LAMP 60 WATT INCANDESCENT	2080.00	4	18.00	72.00	149.76	0.07	CREE 100W EQUIVALENT BULB DIMMABLE	349.44	0.17
Chatham High School	A faculty lounge	2080.00	18	64.00	1152.00	2396.16	1.15	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Chatham High School	boys locker	2080.00	24	64.00	1536.00	3194.88	1.54	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Chatham High School	hockey equip st	520.00	5	60.00	300.00	156.00	0.30	A LAMP 60 WATT INCANDESCENT	520.00	5	18.00	90.00	46.80	0.09	CREE 100W EQUIVALENT BULB DIMMABLE	109.20	0.21
Chatham High School	locker st's	520.00	4	60.00	240.00	124.80	0.24	A LAMP 60 WATT INCANDESCENT	520.00	4	18.00	72.00	37.44	0.07	CREE 100W EQUIVALENT BULB DIMMABLE	87.36	0.17
Chatham High School	locker cust cl	520.00	1	60.00	60.00	31.20	0.06	A LAMP 60 WATT INCANDESCENT	520.00	1	18.00	18.00	9.36	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	21.84	0.04
Chatham High School	boys lounge	2080.00	6	64.00	384.00	798.72	0.38	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	boys locker br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Chatham High School	boys gym office	2080.00	7	64.00	448.00	931.84	0.45	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	14	15.00	210.00	393.12	0.21	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	538.72	0.24
Chatham High School	fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	7	0.00	0.00	0.00	0.00	4FT 2 LAMP INDUSTRIAL HOOD	0.00	0.00
Chatham High School	boys gym office br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Chatham High School	health office	2080.00	13	64.00	832.00	1730.56	0.83	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	26	15.00	390.00	730.08	0.39	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1000.48	0.44
Chatham High School	Lattarolo office	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	4	15.00	60.00	112.32	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	153.92	0.07
Chatham High School	health st	520.00	1	64.00	64.00	33.28	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	2	15.00	30.00	15.60	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	17.68	0.03
Chatham High School	health br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham High School	mens br	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Chatham High School	cust cl	520.00	1	60.00	60.00	31.20	0.06	A LAMP 60 WATT INCANDESCENT	520.00	1	18.00	18.00	9.36	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	21.84	0.04
Chatham High School	girls br	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Chatham High School	storage	520.00	1	64.00	64.00	33.28	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	2	15.00	30.00	15.60	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	17.68	0.03
Chatham High School	A hall side	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham High School	A hall side em	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	22.00	88.00	183.04	0.09	4 FOOT 22W NWM BALLAST READY LED TUBE	83.20	0.04
Chatham High School	A conf rm	2080.00	8	128.00	1024.00	2129.92	1.02	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	32	15.00	480.00	898.56	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1231.36	0.54
Chatham High School	A 104	2080.00	14	128.00	1792.00	3727.36	1.79	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	56	15.00	840.00	1572.48	0.84	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2154.88	0.95
Chatham High School	A 106	2080.00	9	128.00	1152.00	2396.16	1.15	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Chatham High School	A 106	2080.00	3	64.00	192.00	399.36	0.19	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	1872.00	9	12.00	108.00	202.18	0.11	2 FOOT 12W NWM BALLAST READY LED TUBE	197.18	0.08
Chatham High School	A 106 kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	3	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Chatham High School	A 108	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Chatham High School	A 107	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Chatham High School	A 109	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Chatham High School	A 110	2080.00	12	64.00	768.00	1597.44	0.77	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	24	15.00	360.00	673.92	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	923.52	0.41
Chatham High School	A 111	2080.00	4	128.00	512.00	1064.96	0.51	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	16	15.00	240.00	449.28	0.24	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	615.68	0.27
Chatham High School	A 110A	2080.00	4	64.00	256.00	532.48	0.26	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	8	15.00	120.00	224.64	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.14
Chatham High School	B st	520.00	1	64.00	64.00	33.28	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	2	15.00	30.00	15.60	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	17.68	0.03
Chatham High School	girls locker	2080.00	27	64.00	1728.00	3594.24	1.73	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	54	15.00	810.00	1516.32	0.81	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2077.92	0.92
Chatham High School	girlsl locker st's	520.00	2	60.00	120.00	62.40	0.12	A LAMP 60 WATT INCANDESCENT	520.00	2	18.00	36.00	18.72	0.04	CREE 100W EQUIVALENT BULB DIMMABLE	43.68	0.08
Chatham High School	girls locker cust st	520.00	1	60.00	60.00	31.20	0.06	A LAMP 60 WATT INCANDESCENT	520.00	1	18.00	18.00	9.36	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	21.84	0.04
Chatham High School	girls locker office	2080.00	6	64.00	384.00	798.72	0.38	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Chatham High School	girls locker office	2080.00	2	60.00	120.00	249.60	0.12	A LAMP 60 WATT INCANDESCENT	2080.00	2	18.00	36.00	74.88	0.04	CREE 100W EQUIVALENT BULB DIMMABLE	174.72	0.08
Chatham High School	1L sockets	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	54	0.00	0.00	0.00	0.00	NON-SHUNTED SOCKET, 600V, 660W	0.00	0.00
Chatham High School	2 L Harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	520	0.00	0.00	0.00	0.00	2 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Chatham High School	3 L Harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	763	0.00	0.00	0.00	0.00	3 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Chatham High School	4L Harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	717	0.00	0.00	0.00	0.00	4 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Chatham High School	Closet stock	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	100	15.00	1500.00	6570.00	1.50	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	-6570.00	-1.50
Chatham High School	closet stock	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	5	22.00	110.00	481.80	0.11	4 FOOT 22W NWM BALLAST READY LED TUBE	-481.80	-0.11
Chatham High School	closet stock	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	5	9.00	45.00	197.10	0.04	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	-197.10	-0.04
Chatham High School	exit signs	4380.00	67	26.00	1742.00	7629.96	1.74	2 - 13 WATT BI PIN FLUORESCENT FIXTURE WITH ELECTRONIC BALLAST	4380.00	67	1.31	87.77	384.43	0.09	COOPER SURELITE LED THERMOPLASTIC EXIT SIGN WITH BATTERY BACKUP (RED LETTERS)	7245.53	1.65
Chatham High School	bays	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	34	0.00	0.00	0.00	0.00	CREE ALUMINUM REFLECTOR 16"	0.00	0.00
Chatham High School	exterior	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	28	0.00	0.00	0.00	0.00	PENCIL PHOTOCEL 120V	0.00	0.00

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Chatham Middle School	main office	2080.00	12	64.00	768.00	1597.44	0.77	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	24	15.00	360.00	748.80	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	848.64	0.41
Chatham Middle School	main office kitchen	2080.00	5	64.00	320.00	665.60	0.32	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	10	15.00	150.00	312.00	0.15	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	353.60	0.17
Chatham Middle School	main office copy rm115	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Chatham Middle School	main office copy rm 115	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham Middle School	prinicipal	2080.00	6	64.00	384.00	798.72	0.38	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	12	15.00	180.00	374.40	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	424.32	0.20
Chatham Middle School	princ br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham Middle School	princ br	2080.00	1	32.00	32.00	66.56	0.03	CIRCLE FIXTURE 32 WATT T8 FLUORESCENT	2080.00	3	9.50	28.50	59.28	0.03	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	7.28	0.00
Chatham Middle School	princ br fixture	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	13" SURFACE MOUNT FIXTURE WITH 3 A-LAMP SOCKETS	0.00	0.00
Chatham Middle School	assist princ	2080.00	5	64.00	320.00	665.60	0.32	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	10	15.00	150.00	312.00	0.15	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	353.60	0.17
Chatham Middle School	main office closet	2080.00	1	60.00	60.00	124.80	0.06	A LAMP 60 WATT INCANDESCENT	2080.00	1	9.50	9.50	19.76	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	105.04	0.05
Chatham Middle School	113	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham Middle School	100	2080.00	6	96.00	576.00	1198.08	0.58	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	18	15.00	270.00	561.60	0.27	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	636.48	0.31
Chatham Middle School	118	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	48	15.00	720.00	1497.60	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1697.28	0.82
Chatham Middle School	119/120	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	48	15.00	720.00	1497.60	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1697.28	0.82
Chatham Middle School	media center	2080.00	26	96.00	2496.00	5191.68	2.50	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	2080.00	104	9.00	936.00	1946.88	0.94	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	3244.80	1.56
Chatham Middle School	media center kits	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	26	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00
Chatham Middle School	media center hall	2080.00	4	99.00	396.00	823.68	0.40	2' 3-F40T8, BIAX ELECTRONIC BALLAST	2080.00	4	35.00	140.00	291.20	0.14	ZR22, 35 WATT, 3200LM, 4000K, 0-10V DIMMING	532.48	0.26
Chatham Middle School	media hall displays	2080.00	4	64.00	256.00	532.48	0.26	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Chatham Middle School	media center	2080.00	41	36.00	1476.00	3070.08	1.48	2 - 18 WATT QUAD-PIN CFL	2080.00	82	15.00	1230.00	2558.40	1.23	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	511.68	0.25
Chatham Middle School	media center	2080.00	36	96.00	3456.00	7188.48	3.46	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	108	15.00	1620.00	3369.60	1.62	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	3818.88	1.84
Chatham Middle School	hall to 118	2080.00	4	36.00	144.00	299.52	0.14	2 - 18 WATT QUAD-PIN CFL	2080.00	8	15.00	120.00	249.60	0.12	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	49.92	0.02
Chatham Middle School	hall 1st fl	2080.00	23	128.00	2944.00	6123.52	2.94	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	92	15.00	1380.00	2870.40	1.38	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	3253.12	1.56
Chatham Middle School	art music wing hall 1st fl	2080.00	28	64.00	1792.00	3727.36	1.79	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	56	15.00	840.00	1747.20	0.84	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1980.16	0.95
Chatham Middle School	auditorium hall	2080.00	12	120.00	1440.00	2995.20	1.44	2' FIXTURE, 6-F20/T12-20 WATT LAMPS, ELECTRONIC BALLAST	2080.00	72	9.00	648.00	1347.84	0.65	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	1647.36	0.79
Chatham Middle School	auditoirum	2080.00	54	300.00	16200.00	33696.00	16.20	A LAMP 300 W INCANDESCENT	2080.00	54	19.00	1026.00	2134.08	1.03	PAR38, E26 BASE, 19 WATT, 120V 40°, 2700K, DIMMABLE - ENERGY STAR	31561.92	15.17
Chatham Middle School	aud exit areas	2080.00	2	60.00	120.00	249.60	0.12	A LAMP 60 WATT INCANDESCENT	2080.00	4	9.50	38.00	79.04	0.04	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	170.56	0.08
Chatham Middle School	stage	2080.00	10	96.00	960.00	1996.80	0.96	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	30	15.00	450.00	936.00	0.45	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1060.80	0.51
Chatham Middle School	stage	2080.00	4	300.00	1200.00	2496.00	1.20	A LAMP 300 W INCANDESCENT	2080.00	4	19.00	76.00	158.08	0.08	PAR38, E26 BASE, 19 WATT, 120V 40°, 2700K, DIMMABLE - ENERGY STAR	2337.92	1.12
Chatham Middle School	band rm	2080.00	38	64.00	2432.00	5058.56	2.43	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	72	15.00	1080.00	2246.40	1.08	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2812.16	1.35
Chatham Middle School	mens fac br	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham Middle School	j6 st	2080.00	1	60.00	60.00	124.80	0.06	A LAMP 60 WATT INCANDESCENT	2080.00	1	9.50	9.50	19.76	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	105.04	0.05
Chatham Middle School	womens fac br	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	6	15.00	90.00	187.20	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	212.16	0.10
Chatham Middle School	band rm hall	2080.00	6	64.00	384.00	798.72	0.38	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	12	15.00	180.00	374.40	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	424.32	0.20
Chatham Middle School	153	2080.00	15	128.00	1920.00	3993.60	1.92	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	60	15.00	900.00	1872.00	0.90	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2121.60	1.02
Chatham Middle School	153 st	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham Middle School	155 st	2080.00	1	100.00	100.00	208.00	0.10	A LAMP 100 WATT INCANDESCENT	2080.00	1	18.00	18.00	37.44	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	170.56	0.08
Chatham Middle School	152	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	48	15.00	720.00	1497.60	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1697.28	0.82
Chatham Middle School	151	2080.00	6	64.00	384.00	798.72	0.38	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	12	15.00	180.00	374.40	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	424.32	0.20
Chatham Middle School	149	2080.00	1	32.00	32.00	66.56	0.03	1- 32 WATT 4 PIN/PL-T-32W/41/4P	2080.00	1	15.00	15.00	31.20	0.01	HELEN LAMP, VERTICAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	35.36	0.02
Chatham Middle School	149	2080.00	10	96.00	960.00	1996.80	0.96	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	30	15.00	450.00	936.00	0.45	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1060.80	0.51
Chatham Middle School	148	2080.00	1	32.00	32.00	66.56	0.03	1- 32 WATT 4 PIN/PL-T-32W/41/4P	2080.00	1	15.00	15.00	31.20	0.01	HELEN LAMP, VERTICAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	35.36	0.02
Chatham Middle School	148	2080.00	10	96.00	960.00	1996.80	0.96	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	30	15.00	450.00	936.00	0.45	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1060.80	0.51

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Chatham Middle School	147	2080.00	18	96.00	1728.00	3594.24	1.73	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	54	15.00	810.00	1684.80	0.81	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1909.44	0.92
Chatham Middle School	146	2080.00	4	64.00	256.00	532.48	0.26	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	12	9.00	108.00	224.64	0.11	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.15
Chatham Middle School	146 kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	4	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Chatham Middle School	146	2080.00	8	128.00	1024.00	2129.92	1.02	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	32	15.00	480.00	998.40	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1131.52	0.54
Chatham Middle School	141 art	2080.00	14	128.00	1792.00	3727.36	1.79	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	56	15.00	840.00	1747.20	0.84	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1980.16	0.95
Chatham Middle School	141 art cl	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	6	15.00	90.00	187.20	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	212.16	0.10
Chatham Middle School	144	2080.00	1	75.00	75.00	156.00	0.08	BR 40 75 WATT INCANDESCENT	2080.00	1	17.00	17.00	35.36	0.02	BR40, E26 BASE, 17 WATT, 120V, 3000K, DIMMABLE - ENERGY STAR	120.64	0.06
Chatham Middle School	143	2080.00	2	173.00	346.00	719.68	0.35	8' FIXTURE, 2-F96/T12/ 75 WATT LAMPS, STANDARD MAGNETIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	470.08	0.23
Chatham Middle School	143 fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	2	0.00	0.00	0.00	0.00	4FT WRAP AROUND 4 LAMP	0.00	0.00
Chatham Middle School	138	2080.00	3	96.00	288.00	599.04	0.29	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	9	15.00	135.00	280.80	0.13	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	318.24	0.15
Chatham Middle School	136	2080.00	11	128.00	1408.00	2928.64	1.41	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	44	15.00	660.00	1372.80	0.66	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1555.84	0.75
Chatham Middle School	136	2080.00	1	64.00	64.00	133.12	0.06	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	3	9.00	27.00	56.16	0.03	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.04
Chatham Middle School	136	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Chatham Middle School	136 office	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham Middle School	136 st	2080.00	1	100.00	100.00	208.00	0.10	A LAMP 100 WATT INCANDESCENT	2080.00	1	18.00	18.00	37.44	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	170.56	0.08
Chatham Middle School	134	2080.00	24	64.00	1536.00	3194.88	1.54	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	48	15.00	720.00	1497.60	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1697.28	0.82
Chatham Middle School	132	2080.00	9	128.00	1152.00	2396.16	1.15	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham Middle School	131	2080.00	6	128.00	768.00	1597.44	0.77	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	24	15.00	360.00	748.80	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	848.64	0.41
Chatham Middle School	131	2080.00	3	64.00	192.00	399.36	0.19	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	9	9.00	81.00	168.48	0.08	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.11
Chatham Middle School	131 kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	3	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Chatham Middle School	160's hall	2080.00	14	64.00	896.00	1863.68	0.90	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	28	15.00	420.00	873.60	0.42	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	990.08	0.48
Chatham Middle School	166	2080.00	9	96.00	864.00	1797.12	0.86	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	27	15.00	405.00	842.40	0.40	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	954.72	0.46
Chatham Middle School	164	2080.00	9	96.00	864.00	1797.12	0.86	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	27	15.00	405.00	842.40	0.40	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	954.72	0.46
Chatham Middle School	167	2080.00	9	96.00	864.00	1797.12	0.86	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	27	15.00	405.00	842.40	0.40	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	954.72	0.46
Chatham Middle School	165	2080.00	9	96.00	864.00	1797.12	0.86	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	27	15.00	405.00	842.40	0.40	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	954.72	0.46
Chatham Middle School	163	2080.00	9	96.00	864.00	1797.12	0.86	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	27	15.00	405.00	842.40	0.40	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	954.72	0.46
Chatham Middle School	162	2080.00	9	96.00	864.00	1797.12	0.86	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	27	15.00	405.00	842.40	0.40	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	954.72	0.46
Chatham Middle School	161	2080.00	9	96.00	864.00	1797.12	0.86	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	27	15.00	405.00	842.40	0.40	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	954.72	0.46
Chatham Middle School	160	2080.00	9	96.00	864.00	1797.12	0.86	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	27	15.00	405.00	842.40	0.40	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	954.72	0.46
Chatham Middle School	160 men br	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham Middle School	160 men br	2080.00	1	64.00	64.00	133.12	0.06	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	3	9.00	27.00	56.16	0.03	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.04
Chatham Middle School	160 men br kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Chatham Middle School	160st	2080.00	1	56.00	56.00	116.48	0.06	2' FIXTURE, 2-F20/T12/STD LAMPS, STANDARD MAGNETIC BALLAST	2080.00	2	9.00	18.00	37.44	0.02	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	79.04	0.04
Chatham Middle School	160 women br	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham Middle School	160 womens br	2080.00	1	64.00	64.00	133.12	0.06	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	3	9.00	27.00	56.16	0.03	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.04
Chatham Middle School	160 women br kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Chatham Middle School	160 roof access	2080.00	1	56.00	56.00	116.48	0.06	2' FIXTURE, 2-F20/T12/STD LAMPS, STANDARD MAGNETIC BALLAST	2080.00	2	9.00	18.00	37.44	0.02	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	79.04	0.04
Chatham Middle School	130	2080.00	4	128.00	512.00	1064.96	0.51	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	16	15.00	240.00	499.20	0.24	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	565.76	0.27
Chatham Middle School	129	2080.00	9	128.00	1152.00	2396.16	1.15	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham Middle School	128	2080.00	6	128.00	768.00	1597.44	0.77	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	24	15.00	360.00	748.80	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	848.64	0.41
Chatham Middle School	128	2080.00	3	64.00	192.00	399.36	0.19	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	9	9.00	81.00	168.48	0.08	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.11
Chatham Middle School	128 kit	2080.00	0	0.00	0.00	0.00	0.00	0 - N/A	2080.00	3	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Chatham Middle School	127	2080.00	9	128.00	1152.00	2396.16	1.15	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Chatham Middle School	126	2080.00	8	128.00	1024.00	2129.92	1.02	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	32	15.00	480.00	998.40	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1131.52	0.54
Chatham Middle School	126	2080.00	1	64.00	64.00	133.12	0.06	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	3	9.00	27.00	56.16	0.03	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.04
Chatham Middle School	126 kit	2080.00	0	0.00	0.00	0.00	0.00	0 - N/A	2080.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Chatham Middle School	125	2080.00	6	96.00	576.00	1198.08	0.58	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	18	15.00	270.00	561.60	0.27	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	636.48	0.31
Chatham Middle School	1st fl girls br	2080.00	3	96.00	288.00	599.04	0.29	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	9	15.00	135.00	280.80	0.13	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	318.24	0.15
Chatham Middle School	123 cust closet	2080.00	1	100.00	100.00	208.00	0.10	A LAMP 100 WATT INCANDESCENT	2080.00	1	18.00	18.00	37.44	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	170.56	0.08
Chatham Middle School	1st fl boys br	2080.00	3	96.00	288.00	599.04	0.29	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	9	15.00	135.00	280.80	0.13	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	318.24	0.15
Chatham Middle School	170's hall	2080.00	12	64.00	768.00	1597.44	0.77	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	24	15.00	360.00	748.80	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	848.64	0.41
Chatham Middle School	170's hall em	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	22.00	44.00	91.52	0.04	4 FOOT 22W NWM BALLAST READY LED TUBE	41.60	0.02
Chatham Middle School	177	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham Middle School	177 server rm	2080.00	1	96.00	96.00	199.68	0.10	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	3	15.00	45.00	93.60	0.04	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	106.08	0.05
Chatham Middle School	176	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham Middle School	174	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham Middle School	175	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham Middle School	173	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham Middle School	171	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham Middle School	172	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham Middle School	170	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham Middle School	121	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham Middle School	1 st fl hall	2080.00	25	64.00	1600.00	3328.00	1.60	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	50	15.00	750.00	1560.00	0.75	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1768.00	0.85
Chatham Middle School	1st fl hall display	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham Middle School	gym entry	2080.00	2	100.00	200.00	416.00	0.20	A LAMP 100 WATT INCANDESCENT	2080.00	2	18.00	36.00	74.88	0.04	CREE 100W EQUIVALENT BULB DIMMABLE	341.12	0.16
Chatham Middle School	GYM	2080.00	24	432.00	10368.00	21565.44	10.37	4' FIXTURE. 8-F54/T5/HO-54 WATT, ELECTRONIC BALLAST	2080.00	192	18.00	3456.00	7188.48	3.46	G3 HP 4 FOOT 18W 5000K CLEAR LENS SEP LED TUBE - DLC LISTED	14376.96	6.91
Chatham Middle School	GYM fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	24	0.00	0.00	0.00	0.00	8 LAMP OPEN HIGH BAY WITH LOCKING SOCKETS	0.00	0.00
Chatham Middle School	gym	2080.00	8	252.00	2016.00	4193.28	2.02	PL HIGH BAY 6-42 WATT CFL AT 252 WATTS	2080.00	8	160.00	1280.00	2662.40	1.28	HH HIGHBAY,160W,18,000 LM,40K,120-277V, 0-10V DIMMING,15 AMP 120V TWIST LOCK PLUG (REFLECTOR NOT INCLUDED)	1530.88	0.74
Chatham Middle School	cicarelli office	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham Middle School	cicarelli br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham Middle School	boys locker	2080.00	23	64.00	1472.00	3061.76	1.47	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	46	15.00	690.00	1435.20	0.69	G3 SP 4 FOOT 15W DW MILKY LENS SEP LED TUBE - DLC LISTED	1626.56	0.78
Chatham Middle School	boys locker closet	2080.00	1	100.00	100.00	208.00	0.10	A LAMP 100 WATT INCANDESCENT	2080.00	1	18.00	18.00	37.44	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	170.56	0.08
Chatham Middle School	gym st	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham Middle School	gym entry stairs 1	2080.00	6	108.00	648.00	1347.84	0.65	2'-3 LAMP/PL/36 WATT CFL	2080.00	6	35.00	210.00	436.80	0.21	ZR22, 35 WATT, 3200LM, 4000K, 0-10V DIMMING	911.04	0.44
Chatham Middle School	lower hall	2080.00	36	108.00	3888.00	8087.04	3.89	2'-3 LAMP/PL/36 WATT CFL	2080.00	36	35.00	1260.00	2620.80	1.26	ZR22, 35 WATT, 3200LM, 4000K, 0-10V DIMMING	5466.24	2.63
Chatham Middle School	lower stair 4	2080.00	6	108.00	648.00	1347.84	0.65	2'-3 LAMP/PL/36 WATT CFL	2080.00	6	35.00	210.00	436.80	0.21	ZR22, 35 WATT, 3200LM, 4000K, 0-10V DIMMING	911.04	0.44
Chatham Middle School	lower elev machine rm em	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	22.00	44.00	91.52	0.04	4 FOOT 22W NWM BALLAST READY LED TUBE	41.60	0.02
Chatham Middle School	lower elev closet em	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	22.00	44.00	91.52	0.04	4 FOOT 22W NWM BALLAST READY LED TUBE	41.60	0.02
Chatham Middle School	lower cust cl	2080.00	1	128.00	128.00	266.24	0.13	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham Middle School	lower stair 2	2080.00	6	99.00	594.00	1235.52	0.59	2' 3-F40T8, BIAX ELECTRONIC BALLAST	2080.00	6	35.00	210.00	436.80	0.21	ZR22, 35 WATT, 3200LM, 4000K, 0-10V DIMMING	798.72	0.38
Chatham Middle School	c gym	2080.00	16	252.00	4032.00	8386.56	4.03	PL HIGH BAY 6-42 WATT CFL AT 252 WATTS	2080.00	16	160.00	2560.00	5324.80	2.56	HH HIGHBAY,160W,18,000 LM,40K,120-277V, 0-10V DIMMING,15 AMP 120V TWIST LOCK PLUG (REFLECTOR NOT INCLUDED)	3061.76	1.47
Chatham Middle School	c girls locker	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W DW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham Middle School	c girls locker	2080.00	7	96.00	672.00	1397.76	0.67	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	21	15.00	315.00	655.20	0.31	G3 SP 4 FOOT 15W DW MILKY LENS SEP LED TUBE - DLC LISTED	742.56	0.36
Chatham Middle School	c girls locker em	2080.00	1	96.00	96.00	199.68	0.10	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	3	22.00	66.00	137.28	0.07	4 FOOT 22W DWM BALLAST READY LED TUBE	62.40	0.03
Chatham Middle School	coach bray office	2080.00	4	96.00	384.00	798.72	0.38	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	2080.00	16	9.00	144.00	299.52	0.14	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	499.20	0.24

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Chatham Middle School	coach bray kit	2080.00	0	0.00	0.00	0.00	0.00	0 - N/A	2080.00	4	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00
Chatham Middle School	c boys locker	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Chatham Middle School	c girls locker	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	1	15.00	15.00	31.20	0.01	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	43.68	0.02
Chatham Middle School	c boys lcoker	2080.00	8	96.00	768.00	1597.44	0.77	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	24	15.00	360.00	748.80	0.36	G3 SP 4 FOOT 15W DW MILKY LENS SEP LED TUBE - DLC LISTED	848.64	0.41
Chatham Middle School	c boys locker em	2080.00	1	96.00	96.00	199.68	0.10	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	3	22.00	66.00	137.28	0.07	4 FOOT 22W DWM BALLAST READY LED TUBE	62.40	0.03
Chatham Middle School	c phys ed office boys locker	2080.00	4	96.00	384.00	798.72	0.38	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	2080.00	16	9.00	144.00	299.52	0.14	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	499.20	0.24
Chatham Middle School	c phys ed office boys kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	4	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00
Chatham Middle School	lower st	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham Middle School	lower mech st	2080.00	5	64.00	320.00	665.60	0.32	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	10	15.00	150.00	312.00	0.15	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	353.60	0.17
Chatham Middle School	lower team locker	2080.00	5	128.00	640.00	1331.20	0.64	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	20	15.00	300.00	624.00	0.30	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	707.20	0.34
Chatham Middle School	lower team locker	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham Middle School	coach ullmeyer	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham Middle School	ullmeyer br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham Middle School	girls locker	2080.00	21	64.00	1344.00	2795.52	1.34	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	42	15.00	630.00	1310.40	0.63	G3 SP 4 FOOT 15W DW MILKY LENS SEP LED TUBE - DLC LISTED	1485.12	0.71
Chatham Middle School	girls cust cl	2080.00	1	60.00	60.00	124.80	0.06	A LAMP 60 WATT INCANDESCENT	2080.00	1	18.00	18.00	37.44	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	87.36	0.04
Chatham Middle School	fac br mens 1st fl	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	12	15.00	180.00	374.40	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	424.32	0.20
Chatham Middle School	pay phone 1st fl	2080.00	1	60.00	60.00	124.80	0.06	A LAMP 60 WATT INCANDESCENT	2080.00	1	9.50	9.50	19.76	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	105.04	0.05
Chatham Middle School	103 cl	2080.00	1	60.00	60.00	124.80	0.06	A LAMP 60 WATT INCANDESCENT	2080.00	1	9.50	9.50	19.76	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	105.04	0.05
Chatham Middle School	fac br womens 1st fl	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	12	15.00	180.00	374.40	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	424.32	0.20
Chatham Middle School	106	2080.00	4	96.00	384.00	798.72	0.38	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	2080.00	16	9.00	144.00	299.52	0.14	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	499.20	0.24
Chatham Middle School	106 kit	2080.00	0	0.00	0.00	0.00	0.00	0 - N/A	2080.00	4	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00
Chatham Middle School	106b	2080.00	5	96.00	480.00	998.40	0.48	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	15	15.00	225.00	468.00	0.22	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	530.40	0.26
Chatham Middle School	106a	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	6	15.00	90.00	187.20	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	212.16	0.10
Chatham Middle School	admin trebour	2080.00	8	96.00	768.00	1597.44	0.77	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	2080.00	32	9.00	288.00	599.04	0.29	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	998.40	0.48
Chatham Middle School	admin trebour kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	8	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00
Chatham Middle School	admin br	2080.00	1	128.00	128.00	266.24	0.13	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham Middle School	106	2080.00	7	128.00	896.00	1863.68	0.90	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	28	15.00	420.00	873.60	0.42	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	990.08	0.48
Chatham Middle School	106 br	2080.00	1	74.00	74.00	153.92	0.07	*2' FIXTURE, 4-F17/T8/STD LAMPS, ELECTRONIC BALLAST	2080.00	4	9.00	36.00	74.88	0.04	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	79.04	0.04
Chatham Middle School	106 waiting	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham Middle School	guidance	2080.00	11	64.00	704.00	1464.32	0.70	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	22	15.00	330.00	686.40	0.33	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	777.92	0.37
Chatham Middle School	dicarlo office	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham Middle School	montifiore office	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham Middle School	soder office	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham Middle School	kashetta office	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham Middle School	cafeteria stairs	2080.00	4	128.00	512.00	1064.96	0.51	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	16	15.00	240.00	499.20	0.24	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	565.76	0.27
Chatham Middle School	cafeteria	2080.00	18	128.00	2304.00	4792.32	2.30	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	72	15.00	1080.00	2246.40	1.08	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2545.92	1.22
Chatham Middle School	cafeteria	2080.00	20	96.00	1920.00	3993.60	1.92	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	60	15.00	900.00	1872.00	0.90	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2121.60	1.02
Chatham Middle School	cafeteria	2080.00	15	96.00	1440.00	2995.20	1.44	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	45	15.00	675.00	1404.00	0.67	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1591.20	0.77
Chatham Middle School	kitchen	2080.00	37	64.00	2368.00	4925.44	2.37	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	74	15.00	1110.00	2308.80	1.11	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2616.64	1.26
Chatham Middle School	kitchen office	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham Middle School	kitchen st	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Chatham Middle School	boiler hall	2080.00	5	64.00	320.00	665.60	0.32	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	10	15.00	150.00	312.00	0.15	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	353.60	0.17

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Chatham Middle School	boiler rm	2080.00	8	300.00	2400.00	4992.00	2.40	A LAMP 300 W INCANDESCENT	2080.00	8	17.00	136.00	282.88	0.14	BR40, E26 BASE, 17 WATT, 120V, 3000K, DIMMABLE - ENERGY STAR	4709.12	2.26
Chatham Middle School	boiler rm	2080.00	4	60.00	240.00	499.20	0.24	A LAMP 60 WATT INCANDESCENT	2080.00	4	18.00	72.00	149.76	0.07	CREE 100W EQUIVALENT BULB DIMMABLE	349.44	0.17
Chatham Middle School	leon office	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham Middle School	leon office	2080.00	1	60.00	60.00	124.80	0.06	A LAMP 60 WATT INCANDESCENT	2080.00	1	9.50	9.50	19.76	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	105.04	0.05
Chatham Middle School	st near leon office	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham Middle School	j3 closet	2080.00	1	32.00	32.00	66.56	0.03	1 - 32 WATT CFL	2080.00	1	18.00	18.00	37.44	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	29.12	0.01
Chatham Middle School	br near leon office	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham Middle School	st near leon office	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham Middle School	women br boiler hall	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Chatham Middle School	201 hall	2080.00	4	99.00	396.00	823.68	0.40	2' 3-F40T8, BIAX ELECTRONIC BALLAST	2080.00	4	35.00	140.00	291.20	0.14	ZR22, 35 WATT, 3200LM, 4000K, 0-10V DIMMING	532.48	0.26
Chatham Middle School	201 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Chatham Middle School	201	2080.00	8	96.00	768.00	1597.44	0.77	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	24	15.00	360.00	748.80	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	848.64	0.41
Chatham Middle School	203	2080.00	9	96.00	864.00	1797.12	0.86	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	27	15.00	405.00	842.40	0.40	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	954.72	0.46
Chatham Middle School	car 2 elev	2080.00	6	32.00	192.00	399.36	0.19	1 - 32 WATT CFL	2080.00	6	9.50	57.00	118.56	0.06	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	280.80	0.14
Chatham Middle School	2nd fl hall	2080.00	8	99.00	792.00	1647.36	0.79	2' 3-F40T8, BIAX ELECTRONIC BALLAST	2080.00	8	35.00	280.00	582.40	0.28	ZR22, 35 WATT, 3200LM, 4000K, 0-10V DIMMING	1064.96	0.51
Chatham Middle School	205 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Chatham Middle School	205	2080.00	8	96.00	768.00	1597.44	0.77	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	24	15.00	360.00	748.80	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	848.64	0.41
Chatham Middle School	207 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Chatham Middle School	207	2080.00	8	96.00	768.00	1597.44	0.77	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	24	15.00	360.00	748.80	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	848.64	0.41
Chatham Middle School	202 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Chatham Middle School	202	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham Middle School	204 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Chatham Middle School	204	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham Middle School	209 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Chatham Middle School	209	2080.00	8	96.00	768.00	1597.44	0.77	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	24	15.00	360.00	748.80	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	848.64	0.41
Chatham Middle School	206 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Chatham Middle School	206	2080.00	16	96.00	1536.00	3194.88	1.54	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	48	15.00	720.00	1497.60	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1697.28	0.82
Chatham Middle School	a v rm	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Chatham Middle School	200	2080.00	6	96.00	576.00	1198.08	0.58	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	18	15.00	270.00	561.60	0.27	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	636.48	0.31
Chatham Middle School	stair 5	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	6	15.00	90.00	187.20	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	212.16	0.10
Chatham Middle School	2nd fl hall	2080.00	25	64.00	1600.00	3328.00	1.60	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	50	15.00	750.00	1560.00	0.75	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1768.00	0.85
Chatham Middle School	2nd fl boys br	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	6	15.00	90.00	187.20	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	212.16	0.10
Chatham Middle School	2nd fl cust cl	2080.00	1	100.00	100.00	208.00	0.10	A LAMP 100 WATT INCANDESCENT	2080.00	1	18.00	18.00	37.44	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	170.56	0.08
Chatham Middle School	2nd fl girls br	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	6	15.00	90.00	187.20	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	212.16	0.10
Chatham Middle School	211	2080.00	9	128.00	1152.00	2396.16	1.15	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham Middle School	213	2080.00	10	128.00	1280.00	2662.40	1.28	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	40	15.00	600.00	1248.00	0.60	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1414.40	0.68
Chatham Middle School	215	2080.00	10	64.00	640.00	1331.20	0.64	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	20	15.00	300.00	624.00	0.30	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	707.20	0.34
Chatham Middle School	217	2080.00	10	64.00	640.00	1331.20	0.64	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	20	15.00	300.00	624.00	0.30	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	707.20	0.34
Chatham Middle School	221	2080.00	8	128.00	1024.00	2129.92	1.02	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	32	15.00	480.00	998.40	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1131.52	0.54
Chatham Middle School	221	2080.00	2	64.00	128.00	266.24	0.13	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	6	9.00	54.00	112.32	0.05	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	153.92	0.07
Chatham Middle School	221 kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	2	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Chatham Middle School	223	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	48	15.00	720.00	1497.60	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1697.28	0.82
Chatham Middle School	2nd fl aud hall	2080.00	5	120.00	600.00	1248.00	0.60	2' FIXTURE, 6-F20/T12-20 WATT LAMPS, ELECTRONIC BALLAST	2080.00	30	9.00	270.00	561.60	0.27	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	686.40	0.33

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Chatham Middle School	222	2080.00	10	64.00	640.00	1331.20	0.64	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	20	15.00	300.00	624.00	0.30	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	707.20	0.34
Chatham Middle School	stair 8	2080.00	5	64.00	320.00	665.60	0.32	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	10	15.00	150.00	312.00	0.15	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	353.60	0.17
Chatham Middle School	2nd fl womens facc br	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Chatham Middle School	219	2080.00	8	64.00	512.00	1064.96	0.51	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	16	15.00	240.00	499.20	0.24	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	565.76	0.27
Chatham Middle School	218	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Chatham Middle School	218 br	4380.00	1	64.00	64.00	280.32	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	4380.00	2	15.00	30.00	131.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	148.92	0.03
Chatham Middle School	216	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	12	15.00	180.00	374.40	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	424.32	0.20
Chatham Middle School	214	2080.00	8	128.00	1024.00	2129.92	1.02	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	32	15.00	480.00	998.40	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1131.52	0.54
Chatham Middle School	214	2080.00	2	64.00	128.00	266.24	0.13	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	6	9.00	54.00	112.32	0.05	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	153.92	0.07
Chatham Middle School	214 kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	2	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Chatham Middle School	212	2080.00	8	128.00	1024.00	2129.92	1.02	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	32	15.00	480.00	998.40	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1131.52	0.54
Chatham Middle School	210	2080.00	9	128.00	1152.00	2396.16	1.15	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham Middle School	208 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Chatham Middle School	208	2080.00	10	96.00	960.00	1996.80	0.96	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	30	15.00	450.00	936.00	0.45	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1060.80	0.51
Chatham Middle School	270's hall	2080.00	2	36.00	72.00	149.76	0.07	2 - 18 WATT QUAD-PIN CFL	2080.00	4	15.00	60.00	124.80	0.06	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	24.96	0.01
Chatham Middle School	270's elec closet	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	6	15.00	90.00	187.20	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	212.16	0.10
Chatham Middle School	276 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Chatham Middle School	276	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham Middle School	274 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Chatham Middle School	274	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham Middle School	275 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Chatham Middle School	275	2080.00	16	96.00	1536.00	3194.88	1.54	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	48	15.00	720.00	1497.60	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1697.28	0.82
Chatham Middle School	273 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Chatham Middle School	273	2080.00	16	96.00	1536.00	3194.88	1.54	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	48	15.00	720.00	1497.60	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1697.28	0.82
Chatham Middle School	271 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Chatham Middle School	271	2080.00	16	96.00	1536.00	3194.88	1.54	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	48	15.00	720.00	1497.60	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1697.28	0.82
Chatham Middle School	272 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Chatham Middle School	272	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham Middle School	270 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Chatham Middle School	270	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Chatham Middle School	ext entry	4380.00	4	60.00	240.00	1051.20	0.24	A LAMP 60 WATT INCANDESCENT	4380.00	4	18.00	72.00	315.36	0.07	CREE 100W EQUIVALENT BULB DIMMABLE	735.84	0.17
Chatham Middle School	ext entry flood	4380.00	1	465.00	465.00	2036.70	0.47	HIGH PRESSURE SODIUM, 1-400 WATT LAMP	4380.00	1	150.00	150.00	657.00	0.15	FLEXFLOOD 150W COOL LED SLIPFITTER BRONZE - DLC LISTED	1379.70	0.32
Chatham Middle School	ext wp	4380.00	25	295.00	7375.00	32302.50	7.38	HIGH PRESSURE SODIUM, 1-250 WATT LAMP	4380.00	25	62.00	1550.00	6789.00	1.55	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	25513.50	5.83
Chatham Middle School	ext pkg lot floods	4380.00	10	465.00	4650.00	20367.00	4.65	HIGH PRESSURE SODIUM, 1-400 WATT LAMP	4380.00	10	150.00	1500.00	6570.00	1.50	FLEXFLOOD 150W COOL LED SLIPFITTER BRONZE - DLC LISTED	13797.00	3.15
Chatham Middle School	ext garbage area	4380.00	1	32.00	32.00	140.16	0.03	1 - 32 WATT CFL	4380.00	1	18.00	18.00	78.84	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	61.32	0.01
Chatham Middle School	exits	4380.00	59	36.00	2124.00	9303.12	2.12	2 - 18 WATT BI PIN FLUORESCENT FIXTURE WITH ELECTRONIC BALLAST	4380.00	59	1.31	77.29	338.53	0.08	COOPER SURELITE LED THERMOPLASTIC EXIT SIGN WITH BATTERY BACKUP (RED LETTERS)	8964.59	2.05
Chatham Middle School	2L harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	417	0.00	0.00	0.00	0.00	2 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Chatham Middle School	3L harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	526	0.00	0.00	0.00	0.00	3 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Chatham Middle School	4L harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	276	0.00	0.00	0.00	0.00	4 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Chatham Middle School	6L harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	17	0.00	0.00	0.00	0.00	6 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Chatham Middle School	closet stock	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	10	9.00	90.00	394.20	0.09	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	-394.20	-0.09
Chatham Middle School	closet stock	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	110	15.00	1650.00	7227.00	1.65	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	-7227.00	-1.65
Chatham Middle School	closet stock	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	3	22.00	66.00	289.08	0.07	4 FOOT 22W NWM BALLAST READY LED TUBE	-289.08	-0.07
Chatham Middle School	bays	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	24	0.00	0.00	0.00	0.00	CREE ALUMINUM REFLECTOR 16"	0.00	0.00
Chatham Middle School	exterior	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	36	0.00	0.00	0.00	0.00	PENCIL PHOTOCEL 120V	0.00	0.00
Lafayette School	library kits	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	17	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Lafayette School	Library EM kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	2	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00
Lafayette School	fixture	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	4FT WRAP AROUND 2 LAMP	0.00	0.00
Lafayette School	electric closet ballasted fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	4FT WRAP AROUND 2 LAMP	0.00	0.00
Lafayette School	fixture	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	4FT WRAP AROUND 2 LAMP	0.00	0.00
Lafayette School	boys/girls br kits	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	8	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00
Lafayette School	boys/girls EM kits	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	2	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00
Lafayette School	15 utube kits	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	16	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Lafayette School	fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	2	0.00	0.00	0.00	0.00	4FT WRAP AROUND 4 LAMP	0.00	0.00
Lafayette School	faculty mens/womens br	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	2	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Lafayette School	boiler rm fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	2	0.00	0.00	0.00	0.00	4FT 2 LAMP INDUSTRIAL HOOD	0.00	0.00
Lafayette School	kitchen fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	2	0.00	0.00	0.00	0.00	4FT WRAP AROUND 4 LAMP	0.00	0.00
Lafayette School	1L sockets	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	19	0.00	0.00	0.00	0.00	NON-SHUNTED SOCKET, 600V, 660W	0.00	0.00
Lafayette School	2L harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	130	0.00	0.00	0.00	0.00	2 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Lafayette School	3 L harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	578	0.00	0.00	0.00	0.00	3 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Lafayette School	4 L harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	96	0.00	0.00	0.00	0.00	4 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Lafayette School	closet stock	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	5	9.00	45.00	197.10	0.04	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	-197.10	-0.04
Lafayette School	closet stock	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	5	12.00	60.00	262.80	0.06	2 FOOT 12W NWM BALLAST READY LED TUBE	-262.80	-0.06
Lafayette School	closet stock	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	72	15.00	1080.00	4730.40	1.08	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	-4730.40	-1.08
Lafayette School	closet stock	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	10	22.00	220.00	963.60	0.22	4 FOOT 22W NWM BALLAST READY LED TUBE	-963.60	-0.22
Lafayette School	bays	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	18	0.00	0.00	0.00	0.00	CREE ALUMINUM REFLECTOR 16"	0.00	0.00
Lafayette School	exterior	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	27	0.00	0.00	0.00	0.00	PENCIL PHOTOCEL 120V	0.00	0.00
Lafayette School	15	2080.00	16	64.00	1024.00	2129.92	1.02	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	1872.00	48	9.00	432.00	808.70	0.43	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	1321.22	0.59
Lafayette School	faculty mens & womens br	2080.00	2	64.00	128.00	266.24	0.13	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	1872.00	6	9.00	54.00	101.09	0.05	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	165.15	0.07
Lafayette School	8	2080.00	8	50.00	400.00	832.00	0.40	4' FIXTURE, 1-F34/T12 LAMP, STANDARD MAGNETIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	582.40	0.28
Lafayette School	9	2080.00	6	50.00	300.00	624.00	0.30	4' FIXTURE, 1-F34/T12 LAMP, STANDARD MAGNETIC BALLAST	2080.00	6	15.00	90.00	187.20	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	436.80	0.21
Lafayette School	kithcen	2080.00	2	32.00	64.00	133.12	0.06	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Lafayette School	conf rm	2080.00	4	96.00	384.00	798.72	0.38	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Lafayette School	office	2080.00	3	96.00	288.00	599.04	0.29	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	9	15.00	135.00	252.72	0.13	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	346.32	0.15
Lafayette School	josepin office	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Lafayette School	magno office	2080.00	3	96.00	288.00	599.04	0.29	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	9	15.00	135.00	252.72	0.13	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	346.32	0.15
Lafayette School	office	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Lafayette School	badian office	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Lafayette School	office waiting	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Lafayette School	freyre office	2080.00	4	96.00	384.00	798.72	0.38	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Lafayette School	weiner office	2080.00	4	96.00	384.00	798.72	0.38	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Lafayette School	sgi	2080.00	14	96.00	1344.00	2795.52	1.34	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	42	15.00	630.00	1179.36	0.63	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1616.16	0.71
Lafayette School	sgi office	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Lafayette School	10	2080.00	10	96.00	960.00	1996.80	0.96	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	30	15.00	450.00	842.40	0.45	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1154.40	0.51
Lafayette School	11	2080.00	10	96.00	960.00	1996.80	0.96	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	30	15.00	450.00	842.40	0.45	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1154.40	0.51
Lafayette School	8	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	31	2080.00	15	96.00	1440.00	2995.20	1.44	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	45	15.00	675.00	1263.60	0.67	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1731.60	0.77
Lafayette School	30	2080.00	15	96.00	1440.00	2995.20	1.44	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	45	15.00	675.00	1263.60	0.67	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1731.60	0.77
Lafayette School	33	2080.00	15	96.00	1440.00	2995.20	1.44	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	45	15.00	675.00	1263.60	0.67	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1731.60	0.77
Lafayette School	32	2080.00	15	96.00	1440.00	2995.20	1.44	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	45	15.00	675.00	1263.60	0.67	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1731.60	0.77
Lafayette School	hall	2080.00	10	96.00	960.00	1996.80	0.96	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	30	15.00	450.00	936.00	0.45	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1060.80	0.51
Lafayette School	library	2080.00	24	96.00	2304.00	4792.32	2.30	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	72	15.00	1080.00	2021.76	1.08	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2770.56	1.22
Lafayette School	library conf rm	2080.00	4	96.00	384.00	798.72	0.38	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Lafayette School	29	2080.00	15	96.00	1440.00	2995.20	1.44	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	45	15.00	675.00	1263.60	0.67	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1731.60	0.77

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Lafayette School	7	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	6	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	5	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	4	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	3	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	2	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	1	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	12	2080.00	10	96.00	960.00	1996.80	0.96	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	30	15.00	450.00	842.40	0.45	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1154.40	0.51
Lafayette School	13	2080.00	10	96.00	960.00	1996.80	0.96	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	30	15.00	450.00	842.40	0.45	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1154.40	0.51
Lafayette School	14	2080.00	10	96.00	960.00	1996.80	0.96	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	30	15.00	450.00	842.40	0.45	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1154.40	0.51
Lafayette School	main office	2080.00	5	96.00	480.00	998.40	0.48	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	15	15.00	225.00	421.20	0.22	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	577.20	0.26
Lafayette School	art rm	2080.00	20	96.00	1920.00	3993.60	1.92	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	60	15.00	900.00	1684.80	0.90	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2308.80	1.02
Lafayette School	entry hall main	2080.00	7	96.00	672.00	1397.76	0.67	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	21	15.00	315.00	655.20	0.31	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	742.56	0.36
Lafayette School	15 otc	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Lafayette School	15	2080.00	15	96.00	1440.00	2995.20	1.44	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	45	15.00	675.00	1263.60	0.67	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1731.60	0.77
Lafayette School	music	2080.00	6	96.00	576.00	1198.08	0.58	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	18	15.00	270.00	505.44	0.27	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	692.64	0.31
Lafayette School	m15	2080.00	24	96.00	2304.00	4792.32	2.30	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	72	15.00	1080.00	2021.76	1.08	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2770.56	1.22
Lafayette School	hall	2080.00	4	96.00	384.00	798.72	0.38	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	12	15.00	180.00	374.40	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	424.32	0.20
Lafayette School	principal office	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Lafayette School	17	2080.00	14	96.00	1344.00	2795.52	1.34	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	42	15.00	630.00	1179.36	0.63	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1616.16	0.71
Lafayette School	23-33 hall	2080.00	5	96.00	480.00	998.40	0.48	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	15	15.00	225.00	468.00	0.22	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	530.40	0.26
Lafayette School	28 sgi	2080.00	8	96.00	768.00	1597.44	0.77	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	24	15.00	360.00	673.92	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	923.52	0.41
Lafayette School	27 sgi	2080.00	8	96.00	768.00	1597.44	0.77	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	24	15.00	360.00	673.92	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	923.52	0.41
Lafayette School	26	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	25	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	24	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	16	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	boys br	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Lafayette School	girls br	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Lafayette School	9	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	faculty lounge	2080.00	9	96.00	864.00	1797.12	0.86	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	27	15.00	405.00	758.16	0.40	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1038.96	0.46
Lafayette School	23	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	17	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	22	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	18	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	21	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	19	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	20	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Lafayette School	office	2080.00	1	128.00	128.00	266.24	0.13	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	4	15.00	60.00	112.32	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	153.92	0.07
Lafayette School	nurse	2080.00	4	128.00	512.00	1064.96	0.51	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	16	15.00	240.00	449.28	0.24	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	615.68	0.27
Lafayette School	cafeterias	2080.00	27	128.00	3456.00	7188.48	3.46	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	108	15.00	1620.00	3032.64	1.62	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	4155.84	1.84
Lafayette School	hall	2080.00	14	128.00	1792.00	3727.36	1.79	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	56	15.00	840.00	1747.20	0.84	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1980.16	0.95

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Lafayette School	storage upstairs	520.00	2	128.00	256.00	133.12	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	8	15.00	120.00	62.40	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.14
Lafayette School	chorus m16	2080.00	24	128.00	3072.00	6389.76	3.07	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	96	15.00	1440.00	2695.68	1.44	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	3694.08	1.63
Lafayette School	orchestra m17	2080.00	24	128.00	3072.00	6389.76	3.07	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	96	15.00	1440.00	2695.68	1.44	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	3694.08	1.63
Lafayette School	exit signs	4380.00	25	23.00	575.00	2518.50	0.58	23 WATT BI PIN FLUORESCENT FIXTURE WITH ELECTRONIC BALLAST	4380.00	25	0.75	18.75	82.12	0.02	COOPER SURELITE LED EXIT/EMERGENCY COMBO (RED LETTERS)	2436.37	0.56
Lafayette School	door	4380.00	1	75.00	75.00	328.50	0.08	PAR 38 FLOOD 75 WATT	4380.00	1	19.00	19.00	83.22	0.02	PAR38, E26 BASE, 19 WATT, 120V 40°, 2700K, DIMMABLE - ENERGY STAR	245.28	0.06
Lafayette School	ext entry	4380.00	7	60.00	420.00	1839.60	0.42	A LAMP 60 WATT INCANDESCENT	4380.00	7	18.00	126.00	551.88	0.13	CREE 100W EQUIVALENT BULB DIMMABLE	1287.72	0.29
Lafayette School	canopy	4380.00	1	60.00	60.00	262.80	0.06	A LAMP 60 WATT INCANDESCENT	4380.00	1	18.00	18.00	78.84	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	183.96	0.04
Lafayette School	cust closet	520.00	1	60.00	60.00	31.20	0.06	A LAMP 60 WATT INCANDESCENT	520.00	1	18.00	18.00	9.36	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	21.84	0.04
Lafayette School	cust closet	520.00	1	60.00	60.00	31.20	0.06	A LAMP 60 WATT INCANDESCENT	520.00	1	18.00	18.00	9.36	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	21.84	0.04
Lafayette School	storage in hall	520.00	1	60.00	60.00	31.20	0.06	A LAMP 60 WATT INCANDESCENT	520.00	1	18.00	18.00	9.36	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	21.84	0.04
Lafayette School	cust closet	520.00	1	60.00	60.00	31.20	0.06	A LAMP 60 WATT INCANDESCENT	520.00	1	18.00	18.00	9.36	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	21.84	0.04
Lafayette School	men br	2080.00	2	60.00	120.00	249.60	0.12	A LAMP 60 WATT INCANDESCENT	2080.00	2	18.00	36.00	74.88	0.04	CREE 100W EQUIVALENT BULB DIMMABLE	174.72	0.08
Lafayette School	womens br	2080.00	2	60.00	120.00	249.60	0.12	A LAMP 60 WATT INCANDESCENT	2080.00	2	18.00	36.00	74.88	0.04	CREE 100W EQUIVALENT BULB DIMMABLE	174.72	0.08
Lafayette School	kitchen hoods	2080.00	3	60.00	180.00	374.40	0.18	A LAMP 60 WATT INCANDESCENT	2080.00	3	18.00	54.00	112.32	0.05	CREE 100W EQUIVALENT BULB DIMMABLE	262.08	0.13
Lafayette School	kitchen office	2080.00	1	32.00	32.00	66.56	0.03	1 - 32 WATT CFL	1872.00	1	18.00	18.00	33.70	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	32.86	0.01
Lafayette School	av closet	520.00	1	32.00	32.00	16.64	0.03	1 - 32 WATT CFL	520.00	1	18.00	18.00	9.36	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	7.28	0.01
Lafayette School	back walls	4380.00	7	188.00	1316.00	5764.08	1.32	HIGH PRESSURE SODIUM, 1-150 WATT LAMP	4380.00	7	26.00	182.00	797.16	0.18	SLIM 26W COOL LED 120V TO 277V WALLMOUNT BRONZE - DLC LISTED	4966.92	1.13
Lafayette School	ext wp	4380.00	7	295.00	2065.00	9044.70	2.07	HIGH PRESSURE SODIUM, 1-250 WATT LAMP	4380.00	7	62.00	434.00	1900.92	0.43	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	7143.78	1.63
Lafayette School	courtyard ext wp	4380.00	2	295.00	590.00	2584.20	0.59	HIGH PRESSURE SODIUM, 1-250 WATT LAMP	4380.00	2	62.00	124.00	543.12	0.12	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	2041.08	0.47
Lafayette School	courtyard ext	4380.00	2	295.00	590.00	2584.20	0.59	HIGH PRESSURE SODIUM, 1-250 WATT LAMP	4380.00	2	62.00	124.00	543.12	0.12	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	2041.08	0.47
Lafayette School	ext wp	4380.00	2	295.00	590.00	2584.20	0.59	HIGH PRESSURE SODIUM, 1-250 WATT LAMP	4380.00	2	62.00	124.00	543.12	0.12	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	2041.08	0.47
Lafayette School	cafe door	4380.00	1	295.00	295.00	1292.10	0.30	HIGH PRESSURE SODIUM, 1-250 WATT LAMP	4380.00	1	62.00	62.00	271.56	0.06	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	1020.54	0.23
Lafayette School	garbage area	4380.00	1	295.00	295.00	1292.10	0.30	HIGH PRESSURE SODIUM, 1-250 WATT LAMP	4380.00	1	78.00	78.00	341.64	0.08	FLEXFLOOD 78W COOL LED TRUNNION BRONZE - DLC LISTED	950.46	0.22
Lafayette School	door 10	4380.00	1	295.00	295.00	1292.10	0.30	HIGH PRESSURE SODIUM, 1-250 WATT LAMP	4380.00	1	62.00	62.00	271.56	0.06	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	1020.54	0.23
Lafayette School	library & offices	2080.00	17	96.00	1632.00	3394.56	1.63	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	1872.00	68	9.00	612.00	1145.66	0.61	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	2248.90	1.02
Lafayette School	library EM	2080.00	2	96.00	192.00	399.36	0.19	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	1872.00	8	12.00	96.00	179.71	0.10	2 FOOT 12W NWM BALLAST READY LED TUBE	219.65	0.10
Lafayette School	boys/girls BR EMs	2080.00	2	96.00	192.00	399.36	0.19	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	2080.00	8	12.00	96.00	199.68	0.10	2 FOOT 12W NWM BALLAST READY LED TUBE	199.68	0.10
Lafayette School	boys br	2080.00	4	96.00	384.00	798.72	0.38	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	2080.00	16	9.00	144.00	299.52	0.14	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	499.20	0.24
Lafayette School	girls br	2080.00	4	96.00	384.00	798.72	0.38	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	2080.00	16	9.00	144.00	299.52	0.14	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	499.20	0.24
Lafayette School	hall	2080.00	17	72.00	1224.00	2545.92	1.22	2-36W BIAX	2080.00	17	35.00	595.00	1237.60	0.59	ZR22, 35 WATT, 3200LM, 4000K, 0-10V DIMMING	1308.32	0.63
Lafayette School	32 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Lafayette School	33 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Lafayette School	30 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Lafayette School	31 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Lafayette School	hall	2080.00	4	36.00	144.00	299.52	0.14	2 - 18 WATT QUAD-PIN CFL	2080.00	8	15.00	120.00	249.60	0.12	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	49.92	0.02
Lafayette School	library	2080.00	3	36.00	108.00	224.64	0.11	2 - 18 WATT QUAD-PIN CFL	1872.00	6	15.00	90.00	168.48	0.09	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	56.16	0.02
Lafayette School	library entry	2080.00	2	36.00	72.00	149.76	0.07	2 - 18 WATT QUAD-PIN CFL	1872.00	4	15.00	60.00	112.32	0.06	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	37.44	0.01
Lafayette School	library ceiling	2080.00	12	36.00	432.00	898.56	0.43	2 - 18 WATT QUAD-PIN CFL	1872.00	24	15.00	360.00	673.92	0.36	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	224.64	0.07
Lafayette School	library	2080.00	3	36.00	108.00	224.64	0.11	2 - 18 WATT QUAD-PIN CFL	1872.00	6	15.00	90.00	168.48	0.09	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	56.16	0.02
Lafayette School	courtyard ext	4380.00	4	36.00	144.00	630.72	0.14	2 - 18 WATT QUAD-PIN CFL	4380.00	4	12.00	48.00	210.24	0.05	ENTRA 12W COOL LED 120V PC WALLMOUNT BRONZE - DLC LISTED	420.48	0.10
Lafayette School	29 entry	2080.00	1	36.00	36.00	74.88	0.04	2 - 18 WATT QUAD-PIN CFL	2080.00	2	15.00	30.00	62.40	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	12.48	0.01
Lafayette School	hall near BR's	2080.00	2	36.00	72.00	149.76	0.07	2 - 18 WATT QUAD-PIN CFL	2080.00	4	15.00	60.00	124.80	0.06	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	24.96	0.01
Lafayette School	hall	2080.00	2	36.00	72.00	149.76	0.07	2 - 18 WATT QUAD-PIN CFL	2080.00	4	15.00	60.00	124.80	0.06	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	24.96	0.01
Lafayette School	conf rm	2080.00	3	36.00	108.00	224.64	0.11	2 - 18 WATT QUAD-PIN CFL	1872.00	6	15.00	90.00	168.48	0.09	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	56.16	0.02
Lafayette School	mech rm	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	6	15.00	90.00	187.20	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	212.16	0.10
Lafayette School	display case	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Lafayette School	kitchen	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	8	15.00	120.00	224.64	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	41.60	0.01

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Lafayette School	performing arts	2080.00	5	64.00	320.00	665.60	0.32	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	10	15.00	150.00	280.80	0.15	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	384.80	0.17
Lafayette School	PA practice rm 1	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Lafayette School	PA practice rm 2	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Lafayette School	PA practice rm 3	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Lafayette School	PA office	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Lafayette School	director	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Lafayette School	room	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Lafayette School	8 office	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Lafayette School	8 office hall	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Lafayette School	Mens br	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Lafayette School	womens br	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Lafayette School	womens br	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Lafayette School	nurse	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Lafayette School	nurse br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Lafayette School	copy rm	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Lafayette School	mens br	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Lafayette School	stairs	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Lafayette School	copy br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Lafayette School	faculty lounge	2080.00	4	64.00	256.00	532.48	0.26	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	8	15.00	120.00	224.64	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.14
Lafayette School	23-33 hall	2080.00	16	64.00	1024.00	2129.92	1.02	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	32	15.00	480.00	998.40	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1131.52	0.54
Lafayette School	23-33 hall EM	2080.00	6	64.00	384.00	798.72	0.38	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	12	22.00	264.00	549.12	0.26	4 FOOT 22W NWM BALLAST READY LED TUBE	249.60	0.12
Lafayette School	hall to cafe	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Lafayette School	printer rm	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Lafayette School	printer rm em	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	22.00	44.00	91.52	0.04	4 FOOT 22W NWM BALLAST READY LED TUBE	41.60	0.02
Lafayette School	men br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Lafayette School	men br em	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	22.00	44.00	82.37	0.04	4 FOOT 22W NWM BALLAST READY LED TUBE	50.75	0.02
Lafayette School	teacher br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Lafayette School	teacher br em	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	22.00	44.00	82.37	0.04	4 FOOT 22W NWM BALLAST READY LED TUBE	50.75	0.02
Lafayette School	boiler rm	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Lafayette School	door I9	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Lafayette School	girls br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Lafayette School	hall	2080.00	12	64.00	768.00	1597.44	0.77	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	24	15.00	360.00	748.80	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	848.64	0.41
Lafayette School	cust closet	520.00	1	64.00	64.00	33.28	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	2	15.00	30.00	15.60	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	17.68	0.03
Lafayette School	server	520.00	1	64.00	64.00	33.28	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	2	15.00	30.00	15.60	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	17.68	0.03
Lafayette School	storage	520.00	1	64.00	64.00	33.28	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	2	15.00	30.00	15.60	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	17.68	0.03
Lafayette School	storage	520.00	2	64.00	128.00	66.56	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	4	15.00	60.00	31.20	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	35.36	0.07
Lafayette School	library closet	520.00	1	64.00	64.00	33.28	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	2	9.00	18.00	9.36	0.02	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	23.92	0.05
Lafayette School	hall	2080.00	25	64.00	1600.00	3328.00	1.60	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	50	15.00	750.00	1560.00	0.75	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1768.00	0.85
Lafayette School	electric closet	520.00	1	64.00	64.00	33.28	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	2	15.00	30.00	15.60	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	17.68	0.03
Lafayette School	electric closet	520.00	1	64.00	64.00	33.28	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	2	22.00	44.00	22.88	0.04	4 FOOT 22W NWM BALLAST READY LED TUBE	10.40	0.02
Lafayette School	cust closet	520.00	1	64.00	64.00	33.28	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	2	15.00	30.00	15.60	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	17.68	0.03
Lafayette School	boys/girls lockers storage	520.00	8	64.00	512.00	266.24	0.51	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	16	15.00	240.00	124.80	0.24	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.27

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Lafayette School	main office st	520.00	1	64.00	64.00	33.28	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	2	15.00	30.00	15.60	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	17.68	0.03
Lafayette School	cust closet	520.00	2	64.00	128.00	66.56	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	4	15.00	60.00	31.20	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	35.36	0.07
Lafayette School	gym offices	2080.00	4	64.00	256.00	532.48	0.26	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	8	15.00	120.00	224.64	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.14
Lafayette School	gym	2080.00	18	336.00	6048.00	12579.84	6.05	8-42 WATT CFL HIGHBAY	1872.00	18	160.00	2880.00	5391.36	2.88	HH HIGHBAY,160W,18,000 LM,40K,120-277V, 0-10V DIMMING,15 AMP 120V TWIST LOCK PLUG (REFLECTOR NOT INCLUDED)	7188.48	3.17
Milton Avenue School	main office	2080.00	8	64.00	512.00	1064.96	0.51	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	16	15.00	240.00	449.28	0.24	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	615.68	0.27
Milton Avenue School	principal office	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	8	15.00	120.00	224.64	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	307.84	0.14
Milton Avenue School	Main office st	520.00	1	60.00	60.00	31.20	0.06	A LAMP 60 WATT INCANDESCENT	520.00	1	18.00	18.00	9.36	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	21.84	0.04
Milton Avenue School	gym st	520.00	3	94.00	282.00	146.64	0.28	8' FIXTURE, 2-F40/T12 LAMPS, STANDARD MAGNETIC BALLAST	520.00	12	15.00	180.00	93.60	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	53.04	0.10
Milton Avenue School	gym st fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	3	0.00	0.00	0.00	0.00	4FT WRAP AROUND 4 LAMP	0.00	0.00
Milton Avenue School	maint office	2080.00	4	32.00	128.00	266.24	0.13	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Milton Avenue School	area	2080.00	1	60.00	60.00	124.80	0.06	A LAMP 60 WATT INCANDESCENT	2080.00	1	18.00	18.00	37.44	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	87.36	0.04
Milton Avenue School	boiler rm	2080.00	10	64.00	640.00	1331.20	0.64	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	20	15.00	300.00	624.00	0.30	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	707.20	0.34
Milton Avenue School	boiler rm fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	10	0.00	0.00	0.00	0.00	4FT 2 LAMP INDUSTRIAL HOOD	0.00	0.00
Milton Avenue School	1st fl hall	2080.00	34	64.00	2176.00	4526.08	2.18	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	68	15.00	1020.00	2121.60	1.02	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2404.48	1.16
Milton Avenue School	1st fl hall EM	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	22.00	88.00	183.04	0.09	4 FOOT 22W NWM BALLAST READY LED TUBE	83.20	0.04
Milton Avenue School	stair a	4380.00	2	64.00	128.00	560.64	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	4380.00	4	15.00	60.00	262.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	297.84	0.07
Milton Avenue School	stair a EM	4380.00	4	64.00	256.00	1121.28	0.26	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	4380.00	8	22.00	176.00	770.88	0.18	4 FOOT 22W NWM BALLAST READY LED TUBE	350.40	0.08
Milton Avenue School	boys br 1st fl	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	4	15.00	60.00	112.32	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	153.92	0.07
Milton Avenue School	cust cl 1st fl	520.00	1	60.00	60.00	31.20	0.06	A LAMP 60 WATT INCANDESCENT	520.00	1	18.00	18.00	9.36	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	21.84	0.04
Milton Avenue School	gym	2080.00	12	336.00	4032.00	8386.56	4.03	8-42 WATT CFL HIGHBAY	1872.00	12	160.00	1920.00	3594.24	1.92	HH HIGHBAY,160W,18,000 LM,40K,120-277V, 0-10V DIMMING,15 AMP 120V TWIST LOCK PLUG (REFLECTOR NOT INCLUDED)	4792.32	2.11
Milton Avenue School	stage	2080.00	3	32.00	96.00	199.68	0.10	1 - 32 WATT CFL	1872.00	3	9.50	28.50	53.35	0.03	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	146.33	0.07
Milton Avenue School	gym office	2080.00	6	64.00	384.00	798.72	0.38	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Milton Avenue School	110	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Milton Avenue School	109	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Milton Avenue School	108	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Milton Avenue School	display case 1st fl	2080.00	1	91.00	91.00	189.28	0.09	8' FIXTURE, 1-F96/T12/ 75 WATT LAMP, ENERGY SAVING MAGNETIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	126.88	0.06
Milton Avenue School	fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	2	0.00	0.00	0.00	0.00	4FT 1 LAMP STRIP	0.00	0.00
Milton Avenue School	117 nurse	2080.00	5	96.00	480.00	998.40	0.48	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	15	15.00	225.00	421.20	0.22	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	577.20	0.26
Milton Avenue School	117 br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Milton Avenue School	st 1st fl	520.00	4	64.00	256.00	133.12	0.26	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	8	15.00	120.00	62.40	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.14
Milton Avenue School	107	2080.00	8	96.00	768.00	1597.44	0.77	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	24	15.00	360.00	673.92	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	923.52	0.41
Milton Avenue School	106	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Milton Avenue School	105	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Milton Avenue School	104	2080.00	13	96.00	1248.00	2595.84	1.25	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	39	15.00	585.00	1095.12	0.58	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1500.72	0.66
Milton Avenue School	104 cl	520.00	1	64.00	64.00	33.28	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	2	15.00	30.00	15.60	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	17.68	0.03
Milton Avenue School	104 br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	22.00	44.00	82.37	0.04	4 FOOT 22W NWM BALLAST READY LED TUBE	50.75	0.02
Milton Avenue School	103	2080.00	13	96.00	1248.00	2595.84	1.25	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	39	15.00	585.00	1095.12	0.58	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1500.72	0.66
Milton Avenue School	103br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	22.00	44.00	82.37	0.04	4 FOOT 22W NWM BALLAST READY LED TUBE	50.75	0.02
Milton Avenue School	103 st	520.00	1	64.00	64.00	33.28	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	2	15.00	30.00	15.60	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	17.68	0.03
Milton Avenue School	102	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Milton Avenue School	102 br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	22.00	44.00	82.37	0.04	4 FOOT 22W NWM BALLAST READY LED TUBE	50.75	0.02
Milton Avenue School	102 st	520.00	1	64.00	64.00	33.28	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	2	15.00	30.00	15.60	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	17.68	0.03
Milton Avenue School	Womens Br 1st fl	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	22.00	44.00	82.37	0.04	4 FOOT 22W NWM BALLAST READY LED TUBE	50.75	0.02
Milton Avenue School	101	2080.00	12	32.00	384.00	798.72	0.38	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Milton Avenue School	101 br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Milton Avenue School	girls br 1st fl	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	4	15.00	60.00	112.32	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	153.92	0.07
Milton Avenue School	cust cl 1st fl	520.00	1	32.00	32.00	16.64	0.03	1 - 32 WATT CFL	520.00	1	9.50	9.50	4.94	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	11.70	0.02
Milton Avenue School	stair c	4380.00	9	64.00	576.00	2522.88	0.58	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	4380.00	18	15.00	270.00	1182.60	0.27	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1340.28	0.31
Milton Avenue School	2nd fl hall	2080.00	29	64.00	1856.00	3860.48	1.86	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	58	15.00	870.00	1809.60	0.87	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2050.88	0.99
Milton Avenue School	2nd fl hall EM	4380.00	4	64.00	256.00	1121.28	0.26	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	4380.00	8	22.00	176.00	770.88	0.18	4 FOOT 22W NWM BALLAST READY LED TUBE	350.40	0.08
Milton Avenue School	counselor office	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	4	15.00	60.00	112.32	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	153.92	0.07
Milton Avenue School	boiler rm 2	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Milton Avenue School	fixture	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	4FT 2 LAMP INDUSTRIAL HOOD	0.00	0.00
Milton Avenue School	boiler rm 2	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Milton Avenue School	maint st	520.00	1	60.00	60.00	31.20	0.06	A LAMP 60 WATT INCANDESCENT	520.00	1	9.50	9.50	4.94	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	26.26	0.05
Milton Avenue School	cust cl 2nd fl	520.00	1	32.00	32.00	16.64	0.03	1 - 32 WATT CFL	520.00	1	9.50	9.50	4.94	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	11.70	0.02
Milton Avenue School	art st 2nd fl	520.00	6	64.00	384.00	199.68	0.38	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	12	15.00	180.00	93.60	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	106.08	0.20
Milton Avenue School	214	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Milton Avenue School	girls br 2nd fl	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	4	15.00	60.00	112.32	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	153.92	0.07
Milton Avenue School	213	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Milton Avenue School	212	2080.00	8	96.00	768.00	1597.44	0.77	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	24	15.00	360.00	673.92	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	923.52	0.41
Milton Avenue School	211	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1385.28	0.61
Milton Avenue School	210	2080.00	13	96.00	1248.00	2595.84	1.25	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	39	15.00	585.00	1095.12	0.58	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1500.72	0.66
Milton Avenue School	209	2080.00	8	128.00	1024.00	2129.92	1.02	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	32	15.00	480.00	898.56	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1231.36	0.54
Milton Avenue School	boys br 2nd fl	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	4	15.00	60.00	112.32	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	153.92	0.07
Milton Avenue School	cust cl 2nd fl	520.00	1	32.00	32.00	16.64	0.03	1 - 32 WATT CFL	520.00	1	9.50	9.50	4.94	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	11.70	0.02
Milton Avenue School	208	2080.00	8	128.00	1024.00	2129.92	1.02	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	32	15.00	480.00	898.56	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1231.36	0.54
Milton Avenue School	207	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1847.04	0.82
Milton Avenue School	library	2080.00	39	64.00	2496.00	5191.68	2.50	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	78	15.00	1170.00	2190.24	1.17	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	3001.44	1.33
Milton Avenue School	216 bsi	2080.00	6	64.00	384.00	798.72	0.38	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Milton Avenue School	206	2080.00	18	117.00	2106.00	4380.48	2.11	4' FIXTURE, 2-F54/T5/HO/LAMPS, ELECTRONIC BALLAST, 117W	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	3369.60	1.57
Milton Avenue School	206	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	18	0.00	0.00	0.00	0.00	EMPTY LED READY 4' PENDANT FIXTURE (2 LAMP)	0.00	0.00
Milton Avenue School	205	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.10
Milton Avenue School	204	2080.00	5	96.00	480.00	998.40	0.48	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	15	15.00	225.00	421.20	0.22	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	577.20	0.26
Milton Avenue School	203 cst	2080.00	6	96.00	576.00	1198.08	0.58	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	18	15.00	270.00	505.44	0.27	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	692.64	0.31
Milton Avenue School	200 fac rm	2080.00	6	96.00	576.00	1198.08	0.58	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	18	15.00	270.00	505.44	0.27	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	692.64	0.31
Milton Avenue School	faculty kitchen	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	4	15.00	60.00	112.32	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	153.92	0.07
Milton Avenue School	womens br 2nd fl	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	22.00	44.00	82.37	0.04	4 FOOT 22W NWM BALLAST READY LED TUBE	50.75	0.02
Milton Avenue School	mens br 2nd fl	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	22.00	44.00	82.37	0.04	4 FOOT 22W NWM BALLAST READY LED TUBE	50.75	0.02
Milton Avenue School	202	2080.00	12	64.00	768.00	1597.44	0.77	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	24	15.00	360.00	673.92	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	923.52	0.41
Milton Avenue School	stair b	4380.00	5	64.00	320.00	1401.60	0.32	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	4380.00	10	15.00	150.00	657.00	0.15	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	744.60	0.17
Milton Avenue School	201	2080.00	4	96.00	384.00	798.72	0.38	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	461.76	0.20
Milton Avenue School	201 br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Milton Avenue School	201 hall	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Milton Avenue School	tech hub 2nd fgl	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.03
Milton Avenue School	ext main entry	4380.00	1	60.00	60.00	262.80	0.06	A LAMP 60 WATT INCANDESCENT	4380.00	1	18.00	18.00	78.84	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	183.96	0.04
Milton Avenue School	ext wp	4380.00	13	295.00	3835.00	16797.30	3.84	HIGH PRESSURE SODIUM, 1-250 WATT LAMP	4380.00	13	62.00	806.00	3530.28	0.81	SLIM WALLPACK 62W COOL LED 120V PC BRONZE WP3 - DLC LISTED	13267.02	3.03

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Milton Avenue School	ext canopy	4380.00	3	60.00	180.00	788.40	0.18	A LAMP 60 WATT INCANDESCENT	4380.00	3	18.00	54.00	236.52	0.05	CREE 100W EQUIVALENT BULB DIMMABLE	551.88	0.13
Milton Avenue School	ext door 6	4380.00	1	60.00	60.00	262.80	0.06	A LAMP 60 WATT INCANDESCENT	4380.00	1	18.00	18.00	78.84	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	183.96	0.04
Milton Avenue School	ext door 7	4380.00	1	60.00	60.00	262.80	0.06	A LAMP 60 WATT INCANDESCENT	4380.00	1	18.00	18.00	78.84	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	183.96	0.04
Milton Avenue School	closet stock	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	40	15.00	600.00	2628.00	0.60	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	-2628.00	-0.60
Milton Avenue School	closet stock EM	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	5	22.00	110.00	481.80	0.11	4 FOOT 22W NWM BALLAST READY LED TUBE	-481.80	-0.11
Milton Avenue School	exits	4380.00	20	36.00	720.00	3153.60	0.72	2 - 18 WATT BI PIN FLUORESCENT FIXTURE WITH ELECTRONIC BALLAST	4380.00	20	0.75	15.00	65.70	0.01	COOPER SURELITE LED EXIT/EMERGENCY COMBO (RED LETTERS)	3087.90	0.71
Milton Avenue School	1L sockets	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	16	0.00	0.00	0.00	0.00	NON-SHUNTED SOCKET, 600V, 660W	0.00	0.00
Milton Avenue School	2L harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	193	0.00	0.00	0.00	0.00	2 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Milton Avenue School	3L harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	107	0.00	0.00	0.00	0.00	3 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Milton Avenue School	4L harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	114	0.00	0.00	0.00	0.00	4 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Milton Avenue School	bays	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	12	0.00	0.00	0.00	0.00	CREE ALUMINUM REFLECTOR 16"	0.00	0.00
Southern Boulevard School	nurse br kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Southern Boulevard School	103	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	3	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Southern Boulevard School	104 kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	3	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Southern Boulevard School	108	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	2	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Southern Boulevard School	106 kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	2	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Southern Boulevard School	106 cl kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Southern Boulevard School	106 br kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Southern Boulevard School	107 kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	2	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Southern Boulevard School	107 cl kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	2	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Southern Boulevard School	girls near br kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Southern Boulevard School	fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	4	0.00	0.00	0.00	0.00	4FT WRAP AROUND 4 LAMP	0.00	0.00
Southern Boulevard School	boys br kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Southern Boulevard School	125 kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	3	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00
Southern Boulevard School	124 kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	4	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00
Southern Boulevard School	124 hall kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	4	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00
Southern Boulevard School	124 hall em kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00
Southern Boulevard School	122 FIXTURE	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	14	0.00	0.00	0.00	0.00	EMPTY LED READY 4' PENDANT FIXTURE (2 LAMP)	0.00	0.00
Southern Boulevard School	library fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	16	0.00	0.00	0.00	0.00	EMPTY LED READY 4' PENDANT FIXTURE (2 LAMP)	0.00	0.00
Southern Boulevard School	library kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	41	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00
Southern Boulevard School	1st fl womens br kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00
Southern Boulevard School	fixture	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	4FT WRAP AROUND 4 LAMP	0.00	0.00
Southern Boulevard School	closet stock	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	10	9.00	90.00	394.20	0.09	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	-394.20	-0.09
Southern Boulevard School	closet stock	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	5	12.00	60.00	262.80	0.06	2 FOOT 12W NWM BALLAST READY LED TUBE	-262.80	-0.06
Southern Boulevard School	strips for class 122, library	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	30	0.00	0.00	0.00	0.00	4FT 2 LAMP STRIP	0.00	0.00
Southern Boulevard School	closet stock	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	50	15.00	750.00	3285.00	0.75	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	-3285.00	-0.75
Southern Boulevard School	closet stock	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	5	22.00	110.00	481.80	0.11	4 FOOT 22W NWM BALLAST READY LED TUBE	-481.80	-0.11
Southern Boulevard School	1L sockets	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	56	0.00	0.00	0.00	0.00	NON-SHUNTED SOCKET, 600V, 660W	0.00	0.00
Southern Boulevard School	2L harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	172	0.00	0.00	0.00	0.00	2 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Southern Boulevard School	3L harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	96	0.00	0.00	0.00	0.00	3 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Southern Boulevard School	4 L harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	222	0.00	0.00	0.00	0.00	4 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Southern Boulevard School	6L harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	2	0.00	0.00	0.00	0.00	6 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Southern Boulevard School	bays	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	18	0.00	0.00	0.00	0.00	CREE ALUMINUM REFLECTOR 16"	0.00	0.00
Southern Boulevard School	exterior	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	29	0.00	0.00	0.00	0.00	PENCIL PHOTOCEL 120V	0.00	0.00
Southern Boulevard School	fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	6	0.00	0.00	0.00	0.00	4FT 2 LAMP INDUSTRIAL HOOD	0.00	0.00
Southern Boulevard School	107 cl	260.00	2	64.00	128.00	33.28	0.13	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	260.00	6	9.00	54.00	14.04	0.05	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	19.24	0.07
Southern Boulevard School	106 cl	260.00	1	64.00	64.00	16.64	0.06	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	260.00	3	9.00	27.00	7.02	0.03	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	9.62	0.04
Southern Boulevard School	nurse br	2080.00	1	64.00	64.00	133.12	0.06	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	3	9.00	27.00	56.16	0.03	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.04
Southern Boulevard School	103	2080.00	3	64.00	192.00	399.36	0.19	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	9	9.00	81.00	168.48	0.08	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.11
Southern Boulevard School	108	2080.00	2	64.00	128.00	266.24	0.13	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	6	9.00	54.00	112.32	0.05	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	153.92	0.07
Southern Boulevard School	106	2080.00	2	64.00	128.00	266.24	0.13	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	6	9.00	54.00	112.32	0.05	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	153.92	0.07

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Southern Boulevard School	104	2080.00	3	64.00	192.00	399.36	0.19	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	9	9.00	81.00	168.48	0.08	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	230.88	0.11
Southern Boulevard School	107	2080.00	2	64.00	128.00	266.24	0.13	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	6	9.00	54.00	112.32	0.05	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	153.92	0.07
Southern Boulevard School	106 br	2080.00	1	64.00	64.00	133.12	0.06	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	3	9.00	27.00	56.16	0.03	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.04
Southern Boulevard School	boys br near gym	2080.00	1	64.00	64.00	133.12	0.06	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	3	9.00	27.00	56.16	0.03	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.04
Southern Boulevard School	girls br near gym	2080.00	1	64.00	64.00	133.12	0.06	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	2080.00	3	9.00	27.00	56.16	0.03	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	76.96	0.04
Southern Boulevard School	110	2080.00	14	32.00	448.00	931.84	0.45	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	2080.00	14	15.00	210.00	436.80	0.21	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	495.04	0.24
Southern Boulevard School	101	2080.00	14	32.00	448.00	931.84	0.45	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	2080.00	14	15.00	210.00	436.80	0.21	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	495.04	0.24
Southern Boulevard School	109	2080.00	14	32.00	448.00	931.84	0.45	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	2080.00	14	15.00	210.00	436.80	0.21	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	495.04	0.24
Southern Boulevard School	102	2080.00	14	32.00	448.00	931.84	0.45	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	2080.00	14	15.00	210.00	436.80	0.21	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	495.04	0.24
Southern Boulevard School	112	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Southern Boulevard School	124	2080.00	14	96.00	1344.00	2795.52	1.34	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	42	15.00	630.00	1310.40	0.63	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1485.12	0.71
Southern Boulevard School	125	2080.00	14	96.00	1344.00	2795.52	1.34	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	42	15.00	630.00	1310.40	0.63	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1485.12	0.71
Southern Boulevard School	201	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Southern Boulevard School	204	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Southern Boulevard School	202	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Southern Boulevard School	library kitchen	2080.00	2	96.00	192.00	399.36	0.19	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	6	15.00	90.00	187.20	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	212.16	0.10
Southern Boulevard School	library office	2080.00	1	96.00	96.00	199.68	0.10	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	3	15.00	45.00	93.60	0.04	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	106.08	0.05
Southern Boulevard School	library conf rm	2080.00	4	96.00	384.00	798.72	0.38	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	12	15.00	180.00	374.40	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	424.32	0.20
Southern Boulevard School	111	2080.00	12	96.00	1152.00	2396.16	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Southern Boulevard School	122 closet	260.00	1	96.00	96.00	24.96	0.10	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	260.00	3	15.00	45.00	11.70	0.04	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	13.26	0.05
Southern Boulevard School	lower st	260.00	4	128.00	512.00	133.12	0.51	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	260.00	16	15.00	240.00	62.40	0.24	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.27
Southern Boulevard School	1st fl girls br	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Southern Boulevard School	203	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	48	15.00	720.00	1497.60	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1697.28	0.82
Southern Boulevard School	art	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	48	15.00	720.00	1497.60	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1697.28	0.82
Southern Boulevard School	main office	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	12	15.00	180.00	374.40	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	424.32	0.20
Southern Boulevard School	1st fl halls	2080.00	8	128.00	1024.00	2129.92	1.02	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	32	15.00	480.00	998.40	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1131.52	0.54
Southern Boulevard School	1st fl long hall	2080.00	25	128.00	3200.00	6656.00	3.20	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	100	15.00	1500.00	3120.00	1.50	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	3536.00	1.70
Southern Boulevard School	2nd fl boys br	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Southern Boulevard School	girls br near gym	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Southern Boulevard School	2nd fl hall	2080.00	14	128.00	1792.00	3727.36	1.79	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	56	15.00	840.00	1747.20	0.84	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1980.16	0.95
Southern Boulevard School	206	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	48	15.00	720.00	1497.60	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1697.28	0.82
Southern Boulevard School	207	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	48	15.00	720.00	1497.60	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1697.28	0.82
Southern Boulevard School	208	2080.00	12	128.00	1536.00	3194.88	1.54	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	48	15.00	720.00	1497.60	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1697.28	0.82
Southern Boulevard School	boys br near gym	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Southern Boulevard School	107	2080.00	7	128.00	896.00	1863.68	0.90	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	28	15.00	420.00	873.60	0.42	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	990.08	0.48
Southern Boulevard School	104	2080.00	6	128.00	768.00	1597.44	0.77	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	24	15.00	360.00	748.80	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	848.64	0.41
Southern Boulevard School	1st fl boys br	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Southern Boulevard School	comba office	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Southern Boulevard School	1st fl br	2080.00	1	128.00	128.00	266.24	0.13	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Southern Boulevard School	1st fl boys br	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Southern Boulevard School	103	2080.00	6	128.00	768.00	1597.44	0.77	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	24	15.00	360.00	748.80	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	848.64	0.41
Southern Boulevard School	principal office	2080.00	3	128.00	384.00	798.72	0.38	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	12	15.00	180.00	374.40	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	424.32	0.20

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Southern Boulevard School	108	2080.00	7	128.00	896.00	1863.68	0.90	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	28	15.00	420.00	873.60	0.42	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	990.08	0.48
Southern Boulevard School	118	2080.00	10	128.00	1280.00	2662.40	1.28	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	40	15.00	600.00	1248.00	0.60	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1414.40	0.68
Southern Boulevard School	105	2080.00	9	128.00	1152.00	2396.16	1.15	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Southern Boulevard School	106	2080.00	6	128.00	768.00	1597.44	0.77	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	24	15.00	360.00	748.80	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	848.64	0.41
Southern Boulevard School	305	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Southern Boulevard School	306	2080.00	4	128.00	512.00	1064.96	0.51	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	16	15.00	240.00	499.20	0.24	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	565.76	0.27
Southern Boulevard School	307	2080.00	4	128.00	512.00	1064.96	0.51	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	16	15.00	240.00	499.20	0.24	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	565.76	0.27
Southern Boulevard School	308	2080.00	1	128.00	128.00	266.24	0.13	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Southern Boulevard School	308 em	2080.00	1	128.00	128.00	266.24	0.13	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	22.00	88.00	183.04	0.09	4 FOOT 22W NWM BALLAST READY LED TUBE	83.20	0.04
Southern Boulevard School	music	2080.00	9	128.00	1152.00	2396.16	1.15	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	36	15.00	540.00	1123.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1272.96	0.61
Southern Boulevard School	counseler	2080.00	8	128.00	1024.00	2129.92	1.02	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	32	15.00	480.00	998.40	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1131.52	0.54
Southern Boulevard School	lower girls br	2080.00	1	128.00	128.00	266.24	0.13	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Southern Boulevard School	lower boys br	2080.00	2	128.00	256.00	532.48	0.26	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Southern Boulevard School	lower classroom	2080.00	8	128.00	1024.00	2129.92	1.02	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	32	15.00	480.00	998.40	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1131.52	0.54
Southern Boulevard School	lower electric room	260.00	1	118.00	118.00	30.68	0.12	*8' FIXTURE, 2-F96/T8/ 59 WATT LAMPS, ELECTRONIC BALLAST	260.00	4	15.00	60.00	15.60	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	15.08	0.06
Southern Boulevard School	gym office	2080.00	4	118.00	472.00	981.76	0.47	*8' FIXTURE, 2-F96/T8/ 59 WATT LAMPS, ELECTRONIC BALLAST	2080.00	16	15.00	240.00	499.20	0.24	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	482.56	0.23
Southern Boulevard School	ext door	2080.00	1	75.00	75.00	156.00	0.08	PAR 38 FLOOD 75 WATT	2080.00	1	19.00	19.00	39.52	0.02	PAR38, E26 BASE, 19 WATT, 120V 40°, 2700K, DIMMABLE - ENERGY STAR	116.48	0.06
Southern Boulevard School	ext main entry sconce	4380.00	2	75.00	150.00	657.00	0.15	A LAMP 75 WATT INCANDESCENT	4380.00	2	13.50	27.00	118.26	0.03	CREE 13.5-WATT (75W) DAY WHITE (5000K) LED LIGHT BULB	538.74	0.12
Southern Boulevard School	ext door 4	4380.00	1	75.00	75.00	328.50	0.08	A LAMP 75 WATT INCANDESCENT	4380.00	1	13.50	13.50	59.13	0.01	CREE 13.5-WATT (75W) DAY WHITE (5000K) LED LIGHT BULB	269.37	0.06
Southern Boulevard School	ext door 5	4380.00	1	75.00	75.00	328.50	0.08	A LAMP 75 WATT INCANDESCENT	4380.00	1	13.50	13.50	59.13	0.01	CREE 13.5-WATT (75W) DAY WHITE (5000K) LED LIGHT BULB	269.37	0.06
Southern Boulevard School	canopy	4380.00	3	75.00	225.00	985.50	0.23	A LAMP 75 WATT INCANDESCENT	4380.00	3	18.00	54.00	236.52	0.05	CREE 100W EQUIVALENT BULB DIMMABLE	748.98	0.17
Southern Boulevard School	ext door 11	4380.00	1	75.00	75.00	328.50	0.08	A LAMP 75 WATT INCANDESCENT	4380.00	1	18.00	18.00	78.84	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	249.66	0.06
Southern Boulevard School	100a	2080.00	1	60.00	60.00	124.80	0.06	A LAMP 60 WATT INCANDESCENT	2080.00	1	9.50	9.50	19.76	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	105.04	0.05
Southern Boulevard School	principal closet	260.00	1	60.00	60.00	15.60	0.06	A LAMP 60 WATT INCANDESCENT	260.00	1	9.50	9.50	2.47	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	13.13	0.05
Southern Boulevard School	comba closet	260.00	1	60.00	60.00	15.60	0.06	A LAMP 60 WATT INCANDESCENT	260.00	1	9.50	9.50	2.47	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	13.13	0.05
Southern Boulevard School	cust closet	260.00	1	60.00	60.00	15.60	0.06	A LAMP 60 WATT INCANDESCENT	260.00	1	9.50	9.50	2.47	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	13.13	0.05
Southern Boulevard School	115 cl	260.00	1	60.00	60.00	15.60	0.06	A LAMP 60 WATT INCANDESCENT	260.00	1	9.50	9.50	2.47	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	13.13	0.05
Southern Boulevard School	1st fll cust cl	260.00	1	60.00	60.00	15.60	0.06	A LAMP 60 WATT INCANDESCENT	260.00	1	9.50	9.50	2.47	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	13.13	0.05
Southern Boulevard School	lower electric rm 2	260.00	4	60.00	240.00	62.40	0.24	A LAMP 60 WATT INCANDESCENT	260.00	4	9.50	38.00	9.88	0.04	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	52.52	0.20
Southern Boulevard School	music cl	260.00	1	60.00	60.00	15.60	0.06	A LAMP 60 WATT INCANDESCENT	260.00	1	9.50	9.50	2.47	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	13.13	0.05
Southern Boulevard School	lower cust cl	260.00	1	60.00	60.00	15.60	0.06	A LAMP 60 WATT INCANDESCENT	260.00	1	9.50	9.50	2.47	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	13.13	0.05
Southern Boulevard School	lower room	2080.00	3	60.00	180.00	374.40	0.18	A LAMP 60 WATT INCANDESCENT	2080.00	3	9.50	28.50	59.28	0.03	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	315.12	0.15
Southern Boulevard School	lower mech rm	2080.00	2	32.00	64.00	133.12	0.06	1 - 32 WATT CFL	2080.00	2	9.50	19.00	39.52	0.02	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	93.60	0.05
Southern Boulevard School	nurse closet	260.00	1	32.00	32.00	8.32	0.03	1 - 32 WATT CFL	260.00	1	9.50	9.50	2.47	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	5.85	0.02
Southern Boulevard School	2nd fl cust cl	260.00	1	32.00	32.00	8.32	0.03	1 - 32 WATT CFL	260.00	1	9.50	9.50	2.47	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	5.85	0.02
Southern Boulevard School	2nd fl closet	260.00	1	32.00	32.00	8.32	0.03	1 - 32 WATT CFL	260.00	1	9.50	9.50	2.47	0.01	CREE 9.5-WATT (60W) WARM WHITE (2700K) LED LIGHT BULB	5.85	0.02
Southern Boulevard School	ext door 12	4380.00	1	295.00	295.00	1292.10	0.30	METAL HALIDE, 1-250 WATT LAMP	4380.00	1	62.00	62.00	271.56	0.06	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	1020.54	0.23
Southern Boulevard School	ext door 13	4380.00	1	295.00	295.00	1292.10	0.30	METAL HALIDE, 1-250 WATT LAMP	4380.00	1	62.00	62.00	271.56	0.06	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	1020.54	0.23
Southern Boulevard School	ext door 8	4380.00	1	295.00	295.00	1292.10	0.30	METAL HALIDE, 1-250 WATT LAMP	4380.00	1	62.00	62.00	271.56	0.06	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	1020.54	0.23
Southern Boulevard School	ext door 10	4380.00	1	295.00	295.00	1292.10	0.30	METAL HALIDE, 1-250 WATT LAMP	4380.00	1	62.00	62.00	271.56	0.06	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	1020.54	0.23
Southern Boulevard School	ext 106	4380.00	1	295.00	295.00	1292.10	0.30	METAL HALIDE, 1-250 WATT LAMP	4380.00	1	62.00	62.00	271.56	0.06	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	1020.54	0.23
Southern Boulevard School	ext 103	4380.00	1	295.00	295.00	1292.10	0.30	METAL HALIDE, 1-250 WATT LAMP	4380.00	1	62.00	62.00	271.56	0.06	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	1020.54	0.23
Southern Boulevard School	ext door 5	4380.00	2	295.00	590.00	2584.20	0.59	METAL HALIDE, 1-250 WATT LAMP	4380.00	2	62.00	124.00	543.12	0.12	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	2041.08	0.47

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Southern Boulevard School	ext wall facing pkg lot	4380.00	4	295.00	1180.00	5168.40	1.18	METAL HALIDE, 1-250 WATT LAMP	4380.00	4	62.00	248.00	1086.24	0.25	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	4082.16	0.93
Southern Boulevard School	ext door 2	4380.00	1	295.00	295.00	1292.10	0.30	METAL HALIDE, 1-250 WATT LAMP	4380.00	1	62.00	62.00	271.56	0.06	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	1020.54	0.23
Southern Boulevard School	ext door 3	4380.00	1	295.00	295.00	1292.10	0.30	METAL HALIDE, 1-250 WATT LAMP	4380.00	1	62.00	62.00	271.56	0.06	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	1020.54	0.23
Southern Boulevard School	ext courtyards	4380.00	2	295.00	590.00	2584.20	0.59	METAL HALIDE, 1-250 WATT LAMP	4380.00	2	62.00	124.00	543.12	0.12	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	2041.08	0.47
Southern Boulevard School	parking shoebox	4380.00	13	458.00	5954.00	26078.52	5.95	METAL HALIDE, 1-400 WATT LAMP - UNDER 15	4380.00	13	150.00	1950.00	8541.00	1.95	ALED150 TYPE IV WITH 8 POLE MOUNTING ARM COOL LED BRONZE - DLC LISTED	17537.52	4.00
Southern Boulevard School	124 hall	2080.00	2	192.00	384.00	798.72	0.38	*4' FIXTURE, 6-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	12	15.00	180.00	374.40	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	424.32	0.20
Southern Boulevard School	124 hall	2080.00	4	96.00	384.00	798.72	0.38	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	2080.00	16	9.00	144.00	299.52	0.14	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	499.20	0.24
Southern Boulevard School	124 hall em	2080.00	1	96.00	96.00	199.68	0.10	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	2080.00	4	12.00	48.00	99.84	0.05	2 FOOT 12W NWM BALLAST READY LED TUBE	99.84	0.05
Southern Boulevard School	124	2080.00	4	96.00	384.00	798.72	0.38	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	2080.00	16	9.00	144.00	299.52	0.14	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	499.20	0.24
Southern Boulevard School	125	2080.00	3	96.00	288.00	599.04	0.29	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	2080.00	12	9.00	108.00	224.64	0.11	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	374.40	0.18
Southern Boulevard School	library em	2080.00	5	96.00	480.00	998.40	0.48	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	2080.00	20	12.00	240.00	499.20	0.24	2 FOOT 12W NWM BALLAST READY LED TUBE	499.20	0.24
Southern Boulevard School	1st fl womens br	2080.00	1	96.00	96.00	199.68	0.10	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	2080.00	4	9.00	36.00	74.88	0.04	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	124.80	0.06
Southern Boulevard School	library	2080.00	36	96.00	3456.00	7188.48	3.46	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	2080.00	144	9.00	1296.00	2695.68	1.30	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	4492.80	2.16
Southern Boulevard School	library entry	2080.00	3	36.00	108.00	224.64	0.11	2 - 18 WATT QUAD-PIN CFL	2080.00	6	15.00	90.00	187.20	0.09	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	37.44	0.02
Southern Boulevard School	1st fl hall	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	6	15.00	90.00	187.20	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	212.16	0.10
Southern Boulevard School	1st fl womens br	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Southern Boulevard School	hall of 125	2080.00	11	64.00	704.00	1464.32	0.70	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	22	15.00	330.00	686.40	0.33	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	777.92	0.37
Southern Boulevard School	stairs	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Southern Boulevard School	stairs em	2080.00	4	64.00	256.00	532.48	0.26	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	22.00	176.00	366.08	0.18	4 FOOT 22W NWM BALLAST READY LED TUBE	166.40	0.08
Southern Boulevard School	stairs	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Southern Boulevard School	stairs em	2080.00	4	64.00	256.00	532.48	0.26	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	22.00	176.00	366.08	0.18	4 FOOT 22W NWM BALLAST READY LED TUBE	166.40	0.08
Southern Boulevard School	stairs	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Southern Boulevard School	stairs em	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	22.00	44.00	91.52	0.04	4 FOOT 22W NWM BALLAST READY LED TUBE	41.60	0.02
Southern Boulevard School	124 br	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Southern Boulevard School	124 hall	2080.00	7	64.00	448.00	931.84	0.45	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	14	15.00	210.00	436.80	0.21	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	495.04	0.24
Southern Boulevard School	gym hall	2080.00	11	64.00	704.00	1464.32	0.70	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	22	15.00	330.00	686.40	0.33	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	777.92	0.37
Southern Boulevard School	nurse	2080.00	8	64.00	512.00	1064.96	0.51	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	16	15.00	240.00	499.20	0.24	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	565.76	0.27
Southern Boulevard School	copy rm	2080.00	4	64.00	256.00	532.48	0.26	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	15.00	120.00	249.60	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	282.88	0.14
Southern Boulevard School	115 + 115 br	2080.00	5	64.00	320.00	665.60	0.32	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	10	15.00	150.00	312.00	0.15	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	353.60	0.17
Southern Boulevard School	126	260.00	1	64.00	64.00	16.64	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	260.00	2	15.00	30.00	7.80	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	8.84	0.03
Southern Boulevard School	124 cl	260.00	1	64.00	64.00	16.64	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	260.00	2	15.00	30.00	7.80	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	8.84	0.03
Southern Boulevard School	art closet	260.00	1	64.00	64.00	16.64	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	260.00	2	15.00	30.00	7.80	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	8.84	0.03
Southern Boulevard School	nurse closet	260.00	1	64.00	64.00	16.64	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	260.00	2	15.00	30.00	7.80	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	8.84	0.03
Southern Boulevard School	main office closet	260.00	1	64.00	64.00	16.64	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	260.00	2	15.00	30.00	7.80	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	8.84	0.03
Southern Boulevard School	100a	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Southern Boulevard School	100	2080.00	12	64.00	768.00	1597.44	0.77	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	24	15.00	360.00	748.80	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	848.64	0.41
Southern Boulevard School	lower closet	260.00	1	64.00	64.00	16.64	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	260.00	2	15.00	30.00	7.80	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	8.84	0.03
Southern Boulevard School	st nrear door 5	260.00	2	64.00	128.00	33.28	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	260.00	4	15.00	60.00	15.60	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	17.68	0.07
Southern Boulevard School	1st fl closet	260.00	2	64.00	128.00	33.28	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	260.00	4	15.00	60.00	15.60	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	17.68	0.07
Southern Boulevard School	counseler closet	260.00	1	64.00	64.00	16.64	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	260.00	2	15.00	30.00	7.80	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	8.84	0.03
Southern Boulevard School	elec panel st	260.00	2	64.00	128.00	33.28	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	260.00	4	15.00	60.00	15.60	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	17.68	0.07
Southern Boulevard School	cafeteria	2080.00	36	64.00	2304.00	4792.32	2.30	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	72	15.00	1080.00	2246.40	1.08	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	2545.92	1.22

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Southern Boulevard School	cust room	2080.00	6	64.00	384.00	798.72	0.38	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	12	15.00	180.00	374.40	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	424.32	0.20
Southern Boulevard School	lower st cafeteria	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Southern Boulevard School	stairs	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Southern Boulevard School	stairs em	2080.00	4	64.00	256.00	532.48	0.26	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	8	22.00	176.00	366.08	0.18	4 FOOT 22W NWM BALLAST READY LED TUBE	166.40	0.08
Southern Boulevard School	stairs	2080.00	3	64.00	192.00	399.36	0.19	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	6	15.00	90.00	187.20	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	212.16	0.10
Southern Boulevard School	stairs em	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	22.00	44.00	91.52	0.04	4 FOOT 22W NWM BALLAST READY LED TUBE	41.60	0.02
Southern Boulevard School	2nd fl girls br	2080.00	2	64.00	128.00	266.24	0.13	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	4	15.00	60.00	124.80	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	141.44	0.07
Southern Boulevard School	lower hall	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Southern Boulevard School	lower room	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Southern Boulevard School	lower hall	2080.00	1	64.00	64.00	133.12	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	2	15.00	30.00	62.40	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	70.72	0.03
Southern Boulevard School	lower hall	2080.00	8	64.00	512.00	1064.96	0.51	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	16	15.00	240.00	499.20	0.24	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	565.76	0.27
Southern Boulevard School	gym	2080.00	18	336.00	6048.00	12579.84	6.05	8-42 WATT CFL HIGHBAY	2080.00	18	160.00	2880.00	5990.40	2.88	HH HIGHBAY,160W,18,000 LM,40K,120-277V, 0-10V DIMMING,15 AMP 120V TWIST LOCK PLUG (REFLECTOR NOT INCLUDED)	6589.44	3.17
Southern Boulevard School	122	2080.00	14	172.00	2408.00	5008.64	2.41	4' FIXTURE, 2-F32/T8/32 WATT LAMPS & 2-F54/T5/54 WATT, ELECT BALL-PEND	2080.00	56	15.00	840.00	1747.20	0.84	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	3261.44	1.57
Southern Boulevard School	library	2080.00	16	172.00	2752.00	5724.16	2.75	4' FIXTURE, 2-F32/T8/32 WATT LAMPS & 2-F54/T5/54 WATT, ELECT BALL-PEND	2080.00	32	15.00	480.00	998.40	0.48	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	4725.76	2.27
Washington Avenue School	boys br kits	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	6	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00
Washington Avenue School	girls br kits	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	6	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00
Washington Avenue School	gym EM packs	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	12	0.00	0.00	0.00	0.00	COOPER SURELITE LED EMERGENCY LIGHT WITH BATTERY BACKUP	0.00	0.00
Washington Avenue School	gym fixtures	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	20	0.00	0.00	0.00	0.00	2X4 ECONOMY LAY IN ACRYLIC 4 LAMP	0.00	0.00
Washington Avenue School	20 br kits	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00
Washington Avenue School	18 br kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Washington Avenue School	17 br kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Washington Avenue School	men br kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Washington Avenue School	women br kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Washington Avenue School	nurse kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Washington Avenue School	special svce kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Washington Avenue School	14 br kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	1	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Washington Avenue School	library hall kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	4	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Washington Avenue School	library kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	6	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)	0.00	0.00
Washington Avenue School	gym office kit	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	4	0.00	0.00	0.00	0.00	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (4) SOCKETS)	0.00	0.00
Washington Avenue School	1L sockets	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	28	0.00	0.00	0.00	0.00	NON-SHUNTED SOCKET, 600V, 660W	0.00	0.00
Washington Avenue School	2l harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	122	0.00	0.00	0.00	0.00	2 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Washington Avenue School	3L harnesses	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	276	0.00	0.00	0.00	0.00	3 LAMP UNIVERSAL TOMBSTONE KIT	0.00	0.00
Washington Avenue School	2ft	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	3	12.00	36.00	157.68	0.04	2 FOOT 12W NWM BALLAST READY LED TUBE	-157.68	-0.04
Washington Avenue School	bays	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	16	0.00	0.00	0.00	0.00	CREE ALUMINUM REFLECTOR 16"	0.00	0.00
Washington Avenue School	closet stock 2 ft	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	3	9.00	27.00	118.26	0.03	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	-118.26	-0.03
Washington Avenue School	exterior	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	9	0.00	0.00	0.00	0.00	PENCIL PHOTOCEL 120V	0.00	0.00
Washington Avenue School	closet stock	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	36	15.00	540.00	2365.20	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	-2365.20	-0.54
Washington Avenue School	tubes	4380.00	0	0.00	0.00	0.00	0.00	0 - N/A	4380.00	2	22.00	44.00	192.72	0.04	4 FOOT 22W NWM BALLAST READY LED TUBE	-192.72	-0.04
Washington Avenue School	library	2080.00	6	73.00	438.00	911.04	0.44	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	1872.00	18	9.00	162.00	303.26	0.16	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	607.78	0.28
Washington Avenue School	library hall	2080.00	4	73.00	292.00	607.36	0.29	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	1872.00	12	9.00	108.00	202.18	0.11	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	405.18	0.18
Washington Avenue School	special svce	2080.00	1	73.00	73.00	151.84	0.07	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	1872.00	3	12.00	36.00	67.39	0.04	2 FOOT 12W NWM BALLAST READY LED TUBE	84.45	0.04
Washington Avenue School	nurse	2080.00	1	73.00	73.00	151.84	0.07	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	1872.00	3	12.00	36.00	67.39	0.04	2 FOOT 12W NWM BALLAST READY LED TUBE	84.45	0.04
Washington Avenue School	women br	2080.00	1	73.00	73.00	151.84	0.07	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	1872.00	3	12.00	36.00	67.39	0.04	2 FOOT 12W NWM BALLAST READY LED TUBE	84.45	0.04
Washington Avenue School	18 br	2080.00	1	73.00	73.00	151.84	0.07	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	1872.00	3	12.00	36.00	67.39	0.04	2 FOOT 12W NWM BALLAST READY LED TUBE	84.45	0.04
Washington Avenue School	14 br	2080.00	1	73.00	73.00	151.84	0.07	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	1872.00	3	9.00	27.00	50.54	0.03	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	101.30	0.05

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Washington Avenue School	men br	2080.00	1	73.00	73.00	151.84	0.07	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	1872.00	3	12.00	36.00	67.39	0.04	2 FOOT 12W NWM BALLAST READY LED TUBE	84.45	0.04
Washington Avenue School	17 br	2080.00	1	73.00	73.00	151.84	0.07	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	1872.00	3	12.00	36.00	67.39	0.04	2 FOOT 12W NWM BALLAST READY LED TUBE	84.45	0.04
Washington Avenue School	hall	2080.00	6	102.00	612.00	1272.96	0.61	2'X2' 2-F40T8, BIAX ELECTRONIC BALLAST	1872.00	6	35.00	210.00	393.12	0.21	ZR22, 35 WATT, 3200LM, 4000K, 0-10V DIMMING	879.84	0.40
Washington Avenue School	hall	2080.00	13	102.00	1326.00	2758.08	1.33	2'X2' 2-F40T8, BIAX ELECTRONIC BALLAST	1872.00	13	35.00	455.00	851.76	0.45	ZR22, 35 WATT, 3200LM, 4000K, 0-10V DIMMING	1906.32	0.87
Washington Avenue School	gym hall	2080.00	5	102.00	510.00	1060.80	0.51	2'X2' 2-F40T8, BIAX ELECTRONIC BALLAST	1872.00	5	35.00	175.00	327.60	0.17	ZR22, 35 WATT, 3200LM, 4000K, 0-10V DIMMING	733.20	0.34
Washington Avenue School	display	2080.00	1	32.00	32.00	66.56	0.03	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	2080.00	1	15.00	15.00	31.20	0.01	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	35.36	0.02
Washington Avenue School	library	2080.00	23	32.00	736.00	1530.88	0.74	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	1872.00	23	15.00	345.00	645.84	0.34	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	885.04	0.39
Washington Avenue School	display case	2080.00	1	32.00	32.00	66.56	0.03	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	2080.00	1	15.00	15.00	31.20	0.01	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	35.36	0.02
Washington Avenue School	display cases (3)	2080.00	3	32.00	96.00	199.68	0.10	*4' FIXTURE, 1-F32/T8 LAMP, ELECTRONIC BALLAST	2080.00	3	15.00	45.00	93.60	0.04	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	106.08	0.05
Washington Avenue School	elec closet	520.00	1	82.00	82.00	42.64	0.08	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	3	15.00	45.00	23.40	0.04	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	19.24	0.04
Washington Avenue School	cust closet	520.00	1	82.00	82.00	42.64	0.08	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	3	15.00	45.00	23.40	0.04	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	19.24	0.04
Washington Avenue School	faculty rm	2080.00	4	82.00	328.00	682.24	0.33	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	12	15.00	180.00	336.96	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	345.28	0.15
Washington Avenue School	3	2080.00	12	82.00	984.00	2046.72	0.98	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1035.84	0.44
Washington Avenue School	20	2080.00	14	82.00	1148.00	2387.84	1.15	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	42	15.00	630.00	1179.36	0.63	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1208.48	0.52
Washington Avenue School	nurse	2080.00	3	82.00	246.00	511.68	0.25	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	9	15.00	135.00	252.72	0.13	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	258.96	0.11
Washington Avenue School	14	2080.00	15	82.00	1230.00	2558.40	1.23	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	45	15.00	675.00	1263.60	0.67	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1294.80	0.56
Washington Avenue School	17	2080.00	15	82.00	1230.00	2558.40	1.23	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	45	15.00	675.00	1263.60	0.67	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1294.80	0.56
Washington Avenue School	24	2080.00	12	82.00	984.00	2046.72	0.98	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1035.84	0.44
Washington Avenue School	23	2080.00	12	82.00	984.00	2046.72	0.98	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1035.84	0.44
Washington Avenue School	22	2080.00	12	82.00	984.00	2046.72	0.98	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1035.84	0.44
Washington Avenue School	21	2080.00	12	82.00	984.00	2046.72	0.98	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1035.84	0.44
Washington Avenue School	5	2080.00	12	82.00	984.00	2046.72	0.98	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1035.84	0.44
Washington Avenue School	boys br	2080.00	2	82.00	164.00	341.12	0.16	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	172.64	0.07
Washington Avenue School	girls br	2080.00	2	82.00	164.00	341.12	0.16	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	172.64	0.07
Washington Avenue School	1	2080.00	12	82.00	984.00	2046.72	0.98	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1035.84	0.44
Washington Avenue School	6	2080.00	12	82.00	984.00	2046.72	0.98	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1035.84	0.44
Washington Avenue School	sgi	2080.00	9	82.00	738.00	1535.04	0.74	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	27	15.00	405.00	758.16	0.40	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	776.88	0.33
Washington Avenue School	5	2080.00	12	82.00	984.00	2046.72	0.98	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1035.84	0.44
Washington Avenue School	18	2080.00	15	82.00	1230.00	2558.40	1.23	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	45	15.00	675.00	1263.60	0.67	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1294.80	0.56
Washington Avenue School	14 art music	2080.00	12	82.00	984.00	2046.72	0.98	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1035.84	0.44
Washington Avenue School	7	2080.00	12	82.00	984.00	2046.72	0.98	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1035.84	0.44
Washington Avenue School	8	2080.00	12	82.00	984.00	2046.72	0.98	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1035.84	0.44
Washington Avenue School	9	2080.00	12	82.00	984.00	2046.72	0.98	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1035.84	0.44
Washington Avenue School	10	2080.00	12	82.00	984.00	2046.72	0.98	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1035.84	0.44
Washington Avenue School	11	2080.00	12	82.00	984.00	2046.72	0.98	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1035.84	0.44
Washington Avenue School	12	2080.00	12	82.00	984.00	2046.72	0.98	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	36	15.00	540.00	1010.88	0.54	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1035.84	0.44
Washington Avenue School	special srvce	2080.00	3	82.00	246.00	511.68	0.25	*4' FIXTURE, 3-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	9	15.00	135.00	252.72	0.13	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	258.96	0.11
Washington Avenue School	hall	2080.00	1	109.00	109.00	226.72	0.11	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	4	15.00	60.00	112.32	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	114.40	0.05
Washington Avenue School	boys	2080.00	2	109.00	218.00	453.44	0.22	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	8	15.00	120.00	224.64	0.12	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	228.80	0.10
Washington Avenue School	4	2080.00	12	109.00	1308.00	2720.64	1.31	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1372.80	0.59
Washington Avenue School	principal	2080.00	4	109.00	436.00	906.88	0.44	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	16	15.00	240.00	449.28	0.24	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	457.60	0.20
Washington Avenue School	office	2080.00	6	109.00	654.00	1360.32	0.65	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	24	15.00	360.00	673.92	0.36	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	686.40	0.29

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Washington Avenue School	faculty br	2080.00	1	109.00	109.00	226.72	0.11	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	4	15.00	60.00	112.32	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	114.40	0.05
Washington Avenue School	cst	2080.00	4	109.00	436.00	906.88	0.44	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	16	15.00	240.00	449.28	0.24	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	457.60	0.20
Washington Avenue School	gym st	520.00	1	109.00	109.00	56.68	0.11	*4' FIXTURE, 4-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	4	15.00	60.00	31.20	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	25.48	0.05
Washington Avenue School	exits	4380.00	30	56.00	1680.00	7358.40	1.68	2 - 28 WATT BI PIN FLUORESCENT FIXTURE WITH ELECTRONIC BALLAST	4380.00	30	0.75	22.50	98.55	0.02	COOPER SURELITE LED EXIT/EMERGENCY COMBO (RED LETTERS)	7259.85	1.66
Washington Avenue School	ext near rock	4380.00	1	90.00	90.00	394.20	0.09	PAR 38 FLOOD 90 WATT	4380.00	1	19.00	19.00	83.22	0.02	PAR38, E26 BASE, 19 WATT, 120V 40°, 2700K, DIMMABLE - ENERGY STAR	310.98	0.07
Washington Avenue School	ext door 7	4380.00	1	90.00	90.00	394.20	0.09	PAR 38 FLOOD 90 WATT	4380.00	1	19.00	19.00	83.22	0.02	PAR38, E26 BASE, 19 WATT, 120V 40°, 2700K, DIMMABLE - ENERGY STAR	310.98	0.07
Washington Avenue School	multipurpose stage	2080.00	6	65.00	390.00	811.20	0.39	PAR 30 FLOOD 65 WATT	1872.00	6	10.00	60.00	112.32	0.06	BR30, E26 BASE, 10 WATT, 120V, 2700K, DIMMABLE - ENERGY STAR	698.88	0.33
Washington Avenue School	cst st	520.00	1	60.00	60.00	31.20	0.06	A LAMP 60 WATT INCANDESCENT	520.00	1	18.00	18.00	9.36	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	21.84	0.04
Washington Avenue School	custodian cl	520.00	1	60.00	60.00	31.20	0.06	A LAMP 60 WATT INCANDESCENT	520.00	1	18.00	18.00	9.36	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	21.84	0.04
Washington Avenue School	multipurpose st	520.00	2	60.00	120.00	62.40	0.12	A LAMP 60 WATT INCANDESCENT	520.00	2	18.00	36.00	18.72	0.04	CREE 100W EQUIVALENT BULB DIMMABLE	43.68	0.08
Washington Avenue School	ext door 6	4380.00	1	60.00	60.00	262.80	0.06	A LAMP 60 WATT INCANDESCENT	4380.00	1	18.00	18.00	78.84	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	183.96	0.04
Washington Avenue School	ext door 1	4380.00	3	60.00	180.00	788.40	0.18	A LAMP 60 WATT INCANDESCENT	4380.00	3	18.00	54.00	236.52	0.05	CREE 100W EQUIVALENT BULB DIMMABLE	551.88	0.13
Washington Avenue School	ext courtyard	4380.00	1	60.00	60.00	262.80	0.06	A LAMP 60 WATT INCANDESCENT	4380.00	1	18.00	18.00	78.84	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	183.96	0.04
Washington Avenue School	library	2080.00	6	60.00	360.00	748.80	0.36	A LAMP 60 WATT INCANDESCENT	1872.00	6	18.00	108.00	202.18	0.11	CREE 100W EQUIVALENT BULB DIMMABLE	546.62	0.25
Washington Avenue School	office	2080.00	1	32.00	32.00	66.56	0.03	1 - 32 WATT CFL	2080.00	1	18.00	18.00	37.44	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	29.12	0.01
Washington Avenue School	14 kiln	2080.00	1	32.00	32.00	66.56	0.03	1 - 32 WATT CFL	1872.00	1	18.00	18.00	33.70	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	32.86	0.01
Washington Avenue School	cust closet	520.00	1	32.00	32.00	16.64	0.03	1 - 32 WATT CFL	520.00	1	18.00	18.00	9.36	0.02	CREE 100W EQUIVALENT BULB DIMMABLE	7.28	0.01
Washington Avenue School	stage	2080.00	3	32.00	96.00	199.68	0.10	1 - 32 WATT CFL	1872.00	3	18.00	54.00	101.09	0.05	CREE 100W EQUIVALENT BULB DIMMABLE	98.59	0.04
Washington Avenue School	ext door 11	4380.00	2	138.00	276.00	1208.88	0.28	HIGH PRESSURE SODIUM, 1-100 WATT LAMP	4380.00	2	12.00	24.00	105.12	0.02	ENTRA 12W COOL LED 120V TO 277V WALLMOUNT BRONZE - DLC LISTED	1103.76	0.25
Washington Avenue School	ext flood near rm 20	4380.00	1	188.00	188.00	823.44	0.19	HIGH PRESSURE SODIUM, 1-150 WATT LAMP	4380.00	1	39.00	39.00	170.82	0.04	FUTURE FLOOD 39W COOL LED 120V TO 277V BRONZE - DLC LISTED	652.62	0.15
Washington Avenue School	ext near rm 24	4380.00	2	295.00	590.00	2584.20	0.59	HIGH PRESSURE SODIUM, 1-250 WATT LAMP	4380.00	2	62.00	124.00	543.12	0.12	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	2041.08	0.47
Washington Avenue School	ext door 3	4380.00	1	295.00	295.00	1292.10	0.30	HIGH PRESSURE SODIUM, 1-250 WATT LAMP	4380.00	1	62.00	62.00	271.56	0.06	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	1020.54	0.23
Washington Avenue School	ext courtyard	4380.00	1	295.00	295.00	1292.10	0.30	HIGH PRESSURE SODIUM, 1-250 WATT LAMP	4380.00	1	62.00	62.00	271.56	0.06	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	1020.54	0.23
Washington Avenue School	ext near door 2	4380.00	2	295.00	590.00	2584.20	0.59	HIGH PRESSURE SODIUM, 1-250 WATT LAMP	4380.00	2	62.00	124.00	543.12	0.12	SLIM WALLPACK 62W COOL LED 120 TO 277V BRONZE WP3 - DLC LISTED	2041.08	0.47
Washington Avenue School	multipurpose rm	2080.00	20	295.00	5900.00	12272.00	5.90	HIGH PRESSURE SODIUM, 1-250 WATT LAMP	1872.00	80	18.00	1440.00	2695.68	1.44	G3 HP 4 FOOT 18W 5000K MILKY LENS SEP LED TUBE - DLC LISTED	9576.32	4.46
Washington Avenue School	multipurpose	2080.00	2	295.00	590.00	1227.20	0.59	HIGH PRESSURE SODIUM, 1-250 WATT LAMP	1872.00	2	19.00	38.00	71.14	0.04	PAR38, E26 BASE, 19 WATT, 120V 40°, 2700K, DIMMABLE - ENERGY STAR	1156.06	0.55
Washington Avenue School	20 br	2080.00	1	108.00	108.00	224.64	0.11	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	1872.00	4	9.00	36.00	67.39	0.04	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	157.25	0.07
Washington Avenue School	boys br	2080.00	6	108.00	648.00	1347.84	0.65	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	1872.00	24	9.00	216.00	404.35	0.22	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	943.49	0.43
Washington Avenue School	girls br	2080.00	6	108.00	648.00	1347.84	0.65	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	1872.00	24	9.00	216.00	404.35	0.22	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	943.49	0.43
Washington Avenue School	gym office	2080.00	4	108.00	432.00	898.56	0.43	*2' FIXTURE, 3-F32/T8/U3 LAMPS, ELECTRONIC BALLAST	2080.00	16	9.00	144.00	299.52	0.14	G3 SP 2 FOOT 9W NW MILKY LENS SEP LED TUBE - DLC LISTED	599.04	0.29
Washington Avenue School	hall	2080.00	1	58.00	58.00	120.64	0.06	2 - 26 WATT CFL QUAD - PIN FIXTURE	1872.00	2	15.00	30.00	56.16	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	64.48	0.03
Washington Avenue School	gym hall	2080.00	5	58.00	290.00	603.20	0.29	2 - 26 WATT CFL QUAD - PIN FIXTURE	1872.00	10	15.00	150.00	280.80	0.15	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	322.40	0.14
Washington Avenue School	22 entry	2080.00	1	58.00	58.00	120.64	0.06	2 - 26 WATT CFL QUAD - PIN FIXTURE	1872.00	2	15.00	30.00	56.16	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	64.48	0.03
Washington Avenue School	21 entry	2080.00	1	58.00	58.00	120.64	0.06	2 - 26 WATT CFL QUAD - PIN FIXTURE	1872.00	2	15.00	30.00	56.16	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	64.48	0.03
Washington Avenue School	faculty rm	2080.00	2	58.00	116.00	241.28	0.12	2 - 26 WATT CFL QUAD - PIN FIXTURE	1872.00	4	15.00	60.00	112.32	0.06	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	128.96	0.06
Washington Avenue School	20	2080.00	1	58.00	58.00	120.64	0.06	2 - 26 WATT CFL QUAD - PIN FIXTURE	1872.00	2	15.00	30.00	56.16	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	64.48	0.03
Washington Avenue School	24 entry	2080.00	1	58.00	58.00	120.64	0.06	2 - 26 WATT CFL QUAD - PIN FIXTURE	1872.00	2	15.00	30.00	56.16	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	64.48	0.03
Washington Avenue School	23 entry	2080.00	1	58.00	58.00	120.64	0.06	2 - 26 WATT CFL QUAD - PIN FIXTURE	1872.00	2	15.00	30.00	56.16	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	64.48	0.03
Washington Avenue School	hall	2080.00	1	58.00	58.00	120.64	0.06	2 - 26 WATT CFL QUAD - PIN FIXTURE	1872.00	2	15.00	30.00	56.16	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	64.48	0.03
Washington Avenue School	hall	2080.00	1	58.00	58.00	120.64	0.06	2 - 26 WATT CFL QUAD - PIN FIXTURE	1872.00	2	15.00	30.00	56.16	0.03	HELEN LAMP, HORIZONTAL, 1-13 WATT 4 PIN LED REPLACEMENT BULB - 4000K	64.48	0.03
Washington Avenue School	princ br	2080.00	1	58.00	58.00	120.64	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	64.48	0.03
Washington Avenue School	cst	520.00	1	58.00	58.00	30.16	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	468.00	2	15.00	30.00	14.04	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	16.12	0.03
Washington Avenue School	office st	520.00	2	58.00	116.00	60.32	0.12	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	4	15.00	60.00	31.20	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	29.12	0.06
Washington Avenue School	st	520.00	6	58.00	348.00	180.96	0.35	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	12	15.00	180.00	93.60	0.18	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	87.36	0.17
Washington Avenue School	cust cl	520.00	2	58.00	116.00	60.32	0.12	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	520.00	4	15.00	60.00	31.20	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	29.12	0.06
Washington Avenue School	hall	2080.00	19	58.00	1102.00	2292.16	1.10	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	38	15.00	570.00	1067.04	0.57	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1225.12	0.53
Washington Avenue School	girls	2080.00	2	58.00	116.00	241.28	0.12	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	4	15.00	60.00	112.32	0.06	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	128.96	0.06

Building	Location	Current Hours	Current Qty	Current Watts	Total Current Watts	Current KwH	Current kW	Current Lighting Description	Proposed Hours	Proposed Qty	Proposed Watts	Total Proposed Watts	Proposed KwH	Proposed kW	Proposed Lighting Description	KwH Reduction	kW Reduction
Washington Avenue School	library 15	2080.00	17	58.00	986.00	2050.88	0.99	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	34	15.00	510.00	954.72	0.51	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1096.16	0.48
Washington Avenue School	library work rm	2080.00	3	58.00	174.00	361.92	0.17	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	193.44	0.08
Washington Avenue School	hall	2080.00	24	58.00	1392.00	2895.36	1.39	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	48	15.00	720.00	1347.84	0.72	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	1547.52	0.67
Washington Avenue School	stage hall	2080.00	1	58.00	58.00	120.64	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	64.48	0.03
Washington Avenue School	hall	2080.00	11	58.00	638.00	1327.04	0.64	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	22	15.00	330.00	617.76	0.33	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	709.28	0.31
Washington Avenue School	hall em	2080.00	2	58.00	116.00	241.28	0.12	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	4	22.00	88.00	164.74	0.09	4 FOOT 22W NWM BALLAST READY LED TUBE	76.54	0.03
Washington Avenue School	13	2080.00	7	58.00	406.00	844.48	0.41	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	14	15.00	210.00	393.12	0.21	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	451.36	0.20
Washington Avenue School	AV	2080.00	8	58.00	464.00	965.12	0.46	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	16	15.00	240.00	449.28	0.24	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	515.84	0.22
Washington Avenue School	av	2080.00	9	58.00	522.00	1085.76	0.52	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	18	15.00	270.00	505.44	0.27	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	580.32	0.25
Washington Avenue School	av st	2080.00	3	58.00	174.00	361.92	0.17	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	6	15.00	90.00	168.48	0.09	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	193.44	0.08
Washington Avenue School	faculty br	2080.00	1	58.00	58.00	120.64	0.06	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	1872.00	2	15.00	30.00	56.16	0.03	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	64.48	0.03
Washington Avenue School	boiler	2080.00	5	58.00	290.00	603.20	0.29	*4' FIXTURE, 2-F32/T8 LAMPS, ELECTRONIC BALLAST	2080.00	10	15.00	150.00	312.00	0.15	G3 SP 4 FOOT 15W NW MILKY LENS SEP LED TUBE - DLC LISTED	291.20	0.14
Washington Avenue School	gym	2080.00	16	336.00	5376.00	11182.08	5.38	8-42 WATT CFL HIGHBAY	2080.00	16	160.00	2560.00	5324.80	2.56	HH HIGHBAY,160W,18,000 LM,40K,120-277V, 0-10V DIMMING,15 AMP 120V TWIST LOCK PLUG (REFLECTOR NOT INCLUDED)	5857.28	2.82

Chathams School District
Exhibit D
ECM 1B - Lighting Controls and Daylight Harvesting
Lighting Controls and Heating Penalty

ECM DESCRIPTION

Retrofit existing lighting fixtures with new energy efficient lighting fixtures, install motion sensors and implement daylight harvesting in selected areas

DATA / ASSUMPTIONS

* Heating Season	20	Weeks
** Fraction of heat to be made-up	40.0%	
Heating Hours (Weather Data)	3,948	Hours

** Fraction of the Year Representing the Cooling Season Liberal estimate of the heating season, as there are times during the year when the building is neither heated nor cooled.
*** Fraction of the Lighting Reduction that Has to Be Made Up by Heating a portion of the lighting heat is released at night plus interior zones will have limited heating loads

MEASUREMENT AND VERIFICATION

Option
A - The
Engine

COMMISSIONING

Confirm lighting operation and occupancy sensors functions

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) =	0%
Safety Factor (Thermal) =	0%

Relatively high safety factor is used for this ECM because of direct measurements are proven over the time and savings are stipulated

Chathams School District
Exhibit D
ECM 1B - Lighting Controls and Daylight Harvesting
Lighting Controls and Heating Penalty

CALCULATIONS

Detailed energy savings calculations are in the line-by-line calculation sheet

*Inputs are blue

Building	Lighting Controls Savings (kWh)
Chatham High School	28,307
Chatham Middle School	33,749
Lafayette School	15,184
Milton Avenue School	5,392
Southern Boulevard School	9,366
Washington Avenue School	9,108
Totals	101,106

CALCULATIONS

	Chatham High School	Chatham Middle School	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School
Lighting Safety Factor	0%	0%	0%	0%	0%	0%
Lighting Savings	28,307	33,749	15,184	5,392	9,366	9,108
Heating Season	20	20	20	20	20	20
** % of Heating Season	38%	38%	38%	38%	38%	38%
***Fraction of Heat to be Made-up	40%	40%	40%	40%	40%	40%
****Annual Equivalent of Lighting kWh Saved in Therms	966	1,152	518	184	320	311
Current Boiler Efficiency	80.0%	87.0%	90.0%	78.0%	76.3%	77.9%
Heating Penalty	(186)	(204)	(89)	(36)	(64)	(61)

Chathams School District
Exhibit D
ECM 1C - Vending Misers
Vending Mizers

ECM DESCRIPTION

Install vending machines with vending misers, mounted on the respective vending machine.

DATA / ASSUMPTIONS

Cold Drink Run Hour Reduction	34%	
Snack Machine Run Hour Reduction	40%	
Typical Cold Drink Wattage	0.339	Watts
Typical Snack Machine Wattage	0.041	Watts

MEASUREMENT AND VERIFICATION

Option A - The Engineering Calculations are based on 5% of the retrofitted lighting fixtures direct kW measurements and operating hours. The kW Measurements are taken for existing lighting fixtures before removal and for new installed lighting fixtures. Lighting operating hours are agreed by client basis from the audit, logging data, and operating personal input. The occupancy sensors savings are calculated as % of operating hours basebd on logging data and historical statistical data.

COMMISSIONING

Confirm vending miser operation

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) = 10%

Relatively high safety factor is used for this ECM because of direct measurements are proven over the time and savings are stipulated

CALCULATIONS

Detailed energy savings calculations are in the line-by-line calculation sheet

*Inputs are blue

Building	Label	Type	Qty	Location
Chatham High School	CHS-VM-1	Cold Beverage	1	Cafeteria
Chatham High School	CHS-VM-2	Snack	1	Cafeteria
Chatham High School	CHS-VM-3	Cold Beverage	1	Cafeteria
Chatham High School	CHS-VM-4	Cold Beverage	1	Hallway
Chatham High School	CHS-VM-5	Cold Beverage	1	Hallway
Chatham High School	CHS-VM-6	Snack	1	Hallway
Chatham High School	CHS-VM-7	Cold Beverage	1	Faculty Room
Chatham High School	CHS-VM-8	Snack	1	Faculty Room
Chatham Middle School	CMS-VM-1	Cold Beverage	1	Cafeteria
Chatham Middle School	CMS-VM-2	Cold Beverage	1	Faculty Room
Chatham Middle School	CMS-VM-3	Snack	1	Faculty Room
Lafayette School	LAF-VM-1	Cold Beverage	1	Faculty Room
Southern Boulevard School	SBS-VM-1	Cold Beverage	1	Hallway
Milton Avenue School	MAS-VM-1	Cold Beverage	1	Faculty Room
Washington Avenue School	WAS-VM-1	Cold Beverage	1	Faculty Room
Totals	-	-	15	-

Chathams School District
Exhibit D
ECM 1C - Vending Misers
Vending Mizers

CALCULATION

	Chatham High School	Chatham High School	Chatham High School	Chatham High School	Chatham High School	Chatham High School	Chatham High School	Chatham High School	Chatham Middle School	Chatham Middle School	Chatham Middle School	Lafayette School	Southern Boulevard School	Milton Avenue School	Washington Avenue School
Label	CHS-VM-1	CHS-VM-2	CHS-VM-3	CHS-VM-4	CHS-VM-5	CHS-VM-6	CHS-VM-7	CHS-VM-8	CMS-VM-1	CMS-VM-2	CMS-VM-3	LAF-VM-1	SBS-VM-1	MAS-VM-1	WAS-VM-1
Type	Cold Beverage	Snack	Cold Beverage	Cold Beverage	Cold Beverage	Snack	Cold Beverage	Snack	Cold Beverage	Cold Beverage	Snack	Cold Beverage	Cold Beverage	Cold Beverage	Cold Beverage
Location	Cafeteria	Cafeteria	Cafeteria	Hallway	Hallway	Hallway	Faculty Room	Faculty Room	Cafeteria	Faculty Room	Faculty Room	Faculty Room	Hallway	Faculty Room	Faculty Room
Quantity	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Run Hours	**8,760**	**8,760**	**8,760**	**8,760**	**8,760**	**8,760**	**8,760**	**8,760**	**8,760**	**8,760**	**8,760**	**8,760**	**8,760**	**8,760**	**8,760**
Existing kWh Consumption	2,970	359	2,970	2,970	2,970	359	2,970	359	2,970	2,970	359	2,970	2,970	2,970	2,970
Proposed kWh Consumption	1,960	215	1,960	1,960	1,960	144	1,010	144	1,010	1,010	144	1,010	1,010	1,010	1,010
Safety Factor	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
kWh Savings	1,010	144	1,010	1,010	1,010	215	1,960	215	1,960	1,960	215	1,960	1,960	1,960	1,960

Chathams School District
Exhibit D
ECM 1D - Install De-stratification Fans
De-stratifcation fans

ECM DESCRIPTION

Install de-stratification fans in large open ares. Fans will push and hold hot air down to reduce heating losses through the roof and upper section of the outside walls due to reducing the indoor temperature in these sections above the fan.

DATA / ASSUMPTIONS

Heating Hours 3,948 Hours

*Heating efficiency of de-stratification fans assumed at 60%

MEASUREMENT AND VERIFICATION

Option C - Savings Calculations are based on regression analysis of utility billing meter data

COMMISSIONING

Verify that the installed fans operate. Install clock meter on fans to verify that fans are running 24/7 during heating season

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) = 0%
Safety Factor (Thermal) = 0%

Fuel savings recovery factor is conservatively set for 0 for the ECM due to the uncertainity in consistency of temperature difference between room and upper level temperatures, electric penalties recovery factor is at 0.

FORMULA

$W_{TOTAL} = W_{FAN} \cdot q \cdot t_{FAN}$

$Q_{SAVINGS} = Q_{TOTAL} \cdot \mu$

$Q_{TOTAL} = Q_{WALL} + Q_{ROOF} + Q_{WIN}$

$Q_{WALL} = \sum^{60}_{-5} ((T_{OCC} - T_{BIN}) \cdot A_{WALL} \cdot U_{WALL} \cdot t_{OCC}) + ((T_{UNOCC} - T_{BIN}) \cdot A_{WALL} \cdot U_{WALL} \cdot t_{UNOCC})$
$Q_{WIN} = \sum^{60}_{-5} ((T_{OCC} - T_{BIN}) \cdot A_{WIN} \cdot U_{WIN} \cdot t_{OCC}) + ((T_{UNOCC} - T_{BIN}) \cdot A_{WIN} \cdot U_{WIN} \cdot t_{UNOCC})$
$Q_{ROOF} = \sum^{60}_{-5} ((T_{OCC} - T_{BIN}) \cdot A_{ROOF} \cdot U_{ROOF} \cdot t_{OCC}) + ((T_{UNOCC} - T_{BIN}) \cdot A_{ROOF} \cdot U_{ROOF} \cdot t_{UNOCC})$

Variable	Units	Description
$Q_{SAVINGS}$	Therms	Annual thermal savings
$\sum^{60}_{-5}$	-	Summation of all bins from -5°F to 60°F
μ	%	Diversity factor of de-stratification fans (25% - 50%)
Q_{TOTAL}	btu	Total heat loss
Q_{WALL}	btu	Heat loss through wall (above de-stratification fan)
Q_{ROOF}	btu	Heat loss through roof
Q_{WIN}	btu	Heat loss through windows (above de-stratification fan)
T_{BIN}	°F	Temperature of respective bin
T_{OCC}	°F	Existing temperature of space during occupied hours
T_{UNOCC}	°F	Existing temperature of space during unoccupied hours
t_{OCC}	Hrs	Occupied Bin Hours in respective temperature bin
t_{UNOCC}	Hrs	Unoccupied Bin Hours in respective temperature bin
A_{WALL}	ft^2	Exposed wall area adove de-stratification fan
A_{ROOF}	ft^2	Exposed roof area adove de-stratification fan
A_{WINDOW}	ft^2	Exposed window area adove de-stratification fan
U_{WALL}	btu / ft^2 / °F	U-factor of wall
U_{ROOF}	btu / ft^2 / °F	U-factor of roof
U_{WIN}	btu / ft^2 / °F	U-factor of windows
W_{TOTAL}	kWh	Annual electrical consumption of fans
q	-	Quantity of fans
W_{FAN}	kW	Input kW of fan
t_{FAN}	Hrs	Annual run time of de-stratification fan (annual heating hours)

Chathams School District
Exhibit D
ECM 1D - Install De-stratification Fans
De-stratifcation fans

ASSUMPTIONS / DATA

* Inputs are in blue

Building	Location	Wall Length Perimeter (ft)	Wall Width Perimeter (ft)	Ceiling Height (ft)	Exposed Wall Height above Fan (ft)	Ceiling Type	Roof Area (ft^2)	Window Area (ft^2 - above Fan)	Roof U-Factor	Window U-Factor	Wall U-Factor
Chatham High School	Main Gym	100	92	24	3.0	Truss	9,200	1440	0.28	0.60	0.22
Chatham High School	Second Gym	92	62	24	3.0	Truss	5,704		0.28		0.22
Chatham High School	Weight Room	35	35	25	2.0	Truss	1,225		0.28		0.22
Chatham High School	Aux Weight Room	17	29	25	2.0	Truss	493		0.28		0.22
Chatham Middle School	Upper Gym	98	89	29	2.0	I-Beam	8,722		0.28		0.22
Chatham Middle School	Lower Gym	90	64	24-29-24	3.0	Truss	5,760	512	0.28	0.60	0.22
Lafayette School	Gym	87	50	17-25-17	3.0	Truss	4,350		0.28		0.22
Milton Avenue School	Multipurpose Room	61	42	21	3.0	I-Beam	2,562	200	0.28	0.60	0.22
Southern Boulevard School	Gym	92	54	25	3.0	Truss	4,968		0.28		0.22
Washington Avenue School	Gym	70	50	27	2.5	Truss	3,500	96	0.28	0.60	0.22
Washington Avenue School	Auditorium	65	45	16	4.0	Drop	2,925		0.28		0.22
Totals							**49,409**				

CALCULATIONS

	Chatham High School	Chatham High School	Chatham High School	Chatham High School	Chatham Middle School	Chatham Middle School	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School	Washington Avenue School
Location #1	Main Gym	Second Gym	Weight Room	Aux Weight Room	Upper Gym	Lower Gym	Gym	Multipurpose Room	Gym	Gym	Auditorium
Wall Length	100	92	35	17	98	90	87	61	92	70	65
Wall Width	92	62	35	29	89	64	50	42	54	50	45
Wall Height Above Fan	3.0	3.0	2.0	2.0	2.0	3.0	3.0	3.0	3.0	2.5	4.0
Roof Area	9,200	5,704	1,225	493	8,722	5,760	4,350	2,562	4,968	3,500	2,925
Window Area	1,440	-	-	-	-	512	-	200	-	96	-
Wall Exposed Area	(864)	462	140	92	374	(50)	411	109	438	204	440
Roof U-Factor	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Window U-Factor	0.60	-	-	-	-	0.60	-	0.60	-	0.60	-
Wall U-Factor	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
Fan Model	Air Pear 25	Air Pear 25	Air Pear 25	Air Pear 25	Air Pear 45	Air Pear 45	Air Pear 25	Air Pear 25	Air Pear 25	Air Pear 25	Air Pear 15
Total run hours	3,948	3,948	3,948	3,948	3,948	3,948	3,948	3,948	3,948	3,948	3,948
Fan Input watts	35	35	35	35	45	45	35	35	35	35	17
kwh consumed by fan	138	138	138	138	178	178	138	138	138	138	67
SF per Fan	1,200	1,200	1,200	1,200	1,500	1,500	1,200	1,200	1,200	1,200	800
Total Fans	8	6	1	1	6	6	4	2	4	4	4
Total Kwh Consumed	1,105	829	138	138	1,066	1,066	553	276	553	553	268
Existing Occupied Heating Setpoint	74.0	74.0	74.0	74	74	74	74	74	74	74	74
Existing Unoccup. Heating Setpoint	70.0	70.0	70.0	70	70	70	70	70	70	70	70
Diversity Factor	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Boiler Efficiency	80.0%	80.0%	80.0%	80.0%	87.0%	87.0%	90.0%	78.0%	76.3%	77.9%	77.9%
Additional Electric Usage	(1,105)	(829)	(138)	(138)	(1,066)	(1,066)	(553)	(276)	(553)	(553)	(268)
Calculated Fuel Savings Therms	2,749	1,437	316	134	1,956	1,480	961	730	1,289	919	778
Safety Factor Electric	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Safety Factor Thermal	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Additional Electric usage	(1,105)	(829)	(138)	(138)	(1,066)	(1,066)	(553)	(276)	(553)	(553)	(268)
Calculated Fuel Savings	2,749	1,437	316	134	1,956	1,480	961	730	1,289	919	778

Chathams School District
Exhibit D
ECM 1D - Install De-stratification Fans
De-stratifcation fans

CHATHAM HIGH SCHOOL

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Exposed Wall area	Exposed Roof area	Window area	Wall U factor	Roof U factor	Window U factor	Wall Heat loss	Roof Heat Loss	Windows Heat Loss	Total Heat loss
HEATING								ft^2	ft^2	ft^2	btu/ft²/°F	btu/ft²/°F	btu/ft²/°F	btu/Yr	btu/Yr	btu/Yr	btu/Yr
55 to 60	57.5	86	144	97	327	199	128	(864)	9,200	1440	0.22	0.28	0.60	(928,568)	12,584,128	4,220,763	15,876,323
50 to 55	52.5	109	182	172	463	283	180	(864)	9,200	1440	0.22	0.28	0.60	(1,755,267)	23,787,704	7,978,485	30,010,922
45 to 50	47.5	105	119	142	366	209	157	(864)	9,200	1440	0.22	0.28	0.60	(1,724,596)	23,372,048	7,839,072	29,486,524
40 to 45	42.5	185	155	177	517	277	240	(864)	9,200	1440	0.22	0.28	0.60	(2,912,704)	39,473,520	13,239,566	49,800,381
35 to 40	37.5	236	200	241	677	364	313	(864)	9,200	1440	0.22	0.28	0.60	(4,459,141)	60,431,120	20,268,823	76,240,802
30 to 35	32.5	237	202	198	637	339	298	(864)	9,200	1440	0.22	0.28	0.60	(4,798,447)	65,029,464	21,811,125	82,042,141
25 to 30	27.5	121	115	113	349	191	158	(864)	9,200	1440	0.22	0.28	0.60	(2,964,433)	40,174,560	13,474,697	50,684,824
20 to 25	22.5	149	68	97	314	146	168	(864)	9,200	1440	0.22	0.28	0.60	(2,945,683)	39,920,456	13,389,470	50,364,242
15 to 20	17.5	95	40	46	181	80	101	(864)	9,200	1440	0.22	0.28	0.60	(1,867,061)	25,302,760	8,486,640	31,922,339
10 to 15	12.5	39	9	28	76	32	44	(864)	9,200	1440	0.22	0.28	0.60	(855,116)	11,588,688	3,886,889	14,620,462
5 to 10	7.5	21	5	5	31	11	20	(864)	9,200	1440	0.22	0.28	0.60	(376,766)	5,106,000	1,712,571	6,441,806
0 to 5	2.5	4	2	-	6	2	4	(864)	9,200	1440	0.22	0.28	0.60	(78,829)	1,068,304	358,313	1,347,788
-5 to 0	-2.5	4	-	-	4	1	3	(864)	9,200	1440	0.22	0.28	0.60	(55,666)	754,400	253,029	951,762
-10 to -5	-7.5	-	-	-	-	-	-	(864)	9,200	1440	0.22	0.28	0.60	-	-	-	-
-15 to -10	-12.5	-	-	-	-	-	-	(864)	9,200	1440	0.22	0.28	0.60	-	-	-	-
Total		1,391	1,241	1,316	3,948	2,135	1,813							(25,722,277)	348,593,152	116,919,442	439,790,317

CHATHAM HIGH SCHOOL

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Exposed Wall area	Exposed Roof area	Window area	Wall U factor	Roof U factor	Window U factor	Wall Heat loss	Roof Heat Loss	Windows Heat Loss	Total Heat loss
HEATING								ft^2	ft^2	ft^2	btu/ft²/°F	btu/ft²/°F	btu/ft²/°F	btu/Yr	btu/Yr	btu/Yr	btu/Yr
55 to 60	57.5	86	144	97	327	199	128	462	5,704	0	0.22	0.28	-	496,526	7,802,159	-	8,298,685
50 to 55	52.5	109	182	172	463	283	180	462	5,704	0	0.22	0.28	-	938,580	14,748,376	-	15,686,957
45 to 50	47.5	105	119	142	366	209	157	462	5,704	0	0.22	0.28	-	922,180	14,490,670	-	15,412,849
40 to 45	42.5	185	155	177	517	277	240	462	5,704	0	0.22	0.28	-	1,557,488	24,473,582	-	26,031,070
35 to 40	37.5	236	200	241	677	364	313	462	5,704	0	0.22	0.28	-	2,384,402	37,467,294	-	39,851,696
30 to 35	32.5	237	202	198	637	339	298	462	5,704	0	0.22	0.28	-	2,565,836	40,318,268	-	42,884,104
25 to 30	27.5	121	115	113	349	191	158	462	5,704	0	0.22	0.28	-	1,585,148	24,908,227	-	26,493,376
20 to 25	22.5	149	68	97	314	146	168	462	5,704	0	0.22	0.28	-	1,575,122	24,750,683	-	26,325,805
15 to 20	17.5	95	40	46	181	80	101	462	5,704	0	0.22	0.28	-	998,359	15,687,711	-	16,686,070
10 to 15	12.5	39	9	28	76	32	44	462	5,704	0	0.22	0.28	-	457,249	7,184,987	-	7,642,236
5 to 10	7.5	21	5	5	31	11	20	462	5,704	0	0.22	0.28	-	201,465	3,165,720	-	3,367,185
0 to 5	2.5	4	2	-	6	2	4	462	5,704	0	0.22	0.28	-	42,152	662,348	-	704,500
-5 to 0	-2.5	4	-	-	4	1	3	462	5,704	0	0.22	0.28	-	29,766	467,728	-	497,494
-10 to -5	-7.5	-	-	-	-	-	-	462	5,704	0	0.22	0.28	-	-	-	-	-
-15 to -10	-12.5	-	-	-	-	-	-	462	5,704	0	0.22	0.28	-	-	-	-	-
Total		1,391	1,241	1,316	3,948	2,135	1,813							13,754,273	216,127,754	-	229,882,028

CHATHAM HIGH SCHOOL

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Exposed Wall area	Exposed Roof area	Window area	Wall U factor	Roof U factor	Window U factor	Wall Heat loss	Roof Heat Loss	Windows Heat Loss	Total Heat loss
HEATING								ft^2	ft^2	ft^2	btu/ft²/°F	btu/ft²/°F	btu/ft²/°F	btu/Yr	btu/Yr	btu/Yr	btu/Yr
55 to 60	57.5	86	144	97	327	199	128	140	1,225	0	0.22	0.28	-	150,462	1,675,604	-	1,826,066
50 to 55	52.5	109	182	172	463	283	180	140	1,225	0	0.22	0.28	-	284,418	3,167,384	-	3,451,803
45 to 50	47.5	105	119	142	366	209	157	140	1,225	0	0.22	0.28	-	279,448	3,112,039	-	3,391,487
40 to 45	42.5	185	155	177	517	277	240	140	1,225	0	0.22	0.28	-	471,966	5,255,985	-	5,727,951
35 to 40	37.5	236	200	241	677	364	313	140	1,225	0	0.22	0.28	-	722,546	8,046,535	-	8,769,081
30 to 35	32.5	237	202	198	637	339	298	140	1,225	0	0.22	0.28	-	777,526	8,658,814	-	9,436,341
25 to 30	27.5	121	115	113	349	191	158	140	1,225	0	0.22	0.28	-	480,348	5,349,330	-	5,829,678
20 to 25	22.5	149	68	97	314	146	168	140	1,225	0	0.22	0.28	-	477,310	5,315,495	-	5,792,805
15 to 20	17.5	95	40	46	181	80	101	140	1,225	0	0.22	0.28	-	302,533	3,369,117	-	3,671,650
10 to 15	12.5	39	9	28	76	32	44	140	1,225	0	0.22	0.28	-	138,560	1,543,059	-	1,681,619
5 to 10	7.5	21	5	5	31	11	20	140	1,225	0	0.22	0.28	-	61,050	679,875	-	740,925
0 to 5	2.5	4	2	-	6	2	4	140	1,225	0	0.22	0.28	-	12,773	142,247	-	155,020
-5 to 0	-2.5	4	-	-	4	1	3	140	1,225	0	0.22	0.28	-	9,020	100,450	-	109,470
-10 to -5	-7.5	-	-	-	-	-	-	140	1,225	0	0.22	0.28	-	-	-	-	-
-15 to -10	-12.5	-	-	-	-	-	-	140	1,225	0	0.22	0.28	-	-	-	-	-
Total		1,391	1,241	1,316	3,948	2,135	1,813							4,167,962	46,415,936	-	50,583,898

Chathams School District
Exhibit D
ECM 1D - Install De-stratification Fans
De-stratifcation fans

CHATHAM HIGH SCHOOL

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Exposed Wall area	Exposed Roof area	Window area	Wall U factor	Roof U factor	Window U factor	Wall Heat loss	Roof Heat Loss	Windows Heat Loss	Total Heat loss
HEATING								ft^2	ft^2	ft^2	btu/ft^2/°F	btu/ft^2/°F	btu/ft^2/°F	btu/Yr	btu/Yr	btu/Yr	btu/Yr
55 to 60	57.5	86	144	97	327	199	128	92	493	0	0.22	0.28	-	98,875	674,345	-	773,220
50 to 55	52.5	109	182	172	463	283	180	92	493	0	0.22	0.28	-	186,903	1,274,711	-	1,461,614
45 to 50	47.5	105	119	142	366	209	157	92	493	0	0.22	0.28	-	183,638	1,252,437	-	1,436,074
40 to 45	42.5	185	155	177	517	277	240	92	493	0	0.22	0.28	-	310,149	2,115,266	-	2,425,415
35 to 40	37.5	236	200	241	677	364	313	92	493	0	0.22	0.28	-	474,816	3,238,320	-	3,713,136
30 to 35	32.5	237	202	198	637	339	298	92	493	0	0.22	0.28	-	510,946	3,484,731	-	3,995,677
25 to 30	27.5	121	115	113	349	191	158	92	493	0	0.22	0.28	-	315,657	2,152,832	-	2,468,490
20 to 25	22.5	149	68	97	314	146	168	92	493	0	0.22	0.28	-	313,661	2,139,216	-	2,452,876
15 to 20	17.5	95	40	46	181	80	101	92	493	0	0.22	0.28	-	198,807	1,355,898	-	1,554,705
10 to 15	12.5	39	9	28	76	32	44	92	493	0	0.22	0.28	-	91,054	621,003	-	712,056
5 to 10	7.5	21	5	5	31	11	20	92	493	0	0.22	0.28	-	40,119	273,615	-	313,734
0 to 5	2.5	4	2	-	6	2	4	92	493	0	0.22	0.28	-	8,394	57,247	-	65,641
-5 to 0	-2.5	4	-	-	4	1	3	92	493	0	0.22	0.28	-	5,927	40,426	-	46,353
-10 to -5	-7.5	-	-	-	-	-	-	92	493	0	0.22	0.28	-	-	-	-	-
-15 to -10	-12.5	-	-	-	-	-	-	92	493	0	0.22	0.28	-	-	-	-	-
Total		1,391	1,241	1,316	3,948	2,135	1,813							2,738,946	18,680,046	-	21,418,992

CHATHAM MIDDLE SCHOOL

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Exposed Wall area	Exposed Roof area	Window area	Wall U factor	Roof U factor	Window U factor	Wall Heat loss	Roof Heat Loss	Windows Heat Loss	Total Heat loss
HEATING								ft^2	ft^2	ft^2	btu/ft^2/°F	btu/ft^2/°F	btu/ft^2/°F	btu/Yr	btu/Yr	btu/Yr	btu/Yr
55 to 60	57.5	86	144	97	327	191	136	374	8,722	0	0.22	0.28	-	399,099	11,845,697	-	12,244,796
50 to 55	52.5	109	182	172	463	268	195	374	8,722	0	0.22	0.28	-	754,749	22,401,759	-	23,156,508
45 to 50	47.5	105	119	142	366	197	169	374	8,722	0	0.22	0.28	-	742,354	22,033,865	-	22,776,219
40 to 45	42.5	185	155	177	517	261	256	374	8,722	0	0.22	0.28	-	1,255,622	37,268,234	-	38,523,856
35 to 40	37.5	236	200	241	677	343	334	374	8,722	0	0.22	0.28	-	1,923,148	57,081,129	-	59,004,277
30 to 35	32.5	237	202	198	637	322	315	374	8,722	0	0.22	0.28	-	2,071,287	61,478,064	-	63,549,351
25 to 30	27.5	121	115	113	349	181	168	374	8,722	0	0.22	0.28	-	1,279,895	37,988,671	-	39,268,566
20 to 25	22.5	149	68	97	314	137	177	374	8,722	0	0.22	0.28	-	1,272,249	37,761,725	-	39,033,973
15 to 20	17.5	95	40	46	181	76	105	374	8,722	0	0.22	0.28	-	806,844	23,947,995	-	24,754,839
10 to 15	12.5	39	9	28	76	30	46	374	8,722	0	0.22	0.28	-	369,331	10,962,158	-	11,331,490
5 to 10	7.5	21	5	5	31	11	20	374	8,722	0	0.22	0.28	-	162,944	4,836,349	-	4,999,293
0 to 5	2.5	4	2	-	6	2	4	374	8,722	0	0.22	0.28	-	34,123	1,012,799	-	1,046,921
-5 to 0	-2.5	4	-	-	4	1	3	374	8,722	0	0.22	0.28	-	24,096	715,204	-	739,300
-10 to -5	-7.5	-	-	-	-	-	-	374	8,722	0	0.22	0.28	-	-	-	-	-
-15 to -10	-12.5	-	-	-	-	-	-	374	8,722	0	0.22	0.28	-	-	-	-	-
Total		1,391	1,241	1,316	3,948	2,017	1,931							11,095,740	329,333,649	-	340,429,389

CHATHAM MIDDLE SCHOOL

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Exposed Wall area	Exposed Roof area	Window area	Wall U factor	Roof U factor	Window U factor	Wall Heat loss	Roof Heat Loss	Windows Heat Loss	Total Heat loss
HEATING								ft^2	ft^2	ft^2	btu/ft^2/°F	btu/ft^2/°F	btu/ft^2/°F	btu/Yr	btu/Yr	btu/Yr	btu/Yr
55 to 60	57.5	86	144	97	327	191	136	(50)	5,760	512	0.22	0.28	0.60	(53,355)	7,822,886	1,490,074	9,259,604
50 to 55	52.5	109	182	172	463	268	195	(50)	5,760	512	0.22	0.28	0.60	(100,902)	14,794,099	2,817,924	17,511,121
45 to 50	47.5	105	119	142	366	197	169	(50)	5,760	512	0.22	0.28	0.60	(99,245)	14,551,142	2,771,646	17,223,543
40 to 45	42.5	185	155	177	517	261	256	(50)	5,760	512	0.22	0.28	0.60	(167,864)	24,611,904	4,687,982	29,132,022
35 to 40	37.5	236	200	241	677	343	334	(50)	5,760	512	0.22	0.28	0.60	(257,105)	37,696,320	7,180,251	44,619,466
30 to 35	32.5	237	202	198	637	322	315	(50)	5,760	512	0.22	0.28	0.60	(276,910)	40,600,051	7,733,343	48,056,484
25 to 30	27.5	121	115	113	349	181	168	(50)	5,760	512	0.22	0.28	0.60	(171,109)	25,087,680	4,778,606	29,695,177
20 to 25	22.5	149	68	97	314	137	177	(50)	5,760	512	0.22	0.28	0.60	(170,087)	24,937,805	4,750,058	29,517,776
15 to 20	17.5	95	40	46	181	76	105	(50)	5,760	512	0.22	0.28	0.60	(107,867)	15,815,232	3,012,425	18,719,790
10 to 15	12.5	39	9	28	76	30	46	(50)	5,760	512	0.22	0.28	0.60	(49,376)	7,239,398	1,378,933	8,568,956
5 to 10	7.5	21	5	5	31	11	20	(50)	5,760	512	0.22	0.28	0.60	(21,784)	3,193,920	608,366	3,780,502
0 to 5	2.5	4	2	-	6	2	4	(50)	5,760	512	0.22	0.28	0.60	(4,562)	668,851	127,400	791,690
-5 to 0	-2.5	4	-	-	4	1	3	(50)	5,760	512	0.22	0.28	0.60	(3,221)	472,320	89,966	559,064
-10 to -5	-7.5	-	-	-	-	-	-	(50)	5,760	512	0.22	0.28	0.60	-	-	-	-
-15 to -10	-12.5	-	-	-	-	-	-	(50)	5,760	512	0.22	0.28	0.60	-	-	-	-
Total		1,391	1,241	1,316	3,948	2,017	1,931							(1,483,388)	217,491,610	41,426,973	257,435,195

Chathams School District
Exhibit D
ECM 1D - Install De-stratification Fans
De-stratifcation fans

LAFAYETTE SCHOOL

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Exposed Wall area	Exposed Roof area	Window area	Wall U factor	Roof U factor	Window U factor	Wall Heat loss	Roof Heat Loss	Windows Heat Loss	Total Heat loss
HEATING								ft^2	ft^2	ft^2	btu/ft²/°F	btu/ft²/°F	btu/ft²/°F	btu/Yr	btu/Yr	btu/Yr	btu/Yr
55 to 60	57.5	86	144	97	327	136	191	411	4,350	0	0.22	0.28	-	418,612	5,638,905	-	6,057,517
50 to 55	52.5	109	182	172	463	180	283	411	4,350	0	0.22	0.28	-	797,795	10,746,675	-	11,544,470
45 to 50	47.5	105	119	142	366	129	237	411	4,350	0	0.22	0.28	-	791,304	10,659,240	-	11,450,544
40 to 45	42.5	185	155	177	517	175	342	411	4,350	0	0.22	0.28	-	1,348,970	18,171,255	-	19,520,225
35 to 40	37.5	236	200	241	677	228	449	411	4,350	0	0.22	0.28	-	2,071,942	27,910,035	-	29,981,977
30 to 35	32.5	237	202	198	637	222	415	411	4,350	0	0.22	0.28	-	2,240,188	30,176,385	-	32,416,573
25 to 30	27.5	121	115	113	349	124	225	411	4,350	0	0.22	0.28	-	1,385,977	18,669,765	-	20,055,742
20 to 25	22.5	149	68	97	314	92	222	411	4,350	0	0.22	0.28	-	1,382,070	18,617,130	-	19,999,200
15 to 20	17.5	95	40	46	181	54	127	411	4,350	0	0.22	0.28	-	878,656	11,835,915	-	12,714,571
10 to 15	12.5	39	9	28	76	18	58	411	4,350	0	0.22	0.28	-	401,788	5,412,270	-	5,814,058
5 to 10	7.5	21	5	5	31	8	23	411	4,350	0	0.22	0.28	-	178,160	2,399,895	-	2,578,055
0 to 5	2.5	4	2	-	6	2	4	411	4,350	0	0.22	0.28	-	37,395	503,730	-	541,125
-5 to 0	-2.5	4	-	-	4	1	3	411	4,350	0	0.22	0.28	-	26,480	356,700	-	383,180
-10 to -5	-7.5	-	-	-	-	-	-	411	4,350	0	0.22	0.28	-	-	-	-	-
-15 to -10	-12.5	-	-	-	-	-	-	411	4,350	0	0.22	0.28	-	-	-	-	-
Total		1,391	1,241	1,316	3,948	1,370	2,578							11,959,337	161,097,900	-	173,057,237

MILTON AVENUE SCHOOL

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Exposed Wall area	Exposed Roof area	Window area	Wall U factor	Roof U factor	Window U factor	Wall Heat loss	Roof Heat Loss	Windows Heat Loss	Total Heat loss
HEATING								ft^2	ft^2	ft^2	btu/ft²/°F	btu/ft²/°F	btu/ft²/°F	btu/Yr	btu/Yr	btu/Yr	btu/Yr
55 to 60	57.5	86	144	97	327	136	191	109	2,562	200	0.22	0.28	0.60	111,019	3,321,121	555,557	3,987,697
50 to 55	52.5	109	182	172	463	180	283	109	2,562	200	0.22	0.28	0.60	211,581	6,329,421	1,058,786	7,599,787
45 to 50	47.5	105	119	142	366	129	237	109	2,562	200	0.22	0.28	0.60	209,859	6,277,925	1,050,171	7,537,955
40 to 45	42.5	185	155	177	517	175	342	109	2,562	200	0.22	0.28	0.60	357,756	10,702,243	1,790,271	12,850,270
35 to 40	37.5	236	200	241	677	228	449	109	2,562	200	0.22	0.28	0.60	549,493	16,438,048	2,749,757	19,737,298
30 to 35	32.5	237	202	198	637	222	415	109	2,562	200	0.22	0.28	0.60	594,113	17,772,850	2,973,043	21,340,006
25 to 30	27.5	121	115	113	349	124	225	109	2,562	200	0.22	0.28	0.60	367,571	10,995,848	1,839,386	13,202,804
20 to 25	22.5	149	68	97	314	92	222	109	2,562	200	0.22	0.28	0.60	366,534	10,964,848	1,834,200	13,165,582
15 to 20	17.5	95	40	46	181	54	127	109	2,562	200	0.22	0.28	0.60	233,026	6,970,946	1,166,100	8,370,071
10 to 15	12.5	39	9	28	76	18	58	109	2,562	200	0.22	0.28	0.60	106,557	3,187,640	533,229	3,827,426
5 to 10	7.5	21	5	5	31	8	23	109	2,562	200	0.22	0.28	0.60	47,249	1,413,455	236,443	1,697,147
0 to 5	2.5	4	2	-	6	2	4	109	2,562	200	0.22	0.28	0.60	9,917	296,680	49,629	356,226
-5 to 0	-2.5	4	-	-	4	1	3	109	2,562	200	0.22	0.28	0.60	7,023	210,084	35,143	252,250
-10 to -5	-7.5	-	-	-	-	-	-	109	2,562	200	0.22	0.28	0.60	-	-	-	-
-15 to -10	-12.5	-	-	-	-	-	-	109	2,562	200	0.22	0.28	0.60	-	-	-	-
Total		1,391	1,241	1,316	3,948	1,370	2,578							3,171,698	94,881,108	15,871,714	113,924,520

SOUTHERN BOULEVARD SCHOOL

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Exposed Wall area	Exposed Roof area	Window area	Wall U factor	Roof U factor	Window U factor	Wall Heat loss	Roof Heat Loss	Windows Heat Loss	Total Heat loss
HEATING								ft^2	ft^2	ft^2	btu/ft²/°F	btu/ft²/°F	btu/ft²/°F	btu/Yr	btu/Yr	btu/Yr	btu/Yr
55 to 60	57.5	86	144	97	327	136	191	438	4,968	0	0.22	0.28	-	446,112	6,440,018	-	6,886,131
50 to 55	52.5	109	182	172	463	180	283	438	4,968	0	0.22	0.28	-	850,205	12,273,444	-	13,123,649
45 to 50	47.5	105	119	142	366	129	237	438	4,968	0	0.22	0.28	-	843,288	12,173,587	-	13,016,875
40 to 45	42.5	185	155	177	517	175	342	438	4,968	0	0.22	0.28	-	1,437,588	20,752,826	-	22,190,414
35 to 40	37.5	236	200	241	677	228	449	438	4,968	0	0.22	0.28	-	2,208,055	31,875,185	-	34,083,240
30 to 35	32.5	237	202	198	637	222	415	438	4,968	0	0.22	0.28	-	2,387,353	34,463,513	-	36,850,866
25 to 30	27.5	121	115	113	349	124	225	438	4,968	0	0.22	0.28	-	1,477,027	21,322,159	-	22,799,186
20 to 25	22.5	149	68	97	314	92	222	438	4,968	0	0.22	0.28	-	1,472,863	21,262,046	-	22,734,909
15 to 20	17.5	95	40	46	181	54	127	438	4,968	0	0.22	0.28	-	936,378	13,517,431	-	14,453,809
10 to 15	12.5	39	9	28	76	18	58	438	4,968	0	0.22	0.28	-	428,183	6,181,186	-	6,609,368
5 to 10	7.5	21	5	5	31	8	23	438	4,968	0	0.22	0.28	-	189,864	2,740,846	-	2,930,709
0 to 5	2.5	4	2	-	6	2	4	438	4,968	0	0.22	0.28	-	39,852	575,294	-	615,146
-5 to 0	-2.5	4	-	-	4	1	3	438	4,968	0	0.22	0.28	-	28,220	407,376	-	435,596
-10 to -5	-7.5	-	-	-	-	-	-	438	4,968	0	0.22	0.28	-	-	-	-	-
-15 to -10	-12.5	-	-	-	-	-	-	438	4,968	0	0.22	0.28	-	-	-	-	-
Total		1,391	1,241	1,316	3,948	1,370	2,578							12,744,987	183,984,912	-	196,729,899

Chathams School District
Exhibit D
ECM 1D - Install De-stratification Fans
De-stratifcation fans

WASHINGTON AVENUE SCHOOL

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Exposed Wall area	Exposed Roof area	Window area	Wall U factor	Roof U factor	Window U factor	Wall Heat loss	Roof Heat Loss	Windows Heat Loss	Total Heat loss
HEATING								ft^2	ft^2	ft^2	btu/ft^2/°F	btu/ft^2/°F	btu/ft^2/°F	btu/Yr	btu/Yr	btu/Yr	btu/Yr
55 to 60	57.5	86	144	97	327	136	191	204	3,500	96	0.22	0.28	0.60	207,778	4,537,050	266,667	5,011,496
50 to 55	52.5	109	182	172	463	180	283	204	3,500	96	0.22	0.28	0.60	395,986	8,646,750	508,217	9,550,953
45 to 50	47.5	105	119	142	366	129	237	204	3,500	96	0.22	0.28	0.60	392,764	8,576,400	504,082	9,473,246
40 to 45	42.5	185	155	177	517	175	342	204	3,500	96	0.22	0.28	0.60	669,562	14,620,550	859,330	16,149,442
35 to 40	37.5	236	200	241	677	228	449	204	3,500	96	0.22	0.28	0.60	1,028,409	22,456,350	1,319,883	24,804,643
30 to 35	32.5	237	202	198	637	222	415	204	3,500	96	0.22	0.28	0.60	1,111,918	24,279,850	1,427,061	26,818,829
25 to 30	27.5	121	115	113	349	124	225	204	3,500	96	0.22	0.28	0.60	687,930	15,021,650	882,905	16,592,485
20 to 25	22.5	149	68	97	314	92	222	204	3,500	96	0.22	0.28	0.60	685,991	14,979,300	880,416	16,545,707
15 to 20	17.5	95	40	46	181	54	127	204	3,500	96	0.22	0.28	0.60	436,121	9,523,150	559,728	10,518,999
10 to 15	12.5	39	9	28	76	18	58	204	3,500	96	0.22	0.28	0.60	199,427	4,354,700	255,950	4,810,077
5 to 10	7.5	21	5	5	31	8	23	204	3,500	96	0.22	0.28	0.60	88,430	1,930,950	113,493	2,132,872
0 to 5	2.5	4	2	-	6	2	4	204	3,500	96	0.22	0.28	0.60	18,561	405,300	23,822	447,683
-5 to 0	-2.5	4	-	-	4	1	3	204	3,500	96	0.22	0.28	0.60	13,143	287,000	16,869	317,012
-10 to -5	-7.5	-	-	-	-	-	-	204	3,500	96	0.22	0.28	0.60	-	-	-	-
-15 to -10	-12.5	-	-	-	-	-	-	204	3,500	96	0.22	0.28	0.60	-	-	-	-
Total		1,391	1,241	1,316	3,948	1,370	2,578							5,936,021	129,619,000	7,618,423	143,173,444

WASHINGTON AVENUE SCHOOL

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Exposed Wall area	Exposed Roof area	Window area	Wall U factor	Roof U factor	Window U factor	Wall Heat loss	Roof Heat Loss	Windows Heat Loss	Total Heat loss
HEATING								ft^2	ft^2	ft^2	btu/ft^2/°F	btu/ft^2/°F	btu/ft^2/°F	btu/Yr	btu/Yr	btu/Yr	btu/Yr
55 to 60	57.5	86	144	97	327	136	191	440	2,925	0	0.22	0.28	-	448,149	3,791,677	-	4,239,827
50 to 55	52.5	109	182	172	463	180	283	440	2,925	0	0.22	0.28	-	854,087	7,226,212	-	8,080,300
45 to 50	47.5	105	119	142	366	129	237	440	2,925	0	0.22	0.28	-	847,138	7,167,420	-	8,014,558
40 to 45	42.5	185	155	177	517	175	342	440	2,925	0	0.22	0.28	-	1,444,152	12,218,602	-	13,662,755
35 to 40	37.5	236	200	241	677	228	449	440	2,925	0	0.22	0.28	-	2,218,137	18,767,092	-	20,985,230
30 to 35	32.5	237	202	198	637	222	415	440	2,925	0	0.22	0.28	-	2,398,255	20,291,017	-	22,689,272
25 to 30	27.5	121	115	113	349	124	225	440	2,925	0	0.22	0.28	-	1,483,771	12,553,807	-	14,037,579
20 to 25	22.5	149	68	97	314	92	222	440	2,925	0	0.22	0.28	-	1,479,588	12,518,415	-	13,998,003
15 to 20	17.5	95	40	46	181	54	127	440	2,925	0	0.22	0.28	-	940,654	7,958,632	-	8,899,286
10 to 15	12.5	39	9	28	76	18	58	440	2,925	0	0.22	0.28	-	430,138	3,639,285	-	4,069,423
5 to 10	7.5	21	5	5	31	8	23	440	2,925	0	0.22	0.28	-	190,731	1,613,722	-	1,804,453
0 to 5	2.5	4	2	-	6	2	4	440	2,925	0	0.22	0.28	-	40,034	338,715	-	378,749
-5 to 0	-2.5	4	-	-	4	1	3	440	2,925	0	0.22	0.28	-	28,349	239,850	-	268,199
-10 to -5	-7.5	-	-	-	-	-	-	440	2,925	0	0.22	0.28	-	-	-	-	-
-15 to -10	-12.5	-	-	-	-	-	-	440	2,925	0	0.22	0.28	-	-	-	-	-
Total		1,391	1,241	1,316	3,948	1,370	2,578							12,803,183	108,324,450	-	121,127,633

Chathams School District
Exhibit D
ECM 1E - Plug Load Management via WiFi
Smart Strips and Smart Board Projectors

ECM DESCRIPTION

Install BERT plug load management plug on the various plug loads throughout the district. Integrate equipment onto a central wifi network to schedule these pieces of equipment

DATA / ASSUMPTIONS

Electrical draw for Cold Beverage Machine when off	350	W
Electrical draw for Snack Machine when off	60	W
Electrical draw for Large Copier when off	60	W
Electrical draw for Medium Printer / Copier when off	20	W
Electrical draw for Lab Monitor when off	15	W
Electrical draw for Labtop Charging Cart when off	35	W
Electrical draw for Projectors when off	12	W
Electrical draw for AC Unit when off	50	W
Electrical draw for Coffee Machine when off	70	W
Electrical draw for Hot/Cold Water Machine when off	60	W

Annual Savings for smart strips and smart board projectors are based on logging results for the various pieces of equipment

MEASUREMENT AND VERIFICATION

Option A - The engineering calculations are based on direct kW measurements over a defined time period of the existing plug load and post BERT device. A population will be measured before the switch to the BERT devices to determine a baseline usage during a defined time period.

COMMISSIONING

Review installation and network integration with the IT department

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) = 0%

The safety factor for this ECM is taken at 0 due to conservative run hours based on data logging results.

FORMULAE

$W_{TOTAL} = (W_{STRIPS} \cdot Strips_{\#}) + (W_{PROJECTORS} \cdot Projectors_{\#})$

Variable	Units	Description
W_{TOTAL}	kWh	Total Electrical Savings associated with this measure
W_{STRIPS}	kWh	Electrical Savings associated with smart strips
$W_{PROJECTORS}$	kWh	Electrical Savings associated with smart boards projectors
$Strips_{\#}$	-	Numbers of Electrical Strips
$Projectors_{\#}$	-	Numbers of Projectors

Chathams School District
Exhibit D
ECM 1E - Plug Load Management via WiFi
Smart Strips and Smart Board Projectors

* Inputs are in blue

Building	Cold Beverage Machine	Snack Machine	Large Copier	Medium Printer \ Copier	Lab Monitor	Laptop Charging Carts	Projectors	AC Unit	Coffee Machine	Hot/Cold Water Machine
Chatham High School			6	15	266	36	130	17	2	
Chatham Middle School			9	3	45	64	124	37		8
Lafayette School			4	4	65	36	75	16		6
Milton Avenue School			2	4	28	22	42	21		12
Southern Boulevard School			3	7	30	26	56	33		
Washington Avenue School			2	1	32	23	50	11		10
Totals	-	-	26	34	466	207	477	135	2	36

CALCULATIONS

	Chatham High School	Chatham Middle School	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School
Cold Beverage Machine	-	-	-	-	-	-
Snack Machine	-	-	-	-	-	-
Large Copier	6	9	4	2	3	2
Small Printer \ Copier	15	3	4	4	7	1
Monitor Combo (Printer)	266	45	65	28	30	32
Laptop Charging Carts	36	64	36	22	26	23
Projectors	130	124	75	42	56	50
Water Fountains	17	37	16	21	33	11
Coffee Machine	2	-	-	-	-	-
Hot / Cold Water Machine	-	8	6	12	-	10
Total Devices	472	290	206	131	155	129
kW Electrical Draw	8.460	7.333	4.615	3.664	4.002	3.175
Unoccupied Hours / Day	12.1	12.9	16.9	16.9	16.9	16.9
Unoccupied Hours / Yr	4,432	4,693	6,153	6,153	6,153	6,153
kWh Savings	37,496	34,413	28,395	22,544	24,624	19,535
Safety Factor	0%	0%	0%	0%	0%	0%
kWh Savings	37,496	34,413	28,395	22,544	24,624	19,535

Chathams School District
Exhibit D
ECM 2A - Boiler Replacements
Boiler Replacement Calculation

ECM DESCRIPTION

Replace boilers in respective buildings with new high efficiency condensing boilers

DATA / ASSUMPTIONS

Typical Condensing Boiler Seasonal Efficiency =	**91.5%**	
Heating Hours	3,948	Hours

* Utility baseline reduced by 10.5% to account for domestic hot water, science labs, and kitchen usage
* An adjusted baseline is used for the boiler baseline usage as to not double-dip on savings

MEASUREMENT AND VERIFICATION

Option C - Savings Calculations are based on regression analysis of utility billing meter data

COMMISSIONING

Verify all functions of the boiler control system, safety and operation. Verify air/fuel ratio is consistent through firing range. Provide training of the boiler operators

RECOVERY/SAFETY FACTOR

Safety Factor (Thermal) = **0%**

A safety factor of 0 is used due to minimal variables and the proven results of this measure

FORMULAE

$Q_{savings} = ((\eta_{NEW} - \eta_{OLD}) / \eta_{NEW}) \cdot Fuel_{ADJ}$

Variable	Units	Description
$Q_{savings}$	Therms	Thermal Savings
η_{NEW}	%	Efficiency of New Boiler
η_{OLD}	%	Efficiency of Old Boiler
$Fuel_{ADJ}$	Therms	Adjusted Boiler Fuel Usage

*Inputs are blue

Building	Label	Boilers to be Replaced
Chatham High School	B1-1	2
Chatham High School	B1-2	1
-	-	-
Totals		**3**

Chatham High School	Chatham High School	-	-	-	-
B1-1	B1-2	-	-	-	-
2	1	-	-	-	-
Natural Gas	Natural Gas	-	-	-	-
Natural Gas	Natural Gas	-	-	-	-

CALCULATIONS

	Chatham High School	Chatham High School
Label	B1-1	B1-2
No. of Units to be Replaced	2	1
Fuel Switch	N	N
Existing Fuel	Natural Gas	Natural Gas
Proposed Fuel	Natural Gas	Natural Gas
Current Boiler Efficiency	80.0%	80.0%
Proposed Boiler Efficiency	91.0%	91.0%
Improvement in Boiler Efficiency	11.0%	11.0%
Annual Boiler Fuel Use	29,737	29,737
Adjusted Boiler Usage	26,201	26,201
Percentage of Building Load	30%	30%
Safety Factor	**0%**	**0%**
Natural Gas Savings	3,167	3,167
Fuel Oil #2 Savings	-	-
Fuel Oil #4 Savings	-	-
Fuel Oil #6 Savings	-	-
Propane Savings	-	-

Notes:

Replacing the existing boiler with a new, high efficiency unit will reduce operating costs at this location.

Improving the air/fuel ratio will increase overall boiler combustion efficiency.

Note that the boiler efficiency discussed here is the overall boiler thermal efficiency, not just its combustion efficiency. The value of this number will be much lower than for combustion efficiency alone as it includes losses from radiation, blowdown, and other related losses. The value for annual boiler fuel has been adjusted for the effect of other ECMs.

New Non -Condensing Boilers will be Equiped with Control Links

Chathams School District
Exhibit D5
ECM 2B - Install Honeywell “Controlinks” Boiler Burner Controller
Boiler Controlinks

ECM DESCRIPTION

Install burner controls on existing burners which optimize fuel to air ratio instantaneously

DATA / ASSUMPTIONS

Heating Hours	3,948	Hours
Controlinks improvement in boiler efficiency:	**5.0%**	
Intellidyne improvement in boiler efficiency:	**4.0%**	

* Utility baseline reduced by 10.5% to account for domestic hot water, science labs, and kitchen usage
* An adjusted baseline is used for the boiler baseline usage as to not double-dip on savings

MEASUREMENT AND VERIFICATION

Option C - Savings Calculations are based on regression analysis of utility billing meter data

COMMISSIONING

Verify all functions of the boiler control system, safety and operation. Verify air/fuel ratio is consistent through firing range. Provide training of the boiler operators

RECOVERY/SAFETY FACTOR

Safety Factor (Thermal) =	**0%**

There is no safety factor as improvement in efficiency is conservative

Chathams School District
Exhibit D5
ECM 2B - Install Honeywell "Controlinks" Boiler Burner Controller
Boiler Controlinks

FORMULAE

$Q_{savings} = (\eta_{BOILER} / (\eta_{BOILER} + \eta_{IMP})) \cdot Fuel_{ADJ}$

Variable	Units	Description
$Q_{savings}$	Therms	Thermal Savings
η_{BOILER}	%	Efficiency of Existing Boiler
η_{IMP}	%	Improvement in Efficiency
$Fuel_{ADJ}$	Therms	Adjusted Boiler Fuel Usage

*Inputs are blue

Building	Label	Units to be Installed	Burner Upgrade Type	Fuel Type
Chatham Middle School	B2-1	2	Control Links	Natural Gas
Totals		**2**		

CALCULATIONS

	Chatham Middle School
Label	B2-1
No. of Units to be Installed	2
Burner Upgrade	Control Links
Fuel Type	Natural Gas
Current Boiler Efficiency	87.0%
Improvement in Boiler Efficiency	5%
Percentage of Load	100.0%
Annual Boiler Fuel Use	99,581
Adjusted Boiler Usage	89,028
Safety Factor	0%
Annual Energy Savings	4,838

Chathams School District
Exhibit D
ECM 2C - Install Premium Efficiency Motors and VFDs
Variable Frequency Drives and Motor Replacements

ECM DESCRIPTION

There are standard efficiency motors and motors that need to be replaced due to poor condition throughout the district. These motors will be replaced with premium high efficiency motors to save electrical energy. In addition some new motors will be equipped with variable frequency drives (VFDs) for additional savings.

DATA / ASSUMPTIONS

Load Factor	**Varies by Building**

*VFD run speed percentages are based on typical VFD curves for hot water / chilled water loops
*Run hours are based on the audit, data logging, and through interviews with facility staff

MEASUREMENT AND VERIFICATION

Option A - The engineering calculations are based on direct kW measurements of the existing and installed motors and operating hours. All existing motors will be measured before removal and new motors after the installation. VFD kW will be measured through the load range and selected motors with VFDs will be monitored for the time period using kW loggers. Equipment operating hours are based on the audit, logging and operating personnel input.

COMMISSIONING

Review installation documents for alignments and vibrations. Start up equipment and measure vibration through the load range along with motor kW. Verify that VFDs are capable of operating in full design range upon the control signal demand.

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) =	**0%**

The safety factor for this ECM is taken at 0 due to some unknown data such as actual existing motor kW loads and operation hours.

FORMULAE

VFD

$W_{SAVINGSVFD} = W_{PROPOSED} - W_{VFD}$

$W_{VFD} = \sum^{60}_{0} Hp \cdot Lf \cdot \eta \cdot f^{\wedge 2.8} \cdot t_f$

Chathams School District
Exhibit D
ECM 2C - Install Premium Efficiency Motors and VFDs
Variable Frequency Drives and Motor Replacements

MOTOR

$W_{SAVINGS} = W_{EXISTING} - W_{PROPOSED}$

$W_{EXISTING} = Hp \cdot Lf \cdot \eta \cdot t$
$W_{PROPOSED} = Hp \cdot Lf \cdot \eta \cdot t$

Variable	Units	Description
$W_{savingsVFD}$	kWh	Electrical Savings associated with VFD
$W_{savings}$	kWh	Electrical Savings for Motor Replacement
Hp	HP	Horsepower of motor
t	Hrs	Existing Run Hours
t	Hrs	Proposed Run Hours
Lf	-	Load Factor of motor
η	-	Existing efficiency of motor
η	-	Proposed efficiency of motor
Σ^{60}_{0}	-	Summation of all frequences (0 Hz to 60 Hz)
f	-	Frequency of drive, as a percentage of full frequency (60 Hz)
t_f	Hrs	Percentage of time motor will run at a particular frequency
W_{VFD}	kWh	Electrical consumption with VFD
$W_{EXISTING}$	kWh	Existing electrical consumption of motor
$W_{PROPOSED}$	kWh	Proposed electrical consumption of motor

ASSUMPTIONS / INPUTS

* Inputs are in blue

Building	Equipment Label	Configuration	Qty	HP	Existing Efficiency	Replace Motor	Add VFD
Chatham High School	CHS-P-1	Primary	1	20.0	91.0%	Y	Y
Chatham High School	CHS-P-2	Standby	1	20.0	91.0%	Y	Y
Chatham High School	CHS-P-3,4	Primary/Standby	2	5.0	82.0%	Y	Y
Chatham Middle School	CMS-P-1,2	Primary/Standby	2	7.5	88.5%	Y	Y
Chatham Middle School	CMS-P-A,B	Primary/Standby	2	7.5	86.5%	Y	Y
Chatham Middle School	CMS-P-4,5	Primary/Standby	2	8	91.7%	Y	Y
Chatham Middle School	CMS-F-1	Primary/Standby	1	5	86.5%	Y	N
Chatham Middle School	CMS-F-2	0	1	8	86.5%	Y	N
Southern Boulevard School	SBS-P-1,2	0	2	5	82.0%	Y	Y
Total							

Chathams School District
Exhibit D
ECM 2C - Install Premium Efficiency Motors and VFDs
Variable Frequency Drives and Motor Replacements

CALCULATIONS (MOTOR)

	Chatham High School	Chatham High School	Chatham High School	Chatham Middle School	Chatham Middle School	Chatham Middle School	Chatham Middle School	Chatham Middle School	Southern Boulevard School
Equipment Label	CHS-P-1	CHS-P-2	CHS-P-3,4	CMS-P-1,2	CMS-P-A,B	CMS-P-4,5	CMS-F-1	CMS-F-2	SBS-P-1,2
Equipment Configuration	Primary	Standby	Primary/Standby	Primary/Standby	Primary/Standby	Primary/Standby	Primary/Standby	0	0
Replace Motor	Y	Y	Y	Y	Y	Y	Y	Y	Y
VFD to be Installed	Y	Y	Y	Y	Y	Y	N	N	Y
Qty	1	1	2	2	2	2	1	1	2
HP	20.0	20.0	5.0	7.5	7.5	7.5	5.0	7.5	5.0
Run Hours	3,948	3,948	3,948	366	366	366	366	366	366
Load Factor	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Existing Motor Efficiency	0.910	0.910	0.820	0.885	0.865	0.917	0.865	0.865	0.820
Proposed Motor Efficiency	0.930	0.930	0.907	0.910	0.910	0.910	0.907	0.910	0.907
Existing kW	10.7	10.7	3.0	4.1	4.2	4.0	2.8	4.2	3.0
Proposed kW	10.4	10.4	2.7	4.0	4.0	4.0	2.7	4.0	2.7
Existing Motor kWh Consumption	42,074	42,074	11,673	1,504	1,539	1,452	1,026	1,539	1,082
Proposed Motor kWh Consumption	41,170	41,170	10,553	1,463	1,463	1,463	978	1,463	978
Proposed Motor kWh Consumption w/ VFD	18,849	18,849	4,832	670	670	670	0	0	448
Safety Factor	0%	0%	0%	0%	0%	0%	0%	0%	0%
kW Savings	0.2	0.2	0.3	0.1	0.2	(0.0)	0.1	0.2	0.3
kWh Savings	23,225	23,225	6,841	834	869	782	48	76	634

MOTOR RUN PERCENTAGES AT RESPECTIVE SPEED

30%	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
40%	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
50%	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
60%	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
70%	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
80%	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
90%	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
100%	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Total	1	1	1	1	1	1	1	1	1

KWH CONSUMPTION W/ VFD

30%	11	11	3	0	0	0	0	0	0
40%	79	79	20	3	3	3	2	3	2
50%	412	412	106	15	15	15	10	15	10
60%	1,067	1,067	274	38	38	38	25	38	25
70%	3,107	3,107	796	110	110	110	74	110	74
80%	6,113	6,113	1,567	217	217	217	145	217	145
90%	6,003	6,003	1,539	213	213	213	143	213	143
100%	2,058	2,058	528	73	73	73	49	73	49

Chathams School District
Exhibit D
ECM 2C - Install Premium Efficiency Motors and VFDs
Variable Frequency Drives and Motor Replacements

30%	0.28	0.28	0.07	0.11	0.11	0.11	0.07	0.11	0.07
40%	0.67	0.67	0.17	0.26	0.26	0.26	0.17	0.26	0.17
50%	1.30	1.30	0.33	0.50	0.50	0.50	0.33	0.50	0.33
60%	2.25	2.25	0.58	0.86	0.86	0.86	0.58	0.86	0.58
70%	3.58	3.58	0.92	1.37	1.37	1.37	0.92	1.37	0.92
80%	5.34	5.34	1.37	2.05	2.05	2.05	1.37	2.05	1.37
90%	7.60	7.60	1.95	2.91	2.91	2.91	1.95	2.91	1.95
100%	10.43	10.43	2.67	4.00	4.00	4.00	2.67	4.00	2.67

Chathams School District
Exhibit D
ECM 2D - Domestic Hot Water Replacement
Domestic Hot Water Upgrades

ECM DESCRIPTION

Replacement of Domestic Hot Water Heaters with high efficiency condensing Domestic Hot Water Heaters

DATA / ASSUMPTIONS

*Isolating a storage tank improves the DHW system efficiency by:	**3.0%**
Current DHW Heater Efficiency	**Varies**

MEASUREMENT AND VERIFICATION

Option C - Savings Calculations are based on regression analysis of utility billing meter data

COMMISSIONING

Verify all functions of the boiler control system, safety and operation. Verify air/fuel ratio is consistent through firing range. Provide training of the boiler operators

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) =	**0.0%**
Safety Factor (Thermal) =	**0.0%**

No Safety Factor is used because of a minimal of variables

Chathams School District
Exhibit D
ECM 2D - Domestic Hot Water Replacement
Domestic Hot Water Upgrades

DHW REPLACEMENT CALCULATION

$Q_{savings} = ((\eta_{NEW} - \eta_{OLD}) / \eta_{NEW}) \cdot Fuel_{DHW}$

Variable	Units	Description
$Q_{Savings}$	Therms	Thermal Savings
η_{NEW}	**%**	Efficiency of Existing DHW Heater
η_{OLD}	**%**	Efficiency of Proposed DHW Heater
$Fuel_{DHW}$	Therms	Annual DHW Fuel Consumption

*Inputs are blue

Building	Label	DHW Quantity
Southern Boulevard School	DHW-5-2	1
Southern Boulevard School	DHW-5-3	1
Totals		**2**

Southern Boulevard Schoo	Southern Boulevard Schoo	-	-
DHW-5-2	DHW-5-3	-	-
1	1	-	-
Natural Gas	Natural Gas	-	-
Natural Gas	Natural Gas	-	-
0.4	0.3	-	-

Chathams School District
Exhibit D
ECM 2D - Domestic Hot Water Replacement
Domestic Hot Water Upgrades

A. DOMESTIC HOT WATER HEATER REPLACEMENT

	Southern Boulevard School	Southern Boulevard School
Label	DHW-5-2	DHW-5-3
Quantity	1	1
Fuel Switch	N	N
Existing Fuel	Natural Gas	Natural Gas
Proposed Fuel	Natural Gas	Natural Gas
Current DHW System Efficiency	80.0%	80.0%
Proposed DHW System Efficiency	90.0%	90.0%
Improvement DHW System Efficiency	10%	10%
Annual DHW Heater Baseline	4,205	4,205
Percentage of DHW Building Load	40%	30%
Safety Factor	0%	0%
Electric Savings	-	-
Natural Gas Savings	210	158
Fuel Oil #2 Savings	-	-
Fuel Oil #4 Savings	-	-
Fuel Oil #6 Savings	-	-
Propane Savings	-	-

B. STORAGE TANK ISOLATION

Storage Tank Isolation
Current DHW System Efficiency
Improvement in System Efficiency
New System Efficiency
Safety Factor
Electric Savings
Natural Gas Savings
Fuel Oil #2 Savings
Fuel Oil #4 Savings
Fuel Oil #6 Savings
Propane Savings

Chathams School District
Exhibit D
ECM 2D - Domestic Hot Water Replacement
Domestic Hot Water Upgrades

C. OIL PUMP CALCULATION

Oil Pump Savings
Oil Pump HP
Efficiency
Load Factor
Annual Run Hours
Safety Factor (Run Hours)
Adjusted Run Hours
Electric Savings

Chathams School District
Exhibit D
ECM 2E - Rooftop Unit Replacements
Rooftop Unit Replacement

ECM DESCRIPTION

Replace existing Rooftop Units with high efficiency units

DATA / ASSUMPTIONS

RTU Supply Air Temperature is assumed at, unless stated otherwise | **85** °F
Full Load is estimated at 7.5°F for heating and 92.5°F for cooling unless stated otherwise

MEASUREMENT AND VERIFICATION

Option A (Electric) - Direct kW and savings measurements before and after installation conducted. A report is generated showing the reduction in kW
Option C (Fuel) - Savings Calculations are based on regression analysis of utility billing meter data

COMMISSIONING

Verify all functions of the rooftop system, safety and operation.

RECOVERY/SAFETY FACTOR

Safety Factor (Thermal) = | **0%**

A safety factor of 0 is used due to minimal variables and the proven results of this measure

FORMULAE

$W_{SAVINGS} = W_C - W_C$

$W_C = (W_{C\text{-}OCC} + W_{C\text{-}UNOCC})$
$W_C = (W_{C\text{-}OCC} + W_{C\text{-}UNOCC})$

$W_{C\text{-}OCC} = \sum^{105}_{60} C \cdot (T_{BIN} - T_{OCC}) / (T_{BIN} - T_{DESIGN}) \cdot t_{OCC} \cdot \eta$
$W_{C\text{-}UNOCC} = \sum^{105}_{60} C \cdot (T_{BIN} - T_{UNOCC}) / (T_{BIN} - T_{DESIGN}) \cdot t_{UNOCC} \cdot \eta$

$W_{C\text{-}OCC} = \sum^{105}_{60} C \cdot (T_{BIN} - T_{OCC}) / (T_{BIN} - T_{DESIGN}) \cdot t_{OCC} \cdot \eta$
$W_{C\text{-}UNOCC} = \sum^{105}_{60} C \cdot (T_{BIN} - T_{UNOCC}) / (T_{BIN} - T_{DESIGN}) \cdot t_{UNOCC} \cdot \eta$

$Q_{SAVINGS} = \sum^{60}_{-5} Q_{INPUT} - Q_{INPUT}$

$Q_{INPUT} = \sum^{60}_{-5} (t_{OCC} \cdot Q_{LOAD} \cdot L_{\%}) / \eta_{RTU}$
$Q_{INPUT} = \sum^{60}_{-5} (t_{OCC} \cdot Q_{LOAD} \cdot L_{\%}) / \eta_{RTU}$

$Q_{LOAD} = \sum^{60}_{-5} 1.08 \cdot CFM_{SUPPLY} \cdot (T_{SUPPLY} - T_{MIXED})$

$T_{RISE} = \sum^{60}_{-5} T_{SUPPLY} - T_{MIXED}$

$T_{MIXED} = \sum^{60}_{-5} ((CFM_{RETURN} \cdot T_{RETURN}) + (CFM_{OA} \cdot T_{BIN})) / (CFM_{RETURN} + CFM_{OA})$

Chathams School District
Exhibit D
ECM 2E - Rooftop Unit Replacements
Rooftop Unit Replacement

Variable	Units	Description
$W_{SAVINGS}$	kWh	Electrical Savings
W_C	kWh	Existing RTU Consumption
W_C	kWh	Proposed RTU Consumption
$\eta_{\%}$	%	Efficiency gain due to RTU optimization
$\sum_{60}^{105}$	-	Summation of all bins from 60°F to 105°F
C	Ton	Tonnage of RTU
η	-	Existing efficiency of RTU (EER)
η	-	Proposed efficiency of RTU (EER)
T_{DESIGN}	°F	Design Temperature of RTU (Usually 97.5°F)
T_{BIN}	°F	Bin Weather Temperature
T_{OCC}	°F	Temperature of building during occupied hours
T_{UNOCC}	°F	Temperature of building during unoccupied hours
t_{OCC}	Hrs	Existing occupied Bin Hours in respective temperature bin
t_{UNOCC}	Hrs	Existing unoccupied Bin Hours in respective temperature bin
$Q_{SAVINGS}$	Therms	Thermal Savings
$\sum_{-5}^{60}$	-	Summation of all bins from -5°F to 60°F
T_{BIN}	°F	Temperature of respective bin
Q_{INPUT}	Therms	Existing Input heat provided by RTUs at respective bin temperature
Q_{INPUT}	Therms	Proposed Input heat provided by RTUs at respective bin temperature
Q_{LOAD}	Therms	Heat load on the unit vent
$L_{\%}$	%	Load % at respective bin
T_{RISE}	°F	Temperature rise across the coil (100% Design at 10°F)
T_{MIXED}	°F	Mixed air temperature
T_{SUPPLY}	Hrs	Temperature of supply air
T_{RETURN}	Hrs	Temperature of return air
CFM_{SUPPLY}	CFM	Total supply CFM of unit vent
CFM_{OA}	CFM	Total outside air CFM of unit vent
CFM_{RETURN}	CFM	Total return air CFM of unit vent
q	-	Quantity of replaced/refurbished RTUs
η_{REFURB}	**%**	Efficiency improvement of refurbished unit vent
$\eta_{REPLACE}$	**%**	Efficiency improvement of replaced unit vent
t_{OCC}	Hrs	Occupied Bin Hours in respective temperature bin

* Inputs are in blue
*Checks against baseline are in purple

Building	Label	Thermal Fuel	Area Serving
Chatham High School	RTU-1-A3	0	A110, A110A
Chatham High School	RTU-1-A8	0	A120
Chatham High School	RTU-1-A2	0	Main Offices + Guidance
Chatham Middle School	RTU-2-AC1	0	200
Chatham Middle School	RTU-2-AC2	0	100
Totals			

Chathams School District
Exhibit D
ECM 2E - Rooftop Unit Replacements
Rooftop Unit Replacement

CALCULATIONS

	Chatham High School	Chatham High School	Chatham High School	Chatham Middle School	Chatham Middle School
Label	RTU-1-A3	RTU-1-A8	RTU-1-A2	RTU-2-AC1	RTU-2-AC2
Fuel Switch	Y	Y	Y	Y	Y
Existing Thermal Fuel	-	-	-	-	-
Proposed Thermal Fuel	None	None	None	None	None
Area Serving	A110, A110A	A120	Main Offices + Guidance	200.00	100.00
Quantity	1	1	1	1	1
RTU Tonnage	6.0	7.5	23.3	3.0	3.0
RTU Supply Air CFM	2,400	3,000	9,333	1,200	1,200
RTU Fresh Air CFM	360	450	1,400	180	180
RTU Return Air CFM	2,040	2,550	7,933	1,020	1,020
Current Thermal Efficiency	80%	80%	80%	-	-
Proposed Thermal Efficiency	80%	80%	80%	0%	0%
Current EER	8.0	8.0	8.9	11.0	11.0
Proposed EER	19.8	20.6	11.2	16.9	16.9
Existing Occupied Heating Setpoint	74.0	74.0	74.0	74.0	74.0
Existing Unoccupied Heating Setpoint	70.0	70.0	70.0	70.0	70.0
Proposed Occupied Cooling Setpoint	70.0	70.0	70.0	70.0	70.0
Proposed Unoccupied Cooling Setpoint	78.0	78.0	78.0	78.0	78.0
Supply Air Temperature	85.0	85.0	85.0	85.0	85.0
Current RTU kWh Consumption	4,912	8,161	22,823	2,328	2,328
Current RTU Thermal Consumption	1,105	1,382	4,298	-	-
Percent of Electric Baseline Consumption	0.3%	0.5%	1.3%	0.2%	0.2%
Percent of Thermal Baseline Consumption	1.1%	1.4%	4.3%	0.0%	0.0%
Proposed RTU kWh Consumption	1,985	3,169	18,136	1,515	1,515
Proposed RTU Thermal Consumption	1,105	1,382	4,298	-	-
Safety Factor	0%	0%	0%	0%	0%
Electrical Savings	2,927	4,992	4,687	813	813
Natural Gas Savings	-	-	-	-	-
Fuel Oil #2 Savings	-	-	-	-	-
Fuel Oil #4 Savings	-	-	-	-	-
Fuel Oil #6 Savings	-	-	-	-	-
Propane Savings	-	-	-	-	-

CHATHAM HIGH SCHOOL

Amb. Temp Bin °F	Avg Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occupied Tons	Unoccupied Tons	Occupied Ton-Hrs	Unoccupied Ton-Hrs	Current Condensing Unit Consumption	Proposed Condensing Unit Consumption	Savings
COOLING												kWh	kWh	kWh
100 to 105	102.5	-	1	-	1	1	0	6.0	6.0	5	1	9	4	5
95 to 100	97.5	-	19	2	21	18	3	6.0	6.0	105	21	189	76	113
90 to 95	92.5	-	44	13	57	46	11	6.0	6.0	275	67	513	207	306
85 to 90	87.5	1	167	60	228	181	47	3.8	2.9	690	138	1,242	502	740
80 to 85	82.5	31	283	162	476	349	127	2.7	1.4	953	175	1,692	684	1,008
75 to 80	77.5	191	235	280	706	411	295	1.6	-	672	-	1,008	407	601
70 to 75	72.5	203	177	222	602	327	275	0.5	-	178	-	267	108	159
65 to 70	67.5	325	165	204	694	327	367	-	-	-	-	-	-	-
60 to 65	62.5	180	152	195	527	284	243	-	-	-	-	-	-	-
Total		931	1,242	1,138	3,311	1,942	1,369	20.7	16.3	2,873	401	4,912	1,985	2,933

Chathams School District
Exhibit D
ECM 2E - Rooftop Unit Replacements
Rooftop Unit Replacement

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Mixed Air Temp	Temp rise across coil	Heat Load on the unit	Load % at bin O/A temp (Note 1)	Heat provided by unit
HEATING								°F	°F	btu/hr	%	Btu/Yr
55 to 60	57.5	86	144	97	327	199	128	68.1	16.9	43,740	69.2%	6,038,463
50 to 55	52.5	109	182	172	463	283	180	67.4	17.6	45,684	72.3%	9,347,172
45 to 50	47.5	105	119	142	366	209	157	66.6	18.4	47,628	75.4%	7,521,927
40 to 45	42.5	185	155	177	517	277	240	65.9	19.1	49,572	78.5%	10,755,149
35 to 40	37.5	236	200	241	677	364	313	65.1	19.9	51,516	81.5%	15,298,200
30 to 35	32.5	237	202	198	637	339	298	64.4	20.6	53,460	84.6%	15,344,489
25 to 30	27.5	121	115	113	349	191	158	63.6	21.4	55,404	87.7%	9,270,200
20 to 25	22.5	149	68	97	314	146	168	62.9	22.1	57,348	90.8%	7,574,836
15 to 20	17.5	95	40	46	181	80	101	62.1	22.9	59,292	93.8%	4,451,461
10 to 15	12.5	39	9	28	76	32	44	61.4	23.6	61,236	96.9%	1,909,857
5 to 10	7.5	21	5	5	31	11	20	60.6	24.4	63,180	100.0%	705,134
0 to 5	2.5	4	2	-	6	2	4	59.9	25.1	65,124	100.0%	158,158
-5 to 0	-2.5	4	-	-	4	1	3	59.1	25.9	67,068	100.0%	47,906
-10 to -5	-7.5	-	-	-	-	-	-	58.4	26.6	69,012	100.0%	-
-15 to -10	-12.5	-	-	-	-	-	-	57.6	27.4	70,956	100.0%	-
Total		1,391	1,241	1,316	3,948	1,935	1,813					88,422,952

CHATHAM HIGH SCHOOL

Amb. Temp Bin °F	Avg Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occupied Tons	Unoccupied Tons	Occupied Ton-Hrs	Unoccupied Ton-Hrs	Current Condensing Unit Consumption (kWh)	Proposed Condensing Unit Consumption (kWh)	Savings (kWh)
COOLING														
100 to 105	102.5	-	1	-	1	1	0	7.5	7.5	6	1	11	4	7
95 to 100	97.5	-	19	2	21	18	3	7.5	7.5	132	26	236	92	145
90 to 95	92.5	-	44	13	57	46	11	7.5	7.5	344	84	641	249	392
85 to 90	87.5	1	167	60	228	181	47	5.2	5.2	939	245	1,776	690	1,086
80 to 85	82.5	31	283	162	476	349	127	4.0	4.0	1,411	511	2,883	1,120	1,764
75 to 80	77.5	191	235	280	706	411	295	2.9	-	1,184	-	1,776	690	1,087
70 to 75	72.5	203	177	222	602	327	275	1.7	-	565	-	848	329	519
65 to 70	67.5	325	165	204	694	327	367	-	-	-	-	-	-	-
60 to 65	62.5	180	152	195	527	284	243	-	-	-	-	-	-	-
Total		931	1,242	1,138	3,311	1,942	1,369	28.8	24.2	4,575	866	8,161	3,169	4,999

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Mixed Air Temp	Temp rise across coil	Heat Load on the unit	Load % at bin O/A temp (Note 1)	Heat provided by unit
HEATING								°F	°F	btu/hr	%	Btu/Yr
55 to 60	57.5	86	144	97	327	199	128	68.1	16.9	54,675	69.2%	7,548,079
50 to 55	52.5	109	182	172	463	283	180	67.4	17.6	57,105	72.3%	11,683,965
45 to 50	47.5	105	119	142	366	209	157	66.6	18.4	59,535	75.4%	9,402,408
40 to 45	42.5	185	155	177	517	277	240	65.9	19.1	61,965	78.5%	13,443,937
35 to 40	37.5	236	200	241	677	364	313	65.1	19.9	64,395	81.5%	19,122,750
30 to 35	32.5	237	202	198	637	339	298	64.4	20.6	66,825	84.6%	19,180,611
25 to 30	27.5	121	115	113	349	191	158	63.6	21.4	69,255	87.7%	11,587,750
20 to 25	22.5	149	68	97	314	146	168	62.9	22.1	71,685	90.8%	9,468,545
15 to 20	17.5	95	40	46	181	80	101	62.1	22.9	74,115	93.8%	5,564,326
10 to 15	12.5	39	9	28	76	32	44	61.4	23.6	76,545	96.9%	2,387,321
5 to 10	7.5	21	5	5	31	11	20	60.6	24.4	78,975	100.0%	881,417
0 to 5	2.5	4	2	-	6	2	4	59.9	25.1	81,405	100.0%	197,698
-5 to 0	-2.5	4	-	-	4	1	3	59.1	25.9	83,835	100.0%	59,882
-10 to -5	-7.5	-	-	-	-	-	-	58.4	26.6	86,265	100.0%	-
-15 to -10	-12.5	-	-	-	-	-	-	57.6	27.4	88,695	100.0%	-
Total		1,391	1,241	1,316	3,948	2,135	1,813					110,528,690

Chathams School District
Exhibit D
ECM 2E - Rooftop Unit Replacements
Rooftop Unit Replacement

CHATHAM HIGH SCHOOL

Amb. Temp Bin °F	Avg Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occupied Tons	Unoccupied Tons	Occupied Ton-Hrs	Unoccupied Ton-Hrs	Current Condensing Unit Consumption (kWh)	Proposed Condensing Unit Consumption (kWh)	Savings (kWh)
COOLING														
100 to 105	102.5	-	1	-	1	1	0	23.3	23.3	20	3	31	25	6
95 to 100	97.5	-	19	2	21	18	3	23.3	23.3	409	81	661	525	136
90 to 95	92.5	-	44	13	57	46	11	23.3	23.3	1,070	260	1,793	1,425	368
85 to 90	87.5	1	167	60	228	181	47	16.2	16.2	2,921	762	4,966	3,946	1,020
80 to 85	82.5	31	283	162	476	349	127	12.6	12.6	4,389	1,591	8,064	6,408	1,656
75 to 80	77.5	191	235	280	706	411	295	9.0	-	3,684	-	4,968	3,947	1,020
70 to 75	72.5	203	177	222	602	327	275	5.4	-	1,759	-	2,372	1,885	487
65 to 70	67.5	325	165	204	694	327	367	-	-	-	-	-	-	-
60 to 65	62.5	180	152	195	527	284	243	-	-	-	-	-	-	-
Total		931	1,242	1,138	3,311	1,942	1,369	89.7	75.4	14,233	2,695	22,823	18,136	4,693

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Mixed Air Temp	Temp rise across coil	Heat Load on the unit	Load % at bin O/A temp (Note 1)	Heat provided by unit
HEATING								°F	°F	btu/hr	%	Btu/Yr
55 to 60	57.5	86	144	97	327	199	128	68.1	16.9	170,100	69.2%	23,482,912
50 to 55	52.5	109	182	172	463	283	180	67.4	17.6	177,660	72.3%	36,350,115
45 to 50	47.5	105	119	142	366	209	157	66.6	18.4	185,220	75.4%	29,251,937
40 to 45	42.5	185	155	177	517	277	240	65.9	19.1	192,780	78.5%	41,825,581
35 to 40	37.5	236	200	241	677	364	313	65.1	19.9	200,340	81.5%	59,492,999
30 to 35	32.5	237	202	198	637	339	298	64.4	20.6	207,900	84.6%	59,673,012
25 to 30	27.5	121	115	113	349	191	158	63.6	21.4	215,460	87.7%	36,050,779
20 to 25	22.5	149	68	97	314	146	168	62.9	22.1	223,020	90.8%	29,457,695
15 to 20	17.5	95	40	46	181	80	101	62.1	22.9	230,580	93.8%	17,311,237
10 to 15	12.5	39	9	28	76	32	44	61.4	23.6	238,140	96.9%	7,427,220
5 to 10	7.5	21	5	5	31	11	20	60.6	24.4	245,700	100.0%	2,742,187
0 to 5	2.5	4	2	-	6	2	4	59.9	25.1	253,260	100.0%	615,060
-5 to 0	-2.5	4	-	-	4	1	3	59.1	25.9	260,820	100.0%	186,300
-10 to -5	-7.5	-	-	-	-	-	-	58.4	26.6	268,380	100.0%	-
-15 to -10	-12.5	-	-	-	-	-	-	57.6	27.4	275,940	100.0%	-
Total		1,391	1,241	1,316	3,948	2,135	1,813					343,867,034

Chathams School District
Exhibit D
ECM 2F - Window AC Unit Replacements
Window AC Replacement

ECM DESCRIPTION

Replace existing low efficiency window units in respective buildings with new high efficiency window units with an EER of 12+

DATA / ASSUMPTIONS

*Run Hours based on occupancy schedule
*Full Load is estimated at (unless stated otherwise) : 97.5 °F
*Run hours are based on chiller cutoff temperature and bin weather data

MEASUREMENT AND VERIFICATION

Option A - The engineering calculations are based on direct kW measurements of the existing and installed chillers and operating hours. All existing chillers will be measured before removal and new motors after the installation.

COMMISSIONING

Start up equipment ensure proper operation

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) = 0%

The safety factor for this ECM is taken at 0 due to some variances on the run hours and the estimated part load efficiencies of the existing chiller.

FORMULAE

OPTIMIZATION

$W_{SAVINGS} = W_C \cdot \eta_{\%}$

REPLACEMENT

$W_{SAVINGS} = W_C - W_C$

$W_C = (W_{C\text{-}OCC} + W_{C\text{-}UNOCC})$
$W_C = (W_{C\text{-}OCC} + W_{C\text{-}UNOCC})$

$W_{C\text{-}OCC} = \sum_{60}^{105} C \cdot (T_{BIN} - T_{OCC}) / (T_{BIN} - T_{DESIGN}) \cdot t_{OCC} \cdot \eta$
$W_{C\text{-}UNOCC} = \sum_{60}^{105} C \cdot (T_{BIN} - T_{UNOCC}) / (T_{BIN} - T_{DESIGN}) \cdot t_{UNOCC} \cdot \eta$

$W_{C\text{-}OCC} = \sum_{60}^{105} C \cdot (T_{BIN} - T_{OCC}) / (T_{BIN} - T_{DESIGN}) \cdot t_{OCC} \cdot \eta$
$W_{C\text{-}UNOCC} = \sum_{60}^{105} C \cdot (T_{BIN} - T_{UNOCC}) / (T_{BIN} - T_{DESIGN}) \cdot t_{UNOCC} \cdot \eta$

Variable	Units	Description
$W_{SAVINGS}$	kWh	Electrical Savings
W_C	kWh	Existing condensing unit Consumption
W_C	kWh	Proposed condensing unit Consumption
$\eta_{\%}$	%	Efficiency gain due to condensing unit optimization
$\sum_{60}^{105}$	-	Summation of all bins from 60°F to 105°F
C	Ton	Tonnage of condensing unit
η	-	Existing efficiency of condensing unit (EER)
η	-	Proposed efficiency of condensing unit (EER)
T_{DESIGN}	°F	Design Temperature of condensing unit (Usually 97.5°F)
T_{BIN}	°F	Bin Weather Temperature
T_{OCC}	°F	Temperature of building during occupied hours
T_{UNOCC}	°F	Temperature of building during unoccupied hours
t_{OCC}	Hrs	Existing occupied Bin Hours in respective temperature bin
t_{UNOCC}	Hrs	Existing unoccupied Bin Hours in respective temperature bin

* Inputs are in blue
*Checks against baseline are in purple

Chathams School District
Exhibit D
ECM 2F - Window AC Unit Replacements
Window AC Replacement

Building	Label	Qty	Tonnage (Each)	Current EER	Proposed IEER	Area Serving
Chatham Middle School	CMS-WU-1-13	13	38.0	10.7	19.5	First Floor
Chatham Middle School	CMS-WU-14-27	16	28.0	10.7	19.5	Second Floor
Totals		**29**	**66.0**			

CALCULATIONS

	Chatham Middle School	Chatham Middle School
Label	CMS-WU-1-13	CMS-WU-14-27
Qty	13.00	16.00
Area Serving	First Floor	Second Floor
Condensing Unit Tonnage	38.0	28.0
Current EER	10.7	10.7
Proposed EER	19.5	19.5
Existing Occupied Cooling Setpoint	74.0	74.0
Existing Unoccupied Cooling Setpoint	70.0	70.0
Current Condensing Unit Consumption	24,255	17,872
Percent of Baseline Consumption	2.0%	1.5%
Proposed Condensing Unit Consumption	13,309	9,807
Electrical Savings	10,965	8,080
Safety Factor	0%	0%
Electrical Savings	10,965	8,080

CHATHAM MIDDLE SCHOOL

Amb. Temp Bin °F	Avg Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occupied Tons	Unoccupied Tons	Occupied Ton-Hrs	Unoccupied Ton-Hrs	Current Condensing Unit Consumption	Proposed Condensing Unit Consumption	Savings
COOLING												kWh	kWh	kWh
100 to 105	102.5	-	1	-	1	1	0	38.0	38.0	33	5	43	23	19
95 to 100	97.5	-	19	2	21	17	4	38.0	38.0	660	138	895	491	404
90 to 95	92.5	-	44	13	57	45	12	38.0	38.0	1,698	468	2,429	1,333	1,096
85 to 90	87.5	1	167	60	228	175	53	21.8	24.2	3,830	1,270	5,720	3,139	2,582
80 to 85	82.5	31	283	162	476	335	141	13.7	17.3	4,603	2,437	7,896	4,332	3,563
75 to 80	77.5	191	235	280	706	386	320	5.7	10.4	2,182	3,321	6,172	3,387	2,785
70 to 75	72.5	203	177	222	602	307	295	-	3.5	-	1,019	1,143	627	516
65 to 70	67.5	325	165	204	694	309	385	-	-	-	-	-	-	-
60 to 65	62.5	180	152	195	527	267	260	-	-	-	-	-	-	-
Total		931	1,242	1,138	3,311	1,840	1,471	117.2	131.3	12,973	8,655	24,255	13,309	10,965

CHATHAM MIDDLE SCHOOL

Amb. Temp Bin °F	Avg Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occupied Tons	Unoccupied Tons	Occupied Ton-Hrs	Unoccupied Ton-Hrs	Current Condensing Unit Consumption	Proposed Condensing Unit Consumption	Savings
COOLING												kWh	kWh	kWh
100 to 105	102.5	-	1	-	1	1	0	28.0	28.0	24	4	31	17	14
95 to 100	97.5	-	19	2	21	17	4	28.0	28.0	486	102	659	362	298
90 to 95	92.5	-	44	13	57	45	12	28.0	28.0	1,251	345	1,790	982	808
85 to 90	87.5	1	167	60	228	175	53	16.1	17.8	2,822	936	4,215	2,313	1,902
80 to 85	82.5	31	283	162	476	335	141	10.1	12.7	3,392	1,796	5,818	3,192	2,625
75 to 80	77.5	191	235	280	706	386	320	4.2	7.6	1,608	2,447	4,548	2,495	2,052
70 to 75	72.5	203	177	222	602	307	295	-	2.5	-	751	842	462	380
65 to 70	67.5	325	165	204	694	309	385	-	-	-	-	-	-	-
60 to 65	62.5	180	152	195	527	267	260	-	-	-	-	-	-	-
Total		931	1,242	1,138	3,311	1,840	1,471	86.4	96.7	9,559	6,377	17,872	9,807	8,080

Chathams School District
Exhibit D
ECM 2G - Kitchen Hood Controllers
Kitchen Hood Replacement

ECM DESCRIPTION

Kitchen hoods in the district's kitchens are ventilated by exhaust fans. Fans are running most of the time at full speed when kitchen is in operation even if there are no activities under the hoods. e new ventilaton control systems will control exhaust fans based on hood exhaust temperatures. The exhaust fan will be equipped with VFDs will control air flows. If the exhaust fan is combined with a make up air unit, then variable air flow will be controlled on both exhaust and make up air fans.

DATA / ASSUMPTIONS

Existing equipment schedule was given by personnel operating the kitchen equipment and with interviews with facility staff

MEASUREMENT AND VERIFICATION

Option A (Both Electric and Fuel) - Measure kW, logging fan operation and calculate energy savings, both electric and fuel, from collected data with fan and make up air information from manufacturer.

COMMISSIONING

Test exhaust fans and make up air units that they operate per design intent, which include simulation of the exhaust temperature driving fan motor speeds. Verify all safety interlocks.

RECOVERY/SAFETY FACTOR

Recovery/Safety Factor (Electric) =	**0%**
Recovery/Safety Factor (Thermal) =	**0%**

Savings calculations are based on weather bin data, make up air flow and operating schedules. A more conservative is used for heating losses due to the uncertainty of the basic operating information in terms of the volume of air being exhausted and other operating perimeters. The heating fuel saving calculations are based upon information provided by the equipment vendor. The exhaust fan electric savings are based on existing fan schedules and proposed fan schedules. Recovery factor of the electric savings is less conservative due to knowledge of technical data and agreed operating schedule.

Chathams School District
Exhibit D
ECM 2G - Kitchen Hood Controllers
Kitchen Hood Replacement

FORMULAE

$W_{SAVINGS} = (W_{FAN} - W_{FAN})$
$Q_{SAVINGS} = (Q_{HOOD} - Q_{HOOD}) / \eta_{Boiler}$

$W_{FAN} = \sum^{100\%}_{0\%} HP \cdot Lf \cdot .746 \cdot t_{HOOD}$
$W_{FAN} = \sum^{100\%}_{0\%} (HP \cdot Lf \cdot .746) \cdot RPM_{\%}^{3} \cdot t_{HOOD}$

$Q_{HOOD} = (1.08 \cdot V_{EX} \cdot HD_{OCC} \cdot (t_{HOOD} / t_{HOOD} + t_{OCC})) / (\eta_{sys} \cdot 100{,}000)$
$Q_{HOOD} = (1.08 \cdot V_{EX} \cdot HD_{OCC} \cdot (t_{HOOD} / t_{HOOD} + t_{OCC})) / (\eta_{sys} \cdot 100{,}000)$

$V_{EX} = V_{EX} \cdot RPM_{W}$

Variable	Units	Description
$W_{savings}$	kWh	kWh Savings
$Q_{savings}$	Therms	Thermal Savings
W_{FAN}	kWh	Existing Annual Fan Electricial Consumption
W_{FAN}	kWh	Proposed Annual Fan Electricial Consumption
HP	HP	Horsepower of Exhaust Fan
$\sum^{100\%}_{0\%}$	-	Summation of run times
$RPM_{\%}$	RPM	Percentage of RPM compared to the motors full speed (0% - 100%)
RPM_{W}	RPM	Weighted RPM of Exhaust Fan
Lf	-	Load Factor of motor
η_{sys}	-	Existing system efficiency
V_{EX}	CFM	Current Exhaust Volume
V_{EX}	CFM	Proposed Exhaust Volume
Q_{HOOD}	Therms	Existing Heat Load of Kitchen Hood
Q_{HOOD}	Therms	Proposed Heat Load of Kitchen Hood
T_{OCC}	°F	Existing temperature of space during occupied hours
η_{Boiler}	-	Existing system efficiency
t_{HOOD}	Hrs	Existing Hood Run Hours
t_{OCC}	Hrs	Occupied Bin Hours
HD_{OCC}	Hrs	Existing occupied heating degree hours

Chathams School District
Exhibit D
ECM 2G - Kitchen Hood Controllers
Kitchen Hood Replacement

* Inputs are in blue

Building	Kitchen Hood Area (ft^2)	HP of Exhaust Fan Motor	HP of MAU Motor	Annual Run Hours	System Efficiency	Current Exhaust Volume (CFM)
Chatham High School	68	5.0	1.5	1,440	60%	5,100
Chatham Middle School	64	5.0	1.5	1,440	60%	4,800
Totals	132	10.0	3.0			9,900

	Chatham High School	Chatham Middle School
Kitchen Hood Area	68	64
HP of Fan Motor	5	5.0
HP Fan MAU Motor	1.5	1.5
Load Factor	90%	90%
Annual Run Hours	1,440	1,440
System Efficiency	60%	60%
Current Exhaust Volume	5,100	4,800
Proposed Exhaust Volume	2,423	2,280
Existing Heat Load	2,768	2,544
Proposed Heat Load	1,315	1,208
Existing Occupied Heating Setpoint	74.0	74.0
Existing Occupied Cooling Setpoint	70.0	70.0
Existing Unoccup. Cooling Setpoint	78.0	78.0
Boiler Efficiency	80.0%	87.0%
Safety Factor	0%	0%
Electrical Savings	5,263	5,263
Thermal Savings	1,816	1,535

Chathams School District
Exhibit D
ECM 2G - Kitchen Hood Controllers
Kitchen Hood Replacement

ELECTRICAL CALCULATIONS

CHATHAM HIGH SCHOOL

Variable Exhaust Volume Analysis

% Rated RPM	% Run Time	Time Hrs/Yr	Weighted RPM	Existing kWh	Proposed kWh	kWh Savings
100%	1%	14	1%	63	63	0
90%	3%	43	3%	189	137	51
80%	6%	86	5%	377	193	184
70%	10%	144	7%	628	216	413
60%	10%	144	6%	628	136	493
50%	20%	288	10%	1,257	157	1,100
40%	20%	288	8%	1,257	80	1,176
30%	20%	288	6%	1,257	34	1,223
20%	10%	144	2%	628	5	623
10%	0%	-	0%	0	0	0
Total		1,440	**48%**	**6,284**	**1,021**	**5,263**

CHATHAM MIDDLE SCHOOL

Variable Exhaust Volume Analysis

% Rated RPM	% Run Time	Time Hrs/Yr	Weighted RPM	Existing kWh	Proposed kWh	kWh Savings
100%	1%	14	1%	63	63	0
90%	3%	43	3%	189	137	51
80%	6%	86	5%	377	193	184
70%	10%	144	7%	628	216	413
60%	10%	144	6%	628	136	493
50%	20%	288	10%	1,257	157	1,100
40%	20%	288	8%	1,257	80	1,176
30%	20%	288	6%	1,257	34	1,223
20%	10%	144	2%	628	5	623
10%	0%	-	0%	0	0	0
Total		1,440	**48%**	**6,284**	**1,021**	**5,263**

Chathams School District
Exhibit D
ECM 2H - Walk-In Freezer/Cooler Controllers
Walk-In Freezer/Cooler Controllers

ECM DESCRIPTION

Installation of a refrigeration controller made by intellidyne on walk-in freezers and refrigerators. This will reduce cycling and improve operating efficiency of the compressor.

DATA / ASSUMPTIONS

Assumed compressor and controller savings	15%	
Assumed Run Hours	4,200	Hours

MEASUREMENT AND VERIFICATION

Option A - Measure kW of selected freezer compressors. Logging compressor operation before and after the controller installations. Calculate savings based on measured results.

COMMISSIONING

Test compressors after installation.

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) = 0%

Recovery factor taken at 0 due to few installations and not proven savings record.

FORMULAE

$W_{SAVINGS} = (kW_{REFRIG} + kW_{FREEZER}) \cdot t \cdot \delta_{\%SAVINGS}$

Variable	Units	Description
$W_{savings}$	kWh	Electrical Savings for Motor Replacement
kW_{REFRIG}	kW	Horsepower of motor
$kW_{FREEZER}$	kW	Existing Run Hours
t	Hrs	Run hours (assumed)
$\delta_{\%SAVINGS}$	%	Compressor and controller savings (assumed)

*Inputs are blue

Chathams School District
Exhibit D
ECM 2H - Walk-In Freezer/Cooler Controllers
Walk-In Freezer/Cooler Controllers

Building	Location	No. of Walk-In Refrigerators	No. of Walk-In Freezers	kW of Refrigerator	kW of Freezer
Chatham High School	Kitchen	1	1	1.152	2.863
Chatham Middle School	Kitchen	1	-	1.152	
-	-	-	-		
-	-	-	-		
Totals	-	2	1	2.3	2.9

*Note Typical Refrig kW = 1.152; Freezer kW = 2.863

CALCULATIONS

	Chatham High School	Chatham Middle School
No. of Walk-In Refrigerators	1	1
No. of Walk-In Freezers	1	0
kW of Refrigerator	1.152	1.152
kW of Freezer	2.863	-
Run Hours	4,200	4,200
Total Electrical Consumption	16,863	4,838
Compressor and Controller Savings	15%	15%
Safety Factor	0%	0%
Electrical Savings	2,529	726

Chathams School District

Exhibit D

ECM 2I - Steam Trap Replacement/Refurbishment

Steam Trap Retrofit

ECM DESCRIPTION

Steam trap audit identified that there are steam traps that are not currently working or are partially working. Faulty steam traps will be either replaced or repaired.

DATA / ASSUMPTIONS

* Percentage of failed steam traps based on audit	0.270	Btu / ft^2 / °F / hr. / inch
*Respective boiler efficiencies are used		
Heating Hours	3,948	Hours

MEASUREMENT AND VERIFICATION

Option C - Savings Calculations are based on regression analysis of utility billing meter data

COMMISSIONING

Verify function of all steam traps per scope of work

RECOVERY/SAFETY FACTOR

Diversity Factor =	100%	Percentage of "lost" steam from orifice size from a failed trap (i.e. Not all all steam will flow through open orifice)
Safety Factor (Thermal) =	0%	

The safety factor for this ECM is taken at 0 due to exactness of the existing trap losses

FORMULAE

$Q_{savings} = (q_{loss} \cdot 1{,}194/100{,}000) / \eta$

$q_{loss} = \Sigma^{TRAPS} \; q_{trap} \cdot st_{fail\%} \cdot t$

$q_{trap} = 10.1 \cdot d^2 \cdot (p + 14.7)$

Variable	Units	Description
$Q_{savings}$	Therms	Thermal Savings
Σ^{TRAPS}	-	Summation of all steam traps
q_{loss}	lb / yr	Annual steam loss through failed office
q_{trap}	lb / hr	Steam loss through failed office
$st_{fail\%}$	%	Percentage of failed steam traps
t	hrs	Annual heating system run hours
p	psig	Pressure of steam through respective system
d	inches	Orifice Diameter
η	**%**	Boiler Efficiency

* Inputs are in blue

Building	% of Population Failed
Milton Avenue School	20%
Washington Avenue School	20%

Chathams School District

Exhibit D

ECM 2I - Steam Trap Replacement/Refurbishment

Steam Trap Retrofit

CALCULATIONS

Hours / Yr	Equipment	Steam Trap Type	Steam Pressure (Psi)	Orifice Diameter (inches)	Failed Loss/hr	Milton Avenue School Qty	Washington Avenue School Qty
4380	Drip	Thermo.	5.0	0.250	12.4		1
4380	Drip	3/4"-1" F&T	5.0	0.218	9.5	8	11
4380	Drip	2" F&T	5.0	0.500	49.7	1	1
1200	Hvac	3/4/-1" F&T	5.0	0.218	9.5	2	1
1200	Hvac	1-1/4" F&T	5.0	0.312	19.4		1
1200	Hvac	1-1/2" F&T	5.0	0.390	30.3		3
1200	UV	3/4"-1" F&T	2.0	0.218	8.0	16	11
1200	UV	Thermo.	2.0	0.250	10.5	2	1
1200	Rad	Thermo.	2.0	0.250	10.5	44	26
1200	Drip	Thermo.	5.0	0.250	12.4		
1200	Drip	F&T	2.0	0.188	6.0		
1200	Hvac	Thermo.	2.0	0.218	8.0		
					Total Traps	73	56
					% of Population Failed	20%	20%
					Failed Steam Traps	15	12
					Steam Loss (lb/hr)	261,543	263,765
					Safety Factor	0%	0%
					Annual Steam Losses (Therms)	3,123	3,149
					Boiler Efficency	78.0%	77.9%
					Annual Heat Input Losses	4,005	4,044

Chathams School District
Exhibit D
ECM 2J - Piping Insulation
Piping Insulation

ECM DESCRIPTION

Insulate bare hot water, steam and condensate piping located in boiler rooms and in transition areas. Repair damaged insulation on piping. Insulate condensate storage tanks where applicable. Insulate steam heat exchangers where applicable.

DATA / ASSUMPTIONS

Run Hours	Varies by building	
* Insulation "k" Factor of New Piping Insulation	0.270	Btu / ft^2 / °F / hr. / inch
*Respective boiler efficiencies are used		

MEASUREMENT AND VERIFICATION

Option C - Savings Calculations are based on regression analysis of utility billing meter data

COMMISSIONING

Visual inspection per scope of work from subcontractor.

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) =	0%
Safety Factor (Thermal) =	0%

The safety factor for this ECM is taken at 0 due to uncertainty of on going steam and hot water piping temperatures incorporated in the savings calculation.

FORMULAE

Detailed energy savings calculations are in the Piping Insulation calculation sheet

* Inputs are in blue

Subcontractor Calculations N * If Yes - Please Refer to tab 'Sub Pipe Insulation' for details

Diameter (in) of Pipe - Input linear feet per diameter

Building	14+	10.00	8.00	6.00	5.00	4.00	3.00	2.50	2.00	1.50	1.00	0.75	0.50
Chatham High School									100.0				
Totals	-	-	-	-	-	-	-	-	100.0	-	-	-	-

CALCULATIONS

	Chatham High School
Total Linear Feet of Insulation	100.0
Losses from Bare Pipe	12,361
Losses from Insulated Pipe	5,675
Boiler Efficiency	80.0%
Thermal Savings (Therms/hr)	0.08
Safety Factor	5%
Thermal Savings	303

Chathams School District
Exhibit D
ECM 2J - Piping Insulation
Piping Insulation

Nominal Pipe Size (inches)	14.00	10.00	8.00	6.00	5.00	4.00	3.00	2.50	2.00	1.50	1.00	0.75	0.50
Contact Temperature of Bare Pipe (baseline)	**155**	**155**	**155**	**155**	**155**	**155**	**155**	**155**	**155**	**155**	**155**	**155**	**155**
Thickness of Insulation (inches)	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.0**	**2.0**	**2.0**	**2.0**	**1.5**	**1.5**	**1.5**	**1.5**
Insulation "k" Factor	0.270	0.270	0.270	0.270	0.270	0.270	0.270	0.270	0.270	0.270	0.270	0.270	0.270
Pipe Length	1	1	1	1	1	1	1	1	1	1	1	1	1
Hours of Operation	3,814	3,814	3,814	3,814	3,814	3,814	3,814	3,814	3,814	3,814	3,814	3,814	3,814
Temperature of Environment	70	70	70	70	70	70	70	70	70	70	70	70	70
Contact Temperature of Floor	60	60	60	60	60	60	60	60	60	60	60	60	60
Contact Temperature of Ceiling	90	90	90	90	90	90	90	90	90	90	90	90	90
Contact Temperature of walls	75	75	75	75	75	75	75	75	75	75	75	75	75
Initial Insulation Fim Coefficient Estimate	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
Emissivity of Bare Pipe	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Emissivity of Insulated Pipe	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Outside Diameter of Bare Pipe (inches)	14.000	10.750	8.625	6.625	5.563	4.500	3.500	2.875	2.375	1.900	1.315	1.050	0.840
Outside Diameter of Insulated Pipe (inches)	19.000	15.750	13.625	11.625	10.563	8.500	7.500	6.875	6.375	4.900	4.315	4.050	3.840
Characteristic Length of Bare Pipe (feet)	1.167	0.896	0.719	0.552	0.464	0.375	0.292	0.240	0.198	0.158	0.110	0.088	0.070
Characteristic Length of Insulated Pipe (feet)	1.583	1.313	1.135	0.969	0.880	0.708	0.625	0.573	0.531	0.408	0.360	0.338	0.320
Average Film Temp. For Bare Pipe (deg. F)	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5
Average Film Temp. For Insulated Pipe (deg. F)	97	96	95	95	94	96	95	94	94	96	95	94	93
Film Coefficient for Bare Pipe (BTU/hr.F.sqft)	0.789	0.843	0.890	0.951	0.994	1.048	1.116	1.172	1.229	1.300	1.425	1.507	1.594
Film Coefficient for Insulated Pipe (BTU/hr.F.sqft)	0.55	0.57	0.59	0.61	0.62	0.66	0.68	0.69	0.70	0.76	0.78	0.78	0.79
Convective Losses for Bare Pipe (BTU/hr.)	245.85	201.67	170.96	140.27	123.04	104.95	86.92	75.00	64.99	54.97	41.71	35.23	29.80
Convective Losses for Insulated Pipe (BTU/hr.)	115.87	99.95	89.09	78.45	72.59	62.68	56.61	52.69	49.45	41.52	37.30	35.29	33.64
Radiant Losses for Bare Pipe (BTU/hr.)	346	265	213	164	137	111	86	71	59	47	32	26	21
Radiant Losses for Insulated Pipe (BTU/hr.)	22	18	16	13	12	10	9	8	7	6	5	5	4
Total Losses for Bare Pipe (BTU/hr.)	591	467	384	304	260	216	173	146	124	102	74	61	51
Total Losses for Insulated Pipe (BTU/hr.)	138	118	105	92	85	72	65	61	57	47	42	40	38
Savings (BTU/hr.) With Boiler Eff. =	**454**	**349**	**279**	**212**	**176**	**144**	**108**	**85**	**67**	**55**	**32**	**21**	**13**
Savings (MMBTU)	**1.56**	**1.20**	**0.96**	**0.73**	**0.60**	**0.49**	**0.37**	**0.29**	**0.23**	**0.19**	**0.11**	**0.07**	**0.04**

SURFACE TEMPERATURE CALCULATION 14.0 inch pipe		**First Iteration Heat Loss**	282
		First Iteration Insulation Surface Temp.	104
		First Iteration Film Coefficient	0.621
		Second Iteration Heat Loss	169
NPS Pipe Size (inches)	14.00	**Second Iteration Insulation Surface Temp.**	125
Bare Pipe Surface Temperature	155	**Second Iteration Film Coefficient**	0.654
Initial Film Coefficient	1.65	**Third Iteration Heat Loss**	175
Insulation Thickness (inches)	2.5	**Third Iteration Insulation Surface Temp.**	124
Insulation "K" Factor	0.270	**Third Iteration Film Coefficient**	0.651
Environment Temperature	70	**Fourth Iteration Heat Loss**	174
External Pipe Diameter	14	**Fourth Iteration Insulation Surface Temp.**	124
Insulation Surface Temp	**124**	**Fourth Iteration Film Coefficient**	0.652

SURFACE TEMPERATURE CALCULATION 3.0 inch pipe		**First Iteration Heat Loss**	112
		First Iteration Insulation Surface Temp.	105
		First Iteration Film Coefficient	0.622
		Second Iteration Heat Loss	67
NPS Pipe Size (inches)	3.00	**Second Iteration Insulation Surface Temp.**	125
Bare Pipe Surface Temper	155	**Second Iteration Film Coefficient**	0.827
Initial Film Coefficient	1.65	**Third Iteration Heat Loss**	80
Insulation Thickness (inch	2.0	**Third Iteration Insulation Surface Temp.**	119
Insulation "K" Factor	0.270	**Third Iteration Film Coefficient**	0.804
Environment Temperatur	70	**Fourth Iteration Heat Loss**	79
External Pipe Diameter	3.5	**Fourth Iteration Insulation Surface Temp.**	120
Insulation Surface Te	**120**	**Fourth Iteration Film Coefficient**	0.806

SURFACE TEMPERATURE CALCULATION 10.0 inch pipe		**First Iteration Heat Loss**	229
		First Iteration Insulation Surface Temp.	104
		First Iteration Film Coefficient	0.617
		Second Iteration Heat Loss	138
NPS Pipe Size (inches)	10.00	**Second Iteration Insulation Surface Temp.**	124
Bare Pipe Surface Temperature	155	**Second Iteration Film Coefficient**	0.684
Initial Film Coefficient	1.65	**Third Iteration Heat Loss**	147
Insulation Thickness (inches)	2.5	**Third Iteration Insulation Surface Temp.**	122
Insulation "K" Factor	0.270	**Third Iteration Film Coefficient**	0.677
Environment Temperature	70	**Fourth Iteration Heat Loss**	146
External Pipe Diameter	10.75	**Fourth Iteration Insulation Surface Temp.**	122
Insulation Surface Temp	**122**	**Fourth Iteration Film Coefficient**	0.678

SURFACE TEMPERATURE CALCULATION 2.5 inch pipe		**First Iteration Heat Loss**	100
		First Iteration Insulation Surface Temp.	104
		First Iteration Film Coefficient	0.618
		Second Iteration Heat Loss	60
NPS Pipe Size (inches)	2.50	**Second Iteration Insulation Surface Temp.**	124
Bare Pipe Surface Temper	155	**Second Iteration Film Coefficient**	0.842
Initial Film Coefficient	1.65	**Third Iteration Heat Loss**	72
Insulation Thickness (inch	2.0	**Third Iteration Insulation Surface Temp.**	118
Insulation "K" Factor	0.270	**Third Iteration Film Coefficient**	0.816
Environment Temperatur	70	**Fourth Iteration Heat Loss**	71
External Pipe Diameter	2.875	**Fourth Iteration Insulation Surface Temp.**	118
Insulation Surface Te	**118**	**Fourth Iteration Film Coefficient**	0.819

Chathams School District
Exhibit D
ECM 2J - Piping Insulation
Piping Insulation

SURFACE TEMPERATURE CALCULATION		First Iteration Heat Loss	194
8.0 inch pipe		First Iteration Insulation Surface Temp.	103
		First Iteration Film Coefficient	0.614
		Second Iteration Heat Loss	117
NPS Pipe Size (inches)	8.00	Second Iteration Insulation Surface Temp.	123
Bare Pipe Surface Temperature	155	Second Iteration Film Coefficient	0.707
Initial Film Coefficient	1.65	Third Iteration Heat Loss	128
Insulation Thickness (inches)	2.5	Third Iteration Insulation Surface Temp.	121
Insulation "K" Factor	0.270	Third Iteration Film Coefficient	0.698
Environment Temperature	70	Fourth Iteration Heat Loss	127
External Pipe Diameter	8.625	Fourth Iteration Insulation Surface Temp.	121
Insulation Surface Temp	**121**	Fourth Iteration Film Coefficient	0.699

SURFACE TEMPERATURE CALCULATION		First Iteration Heat Loss	160
6.0 inch pipe		First Iteration Insulation Surface Temp.	102
		First Iteration Film Coefficient	0.609
		Second Iteration Heat Loss	98
NPS Pipe Size (inches)	6.00	Second Iteration Insulation Surface Temp.	123
Bare Pipe Surface Temperature	155	Second Iteration Film Coefficient	0.733
Initial Film Coefficient	1.65	Third Iteration Heat Loss	109
Insulation Thickness (inches)	2.5	Third Iteration Insulation Surface Temp.	119
Insulation "K" Factor	0.270	Third Iteration Film Coefficient	0.720
Environment Temperature	70	Fourth Iteration Heat Loss	108
External Pipe Diameter	6.625	Fourth Iteration Insulation Surface Temp.	119
Insulation Surface Temp	**119**	Fourth Iteration Film Coefficient	0.721

SURFACE TEMPERATURE CALCULATION		First Iteration Heat Loss	142
5.0 inch pipe		First Iteration Insulation Surface Temp.	101
		First Iteration Film Coefficient	0.606
		Second Iteration Heat Loss	87
NPS Pipe Size (inches)	5.00	Second Iteration Insulation Surface Temp.	122
Bare Pipe Surface Temperature	155	Second Iteration Film Coefficient	0.749
Initial Film Coefficient	1.65	Third Iteration Heat Loss	99
Insulation Thickness (inches)	2.5	Third Iteration Insulation Surface Temp.	118
Insulation "K" Factor	0.270	Third Iteration Film Coefficient	0.732
Environment Temperature	70	Fourth Iteration Heat Loss	98
External Pipe Diameter	5.563	Fourth Iteration Insulation Surface Temp.	118
Insulation Surface Temp	**118**	Fourth Iteration Film Coefficient	0.734

SURFACE TEMPERATURE CALCULATION		First Iteration Heat Loss	131
4.0 inch pipe		First Iteration Insulation Surface Temp.	106
		First Iteration Film Coefficient	0.627
		Second Iteration Heat Loss	78
NPS Pipe Size (inches)	4.00	Second Iteration Insulation Surface Temp.	126
Bare Pipe Surface Temperature	155	Second Iteration Film Coefficient	0.804
Initial Film Coefficient	1.65	Third Iteration Heat Loss	91
Insulation Thickness (inches)	2.0	Third Iteration Insulation Surface Temp.	121
Insulation "K" Factor	0.270	Third Iteration Film Coefficient	0.786
Environment Temperature	70	Fourth Iteration Heat Loss	90
External Pipe Diameter	4.5	Fourth Iteration Insulation Surface Temp.	121
Insulation Surface Temp	**121**	Fourth Iteration Film Coefficient	0.788

SURFACE TEMPERATURE CALCULATION		First Iteration Heat Loss	90
2.0 inch pipe		First Iteration Insulation Surface Temp.	103
		First Iteration Film Coefficient	0.613
		Second Iteration Heat Loss	55
NPS Pipe Size (inches)	2.00	Second Iteration Insulation Surface Temp.	123
Bare Pipe Surface Temper	155	Second Iteration Film Coefficient	0.854
Initial Film Coefficient	1.65	Third Iteration Heat Loss	66
Insulation Thickness (inch	2.0	Third Iteration Insulation Surface Temp.	116
Insulation "K" Factor	0.270	Third Iteration Film Coefficient	0.826
Environment Temperatur	70	Fourth Iteration Heat Loss	65
External Pipe Diameter	2.375	Fourth Iteration Insulation Surface Temp.	117
Insulation Surface Te	**117**	Fourth Iteration Film Coefficient	0.829

SURFACE TEMPERATURE CALCULATION		First Iteration Heat Loss	82
1.5 inch pipe		First Iteration Insulation Surface Temp.	109
		First Iteration Film Coefficient	0.641
		Second Iteration Heat Loss	48
NPS Pipe Size (inches)	1.50	Second Iteration Insulation Surface Temp.	128
Bare Pipe Surface Temper	155	Second Iteration Film Coefficient	0.933
Initial Film Coefficient	1.65	Third Iteration Heat Loss	61
Insulation Thickness (inch	1.5	Third Iteration Insulation Surface Temp.	121
Insulation "K" Factor	0.270	Third Iteration Film Coefficient	0.902
Environment Temperatur	70	Fourth Iteration Heat Loss	60
External Pipe Diameter	1.9	Fourth Iteration Insulation Surface Temp.	122
Insulation Surface Te	**122**	Fourth Iteration Film Coefficient	0.905

SURFACE TEMPERATURE CALCULATION		First Iteration Heat Loss	69
1.0 inch pipe		First Iteration Insulation Surface Temp.	107
		First Iteration Film Coefficient	0.632
		Second Iteration Heat Loss	40
NPS Pipe Size (inches)	1.00	Second Iteration Insulation Surface Temp.	127
Bare Pipe Surface Temper	155	Second Iteration Film Coefficient	0.957
Initial Film Coefficient	1.65	Third Iteration Heat Loss	52
Insulation Thickness (inch	1.5	Third Iteration Insulation Surface Temp.	118
Insulation "K" Factor	0.270	Third Iteration Film Coefficient	0.920
Environment Temperatur	70	Fourth Iteration Heat Loss	51
External Pipe Diameter	1.315	Fourth Iteration Insulation Surface Temp.	119
Insulation Surface Te	**119**	Fourth Iteration Film Coefficient	0.923

SURFACE TEMPERATURE CALCULATION		First Iteration Heat Loss	62
0.8 inch pipe		First Iteration Insulation Surface Temp.	106
		First Iteration Film Coefficient	0.626
		Second Iteration Heat Loss	37
NPS Pipe Size (inches)	0.75	Second Iteration Insulation Surface Temp.	126
Bare Pipe Surface Temper	155	Second Iteration Film Coefficient	0.967
Initial Film Coefficient	1.65	Third Iteration Heat Loss	48
Insulation Thickness (inch	1.5	Third Iteration Insulation Surface Temp.	117
Insulation "K" Factor	0.270	Third Iteration Film Coefficient	0.927
Environment Temperatur	70	Fourth Iteration Heat Loss	47
External Pipe Diameter	1.05	Fourth Iteration Insulation Surface Temp.	118
Insulation Surface Te	**118**	Fourth Iteration Film Coefficient	0.931

SURFACE TEMPERATURE CALCULATION		First Iteration Heat Loss	57
0.5 inch pipe		First Iteration Insulation Surface Temp.	104
		First Iteration Film Coefficient	0.620
		Second Iteration Heat Loss	34
NPS Pipe Size (inches)	0.50	Second Iteration Insulation Surface Temp.	125
Bare Pipe Surface Temper	155	Second Iteration Film Coefficient	0.976
Initial Film Coefficient	1.65	Third Iteration Heat Loss	44
Insulation Thickness (inch	1.5	Third Iteration Insulation Surface Temp.	115
Insulation "K" Factor	0.270	Third Iteration Film Coefficient	0.931
Environment Temperatur	70	Fourth Iteration Heat Loss	43
External Pipe Diameter	0.84	Fourth Iteration Insulation Surface Temp.	116
Insulation Surface Te	**116**	Fourth Iteration Film Coefficient	0.936

Chathams School District
Exhibit D
ECM 2J - Piping Insulation
Piping Insulation

SURFACE TEMPERATURE CALCULATION Use this section to find the expected insulation surface temperature if unknown or evaluating project potential			
		First Iteration Heat Loss	219
		First Iteration Insulation S	104
		First Iteration Film Coeffic	0.621
		Second Iteration Heat Los	179
NPS Pipe Size (inches)	10	Second Iteration Insulatio	145
Bare Pipe Surface Temperature	325	Second Iteration Film Coe	0.754
Initial Film Coefficient	1.65	Third Iteration Heat Loss	189
Insulation Thickness (inches)	2	Third Iteration Insulation	135
Insulation "K" Factor	0.05	Third Iteration Film Coeffi	0.728
Environment Temperature	70	Fourth Iteration Heat Loss	187
External Pipe Diameter	10.75	Fourth Iteration Insulation	137
Insulation Surface Temp	**137**	Fourth Iteration Film Coef	0.732

This spreadsheet calculates insulation performance and bare pipe thermal losses for schedule 40 steel horizontal pipes. The calculation computes natural convective and radiant losses based on actual conditions using the Stephan-Boltzmann, radial heat flow and Nusselt equations. This calculation does not depend on insulation "k" factors but rather actual measured temperature data.

To use this spreadsheet, simply fill in all the blue cells. The tan cells contain fixed data or calculations and should not normally require change. All temperatures are in degrees F. If the nominal pipe size (NPS) for an application is greater than 10 inches, or other than listed, use the "OTHER" column. Other parameters will then be calculated automatically. If the insulation temp is known, insert the figures in row 20, (this color) otherwise the program will calculate an estimated value for you.

0.50	0.75	1.00	1.25	1.50	2.00	2.50	3.00	3.50	4.00	5.00	6.00	8.00	10.00	12.00	14.00
0.84	1.05	1.32	1.66	1.90	2.38	2.88	3.50	4.00	4.50	5.56	6.63	8.63	10.75	12.75	14.00

Chathams School District
Exhibit D
ECM 2K - Window Replacements
Window Replacement

ECM DESCRIPTION

Replacement of windows with double-pane, low-e, metal frame windows.

DATA / ASSUMPTIONS

Recovery/Safety Factor (Electric) =	0%	
Recovery/Safety Factor (Thermal) =	0%	
Heating Hours	3,948	Hours

*U Factors for the new windows are obtained by manufacturer data. U Factors for the existing windows are based on type, material, and thickness

MEASUREMENT AND VERIFICATION

Option C - Savings Calculations are based on regression analysis of utility billing meter data

COMMISSIONING

Verify quantities installed and total square feet.

RECOVERY/SAFETY FACTOR

Savings calculations are based on weather bin data, fresh air flows and temperature setpoints. A more conservative of 0 percent is used for this ECM due to the uncertainty of variables. The heating fuel savings calculations are based upon information provided by the equipment vendor.

FORMULAE

$Q_{SAVINGS} = (Q_C - Q_C) + Q_{INF}$

$Q_{INF} = \sum_{-5}^{100} \left(1.08 \cdot (i_{WIN} - i_{WIN}) \cdot (T_{W/S} - T_{BIN}) \cdot l_W \cdot t_{BIN} \right) / {}_{100,000}$

$Q_C = \sum_{-5}^{100} \left((T_{W/S} - T_{BIN}) \cdot A_{WIN} \cdot U_{WIN} \cdot t_{BIN} \right) / {}_{100,000}$

$Q_C = \sum_{-5}^{100} \left((T_{W/S} - T_{BIN}) \cdot A_{WIN} \cdot U_{WIN} \cdot t_{BIN} \right) / {}_{100,000}$

*Note W/S designates use of either winter building setpoint or summer building setpoint with the appropiate bin

Variable	Units	Description
$Q_{savings}$	Therms	Thermal Savings
Q_C	Therms	Conductive/convective cooling gain and heating loss with existing windows
Q_C	Therms	Conductive/convective cooling gain and heating loss with proposed windows
Q_{INF}	Therms	Infiltration savings with proposed windows
$\sum_{-5}^{100}$	-	Summation of all bins from -5°F to 100°F
T_W	°F	Winter building setpoint
T_S	°F	Summer building setpoint
T_{BIN}	°F	Temperature of respective bin
t_{BIN}	Hrs	Hrs in respective bin
A_{WIN}	ft^2	Existing unoccupied Bin Hours in respective temperature bin
U_{WIN}	btu / ft^2 / °F	Existing U-factor of roof
U_{WIN}	btu / ft^2 / °F	Proposed U-factor of roof
i_{WIN}	Cfm/ft	Infiltration constant for existing windows
i_{WIN}	Cfm/ft	Infiltration constant for proposed windows
l_W	ft	Linear feet of curtain wall

* Inputs are in blue

Chathams School District
Exhibit D
ECM 2K - Window Replacements
Window Replacement

Building	Window Area (ft^2)	U-Factor of Existing Window	U-Factor of Proposed Window	Infiltration of Existing Window (CFM / linear ft)	Infiltration of Proposed Window (CFM / linear ft)	Total Linear feet of Curtain Wall	EER of Cooling System (Average)
Chatham High School	14,369	1.13	0.45	0.20	0.10		10.0
Totals	14,369						

	Chatham High School
Window ft^2 Audited	14,369
U of Existing Window	1.13
U of Proposed Window	0.45
Infiltration of Existing Windows	0.20
Infiltration of Proposed Windows	0.10
Total Linear Ft of Curtain Wall	-
EER of Cooling System (Average)	10.0
Existing Occupied Heating Setpoint	74.0
Existing Unoccup. Heating Setpoint	70.0
Existing Occupied Cooling Setpoint	70.0
Existing Unoccup. Cooling Setpoint	78.0
Boiler Efficiency	80.0%
Safety Factor	0%
Electrical Savings	46,858
Thermal Savings	11,874

	Total	
		ft^2
		btu/ft^2/°F
		btu/ft^2/°F
		CFM / ft
		CFM / ft
		ft
		°F
		°F
		°F
		°F
		%
		%
		kWh/Yr
		Therms/Yr

CALCULATIONS

CHATHAM HIGH SCHOOL

Amb. Temp Bin °F	Avg Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Hours	Unoccupied Hours	Window Square Feet	Existing Occupied Cooling Gain and Heating Loss	Existing Unoccupied Cooling Gain and Heating Loss	Proposed Occupied Cooling Gain and Heating Loss	Proposed Unoccupied Cooling Gain and Heating Loss	Cooling or Heating Savings	Infiltration savings	Total Heating or Cooling Savings	Safety Factor	kWh Saved	Input Therms Saved
COOLING									(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)			
100 to 105	102.5	-	1	-	1	1	0	14,369	0.5	0.1	0.2	0.0	0.4		0.4	0%	108	
95 to 100	97.5	-	19	2	21	18	3	14,369	9.4	1.3	3.7	0.5	6.4		6.4	0%	1,889	
90 to 95	92.5	-	44	13	57	46	11	14,369	20.1	3.2	8.0	1.3	14.0		14.0	0%	4,100	
85 to 90	87.5	1	167	60	228	181	47	14,369	61.7	8.7	24.6	3.5	42.4		42.4	0%	12,412	
80 to 85	82.5	31	283	162	476	349	127	14,369	85.1	11.1	33.9	4.4	57.9		57.9	0%	16,962	
75 to 80	77.5	191	235	280	706	411	295	14,369	60.0	-	23.9	-	36.1		36.1	0%	10,579	
70 to 75	72.5	203	177	222	602	327	275	14,369	15.9	-	6.3	-	9.6		9.6	0%	2,806	
65 to 70	67.5	325	165	204	694	327	367	14,369	-	-	-	-	-		-	0%	-	
60 to 65	62.5	180	152	195	527	284	243	14,369	-	-	-	-	-		-	0%	-	
HEATING																		
55 to 60	57.5	86	144	97	327	199	128	14,369	53.4	12.4	21.3	10.3	34.3	-	34.3	0%		428
50 to 55	52.5	109	182	172	463	283	180	14,369	98.8	17.5	39.3	20.4	62.3	-	62.3	0%		778
45 to 50	47.5	105	119	142	366	209	157	14,369	90.1	15.2	35.9	22.8	61.8	-	61.8	0%		772
40 to 45	42.5	185	155	177	517	277	240	14,369	141.4	23.4	56.3	42.8	104.4	-	104.4	0%		1,306
35 to 40	37.5	236	200	241	677	364	313	14,369	215.8	30.5	86.0	65.7	165.2	-	165.2	0%		2,064
30 to 35	32.5	237	202	198	637	339	298	14,369	228.6	29.0	91.0	72.2	180.7	-	180.7	0%		2,259
25 to 30	27.5	121	115	113	349	191	158	14,369	144.1	15.4	57.4	43.5	114.8	-	114.8	0%		1,434
20 to 25	22.5	149	68	97	314	146	168	14,369	121.7	16.4	48.5	51.7	108.6	-	108.6	0%		1,357
15 to 20	17.5	95	40	46	181	80	101	14,369	73.4	9.8	29.2	34.3	68.6	-	68.6	0%		858
10 to 15	12.5	39	9	28	76	32	44	14,369	32.1	4.3	12.8	16.3	31.4	-	31.4	0%		392
5 to 10	7.5	21	5	5	31	11	20	14,369	12.1	1.9	4.8	8.0	13.3	-	13.3	0%		167
0 to 5	2.5	4	2	-	6	2	4	14,369	2.8	0.3	1.1	1.6	2.9	-	2.9	0%		36
-5 to 0	-2.5	4	-	-	4	1	3	14,369	0.9	0.3	0.4	1.5	1.8	-	1.8	0%		22
-10 to -5	-7.5	-	-	-	-	-	-	14,369	-	-	-	-	-	-	-	0%		-
-15 to -10	-12.5	-	-	-	-	-	-	14,369	-	-	-	-	-	-	-	0%		-
Total		2,322	2,484	2,454	7,260	4,078	3,182										46,858	11,874

Chathams School District
Exhibit D
ECM 2L - AHU Replacement
Replace/Refurbished Air Handling Units

ECM DESCRIPTION

Replace and/or refurbish existing air handlers with new units.

DATA / ASSUMPTIONS

Efficiency Gain with refurbishment	2.5%	
Efficiency Gain with replacement	5.0%	
Supply Air Temperature	85.0	°F

*Air Handler Supply CFM and OA CFM is obtained by drawings and equipment manuals
*Air Handler load is assumed to occur at 7.5 degrees F bin average temperature

MEASUREMENT AND VERIFICATION

Option C - Savings Calculations are based on regression analysis of utility billing meter data

COMMISSIONING

Review installation documents for wiring and vibrations. Start up equipment, test thermostat/building management system response, and inspect perimeter of new units for any air infiltration.

RECOVERY/SAFETY FACTOR

Safety Factor (Thermal) =	10%

The safety factor for this ECM is taken at 0.1 due to some variability in schedule and load changes.

FORMULAE

$Q_{SAVINGS} = \sum^{60}_{-5} Q_{INPUT} \cdot \eta_{REFURB/REPLACE}$

$Q_{INPUT} = \sum^{60}_{-5} (t_{OCC} \cdot Q_{LOAD} \cdot L_{\%}) / \eta_{BOILER}$

$Q_{LOAD} = \sum^{60}_{-5} 1.08 \cdot CFM_{SUPPLY} \cdot (T_{SUPPLY} - T_{MIXED})$

$T_{RISE} = \sum^{60}_{-5} T_{SUPPLY} - T_{MIXED}$

$T_{MIXED} = \sum^{60}_{-5} ((CFM_{RETURN} \cdot T_{RETURN}) + (CFM_{OA} \cdot T_{BIN})) / (CFM_{RETURN} + CFM_{OA})$

Chathams School District
Exhibit D
ECM 2L - AHU Replacement
Replace/Refurbished Air Handling Units

Variable	Units	Description
$Q_{SAVINGS}$	Therms	Thermal Savings
$\sum^{60}_{-5}$	-	Summation of all bins from -5°F to 60°F
η_{BOILER}	%	Efficiency of boiler
T_{BIN}	°F	Temperature of respective bin
Q_{INPUT}	Therms	Input heat provided by air handlers at respective bin temperature
Q_{LOAD}	Therms	Heat load on the air handler
$L_{\%}$	%	Load % at respective bin
T_{RISE}	°F	Temperature rise across the coil (100% Design at 10°F)
T_{MIXED}	°F	Mixed air temperature
T_{SUPPLY}	Hrs	Temperature of supply air
T_{RETURN}	Hrs	Temperature of return air
CFM_{SUPPLY}	CFM	Total supply CFM of air handler
CFM_{OA}	CFM	Total outside air CFM of air handler
CFM_{RETURN}	CFM	Total return air CFM of air handler
q	-	Quantity of replaced/refurbished air handlers
η_{REFURB}	%	Efficiency improvement of refurbished air handler
$\eta_{REPLACE}$	%	Efficiency improvement of replaced air handler
t_{OCC}	Hrs	Occupied Bin Hours in respective temperature bin

*Inputs are blue

Building	Qty (Refurbished)	Qty (Replaced)	Total Supply (CFM)	Total OA (CFM)
Chatham High School	0	1	4,000	836
Totals		1	4,000	836

	Chatham High School
No. of Units to be Refurbished	-
No. of Units to be Replaced	1
Total Supply Air CFM	4,000
Total Outdoor Air CFM	836
Total Return Air CFM	3,164
Efficiency Gain w/ Refurbished and Replaced Units	5.0%
Return Air Temperature	70.0
Supply Air Temperature	85.0
Boiler Efficiency	80.0%
Annual Energy Savings	96
Safety Factor	10%
Annual Energy Savings	86

Chathams School District
Exhibit D
ECM 2L - AHU Replacement
Replace/Refurbished Air Handling Units

CALCULATIONS

CHATHAM HIGH SCHOOL

Amb. Temp Bin deg. F	Avg Temp deg. F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Mixed air Temp	Temp rise across coil	Heat Load on the unit	Load % at bin O/A temp	Heat Provided by Units	Input Heat to Units	Heat Savings by Refurb/Replace
HEATING											BTU	BTU	Therms
55 to 60	57.5	86	144	97	327	199	67.4	17.6	76,085	63%	9,522,586	11,903,233	6.0
50 to 55	52.5	109	182	172	463	283	66.3	18.7	80,599	66%	15,163,483	18,954,354	9.5
45 to 50	47.5	105	119	142	366	209	65.3	19.7	85,113	70%	12,519,402	15,649,253	7.8
40 to 45	42.5	185	155	177	517	277	64.3	20.7	89,627	74%	18,323,500	22,904,375	11.5
35 to 40	37.5	236	200	241	677	364	63.2	21.8	94,141	78%	26,625,674	33,282,093	16.6
30 to 35	32.5	237	202	198	637	339	62.2	22.8	98,655	81%	27,234,504	34,043,129	17.0
25 to 30	27.5	121	115	113	349	191	61.1	23.9	103,169	85%	16,752,973	20,941,216	10.5
20 to 25	22.5	149	68	97	314	146	60.1	24.9	107,683	89%	13,919,299	17,399,124	8.7
15 to 20	17.5	95	40	46	181	80	59.0	26.0	112,197	93%	8,307,285	10,384,106	5.2
10 to 15	12.5	39	9	28	76	32	58.0	27.0	116,711	96%	3,615,737	4,519,671	2.3
5 to 10	7.5	21	5	5	31	11	56.9	28.1	121,225	100%	1,352,953	1,691,191	0.8
0 to 5	2.5	4	2	-	6	2	55.9	29.1	125,739	104%	316,736	395,920	0.2
-5 to 0	-2.5	4	-	-	4	1	54.8	30.2	130,253	107%	99,966	124,958	0.1
-10 to -5	-7.5	-	-	-	-	-	53.8	31.2	134,767	111%	-	-	-
-15 to -10	-12.5	-	-	-	-	-	52.8	32.2	139,280	115%	-	-	-
Total		**1,391**	**1,241**	**1,316**	**3,948**	**2,135**					**153,754,099**		**96**

Chathams School District
Exhibit D
ECM 2M - Condensing Unit Replacement
Condensing Unit Replacement

ECM DESCRIPTION

Replace existing low efficiency condensing units in respective buildings with new high efficiency condensing units with an EER of 12+

CLARIFICATIONS, DELETIONS

*Run Hours based on occupancy schedule
*Full Load is estimated at (unless stated otherwise) : 97.5 °F
*Run hours are based on chiller cutoff temperature and bin weather data

MEASUREMENT AND VERIFICATION

Option A - The engineering calculations are based on direct kW measurements of the existing and installed chillers and operating hours. All existing chillers will be measured before removal and new motors after the installation.

COMMISSIONING

Start up equipment ensure proper operation

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) = 0%

The safety factor for this ECM is taken at 0 due to some variances on the run hours and the estimated part load efficiencies of the existing chiller.

FORMULAE

OPTIMIZATION

$W_{SAVINGS} = W_C \cdot \eta_{\%}$

REPLACEMENT

$W_{SAVINGS} = W_C - W_C$

$W_C = (W_{C\text{-}OCC} + W_{C\text{-}UNOCC})$
$W_C = (W_{C\text{-}OCC} + W_{C\text{-}UNOCC})$

$W_{C\text{-}OCC} = \sum^{105}_{60} C \cdot (T_{BIN} - T_{OCC}) / (T_{BIN} - T_{DESIGN}) \cdot t_{OCC} \cdot \eta$
$W_{C\text{-}UNOCC} = \sum^{105}_{60} C \cdot (T_{BIN} - T_{UNOCC}) / (T_{BIN} - T_{DESIGN}) \cdot t_{UNOCC} \cdot \eta$

$W_{C\text{-}OCC} = \sum^{105}_{60} C \cdot (T_{BIN} - T_{OCC}) / (T_{BIN} - T_{DESIGN}) \cdot t_{OCC} \cdot \eta$
$W_{C\text{-}UNOCC} = \sum^{105}_{60} C \cdot (T_{BIN} - T_{UNOCC}) / (T_{BIN} - T_{DESIGN}) \cdot t_{UNOCC} \cdot \eta$

Variable	Units	Description
$W_{SAVINGS}$	kWh	Electrical Savings
W_C	kWh	Existing condensing unit Consumption
W_C	kWh	Proposed condensing unit Consumption
$\eta_{\%}$	%	Efficiency gain due to condensing unit optimization
$\sum^{105}_{60}$	-	Summation of all bins from 60°F to 105°F
C	Ton	Tonnage of condensing unit
η	-	Existing efficiency of condensing unit (EER)
η	-	Proposed efficiency of condensing unit (EER)
T_{DESIGN}	°F	Design Temperature of condensing unit (Usually 97.5°F)
T_{BIN}	°F	Bin Weather Temperature
T_{OCC}	°F	Temperature of building during occupied hours
T_{UNOCC}	°F	Temperature of building during unoccupied hours
t_{OCC}	Hrs	Existing occupied Bin Hours in respective temperature bin
t_{UNOCC}	Hrs	Existing unoccupied Bin Hours in respective temperature bin

Chathams School District
Exhibit D
ECM 2M - Condensing Unit Replacement
Condensing Unit Replacement

* Inputs are in blue
*Checks against baseline are in purple

Building	Label	Tonnage	Current EER	Proposed EER	Area Serving
Chatham High School	CU-1-32	20.0	38.2	19.1	New Unit for Cafeteria
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
Totals		**20.0**			

CALCULATIONS

	Chatham High School
Label	CU-1-32
Area Serving	New Unit for Cafeteria
Condensing Unit Tonnage	20.0
Current EER	38.2
Proposed EER	19.1
Existing Occupied Cooling Setpoint	70.0
Existing Unoccupied Cooling Setpoint	78.0
Current Condensing Unit Consumption	3,429
Percent of Baseline Consumption	0.2%
Proposed Condensing Unit Consumption	6,857
Electrical Savings	(3,435)
Safety Factor	0%
Electrical Savings	(3,435)

CHATHAM HIGH SCHOOL

Amb. Temp Bin °F	Avg Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occupied Tons	Unoccupied Tons	Occupied Ton-Hrs	Unoccupied Ton-Hrs	Current Condensing Unit Consumption	Proposed Condensing Unit Consumption	Savings
COOLING												kWh	kWh	kWh
100 to 105	102.5	-	1	-	1	1	0	20.0	20.0	17	3	6	13	(6)
95 to 100	97.5	-	19	2	21	18	3	20.0	20.0	351	69	132	264	(132)
90 to 95	92.5	-	44	13	57	46	11	20.0	20.0	917	223	358	716	(358)
85 to 90	87.5	1	167	60	228	181	47	12.7	9.7	2,301	460	867	1,735	(867)
80 to 85	82.5	31	283	162	476	349	127	9.1	4.6	3,176	585	1,181	2,363	(1,181)
75 to 80	77.5	191	235	280	706	411	295	5.5	-	2,239	-	703	1,407	(703)
70 to 75	72.5	203	177	222	602	327	275	1.8	-	594	-	187	373	(187)
65 to 70	67.5	325	165	204	694	327	367	-	-	-	-	-	-	-
60 to 65	62.5	180	152	195	527	284	243	-	-	-	-	-	-	-
Total		931	1,242	1,138	3,311	1,942	1,369	69.1	54.4	9,578	1,337	3,429	6,857	(3,435)

Chathams School District
Exhibit D
ECM 3A - Building Management Control Systems
BMS Upgrades

ECM DESCRIPTION

The building managament system for the school district will be upgraded. Where the DDC system exists it will be incorporated into a web-based system. The pnaumatic control system in some buildings will be replaced with new DDC controls. The new DDC system will be a web based type that allows remote access to a personnel from any computer using a security password.

DATA / ASSUMPTIONS

Heating Hours 3,948 Hours

*Schedules and temperatures are based on data logging trends performed throughout the building

MEASUREMENT AND VERIFICATION

Option C - Savings Calculations are based on regression analysis of utility billing meter data

COMMISSIONING

Verify functions of all installed controllers. Verify that control loops work properly. Verify function of all alarms installed in the system. Verify that all installed control variables and set points can be set and managed remotely

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) =	0%
Safety Factor (Thermal) =	0%

Savings calculations are based on weather bin data, fresh air flows and temperature setpoints. A more conservative of percent is used for this ECM due to the uncertainty of variables. The heating fuel savings calculations are based upon information provided by the equipment vendor.

FORMULAE

$Q_{SAVINGS} = (HD_{EXISTING} - HD_{PROPOSED} / HD_{EXISTING}) \cdot Fuel_{ADJUSTED}$

$HD_{EXISTING} = \sum^{60}_{-5} (T_{OCC} - T_{BIN}) \cdot t_{OCC} + (T_{UNOCC} - T_{BIN}) \cdot t_{UNOCC}$

$HD_{PROPOSED} = \sum^{60}_{-5} (T_{OCC} - T_{BIN}) \cdot t_{OCC} + (T_{UNOCC} - T_{BIN}) \cdot t_{UNOCC}$

Variable	Units	Description
$Q_{savings}$	Therms	Thermal Savings
$\sum^{60}_{-5}$	-	Summation of all bins from -5°F to 60°F
T_{BIN}	°F	Temperature of respective bin
t_{OCC}	Hrs	Existing occupied Bin Hours in respective temperature bin
t_{UNOCC}	Hrs	Existing unoccupied Bin Hours in respective temperature bin
t_{OCC}	Hrs	Proposed occupied Bin Hours in respective temperature bin
t_{UNOCC}	Hrs	Proposed unoccupied Bin Hours in respective temperature bin
T_{OCC}	°F	Existing temperature of space during occupied hours
T_{UNOCC}	°F	Existing temperature of space during unoccupied hours
T_{OCC}	°F	Proposed temperature of space during occupied hours
T_{UNOCC}	°F	Proposed temperature of space during unoccupied hours
$HD_{EXISTING}$	Hrs	Existing heating degree hours in space
$HD_{PROPOSED}$	Hrs	Proposed heating degree hours in space
$Fuel_{ADJUSTED}$	Therms	Adjusted Boiler Fuel Usage

* Inputs for Section 1 and Section 2 are in blue

	EXISTING									
	Section 1					Section 2				
Building	Percentage of Building	Occupied Heating Temperature (°F)	Unoccupied Heating Temperature (°F)	Occupied Cooling Temperature (°F)	Unoccupied Cooling Temperature (°F)	Percentage of Building	Occupied Heating Temperature (°F)	Unoccupied Heating Temperature (°F)	Occupied Cooling Temperature (°F)	Unoccupied Cooling Temperature (°F)
Chatham High School	100%	74.0	70.0	70.0	78.0					
Chatham Middle School	100%	74.0	70.0	70.0	78.0					
Lafayette School	100%	74.0	70.0	70.0	78.0					
Milton Avenue School	100%	74.0	70.0	70.0	78.0					
Southern Boulevard School	100%	74.0	70.0	70.0	78.0					
Washington Avenue School	100%	74.0	70.0	70.0	78.0					

	PROPOSED							
	Section 1				Section 2			
Building	Occupied Heating Temperature (°F)	Unoccupied Heating Temperature (°F)	Occupied Cooling Temperature (°F)	Unoccupied Cooling Temperature (°F)	Occupied Heating Temperature (°F)	Unoccupied Heating Temperature (°F)	Occupied Cooling Temperature (°F)	Unoccupied Cooling Temperature (°F)
Chatham High School	70.0	60.0	72.0	80.0				
Chatham Middle School	70.0	60.0	72.0	80.0				
Lafayette School	70.0	60.0	72.0	80.0				
Milton Avenue School	70.0	60.0	72.0	80.0				
Southern Boulevard School	70.0	60.0	72.0	80.0				
Washington Avenue School	70.0	60.0	72.0	80.0				

Chathams School District
Exhibit D
ECM 3A - Building Management Control Systems
BMS Upgrades

THERMAL NIGHT SETBACK SAVINGS CALCULATIONS

	Chatham High School	Chatham Middle School	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School
Occupied Bin Hours	2,135	2,017	1,370	1,370	1,370	1,370
Occupied HD-hrs	74,843	70,686	48,039	48,039	48,039	48,039
Annual Fuel Usage	99,122	99,581	48,792	28,758	35,839	34,142
Annual Boiler Usage	87,336	89,028	45,549	22,714	32,965	27,060
Existing Heating Degree-Hrs	135,323	134,853	132,264	132,264	132,264	132,264
Proposed Heating Degree-Hrs	106,234	105,059	98,586	98,586	98,586	98,586
Safety Factor	0%	0%	0%	0%	0%	0%
Thermal Savings	21.5%	22.1%	25.5%	25.5%	25.5%	25.5%
Thermal Savings	18,774	19,670	11,598	5,784	8,394	6,890

ELECTRIC NIGHT SETBACK SAVINGS CALCULATIONS

	Chatham High School	Chatham Middle School	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School
Annual kWh Usage	1,806,760	1,220,773	517,745	198,420	376,860	352,800
Annual Cooling kWh Baseline	542,028	244,155	41,420	15,874	56,529	
Existing Cooling Degree-Hrs	14,220	13,813	11,285	11,285	11,285	11,285
Proposed Cooling Degree-Hrs	10,737	10,420	8,368	8,368	8,368	8,368
Safety Factor	0%	0%	0%	0%	0%	0%
Electrical Savings	24.5%	24.6%	25.8%	25.8%	25.8%	25.8%
Electrical Savings	132,763	59,977	10,706	4,103	14,611	-

CHATHAM HIGH SCHOOL

							Current Operating Schedule													Proposed Operating Schedule						
	Amb. Temp Bin deg. F	Ave Temp deg. F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours	Total heating Deg-hours	Occup.Bin Hours	Unocc. Bin Hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours
							Building	Building	Section 1	Section 1	Section 1	Section 1	Section 1	Section 2	Section 2	Section 2	Section 2	Section 2	Building							
	COOLING																									
CHATHAM HI	100 to 105	102.5	-	1	-	1	1	0	70.0	78.0	28	3	31	-	-	-	-	-	31	1	0	72.0	80.0	26	3	29
CHATHAM HI	95 to 100	97.5	-	19	2	21	18	3	70.0	78.0	482	68	550	-	-	-	-	-	550	17	4	72.0	80.0	443	64	506
CHATHAM HI	90 to 95	92.5	-	44	13	57	46	11	70.0	78.0	1,031	162	1,193	-	-	-	-	-	1,193	45	12	72.0	80.0	916	154	1,070
CHATHAM HI	85 to 90	87.5	1	167	60	228	181	47	70.0	78.0	3,164	448	3,613	-	-	-	-	-	3,613	175	53	72.0	80.0	2,718	395	3,113
CHATHAM HI	80 to 85	82.5	31	283	162	476	349	127	70.0	78.0	4,367	570	4,937	-	-	-	-	-	4,937	332	144	72.0	80.0	3,487	360	3,847
CHATHAM HI	75 to 80	77.5	191	235	280	706	411	295	70.0	78.0	3,079	-	3,079	-	-	-	-	-	3,079	368	338	72.0	80.0	2,027	-	2,027
CHATHAM HI	70 to 75	72.5	203	177	222	602	327	275	70.0	78.0	817	-	817	-	-	-	-	-	817	289	313	72.0	80.0	144	-	144
CHATHAM HI	65 to 70	67.5	325	165	204	694	327	367	70.0	78.0	-	-	-	-	-	-	-	-	-	280	414	72.0	80.0	-	-	-
CHATHAM HI	60 to 65	62.5	180	152	195	527	284	243	70.0	78.0	-	-	-	-	-	-	-	-	-	251	276	72.0	80.0	-	-	-
																			14,220							**10,737**
							Building	Building	Section 1	Section 1	Section 1	Section 1	Section 1	Section 2	Section 2	Section 2	Section 2	Section 2	Building							
	HEATING																									
CHATHAM HI	55 to 60	57.5	86	144	97	327	199	128	74.0	70.0	3,290	1,595	4,885	-	-	-	-	-	4,885	183	144	70	60	2,288	360	2,648
CHATHAM HI	50 to 55	52.5	109	182	172	463	283	180	74.0	70.0	6,084	3,151	9,234	-	-	-	-	-	9,234	258	205	70	60	4,513	1,538	6,051
CHATHAM HI	45 to 50	47.5	105	119	142	366	209	157	74.0	70.0	5,552	3,521	9,073	-	-	-	-	-	9,073	187	179	70	60	4,218	2,232	6,449
CHATHAM HI	40 to 45	42.5	185	155	177	517	277	240	74.0	70.0	8,710	6,613	15,324	-	-	-	-	-	15,324	244	273	70	60	6,715	4,774	11,489
CHATHAM HI	35 to 40	37.5	236	200	241	677	364	313	74.0	70.0	13,293	10,166	23,459	-	-	-	-	-	23,459	322	355	70	60	10,452	7,996	18,449
CHATHAM HI	30 to 35	32.5	237	202	198	637	339	298	74.0	70.0	14,077	11,167	25,244	-	-	-	-	-	25,244	300	337	70	60	11,264	9,257	20,521
CHATHAM HI	25 to 30	27.5	121	115	113	349	191	158	74.0	70.0	8,872	6,723	15,596	-	-	-	-	-	15,596	170	179	70	60	7,221	5,820	13,042
CHATHAM HI	20 to 25	22.5	149	68	97	314	146	168	74.0	70.0	7,494	8,003	15,497	-	-	-	-	-	15,497	124	190	70	60	5,869	7,142	13,011
CHATHAM HI	15 to 20	17.5	95	40	46	181	80	101	74.0	70.0	4,520	5,303	9,822	-	-	-	-	-	9,822	67	114	70	60	3,539	4,828	8,367
CHATHAM HI	10 to 15	12.5	39	9	28	76	32	44	74.0	70.0	1,979	2,520	4,499	-	-	-	-	-	4,499	26	50	70	60	1,506	2,366	3,872
CHATHAM HI	5 to 10	7.5	21	5	5	31	11	20	74.0	70.0	742	1,240	1,982	-	-	-	-	-	1,982	9	22	70	60	552	1,163	1,716
CHATHAM HI	0 to 5	2.5	4	2	-	6	2	4	74.0	70.0	174	241	415	-	-	-	-	-	415	2	4	70	60	140	226	366
CHATHAM HI	-5 to 0	(2.5)	4	-	-	4	1	3	74.0	70.0	55	238	293	-	-	-	-	-	293	0	4	70	60	26	228	254
CHATHAM HI	-10 to -5	(7.5)	-	-	-	-	-	-	74.0	70.0	-	-	-	-	-	-	-	-	-	-	-	70	60	-	-	-
CHATHAM HI	-15 to -10	(12.5)	-	-	-	-	-	-	74.0	70.0	-	-	-	-	-	-	-	-	-	-						
	Total		1,391	1,241	1,316	3,948	2,135	1,813			74,843	60,481	135,323			0	0	0	**135,323**	1,893	2,055			58,304	47,930	**106,234**

Chathams School District
Exhibit D
ECM 3A - Building Management Control Systems
BMS Upgrades

CHATHAM MIDDLE SCHOOL

							Current Operating Schedule													Proposed Operating Schedule						
	Amb. Temp Bin deg. F	Ave Temp deg. F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours	Total heating Deg-hours	Occup.Bin Hours	Unocc. Bin Hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours
							Building	Building	Section 1	Section 1	Section 1	Section 1	Section 1	Section 2	Section 2	Section 2	Section 2	Section 2	Building							
	COOLING																									
CHATHAM M	100 to 105	102.5	-	1	-	1	1	0	70.0	78.0	28	3	31	-	-	-	-	-	31	1	0	72.0	80.0	26	3	29
CHATHAM M	95 to 100	97.5	-	19	2	21	17	4	70.0	78.0	477	71	548	-	-	-	-	-	548	17	4	72.0	80.0	438	67	505
CHATHAM M	90 to 95	92.5	-	44	13	57	45	12	70.0	78.0	1,005	179	1,184	-	-	-	-	-	1,184	44	13	72.0	80.0	892	169	1,061
CHATHAM M	85 to 90	87.5	1	167	60	228	175	53	70.0	78.0	3,071	499	3,570	-	-	-	-	-	3,570	170	58	72.0	80.0	2,635	435	3,070
CHATHAM M	80 to 85	82.5	31	283	162	476	335	141	70.0	78.0	4,186	635	4,821	-	-	-	-	-	4,821	318	158	72.0	80.0	3,335	396	3,731
CHATHAM M	75 to 80	77.5	191	235	280	706	386	320	70.0	78.0	2,892	-	2,892	-	-	-	-	-	2,892	343	363	72.0	80.0	1,889	-	1,889
CHATHAM M	70 to 75	72.5	203	177	222	602	307	295	70.0	78.0	767	-	767	-	-	-	-	-	767	269	333	72.0	80.0	134	-	134
CHATHAM M	65 to 70	67.5	325	165	204	694	309	385	70.0	78.0	-	-	-	-	-	-	-	-	-	262	432	72.0	80.0	-	-	-
CHATHAM M	60 to 65	62.5	180	152	195	527	267	260	70.0	78.0	-	-	-	-	-	-	-	-	-	233	294	72.0	80.0	-	-	-
																			13,813							**10,420**
							Building	Building	Section 1	Section 1	Section 1	Section 1	Section 1	Section 2	Section 2	Section 2	Section 2	Section 2	Building							
	HEATING																									
CHATHAM M	55 to 60	57.5	86	144	97	327	191	136	74.0	70.0	3,147	1,703	4,850	-	-	-	-	-	4,850	174	153	70	60	2,180	381	2,562
CHATHAM M	50 to 55	52.5	109	182	172	463	268	195	74.0	70.0	5,754	3,419	9,173	-	-	-	-	-	9,173	243	220	70	60	4,244	1,654	5,898
CHATHAM M	45 to 50	47.5	105	119	142	366	197	169	74.0	70.0	5,216	3,807	9,022	-	-	-	-	-	9,022	175	191	70	60	3,932	2,390	6,323
CHATHAM M	40 to 45	42.5	185	155	177	517	261	256	74.0	70.0	8,212	7,048	15,260	-	-	-	-	-	15,260	228	289	70	60	6,281	5,051	11,331
CHATHAM M	35 to 40	37.5	236	200	241	677	343	334	74.0	70.0	12,508	10,865	23,373	-	-	-	-	-	23,373	300	377	70	60	9,753	8,480	18,233
CHATHAM M	30 to 35	32.5	237	202	198	637	322	315	74.0	70.0	13,344	11,830	25,174	-	-	-	-	-	25,174	283	354	70	60	10,601	9,743	20,344
CHATHAM M	25 to 30	27.5	121	115	113	349	181	168	74.0	70.0	8,403	7,152	15,555	-	-	-	-	-	15,555	160	189	70	60	6,792	6,148	12,941
CHATHAM M	20 to 25	22.5	149	68	97	314	137	177	74.0	70.0	7,048	8,414	15,462	-	-	-	-	-	15,462	115	199	70	60	5,457	7,467	12,924
CHATHAM M	15 to 20	17.5	95	40	46	181	76	105	74.0	70.0	4,288	5,518	9,806	-	-	-	-	-	9,806	63	118	70	60	3,323	5,002	8,326
CHATHAM M	10 to 15	12.5	39	9	28	76	30	46	74.0	70.0	1,825	2,663	4,489	-	-	-	-	-	4,489	24	52	70	60	1,363	2,484	3,847
CHATHAM M	5 to 10	7.5	21	5	5	31	11	20	74.0	70.0	712	1,268	1,980	-	-	-	-	-	1,980	8	23	70	60	525	1,187	1,711
CHATHAM M	0 to 5	2.5	4	2	-	6	2	4	74.0	70.0	174	241	415	-	-	-	-	-	415	2	4	70	60	140	226	366
CHATHAM M	-5 to 0	(2.5)	4	-	-	4	1	3	74.0	70.0	55	238	293	-	-	-	-	-	293	0	4	70	60	26	228	254
CHATHAM M	-10 to -5	(7.5)	-	-	-	-	-	-	74.0	70.0	-	-	-	-	-	-	-	-	-	-	-	70	60	-	-	-
CHATHAM M	-15 to -10	(12.5)	-	-	-	-	-	-	74.0	70.0	-	-	-	-	-	-	-	-	-	-						
	Total		1,391	1,241	1,316	3,948	2,017	1,931			70,686	64,167	134,853			0	0	0	**134,853**	1,775	2,173			54,617	50,442	**105,059**

LAFAYETTE SCHOOL

							Current Operating Schedule													Proposed Operating Schedule						
	Amb. Temp Bin deg. F	Ave Temp deg. F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours	Total heating Deg-hours	Occup.Bin Hours	Unocc. Bin Hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours
							Building	Building	Section 1	Section 1	Section 1	Section 1	Section 1	Section 2	Section 2	Section 2	Section 2	Section 2	Building							
	COOLING																									
LAFAYETTE S	100 to 105	102.5	-	1	-	1	1	0	70.0	78.0	23	7	30	-	-	-	-	-	30	1	0	72.0	80.0	22	6	28
LAFAYETTE S	95 to 100	97.5	-	19	2	21	14	7	70.0	78.0	383	138	521	-	-	-	-	-	521	14	7	72.0	80.0	351	127	477
LAFAYETTE S	90 to 95	92.5	-	44	13	57	34	23	70.0	78.0	759	337	1,096	-	-	-	-	-	1,096	33	24	72.0	80.0	668	305	973
LAFAYETTE S	85 to 90	87.5	1	167	60	228	130	98	70.0	78.0	2,278	929	3,207	-	-	-	-	-	3,207	125	103	72.0	80.0	1,933	775	2,708
LAFAYETTE S	80 to 85	82.5	31	283	162	476	237	239	70.0	78.0	2,958	1,077	4,035	-	-	-	-	-	4,035	219	257	72.0	80.0	2,303	642	2,945
LAFAYETTE S	75 to 80	77.5	191	235	280	706	252	454	70.0	78.0	1,890	-	1,890	-	-	-	-	-	1,890	210	496	72.0	80.0	1,155	-	1,155
LAFAYETTE S	70 to 75	72.5	203	177	222	602	202	400	70.0	78.0	506	-	506	-	-	-	-	-	506	164	438	72.0	80.0	82	-	82
LAFAYETTE S	65 to 70	67.5	325	165	204	694	212	482	70.0	78.0	-	-	-	-	-	-	-	-	-	165	529	72.0	80.0	-	-	-
LAFAYETTE S	60 to 65	62.5	180	152	195	527	176	351	70.0	78.0	-	-	-	-	-	-	-	-	-	142	385	72.0	80.0	-	-	-
																			11,285							**8,368**
							Building	Building	Section 1	Section 1	Section 1	Section 1	Section 1	Section 2	Section 2	Section 2	Section 2	Section 2	Building							
	HEATING																									
LAFAYETTE S	55 to 60	57.5	86	144	97	327	136	191	74.0	70.0	2,236	2,393	4,630	-	-	-	-	-	4,630	119	208	70	60	1,490	520	2,009
LAFAYETTE S	50 to 55	52.5	109	182	172	463	180	283	74.0	70.0	3,874	4,949	8,823	-	-	-	-	-	8,823	155	308	70	60	2,714	2,309	5,023
LAFAYETTE S	45 to 50	47.5	105	119	142	366	129	237	74.0	70.0	3,421	5,330	8,751	-	-	-	-	-	8,751	107	259	70	60	2,409	3,237	5,646
LAFAYETTE S	40 to 45	42.5	185	155	177	517	175	342	74.0	70.0	5,524	9,395	14,919	-	-	-	-	-	14,919	143	374	70	60	3,933	6,544	10,478
LAFAYETTE S	35 to 40	37.5	236	200	241	677	228	449	74.0	70.0	8,323	14,591	22,915	-	-	-	-	-	22,915	185	492	70	60	6,027	11,060	17,087
LAFAYETTE S	30 to 35	32.5	237	202	198	637	222	415	74.0	70.0	9,212	15,564	24,775	-	-	-	-	-	24,775	183	454	70	60	6,867	12,482	19,349
LAFAYETTE S	25 to 30	27.5	121	115	113	349	124	225	74.0	70.0	5,763	9,566	15,328	-	-	-	-	-	15,328	103	246	70	60	4,379	7,994	12,373
LAFAYETTE S	20 to 25	22.5	149	68	97	314	92	222	74.0	70.0	4,764	10,521	15,285	-	-	-	-	-	15,285	71	243	70	60	3,350	9,130	12,480
LAFAYETTE S	15 to 20	17.5	95	40	46	181	54	127	74.0	70.0	3,037	6,681	9,717	-	-	-	-	-	9,717	41	140	70	60	2,161	5,943	8,104
LAFAYETTE S	10 to 15	12.5	39	9	28	76	18	58	74.0	70.0	1,131	3,312	4,444	-	-	-	-	-	4,444	12	64	70	60	714	3,020	3,734
LAFAYETTE S	5 to 10	7.5	21	5	5	31	8	23	74.0	70.0	546	1,424	1,970	-	-	-	-	-	1,970	6	25	70	60	368	1,318	1,686
LAFAYETTE S	0 to 5	2.5	4	2	-	6	2	4	74.0	70.0	153	260	414	-	-	-	-	-	414	2	4	70	60	121	242	363
LAFAYETTE S	-5 to 0	(2.5)	4	-	-	4	1	3	74.0	70.0	55	238	293	-	-	-	-	-	293	0	4	70	60	26	228	254
LAFAYETTE S	-10 to -5	(7.5)	-	-	-	-	-	-	74.0	70.0	-	-	-	-	-	-	-	-	-	-	-	70	60	-	-	-
LAFAYETTE S	-15 to -10	(12.5)	-	-	-	-	-	-	74.0	70.0	-	-	-	-	-	-	-	-	-	-						
	Total		1,391	1,241	1,316	3,948	1,370	2,578			48,039	84,226	132,264			0	0	0	**132,264**	1,128	2,820			34,559	64,027	**98,586**

Chathams School District
Exhibit D
ECM 3A - Building Management Control Systems
BMS Upgrades

MILTON AVENUE SCHOOL

							Current Operating Schedule													Proposed Operating Schedule						
	Amb. Temp Bin deg. F	Ave Temp deg. F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours	Total heating Deg-hours	Occup.Bin Hours	Unocc. Bin Hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours
							Building	Building	Section 1	Section 1	Section 1	Section 1	Section 1	Section 2	Section 2	Section 2	Section 2	Section 2	Building							
	COOLING																									
MILTON AVE	100 to 105	102.5	-	1	-	1	1	0	70.0	78.0	23	7	30	-	-	-	-	-	30	1	0	72.0	80.0	22	6	28
MILTON AVE	95 to 100	97.5	-	19	2	21	14	7	70.0	78.0	383	138	521	-	-	-	-	-	521	14	7	72.0	80.0	351	127	477
MILTON AVE	90 to 95	92.5	-	44	13	57	34	23	70.0	78.0	759	337	1,096	-	-	-	-	-	1,096	33	24	72.0	80.0	668	305	973
MILTON AVE	85 to 90	87.5	1	167	60	228	130	98	70.0	78.0	2,278	929	3,207	-	-	-	-	-	3,207	125	103	72.0	80.0	1,933	775	2,708
MILTON AVE	80 to 85	82.5	31	283	162	476	237	239	70.0	78.0	2,958	1,077	4,035	-	-	-	-	-	4,035	219	257	72.0	80.0	2,303	642	2,945
MILTON AVE	75 to 80	77.5	191	235	280	706	252	454	70.0	78.0	1,890	-	1,890	-	-	-	-	-	1,890	210	496	72.0	80.0	1,155	-	1,155
MILTON AVE	70 to 75	72.5	203	177	222	602	202	400	70.0	78.0	506	-	506	-	-	-	-	-	506	164	438	72.0	80.0	82	-	82
MILTON AVE	65 to 70	67.5	325	165	204	694	212	482	70.0	78.0	-	-	-	-	-	-	-	-	-	165	529	72.0	80.0	-	-	-
MILTON AVE	60 to 65	62.5	180	152	195	527	176	351	70.0	78.0	-	-	-	-	-	-	-	-	-	142	385	72.0	80.0	-	-	-
																			11,285							8,368
							Building	Building	Section 1	Section 1	Section 1	Section 1	Section 1	Section 2	Section 2	Section 2	Section 2	Section 2	Building							
	HEATING																									
MILTON AVE	55 to 60	57.5	86	144	97	327	136	191	74.0	70.0	2,236	2,393	4,630	-	-	-	-	-	4,630	119	208	70	60	1,490	520	2,009
MILTON AVE	50 to 55	52.5	109	182	172	463	180	283	74.0	70.0	3,874	4,949	8,823	-	-	-	-	-	8,823	155	308	70	60	2,714	2,309	5,023
MILTON AVE	45 to 50	47.5	105	119	142	366	129	237	74.0	70.0	3,421	5,330	8,751	-	-	-	-	-	8,751	107	259	70	60	2,409	3,237	5,646
MILTON AVE	40 to 45	42.5	185	155	177	517	175	342	74.0	70.0	5,524	9,395	14,919	-	-	-	-	-	14,919	143	374	70	60	3,933	6,544	10,478
MILTON AVE	35 to 40	37.5	236	200	241	677	228	449	74.0	70.0	8,323	14,591	22,915	-	-	-	-	-	22,915	185	492	70	60	6,027	11,060	17,087
MILTON AVE	30 to 35	32.5	237	202	198	637	222	415	74.0	70.0	9,212	15,564	24,775	-	-	-	-	-	24,775	183	454	70	60	6,867	12,482	19,349
MILTON AVE	25 to 30	27.5	121	115	113	349	124	225	74.0	70.0	5,763	9,566	15,328	-	-	-	-	-	15,328	103	246	70	60	4,379	7,994	12,373
MILTON AVE	20 to 25	22.5	149	68	97	314	92	222	74.0	70.0	4,764	10,521	15,285	-	-	-	-	-	15,285	71	243	70	60	3,350	9,130	12,480
MILTON AVE	15 to 20	17.5	95	40	46	181	54	127	74.0	70.0	3,037	6,681	9,717	-	-	-	-	-	9,717	41	140	70	60	2,161	5,943	8,104
MILTON AVE	10 to 15	12.5	39	9	28	76	18	58	74.0	70.0	1,131	3,312	4,444	-	-	-	-	-	4,444	12	64	70	60	714	3,020	3,734
MILTON AVE	5 to 10	7.5	21	5	5	31	8	23	74.0	70.0	546	1,424	1,970	-	-	-	-	-	1,970	6	25	70	60	368	1,318	1,686
MILTON AVE	0 to 5	2.5	4	2	-	6	2	4	74.0	70.0	153	260	414	-	-	-	-	-	414	2	4	70	60	121	242	363
MILTON AVE	-5 to 0	(2.5)	4	-	-	4	1	3	74.0	70.0	55	238	293	-	-	-	-	-	293	0	4	70	60	26	228	254
MILTON AVE	-10 to -5	(7.5)	-	-	-	-	-	-	74.0	70.0	-	-	-	-	-	-	-	-	-	-	-	70	60	-	-	-
MILTON AVE	-15 to -10	(12.5)	-	-	-	-	-	-	74.0	70.0	-	-	-	-	-	-	-	-	-	-						
	Total		1,391	1,241	1,316	3,948	1,370	2,578			48,039	84,226	132,264			0	0	0	132,264	1,128	2,820			34,559	64,027	98,586

SOUTHERN BOULEVARD SCHOOL

							Current Operating Schedule													Proposed Operating Schedule						
	Amb. Temp Bin deg. F	Ave Temp deg. F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours	Total heating Deg-hours	Occup.Bin Hours	Unocc. Bin Hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours
							Building	Building	Section 1	Section 1	Section 1	Section 1	Section 1	Section 2	Section 2	Section 2	Section 2	Section 2	Building							
	COOLING																									
SOUTHERN B	100 to 105	102.5	-	1	-	1	1	0	70.0	78.0	23	7	30	-	-	-	-	-	30	1	0	72.0	80.0	22	6	28
SOUTHERN B	95 to 100	97.5	-	19	2	21	14	7	70.0	78.0	383	138	521	-	-	-	-	-	521	14	7	72.0	80.0	351	127	477
SOUTHERN B	90 to 95	92.5	-	44	13	57	34	23	70.0	78.0	759	337	1,096	-	-	-	-	-	1,096	33	24	72.0	80.0	668	305	973
SOUTHERN B	85 to 90	87.5	1	167	60	228	130	98	70.0	78.0	2,278	929	3,207	-	-	-	-	-	3,207	125	103	72.0	80.0	1,933	775	2,708
SOUTHERN B	80 to 85	82.5	31	283	162	476	237	239	70.0	78.0	2,958	1,077	4,035	-	-	-	-	-	4,035	219	257	72.0	80.0	2,303	642	2,945
SOUTHERN B	75 to 80	77.5	191	235	280	706	252	454	70.0	78.0	1,890	-	1,890	-	-	-	-	-	1,890	210	496	72.0	80.0	1,155	-	1,155
SOUTHERN B	70 to 75	72.5	203	177	222	602	202	400	70.0	78.0	506	-	506	-	-	-	-	-	506	164	438	72.0	80.0	82	-	82
SOUTHERN B	65 to 70	67.5	325	165	204	694	212	482	70.0	78.0	-	-	-	-	-	-	-	-	-	165	529	72.0	80.0	-	-	-
SOUTHERN B	60 to 65	62.5	180	152	195	527	176	351	70.0	78.0	-	-	-	-	-	-	-	-	-	142	385	72.0	80.0	-	-	-
																			11,285							8,368
							Building	Building	Section 1	Section 1	Section 1	Section 1	Section 1	Section 2	Section 2	Section 2	Section 2	Section 2	Building							
	HEATING																									
SOUTHERN B	55 to 60	57.5	86	144	97	327	136	191	74.0	70.0	2,236	2,393	4,630	-	-	-	-	-	4,630	119	208	70	60	1,490	520	2,009
SOUTHERN B	50 to 55	52.5	109	182	172	463	180	283	74.0	70.0	3,874	4,949	8,823	-	-	-	-	-	8,823	155	308	70	60	2,714	2,309	5,023
SOUTHERN B	45 to 50	47.5	105	119	142	366	129	237	74.0	70.0	3,421	5,330	8,751	-	-	-	-	-	8,751	107	259	70	60	2,409	3,237	5,646
SOUTHERN B	40 to 45	42.5	185	155	177	517	175	342	74.0	70.0	5,524	9,395	14,919	-	-	-	-	-	14,919	143	374	70	60	3,933	6,544	10,478
SOUTHERN B	35 to 40	37.5	236	200	241	677	228	449	74.0	70.0	8,323	14,591	22,915	-	-	-	-	-	22,915	185	492	70	60	6,027	11,060	17,087
SOUTHERN B	30 to 35	32.5	237	202	198	637	222	415	74.0	70.0	9,212	15,564	24,775	-	-	-	-	-	24,775	183	454	70	60	6,867	12,482	19,349
SOUTHERN B	25 to 30	27.5	121	115	113	349	124	225	74.0	70.0	5,763	9,566	15,328	-	-	-	-	-	15,328	103	246	70	60	4,379	7,994	12,373
SOUTHERN B	20 to 25	22.5	149	68	97	314	92	222	74.0	70.0	4,764	10,521	15,285	-	-	-	-	-	15,285	71	243	70	60	3,350	9,130	12,480
SOUTHERN B	15 to 20	17.5	95	40	46	181	54	127	74.0	70.0	3,037	6,681	9,717	-	-	-	-	-	9,717	41	140	70	60	2,161	5,943	8,104
SOUTHERN B	10 to 15	12.5	39	9	28	76	18	58	74.0	70.0	1,131	3,312	4,444	-	-	-	-	-	4,444	12	64	70	60	714	3,020	3,734
SOUTHERN B	5 to 10	7.5	21	5	5	31	8	23	74.0	70.0	546	1,424	1,970	-	-	-	-	-	1,970	6	25	70	60	368	1,318	1,686
SOUTHERN B	0 to 5	2.5	4	2	-	6	2	4	74.0	70.0	153	260	414	-	-	-	-	-	414	2	4	70	60	121	242	363
SOUTHERN B	-5 to 0	(2.5)	4	-	-	4	1	3	74.0	70.0	55	238	293	-	-	-	-	-	293	0	4	70	60	26	228	254
SOUTHERN B	-10 to -5	(7.5)	-	-	-	-	-	-	74.0	70.0	-	-	-	-	-	-	-	-	-	-	-	70	60	-	-	-
SOUTHERN B	-15 to -10	(12.5)	-	-	-	-	-	-	74.0	70.0	-	-	-	-	-	-	-	-	-	-						
	Total		1,391	1,241	1,316	3,948	1,370	2,578			48,039	84,226	132,264			0	0	0	132,264	1,128	2,820			34,559	64,027	98,586

Chathams School District
Exhibit D
ECM 3A - Building Management Control Systems
BMS Upgrades

WASHINGTON AVENUE SCHOOL

							Current Operating Schedule													Proposed Operating Schedule						
	Amb. Temp Bin deg. F	Ave Temp deg. F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours	Total heating Deg-hours	Occup.Bin Hours	Unocc. Bin Hours	Occup. Indoor temp	Unocc. Indoor temp	Occup. heating Deg-hours	Unocc. heating Deg-hours	Total heating Deg-hours
							Building	Building	Section 1	Section 1	Section 1	Section 1	Section 1	Section 2	Section 2	Section 2	Section 2	Section 2	Building							
	COOLING																									
WASHINGTO	100 to 105	102.5	-	1	-	1	1	0	70.0	78.0	23	7	30	-	-	-	-	-	30	1	0	72.0	80.0	22	6	28
WASHINGTO	95 to 100	97.5	-	19	2	21	14	7	70.0	78.0	383	138	521	-	-	-	-	-	521	14	7	72.0	80.0	351	127	477
WASHINGTO	90 to 95	92.5	-	44	13	57	34	23	70.0	78.0	759	337	1,096	-	-	-	-	-	1,096	33	24	72.0	80.0	668	305	973
WASHINGTO	85 to 90	87.5	1	167	60	228	130	98	70.0	78.0	2,278	929	3,207	-	-	-	-	-	3,207	125	103	72.0	80.0	1,933	775	2,708
WASHINGTO	80 to 85	82.5	31	283	162	476	237	239	70.0	78.0	2,958	1,077	4,035	-	-	-	-	-	4,035	219	257	72.0	80.0	2,303	642	2,945
WASHINGTO	75 to 80	77.5	191	235	280	706	252	454	70.0	78.0	1,890	-	1,890	-	-	-	-	-	1,890	210	496	72.0	80.0	1,155	-	1,155
WASHINGTO	70 to 75	72.5	203	177	222	602	202	400	70.0	78.0	506	-	506	-	-	-	-	-	506	164	438	72.0	80.0	82	-	82
WASHINGTO	65 to 70	67.5	325	165	204	694	212	482	70.0	78.0	-	-	-	-	-	-	-	-	-	165	529	72.0	80.0	-	-	-
WASHINGTO	60 to 65	62.5	180	152	195	527	176	351	70.0	78.0	-	-	-	-	-	-	-	-	-	142	385	72.0	80.0	-	-	-
																			11,285							**8,368**
							Building	Building	Section 1	Section 1	Section 1	Section 1	Section 1	Section 2	Section 2	Section 2	Section 2	Section 2	Building							
	HEATING																									
WASHINGTO	55 to 60	57.5	86	144	97	327	136	191	74.0	70.0	2,236	2,393	4,630	-	-	-	-	-	4,630	119	208	70	60	1,490	520	2,009
WASHINGTO	50 to 55	52.5	109	182	172	463	180	283	74.0	70.0	3,874	4,949	8,823	-	-	-	-	-	8,823	155	308	70	60	2,714	2,309	5,023
WASHINGTO	45 to 50	47.5	105	119	142	366	129	237	74.0	70.0	3,421	5,330	8,751	-	-	-	-	-	8,751	107	259	70	60	2,409	3,237	5,646
WASHINGTO	40 to 45	42.5	185	155	177	517	175	342	74.0	70.0	5,524	9,395	14,919	-	-	-	-	-	14,919	143	374	70	60	3,933	6,544	10,478
WASHINGTO	35 to 40	37.5	236	200	241	677	228	449	74.0	70.0	8,323	14,591	22,915	-	-	-	-	-	22,915	185	492	70	60	6,027	11,060	17,087
WASHINGTO	30 to 35	32.5	237	202	198	637	222	415	74.0	70.0	9,212	15,564	24,775	-	-	-	-	-	24,775	183	454	70	60	6,867	12,482	19,349
WASHINGTO	25 to 30	27.5	121	115	113	349	124	225	74.0	70.0	5,763	9,566	15,328	-	-	-	-	-	15,328	103	246	70	60	4,379	7,994	12,373
WASHINGTO	20 to 25	22.5	149	68	97	314	92	222	74.0	70.0	4,764	10,521	15,285	-	-	-	-	-	15,285	71	243	70	60	3,350	9,130	12,480
WASHINGTO	15 to 20	17.5	95	40	46	181	54	127	74.0	70.0	3,037	6,681	9,717	-	-	-	-	-	9,717	41	140	70	60	2,161	5,943	8,104
WASHINGTO	10 to 15	12.5	39	9	28	76	18	58	74.0	70.0	1,131	3,312	4,444	-	-	-	-	-	4,444	12	64	70	60	714	3,020	3,734
WASHINGTO	5 to 10	7.5	21	5	5	31	8	23	74.0	70.0	546	1,424	1,970	-	-	-	-	-	1,970	6	25	70	60	368	1,318	1,686
WASHINGTO	0 to 5	2.5	4	2	-	6	2	4	74.0	70.0	153	260	414	-	-	-	-	-	414	2	4	70	60	121	242	363
WASHINGTO	-5 to 0	(2.5)	4	-	-	4	1	3	74.0	70.0	55	238	293	-	-	-	-	-	293	0	4	70	60	26	228	254
WASHINGTO	-10 to -5	(7.5)	-	-	-	-	-	-	74.0	70.0	-	-	-	-	-	-	-	-	-	-	-	70	60	-	-	-
WASHINGTO	-15 to -10	(12.5)	-	-	-	-	-	-	74.0	70.0	-	-	-	-	-	-	-	-	-	-						
	Total		1,391	1,241	1,316	3,948	1,370	2,578			48,039	84,226	132,264			0	0	0	**132,264**	1,128	2,820			34,559	64,027	**98,586**

Chathams School District
Exhibit D
ECM 3B - Demand Control Ventilation
Demand Control Ventilation

ECM DESCRIPTION

Install CO2 sensors in large areas to control fresh air intake

DATA / ASSUMPTIONS

Heating Hours 3,948 Hours

*Schedules and temperatures are based on data logging trends performed throughout the building
* Proposed setpoints are used as to not capture thermal savings twice

MEASUREMENT AND VERIFICATION

Option A (Electric) -
Option C (Thermal) - Savings Calculations are based on regression analysis of utility billing meter data

COMMISSIONING

Simulate function of CO2 control signal. Test all equipment involved in DCV, which will include but not limited to testing function of fresh air damper response to the CO2 sensor signal and sequence of operation per design (Override CO2 signal during the building warm up, etc.).

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) = 0%
Safety Factor (Thermal) = 0%

Savings calculations are based on weather bin data, fresh air flows and temperature setpoints. A more conservative of 0 percent is used for this ECM due to the uncertainty of variables.

FORMULAE

$W_{SAVINGS} = \sum^{60}_{-5} [(kW_{FAN} \cdot t_{OCC}) - (kW_{FAN} \cdot (1 - RPM_{-\%})^{2.8}) \cdot t_{OCC}]$

$Q_{SAVINGS} = \sum^{60}_{-5} \{ [Q_{LOAD} \cdot t_{OCC} \cdot (1 - OA_{\%OCC})] + [Q_{LOAD} \cdot t_{UNOCC} \cdot (1 - OA_{\%UNOCC})] \} / \eta_{BOILER}$

$Q_{LOAD} = 1.08 \cdot CFM_{OA} \cdot (T_{OCC} - T_{BIN}) / 1000$

Variable	Units	Description
$W_{SAVINGS}$	kWh	Annual kWh Savings
$Q_{SAVINGS}$	Therms	Annual Thermal Savings
Q_{LOAD}	Mmbtu	Thermal Load of unit at respective temperature bin
kW_{FAN}	kW	Total kW of Fan
$\sum^{60}_{-5}$	-	Summation of all bins from -5°F to 60°F
T_{BIN}	°F	Temperature of respective bin
t_{OCC}	Hrs	Proposed occupied Bin Hours in respective temperature bin
t_{UNOCC}	Hrs	Proposed unoccupied Bin Hours in respective temperature bin
$RPM_{-\%}$	%	Percentage of RPM fan will be reduced due to VFD
$OA_{\%OCC}$	%	Percentage Fresh Air Reduction during occupied hours
$OA_{\%UNOCC}$	%	Percentage Fresh Air Reduction during unoccupied hours
CFM_{SUPPLY}	CFM	Total supply CFM of units
CFM_{OA}	CFM	Total outside air CFM of units
T_{OCC}	°F	Proposed occupied Temperature
T_{UNOCC}	°F	Proposed unoccupied Temperature
$T_{OCC/UNOCC}$	°F	Proposed occupied/unoccupied Mode Temperature for controlled unit
η_{BOILER}	%	Boiler Efficiency

* Inputs are in blue

Building	Area Served	Qty	HP (Each)	Supply CFM (Each)	OA CFM (Each)
Chatham High School	1973 Gym addition	1	5.0	8,000	1,600
Chatham High School	Cafeteria	1	3.0	5,157	1,031

Chathams School District
Exhibit D
ECM 3B - Demand Control Ventilation
Demand Control Ventilation

Chatham Middle School	Upper Gymnasium	1	3.0	8,250	1,650
Chatham Middle School	Upper Gymnasium	1	3.0	8,250	1,650
Chatham Middle School	Auditorium	1	7.5	8,000	1,600
Milton Avenue School	Gymnasium	1	5.0	4,000	800
Milton Avenue School	Gymnasium	1	5.0	4,000	800
Southern Boulevard School	Gymnasium	2	3.0	4,000	800
Chatham High School	Auditorium	1	25.0	15,416	3,083
Chatham High School	Auditorium	1	25.0	15,416	3,083
Chatham Middle School	Gymnasium	1	3.0	12,400	2,480
Chatham Middle School	Gymnasium	1	3.0	12,400	2,480
Totals		**13**	**90.5**	**105,289**	**21,058**

	Chatham High School	Chatham High School	Chatham Middle School	Chatham Middle School	Chatham Middle School	Milton Avenue School	Milton Avenue School	Southern Boulevard School	Chatham High School	Chatham High School	Chatham Middle School	Chatham Middle School
Location	1973 Gym addition	Cafeteria	Upper Gymnasium	Upper Gymnasium	Auditorium	Gymnasium	Gymnasium	Gymnasium	Auditorium	Auditorium	Gymnasium	Gymnasium
Quantity	1	1	1	1	1	1	1	2	1	1	1	1
HP Motor Total	5	3	3	3	7.5	5	5	6	25	25	3	3
Motor Load Factor	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
kW Motor Total	2.42	1.45	1.45	1.45	3.64	2.42	2.42	1.45	12.12	12.12	1.45	1.45
CFM Total	8,000	5,157	8,250	8,250	8,000	4,000	4,000	8,000	15,416	15,416	12,400	12,400
Outside Air Total	1,600	1,031	1,650	1,650	1,600	800	800	1,600	3,083	3,083	2,480	2,480
**Proposed Occupied Heating Setpoint	70.0	70	70	70	70	70	70	70	70	70	70	70
**Proposed Unoccup. Heating Setpoint	60.0	60	60	60	60	60	60	60	60	60	60	60
**Proposed Occupied Cooling Setpoint	72.0	72	72	72	72	72	72	72	72	72	72	72
**Proposed Unoccup. Cooling Setpoint	80.0	80	80	80	80	80	80	80	80	80	80	80
Existing Boiler Efficiency	80.0%	80.0%	87.0%	87.0%	87.0%	78.0%	78.0%	76.3%	80.0%	80.0%	87.0%	87.0%
Average Fan Speed Reduction	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Average Occupied Heating Reduction	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
Average Unoccupied Heating Reduction	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Safety Factor	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Electrical Savings	-	-	-	-	-	-	-	-	-	-	-	-
Thermal Savings	291	188	261	261	253	96	96	196	561	561	392	392

Chathams School District
Exhibit D
ECM 3B - Demand Control Ventilation
Demand Control Ventilation

CALCULATIONS

CHATHAM HIGH SCHOOL

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	86	144	97	327	199	128	1,600	4	0	0.3	0.0	3
50 to 55	52.5	109	182	172	463	283	180	1,600	13	0	1.1	0.0	14
45 to 50	47.5	105	119	142	366	209	157	1,600	22	0	1.4	0.0	17
40 to 45	42.5	185	155	177	517	277	240	1,600	30	0	2.5	0.0	31
35 to 40	37.5	236	200	241	677	364	313	1,600	39	0	4.2	0.0	53
30 to 35	32.5	237	202	198	637	339	298	1,600	48	0	4.8	0.0	60
25 to 30	27.5	121	115	113	349	191	158	1,600	56	0	3.2	0.0	40
20 to 25	22.5	149	68	97	314	146	168	1,600	65	0	2.8	0.0	35
15 to 20	17.5	95	40	46	181	80	101	1,600	73	0	1.8	0.0	22
10 to 15	12.5	39	9	28	76	32	44	1,600	82	0	0.8	0.0	10
5 to 10	7.5	21	5	5	31	11	20	1,600	91	0	0.3	0.0	4
0 to 5	2.5	4	2	-	6	2	4	1,600	99	0	0.1	0.0	1
-5 to 0	-2.5	4	-	-	4	1	3	1,600	108	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	1,600	117	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	1,600	125	0	0.0	0.0	0
Total		1,391	1,241	1,316	3,948	2,135	1,813			-	23		291

CHATHAM HIGH SCHOOL

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	86	144	97	327	199	128	1,031	3	0	0.2	0.0	2
50 to 55	52.5	109	182	172	463	283	180	1,031	8	0	0.7	0.0	9
45 to 50	47.5	105	119	142	366	209	157	1,031	14	0	0.9	0.0	11
40 to 45	42.5	185	155	177	517	277	240	1,031	19	0	1.6	0.0	20
35 to 40	37.5	236	200	241	677	364	313	1,031	25	0	2.7	0.0	34
30 to 35	32.5	237	202	198	637	339	298	1,031	31	0	3.1	0.0	39
25 to 30	27.5	121	115	113	349	191	158	1,031	36	0	2.1	0.0	26
20 to 25	22.5	149	68	97	314	146	168	1,031	42	0	1.8	0.0	23
15 to 20	17.5	95	40	46	181	80	101	1,031	47	0	1.1	0.0	14
10 to 15	12.5	39	9	28	76	32	44	1,031	53	0	0.5	0.0	6
5 to 10	7.5	21	5	5	31	11	20	1,031	58	0	0.2	0.0	2
0 to 5	2.5	4	2	-	6	2	4	1,031	64	0	0.0	0.0	1
-5 to 0	-2.5	4	-	-	4	1	3	1,031	70	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	1,031	75	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	1,031	81	0	0.0	0.0	0
Total		1,391	1,241	1,316	3,948	2,135	1,813			-	15		188

Chathams School District
Exhibit D
ECM 3B - Demand Control Ventilation
Demand Control Ventilation

CHATHAM MIDDLE SCHOOL

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	86	144	97	327	191	136	1,650	4	0	0.3	0.0	3
50 to 55	52.5	109	182	172	463	268	195	1,650	13	0	1.1	0.0	12
45 to 50	47.5	105	119	142	366	197	169	1,650	22	0	1.3	0.0	15
40 to 45	42.5	185	155	177	517	261	256	1,650	31	0	2.4	0.0	28
35 to 40	37.5	236	200	241	677	343	334	1,650	40	0	4.1	0.0	47
30 to 35	32.5	237	202	198	637	322	315	1,650	49	0	4.7	0.0	54
25 to 30	27.5	121	115	113	349	181	168	1,650	58	0	3.1	0.0	36
20 to 25	22.5	149	68	97	314	137	177	1,650	67	0	2.7	0.0	32
15 to 20	17.5	95	40	46	181	76	105	1,650	76	0	1.7	0.0	20
10 to 15	12.5	39	9	28	76	30	46	1,650	85	0	0.8	0.0	9
5 to 10	7.5	21	5	5	31	11	20	1,650	94	0	0.3	0.0	3
0 to 5	2.5	4	2	-	6	2	4	1,650	102	0	0.1	0.0	1
-5 to 0	-2.5	4	-	-	4	1	3	1,650	111	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	1,650	120	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	1,650	129	0	0.0	0.0	0
Total		1,391	1,241	1,316	3,948	2,017	1,931			-	23		261

CHATHAM MIDDLE SCHOOL

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	86	144	97	327	191	136	1,650	4	0	0.3	0.0	3
50 to 55	52.5	109	182	172	463	268	195	1,650	13	0	1.1	0.0	12
45 to 50	47.5	105	119	142	366	197	169	1,650	22	0	1.3	0.0	15
40 to 45	42.5	185	155	177	517	261	256	1,650	31	0	2.4	0.0	28
35 to 40	37.5	236	200	241	677	343	334	1,650	40	0	4.1	0.0	47
30 to 35	32.5	237	202	198	637	322	315	1,650	49	0	4.7	0.0	54
25 to 30	27.5	121	115	113	349	181	168	1,650	58	0	3.1	0.0	36
20 to 25	22.5	149	68	97	314	137	177	1,650	67	0	2.7	0.0	32
15 to 20	17.5	95	40	46	181	76	105	1,650	76	0	1.7	0.0	20
10 to 15	12.5	39	9	28	76	30	46	1,650	85	0	0.8	0.0	9
5 to 10	7.5	21	5	5	31	11	20	1,650	94	0	0.3	0.0	3
0 to 5	2.5	4	2	-	6	2	4	1,650	102	0	0.1	0.0	1
-5 to 0	-2.5	4	-	-	4	1	3	1,650	111	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	1,650	120	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	1,650	129	0	0.0	0.0	0
Total		1,391	1,241	1,316	3,948	2,017	1,931			-	23		261

Chathams School District
Exhibit D
ECM 3B - Demand Control Ventilation
Demand Control Ventilation

CHATHAM MIDDLE SCHOOL

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	86	144	97	327	191	136	1,600	4	0	0.2	0.0	3
50 to 55	52.5	109	182	172	463	268	195	1,600	13	0	1.0	0.0	12
45 to 50	47.5	105	119	142	366	197	169	1,600	22	0	1.3	0.0	15
40 to 45	42.5	185	155	177	517	261	256	1,600	30	0	2.4	0.0	27
35 to 40	37.5	236	200	241	677	343	334	1,600	39	0	4.0	0.0	46
30 to 35	32.5	237	202	198	637	322	315	1,600	48	0	4.6	0.0	53
25 to 30	27.5	121	115	113	349	181	168	1,600	56	0	3.0	0.0	35
20 to 25	22.5	149	68	97	314	137	177	1,600	65	0	2.7	0.0	31
15 to 20	17.5	95	40	46	181	76	105	1,600	73	0	1.7	0.0	19
10 to 15	12.5	39	9	28	76	30	46	1,600	82	0	0.7	0.0	8
5 to 10	7.5	21	5	5	31	11	20	1,600	91	0	0.3	0.0	3
0 to 5	2.5	4	2	-	6	2	4	1,600	99	0	0.1	0.0	1
-5 to 0	-2.5	4	-	-	4	1	3	1,600	108	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	1,600	117	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	1,600	125	0	0.0	0.0	0
Total		1,391	1,241	1,316	3,948	2,017	1,931			-	22		253

MILTON AVENUE SCHOOL

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	86	144	97	327	136	191	800	2	0	0.1	0.0	1
50 to 55	52.5	109	182	172	463	180	283	800	6	0	0.4	0.0	4
45 to 50	47.5	105	119	142	366	129	237	800	11	0	0.4	0.0	5
40 to 45	42.5	185	155	177	517	175	342	800	15	0	0.8	0.0	10
35 to 40	37.5	236	200	241	677	228	449	800	19	0	1.3	0.0	17
30 to 35	32.5	237	202	198	637	222	415	800	24	0	1.6	0.0	20
25 to 30	27.5	121	115	113	349	124	225	800	28	0	1.0	0.0	13
20 to 25	22.5	149	68	97	314	92	222	800	32	0	0.9	0.0	12
15 to 20	17.5	95	40	46	181	54	127	800	37	0	0.6	0.0	8
10 to 15	12.5	39	9	28	76	18	58	800	41	0	0.2	0.0	3
5 to 10	7.5	21	5	5	31	8	23	800	45	0	0.1	0.0	1
0 to 5	2.5	4	2	-	6	2	4	800	50	0	0.0	0.0	0
-5 to 0	-2.5	4	-	-	4	1	3	800	54	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	800	58	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	800	63	0	0.0	0.0	0
Total		1,391	1,241	1,316	3,948	1,370	2,578			-	7		96

Chathams School District
Exhibit D
ECM 4A - Building Envelope Improvements
Building Envelope Improvements

ECM DESCRIPTION

Reduce building infiltration by weather stripping doors, sealing roof & wall joints, duct & piping penetrations, skylight perimeters and window corners.

DATA / ASSUMPTIONS

*Crack area determined by survey team

MEASUREMENT AND VERIFICATION

Option C - Savings Calculations are based on regression analysis of utility billing meter data

COMMISSIONING

Visual inspection per scope of work from subcontractor. Inspection might include smoke test.

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) =	**0%**
Safety Factor (Thermal) =	**0%**

Recovery factor taken at 10% due to the uncertainty of variables incorporated in the savings calculations

FORMULAE

$Q_{SAVINGS}$ = ((1.08 · Q_{INF} · HD_{HRS}) / η) $_{/ 100,000}$

Q_{INF} = (A_{CRACK} · ν ·δ ·ς) / η

$A_{CRACK} = A_{VENTS} + A_{WIN} + A_{RTV} + A_{DOORS} + A_{BULK} + A_{ROOF/WALL}$

Honeywell Building Solutions

Chathams School District

Exhibit D

ECM 4A - Building Envelope Improvements

Building Envelope Improvements

Variable	Units	Description
$Q_{SAVINGS}$	kWh	Electrical Savings associated with VFD
Q_{INF}	kWh	Infiltration savings
A_{CRACK}	ft^2	Total square feet of infiltration spaces
v	ft/min	Average wind speed at building location
δ	%	Windspeed Diversity
ς	%	Percentage of crack area to be eliminated
η	%	Heating system efficiency
HD_{HRS}	(Hr-°F)/Yr	Annual heating degree hours
A_{VENTS}	ft^2	Total square feet of infiltration spaces with regards to vents
A_{WIN}	ft^2	Total square feet of infiltration spaces with regards to windows
A_{RTV}	ft^2	Total square feet of infiltration spaces with regards to RTV's
A_{DOORS}	ft^2	Total square feet of infiltration spaces with regards to doors
A_{BULK}	ft^2	Total square feet of infiltration spaces with regards to bulkheads
$A_{ROOF/WALL}$	ft^2	Total square feet of infiltration spaces with regards to the wall roof joint

Very Good
Good
Average
Poor
Loose

ASSUMPTIONS / DATA

Subcontractor Calculations | **N** | * If Yes - Please Refer to tab 'Sub BEI Calculation' for details

Building	Building Envelope Improvements (Y/N)	Envelope Tightness	Cooling Savings Applicable (Y/N)
Chatham High School	Y	Poor	Y
Chatham Middle School	Y	Poor	Y
Lafayette School	Y	Poor	Y
Milton Avenue School	Y	Poor	Y
Southern Boulevard School	Y	Poor	Y
Washington Avenue School	Y	Poor	Y

Chathams School District
Exhibit D
ECM 4A - Building Envelope Improvements
Building Envelope Improvements

CALCULATIONS

	Chatham High School	Chatham Middle School	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School
Building Envelope Improvements	Y	Y	Y	Y	Y	Y
Envelope Tightness	Poor	Poor	Poor	Poor	Poor	Poor
Tightness Multiplier	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
Cooling Savings Applicable	Y	Y	Y	Y	Y	Y
Heating Savings Diversity Factor	**90%**	**90%**	**90%**	**90%**	**90%**	**90%**
Flow Factor	20	20	20	20	20	20
(AP)^n	5.16	5.16	5.16	5.16	5.16	5.16
Crack Area	**37.8**	**36.8**	**19.9**	**10.4**	**14.1**	**12.3**
Air Leakage (CFM)	3,896	3,798	2,056	1,074	1,459	1,271
Heating Degree Days	4,843	4,843	4,843	4,843	4,843	4,843
Heating Efficiency Factor	28,900	28,900	28,900	28,900	28,900	28,900
Cooling Savings Diversity Factor	**70%**	**70%**	**70%**	**50%**	**50%**	**70%**
Constant	4.5	4.5	4.5	4.5	4.5	4.5
CFM	3,896	3,798	2,056	1,074	1,459	1,271
Enthalpy	16.0	16.0	16.0	16.0	16.0	16.0
Tons	23.4	22.8	12.3	6.4	8.8	7.6
Constant	1.2	1.2	1.2	1.2	1.2	1.2
CDD	1,242	1,242	1,242	1,242	1,242	1,242
Load factor	**50%**	**50%**	**50%**	**50%**	**50%**	**50%**
kWh	48,773	47,546	25,737	9,607	13,049	15,917
Therms	5,876	5,728	3,100	1,620	2,201	1,918
Electric Safety Factor	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
Thermal Safety Factor	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
kWh Savings	48,773	47,546	25,737	9,607	13,049	15,917
Thermal Savings	5,876	5,728	3,100	1,620	2,201	1,918

Chathams School District
Exhibit D
ECM 4B - Roof Replacements
Roof Replacement

ECM DESCRIPTION

Furnish and install a PVC roofing system as manufactured by Sika Samafil or equal.

DATA / ASSUMPTIONS

Heating Hours 3,948 Hours

*U Factors for the new roof was obtained by manufacturer and product data. U Factors for the existing roof is based on construction type and material

MEASUREMENT AND VERIFICATION

Option C - Savings Calculations are based on regression analysis of utility billing meter data

COMMISSIONING

Verify area of new roof installed.

RECOVERY/SAFETY FACTOR

Recovery/Safety Factor (Electric) = **0%**
Recovery/Safety Factor (Thermal) = **0%**

Savings calculations are based on weather bin data, fresh air flows and temperature setpoints. A more conservative of 0 percent is used for this ECM due to the uncertainty of variables. The heating fuel savings calculations are based upon information provided by the equipment vendor.

FORMULAE

$Q_{SAVINGS} = (Q_C - Q_C) + Q_{INF}$

$Q_{INF} = \sum_{-5}^{100} \left(1.08 \cdot (i_{ROOF} - i_{ROOF}) \cdot (T_{W/S} - T_{BIN}) \cdot l_R \cdot t_{BIN} \right) / _{100,000}$

$Q_C = \sum_{-5}^{100} \left((T_{W/S} - T_{BIN}) \cdot A_{ROOF} \cdot U_{ROOF} \cdot t_{BIN} \right) / _{100,000}$
$Q_C = \sum_{-5}^{100} \left((T_{W/S} - T_{BIN}) \cdot A_{ROOF} \cdot U_{ROOF} \cdot t_{BIN} \right) / _{100,000}$

*Note W/S designates use of either winter building setpoint or summer building setpoint with the appropiate bin

Variable	Units	Description
$Q_{savings}$	Therms	Thermal Savings
Q_C	Therms	Conductive/convective cooling gain and heating loss with existing windows
Q_C	Therms	Conductive/convective cooling gain and heating loss with proposed windows
Q_{INF}	Therms	Infiltration savings with proposed windows
$\sum_{-5}^{100}$	-	Summation of all bins from -5°F to 100°F
T_W	°F	Winter building setpoint
T_S	°F	Summer building setpoint
T_{BIN}	°F	Temperature of respective bin
t_{BIN}	Hrs	Hrs in respective bin
A_{ROOF}	ft^2	Existing unoccupied Bin Hours in respective temperature bin
U_{ROOF}	$btu / ft^2 / °F$	Existing U-factor of roof
U_{ROOF}	$btu / ft^2 / °F$	Proposed U-factor of roof
i_{ROOF}	Cfm/ft	Infiltration constant for existing windows
i_{ROOF}	Cfm/ft	Infiltration constant for proposed windows
l_R	ft	Linear feet of curtain wall

Chathams School District
Exhibit D
ECM 4B - Roof Replacements
Roof Replacement

* Inputs are in blue

Building	Roof ft² Audited	U Factor of Existing Roof	U Factor of Proposed Roof	Infiltration of Existing Roof (CFM / linear ft)	Infiltration of Proposed Roof (CFM / linear ft)	EER of Cooling System (Average)
Chatham High School	13,525	0.22	0.10	0.25	0.10	10.0
Totals						

	Chatham High School
Roof ft² Audited	13,525
U of Existing Roof	0.22
U of Proposed Roof	0.10
Infiltration of Existing Roofs	0.25
Infiltration of Proposed Roofs	0.10
Total Linear Ft of Perimeter	465
EER of Cooling System (Average)	10.0
Existing Occupied Heating Setpoint	74.0
Existing Unoccup. Heating Setpoint	70.0
Existing Occupied Cooling Setpoint	70.0
Existing Unoccup. Cooling Setpoint	78.0
Boiler Efficiency	80.0%
Safety Factor	0%
Electrical Savings	7,896
Thermal Savings	2,259

	Total	
		ft²
		btu/ft²/°F
		btu/ft²/°F
		CFM / ft
		CFM / ft
		ft
		°F
		°F
		°F
		°F
		%
		%
		kWh/Yr
		Therms/Yr

CALCULATIONS

CHATHAM HIGH SCHOOL

Amb. Temp Bin °F	Avg Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Hours	Unoccupied Hours	Roof Square Feet	Existing Occupied Cooling Gain and Heating Loss	Existing Unoccupied Cooling Gain and Heating Loss	Proposed Occupied Cooling Gain and Heating Loss	Proposed Unoccupied Cooling Gain and Heating Loss	Cooling or Heating Savings	Infiltration savings	Total Heating or Cooling Savings	Safety Factor	kWh Saved	Input Therms Saved
COOLING									(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)			
100 to 105	102.5	-	1	-	1	1	0	13,525	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0%	18	
95 to 100	97.5	-	19	2	21	18	3	13,525	1.7	0.2	0.8	0.1	1.1	0.0	1.1	0%	323	
90 to 95	92.5	-	44	13	57	46	11	13,525	3.7	0.6	1.7	0.3	2.3	0.1	2.4	0%	699	
85 to 90	87.5	1	167	60	228	181	47	13,525	11.3	1.6	5.1	0.7	7.0	0.2	7.2	0%	2,109	
80 to 85	82.5	31	283	162	476	349	127	13,525	15.6	2.0	7.1	0.9	9.6	0.2	9.8	0%	2,865	
75 to 80	77.5	191	235	280	706	411	295	13,525	11.0	-	5.0	-	6.0	-	6.0	0%	1,757	
70 to 75	72.5	203	177	222	602	327	275	13,525	2.9	-	1.3	-	1.6	-	1.6	0%	466	
65 to 70	67.5	325	165	204	694	327	367	13,525	-	-	-	-	-	-	-	0%	-	
60 to 65	62.5	180	152	195	527	284	243	13,525	-	-	-	-	-	-	-	0%	-	
HEATING																		
55 to 60	57.5	86	144	97	327	199	128	13,525	9.8	2.3	4.5	2.2	5.5	0.3	5.8	0%		72
50 to 55	52.5	109	182	172	463	283	180	13,525	18.1	3.2	8.2	4.3	10.9	0.6	11.5	0%		144
45 to 50	47.5	105	119	142	366	209	157	13,525	16.5	2.8	7.5	4.8	11.0	0.6	11.6	0%		145
40 to 45	42.5	185	155	177	517	277	240	13,525	25.9	4.3	11.8	8.9	18.8	1.1	19.9	0%		248
35 to 40	37.5	236	200	241	677	364	313	13,525	39.6	5.6	18.0	13.7	29.7	1.7	31.4	0%		392
30 to 35	32.5	237	202	198	637	339	298	13,525	41.9	5.3	19.0	15.1	32.6	1.8	34.4	0%		430
25 to 30	27.5	121	115	113	349	191	158	13,525	26.4	2.8	12.0	9.1	20.7	1.1	21.8	0%		272
20 to 25	22.5	149	68	97	314	146	168	13,525	22.3	3.0	10.1	10.8	20.0	1.1	21.1	0%		264
15 to 20	17.5	95	40	46	181	80	101	13,525	13.4	1.8	6.1	7.2	12.7	0.7	13.4	0%		168
10 to 15	12.5	39	9	28	76	32	44	13,525	5.9	0.8	2.7	3.4	5.8	0.3	6.2	0%		77
5 to 10	7.5	21	5	5	31	11	20	13,525	2.2	0.4	1.0	1.7	2.5	0.1	2.7	0%		33
0 to 5	2.5	4	2	-	6	2	4	13,525	0.5	0.1	0.2	0.3	0.5	0.0	0.6	0%		7
-5 to 0	-2.5	4	-	-	4	1	3	13,525	0.2	0.1	0.1	0.3	0.4	0.0	0.4	0%		5
-10 to -5	-7.5	-	-	-	-	-	-	13,525	-	-	-	-	-	-	-	0%		-
-15 to -10	-12.5	-	-	-	-	-	-	13,525	-	-	-	-	-	-	-	0%		-
Total		2,322	2,484	2,454	7,260	4,078	3,182										7,896	2,259

Chathams School District
Exhibit D
ECM 5A - Transformer Replacements
Transformer Replacement

ECM DESCRIPTION

Replace dry transformers with new custom designed high efficiency transformers. New transformers will save electricity and avoid the future replacements due to failure.

DATA / ASSUMPTIONS

* Existing loads were obtained by data logging
* Existing efficiencies were obtained by data logging or manufacturer specifications

MEASUREMENT AND VERIFICATION

Option A - Direct kW and savings measurements before and after installation conducted. A report is generated showing the reduction in kW

COMMISSIONING

Test all transformers after installation

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) =	20%

Recovery factor is set at 10% due to unknown flucuations in transformer loads

FORMULAE

$W_{SAVINGS} = \varepsilon_T - \varepsilon_T$

$\varepsilon_T = \varepsilon_{OCC} \cdot t_{OCC} + \varepsilon_{UNOCC} \cdot t_{UNOCC}$
$\varepsilon_T = \varepsilon_{OCC} \cdot t_{OCC} + \varepsilon_{UNOCC} \cdot t_{UNOCC}$

$\varepsilon_{OCC} = [(Lf_{OCC} \cdot KVA) / \eta_L^{OCC}] - (KVA \cdot Lf_{OCC})$
$\varepsilon_{OCC} = [(Lf_{OCC} \cdot KVA) / \eta_L^{OCC}] - (KVA \cdot Lf_{OCC})$

$\varepsilon_{UNOCC} = [(Lf_{OCC} \cdot KVA) / \eta_L^{UNOCC}] - (KVA \cdot Lf_{OCC})$
$\varepsilon_{UNOCC} = [(Lf_{OCC} \cdot KVA) / \eta_L^{UNOCC}] - (KVA \cdot Lf_{OCC})$

$\eta_L^{OCC} = Lf_{OCC} \cdot kVA \cdot \eta_T$
$\eta_L^{OCC} = Lf_{OCC} \cdot kVA \cdot \eta_T$

$\eta_L^{UNOCC} = Lf_{UNOCC} \cdot kVA \cdot \eta_T$
$\eta_L^{UNOCC} = Lf_{UNOCC} \cdot kVA \cdot \eta_T$

Chathams School District
Exhibit D
ECM 5A - Transformer Replacements
Transformer Replacement

Variable	Units	Description
$W_{savings}$	kWh	Electrical Savings
ε_T	kW	Existing annual transformer losses
ε_T	kW	Proposed annual transformer losses
t_{OCC}	Hrs	Existing Run Hours
t_{UNOCC}	Hrs	Proposed Run Hours
ε_{OCC}	kW	Existing transformer losses during occupied hours
ε_{OCC}	kW	Proposed transformer losses during occupied hours
ε_{UNOCC}	kW	Existing transformer losses during unoccupied hours
ε_{UNOCC}	kW	Proposed transformer losses during unoccupied hours
kVA	kVA	kVA of existing transformer
Lf_{OCC}	-	Load Factor of transformer during occupied hours
Lf_{UNOCC}	-	Load Factor of transformer during unoccupied hours
η_L^{OCC}	%	Existing efficiency of transformer during occupied hours
η_L^{OCC}	%	Proposed efficiency of transformer during occupied hours
η_L^{UNOCC}	%	Existing efficiency of transformer during unoccupied hours
η_L^{UNOCC}	%	Proposed efficiency of transformer during unoccupied hours
η_T	%	Existing weighted efficiency of transformer at various loads
η_T	%	Proposed weighted efficiency of transformer at various loads

* Inputs are in blue
Calculation is automatic. If Efficiencies are known override automatically generated efficiencies in Columns G through M when necessary

	EXISTING							PROPOSED	
Building	**Replace**	**Qty**	**kVA**	**% Load During Occupied Hours**	**% Load During Unoccupied Hours**	**Efficiency at Occupied Loads**	**Efficiency at Unoccupied Loads**	**Efficiency Occupied Loads**	**Efficiency Unoccupied Loads**
Chatham High School	Y	1	15.0	15.0%	10.0%	86.88%	81.90%	96.75%	95.75%
Chatham High School	Y	1	112.5	15.0%	10.0%	92.50%	90.52%	98.20%	97.80%
Chatham High School	Y	1	75.0	15.0%	10.0%	93.00%	91.00%	97.30%	96.20%
Chatham High School	Y	1	75.0	15.0%	10.0%	93.00%	91.00%	97.30%	96.20%
Lafayette School	Y	1	30.0	15.0%	10.0%	89.89%	85.78%	96.90%	95.90%
Chatham Middle School	Y	1	15.0	15.0%	10.0%	86.88%	81.90%	96.75%	95.75%
Chatham Middle School	Y	1	30.0	15.0%	10.0%	89.89%	85.78%	96.90%	95.90%
Chatham Middle School	Y	1	30.0	15.0%	10.0%	89.89%	85.78%	96.90%	95.90%
Chatham Middle School	Y	1	75.0	15.0%	10.0%	93.00%	91.00%	97.30%	96.20%
Chatham Middle School	Y	1	45.0	15.0%	10.0%	90.53%	86.68%	97.10%	96.10%
Chatham Middle School	Y	1	30.0	15.0%	10.0%	89.89%	85.78%	96.90%	95.90%
Chatham Middle School	Y	1	500.0	15.0%	10.0%	94.48%	91.57%	98.45%	98.12%
Washington Avenue School	Y	1	30.0	15.0%	10.0%	89.89%	85.78%	96.90%	95.90%
Southern Boulevard School	Y	1	30.0	15.0%	10.0%	89.89%	85.78%	96.90%	95.90%
Totals		**14**	**1093**						

Chathams School District
Exhibit D
ECM 5A - Transformer Replacements
Transformer Replacement

CALCULATIONS

	Chatham High School	Chatham High School	Chatham High School	Chatham High School	Lafayette School	Chatham Middle School	Chatham Middle School	Chatham Middle School	Chatham Middle School	Chatham Middle School	Chatham Middle School	Chatham Middle School	Washington Avenue School	Southern Boulevard School
Replace Transformer	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
kVa	15.0	112.5	75.0	75.0	30.0	15.0	30.0	30.0	75.0	45.0	30.0	500.0	30.0	30.0
Quantity	1	1	1	1	1	1	1	1	1	1	1	1	1	1
% Load at Occupied Hours	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
% Load at Unoccupied Hours	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Existing Efficiency at Occupied Loads	86.9%	92.5%	93.0%	93.0%	89.9%	86.9%	89.9%	89.9%	93.0%	90.5%	89.9%	94.5%	89.9%	89.9%
Existing Efficiency at Unoccupied Loads	81.9%	90.5%	91.0%	91.0%	85.8%	81.9%	85.8%	85.8%	91.0%	86.7%	85.8%	91.6%	85.8%	85.8%
Proposed Efficiency at Occupied Loads	96.8%	98.2%	97.3%	97.3%	96.9%	96.8%	96.9%	96.9%	97.3%	97.1%	96.9%	98.5%	96.9%	96.9%
Proposed Efficiency at Unoccupied Loads	95.8%	97.8%	96.2%	96.2%	95.9%	95.8%	95.9%	95.9%	96.2%	96.1%	95.9%	98.1%	95.9%	95.9%
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Existing kW Losses Occupied Hours	0.3399	1.3682	0.8468	0.8468	0.5064	0.3399	0.5064	0.5064	0.8468	0.7060	0.5064	4.3819	0.5064	0.5064
Existing kW Losses Unoccupied Hours	0.4974	1.7673	1.1126	1.1126	0.7459	0.4974	0.7459	0.7459	1.1126	1.0373	0.7459	6.9037	0.7459	0.7459
Occupied Hours per Day	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
Occupied Days per Year	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**180**	**180**	**180**	**180**	**180**	**180**	**180**
Existing Annual kWh Losses	4,042	14,683	9,215	9,215	6,055	4,042	6,055	6,103	9,268	8,491	6,103	55,937	6,103	6,103
Proposed kW Losses Occupied Hours	0.0756	0.3093	0.3122	0.3122	0.1440	0.0756	0.1440	0.1440	0.3122	0.2016	0.1440	1.1808	0.1440	0.1440
Proposed kW Losses Unoccupied Hours	0.0666	0.2531	0.2963	0.2963	0.1283	0.0666	0.1283	0.1283	0.2963	0.1826	0.1283	0.9580	0.1283	0.1283
Proposed Annual kWh Losses	601	2,329	2,627	2,627	1,155	601	1,155	1,152	2,624	1,634	1,152	8,793	1,152	1,152
Safety Factor	**20%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**10%**	**10%**	**10%**	**10%**	**10%**
kW Savings	0.211	1.059	0.535	0.535	0.362	0.264	0.362	0.362	0.535	0.454	0.326	2.881	0.326	0.326
kWh Savings	2,753	12,354	6,588	6,588	4,900	3,441	4,900	4,951	6,644	6,171	4,456	42,429	4,456	4,456

Chathams School District
Exhibit D
ECM 6A - Demand Response/Permanent Load Reduction
Demand Response

ECM DESCRIPTION

PJM Demand Response Program based on Shedable Load on Peak Demand Curtailment Day

DATA / ASSUMPTIONS

Demand Response Revenue	$ 44,125	/ MW
Customer Share (Typically between 60-70%)	70%	

*Demand Response Savings = Assumed between 1 - 4% Annual Electrical Load
*Assume 2% of Total District Load as Shedable
*Savings is not Guaranteed any savings from program will be considered operational savings only

MEASUREMENT AND VERIFICATION

None - Operational Savings

COMMISSIONING

N/A

RECOVERY/SAFETY FACTOR

N/A

FORMULAE

$\$_{savings} = kWh_{ADJ} \cdot Cust_{\%} \cdot DM_{\%}$

Variable	Units	Description
$\$_{savings}$	Dollars	Dollar Savings from Demand Response
$DM_{\%}$	%	Demand Response Savings as a percentage of electric baseline
$Cust_{\%}$	**%**	Customer Percentage of Savings
kWh_{BASE}	kWh	Adjusted Boiler Fuel Usage

Chathams School District
Exhibit D
ECM 6A - Demand Response/Permanent Load Reduction
Demand Response

* Inputs are in blue

Building	Demand Response Participation (Y/N)
Chatham High School	Y
Chatham Middle School	Y
Lafayette School	Y
Milton Avenue School	Y
Southern Boulevard School	Y
Washington Avenue School	Y

CALCULATIONS

	Chatham High School	Chatham Middle School	Lafayette School	Milton Avenue School	Southern Boulevard School	Washington Avenue School
Demand Response Participation	Y	Y	Y	Y	Y	Y
Average Monthly kW	540	373	167	76	118	130
Permanent Load Shed Reduction (kW)	153	109	52	28	46	31
Sheddable Load (kW)						
Percentage of Baseline Demand	28.3%	29.2%	31.5%	36.5%	38.7%	24.2%
$ / MW	$ 44,125	$ 44,125	$ 44,125	$ 44,125	$ 44,125	$ 44,125
Demand Hours / Year	100	100	100	100	100	100
Cost to Run Generator / hr	$ -	$ -				
Cost to Run Generator / yr	$ -	$ -				
Safety Factor	0%	0%	0%	0%	0%	20%
Demand Response Savings	$ 6,742	$ 4,799	$ 2,314	$ 1,226	$ 2,013	$ 1,388
Net Demand Response Savings	$ 6,742	$ 4,799	$ 2,314	$ 1,226	$ 2,013	$ 1,388

APPENDIX 3 CUTSHEETS

This Page Intentionally Left Blank

RCS™ Condensing Unit

Job Information	*Technical Data Sheet*
Job Name	Honeywell-Chatham School District
Date	12/9/2014
Submitted By	Jennifer Olivo
Software Version	03.50
Unit Tag	Chatham HS -CU-1-32

Unit Overview

Model Number	Voltage V/Hz/Phase	Refrigeration Effect Btu/hr	Unit Power kW	EER
RCS10F120C	208/60/3	115318	8.9	13.0

Unit

Model Number:	RCS10F120C
Type:	Commercial
Approval:	UL - Canada

Refrigerant Type:	Refrigerant Weight
R410A	21.2 lb

Condensing Section

Temperature		Altitude	Refrigeration Effect	Power
Suction	Ambient			
45.0 °F	95.0 °F	0 ft	115318 Btu/hr	8.9 kW

Compressor

Quantity	Type	Capacity Control	Compressor Isolation
1	Scroll	1 step	Resilient

Full Load Current:

Compressor 1	30.1 A

Condenser

Coil			Fans	Fan Motors	
Type	Number of Rows	Fins per Inch	Condenser Fan Type	Quantity	Full Load Current
Copper tube	2	18	Standard	2	2.40 A

Physical

Dimensions and Weight

Length	Height	Width	Operating Weight
62.1 in	44.8 in	38.4 in	501 lb

Electrical

Voltage	MROPD	Field Power Connection	MCA	SCCR	Field Outlet Connection
208/60/3 V/Hz/Phase	60 A	Single power block	43.0 A	10 kAIC	115V, 20 amp service

Options

Unit	
Condenser Coil Options:	Aluminum fins
Electrical	
Wiring Options	Sealtite conduit
GFI Receptacle	None
Unit Control	
Temperature Controls:	Terminal strip for YGR
Low Ambient Control:	0 degree standard

Warranty

Parts:	Standard one year parts
Compressor:	Standard five year compressor

Notes

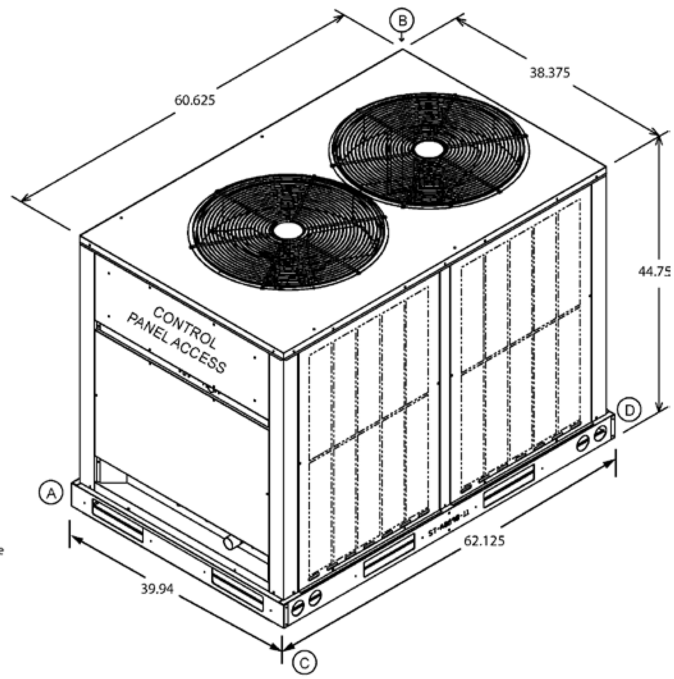
UNIT DIMENSIONS

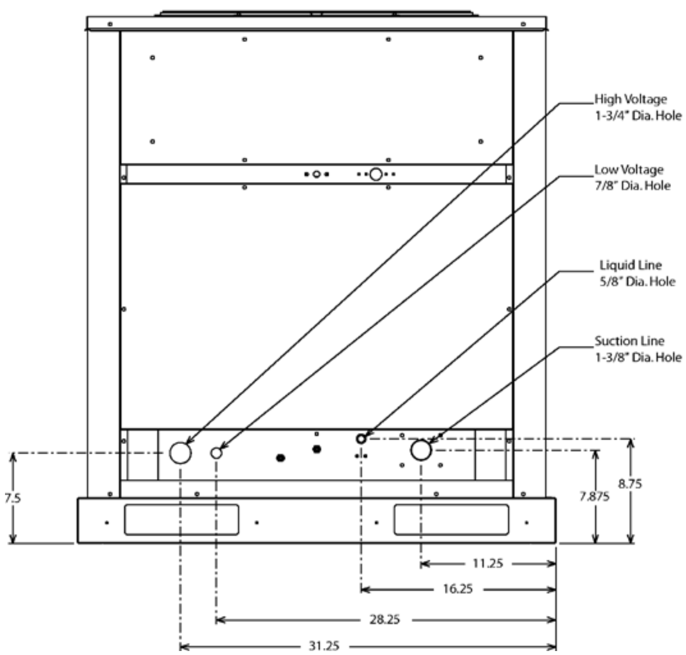
10 TON [35.2 kW]

CORNER WEIGHTS (LBS.) [kg]

MODEL	TOTAL WEIGHT LBS . [k g]	Corner Weights, Lbs. [kg]			
		A	B	C	D
RCS 10F	501 [228]	123 [55.9]	132 [60.0]	119 [54.1]	127 [58.0]
RCS 11F	586 [266]	144 [65.3]	154 [69.9]	139 [63.2]	149 [67.6]

[ ] Designates Metric Conversions





Product Drawing	Unit Tag: Chatham HS -CU-1-32			DAIKIN		
Product:	Project Name: Honeywell-Chatham School			13600 Industrial Park Blvd. Minneapolis, MN 55441		
Model: RCS10F120C	Sales Office: D & B Eng. of New Jersey, Inc			www.DaikinApplied.com Software Version: 03.50		
Sales Engineer:	Dec. 09, 2014	Ver/Rev:	Sheet 1 of 1	Scale: NTS	Tolerance: +/-0.25"	Dwg Units: in [mm]

No change to this drawing may be made unless approved in writing by Daikin Applied. Purchaser must determine that the equipment is fit and sufficient for the job specifications.

DAIKIN

Job Information	Technical Data Sheet
Job Name	Honeywell-Chatham School District
Date	12/9/2014
Submitted By	Jennifer Olivo
Software Version	04.20
Unit Tag	Chatham HS - Under Cafeteria

Unit Overview

Model Number	Voltage V/Hz/Phase	Airflow CFM	Static Pressure		Unit Configuration
			External inH_2O	Total inH_2O	
LAH010A	208/60/3	5157	1.00	1.78	Horizontal

Unit

Model Number:	LAH010A
Type:	Indoor Air Handler
Configuration	Horizontal
Construction:	Double-wall construction with foam injected insulation
Approval:	AHRI, ETL, CETL & MEA

Physical

Unit

Length	Height	Width	Weight
58.9 in	32.5 in	63.0 in	524 lb

Unit Construction

Outer Panel	Inner Liner	Insulation	Frame	Access
Galvanized Steel	Galvanized steel	1 inch Expanded Foam	1 inch Aluminum	Removable panels access; Side filter and fan

Filter

Type	Face Area	Filter Face Velocity	Air Pressure Drop	Air Pressure Drop Type	(Quantity) Height x Width x Depth
Pleated (MERV 8)	10.0 ft²	518.3 ft/min	0.34 inH_2O	Clean Pressure Drop	(3) 20 in x 25 in x 2 in

Chilled Water Cooling Coil

Physical

Fins per Inch	Rows	Face Area	Face Velocity	Fin Height	Fin Length	Air Pressure Drop
12	4	9.8 ft^2	528.9 ft/min	26.0 in	54.0 in	0.44 inH_2O

Material

Fin	Tube	Header	Casing
.0060 in Aluminum	.013 in Copper	Copper	Galvanized steel casing

Connection

Size	Type	Location
1.625 in OD	Copper Sweat	Drive Side

Drain Pan

Material	Connection	Secondary Connection
Stainless steel	1 in ID MPT	1/2 in ID MPT

Performance

Capacity		Air Temperature			
		Entering		Leaving	
Total Btu/hr	Sensible Btu/hr	Dry Bulb °F	Wet Bulb °F	Dry Bulb °F	Wet Bulb °F
179534	128940	80.0	67.0	57.1	55.9

Fluid

Type	Entering Temperature	Leaving Temperature	Flow Rate gpm	Pressure Drop ft H_2O	Velocity ft/min
Water	45.0	53.7	41.3	14.5	4.9

Supply Fan

Fan

Type	Class	Wheel Diameter	Orientation	Vibration Isolation
Forward Curved	Class 1	12 in x 12 in	Top Horizontal - CCW Rotation	Rubber in Shear

Motor

Horsepower	Type	Efficiency	Voltage	Full Load Current	Drive Side
7.5 HP	Open Drip Proof	91.0 %	208/60/3 V/Hz/Phase	22.3 A	Left Hand

Drives

VFD	Sheaves		Belts	
	Fan	Motor	Quantity	Part Number
60 Hz	2B5V62	2VP60	2	B47

Performance

Air Flow CFM	Total Static Pressure inH_2O	Fan Speed RPM	Brake Horsepower HP	Outlet Velocity ft/min	Altitude ft
5157	1.78	1378	5.71	3557	0

Sound

Sound Power (db)

Frequency	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Inlet	96	90	88	89	87	86	84
Discharge	96	95	97	94	92	89	83
Radiated	91	83	82	78	76	70	61

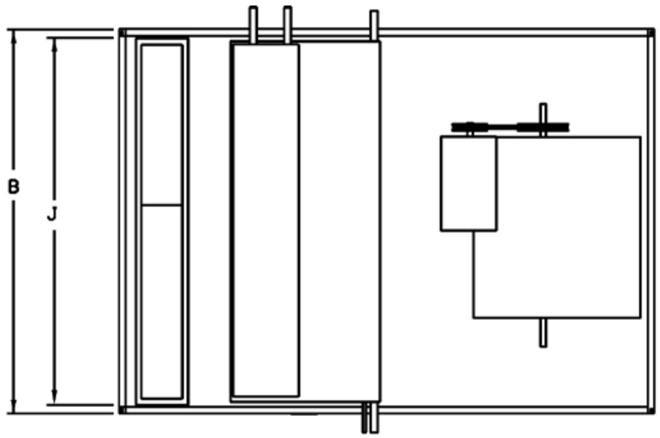
Internal Pressure Drop Calculation

Cooling Coil:	0.44 inH_2O
Filter:	0.34 inH_2O
Total Internal Pressure Drop:	0.78 inH_2O

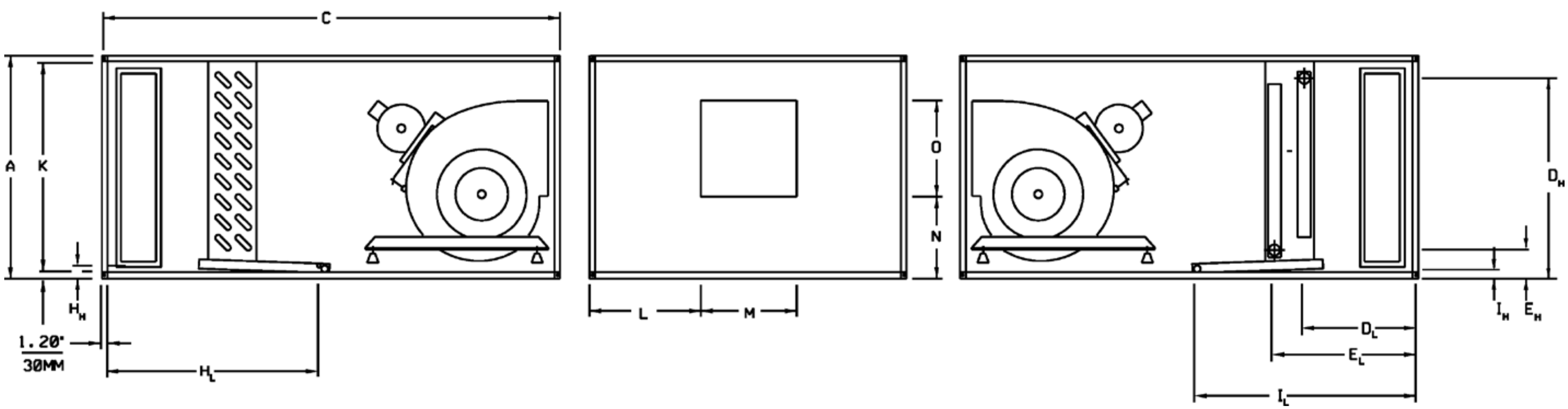
AHRI Certification

All equipment is rated and certified in accordance with AHRI 430.

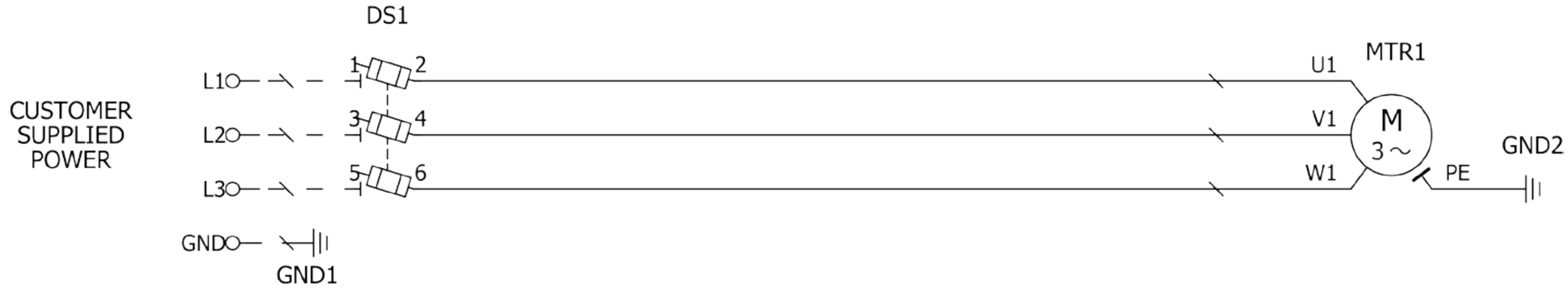
Notes



Dimensions		
Description	**Letter**	**Dimension (in)**
Unit Height	A	32.48
Unit Width	B	63
Unit Length	C	58.86
Coil 1 (Water Return) (DX Suction) Connection	D_L	11.87
Coil 1 (Water Return) (DX Suction) Connection	D_H	26.66
Coil 1 (Water Supply) (DX Liquid) Connection	E_L	14.47
Coil 1 (Water Supply) (DX Liquid) Connection	E_H	5.2
Drain Connection - Secondary	H_L	22.1
	H_H	2.48
Drain Connection - Primary	I_L	24.85
	I_H	1.72
Return Opening Width	J	60.64
Return Opening Height	K	30.12
Discharge Opening Location - Width	L	23.74
Discharge Opening Width	M	15.51
Discharge Opening Location - Height	N	8.9
Discharge Opening Height	O	13.46

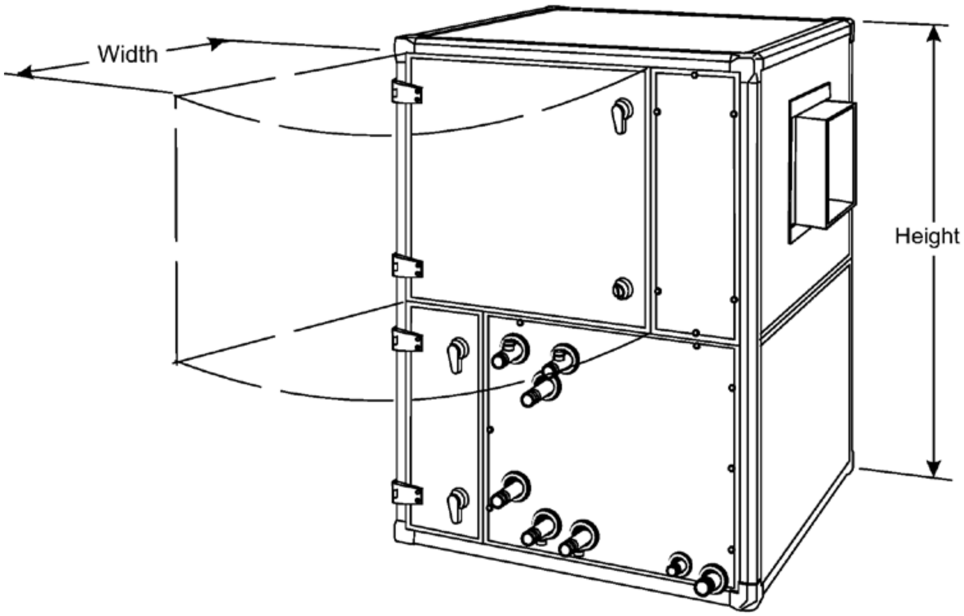


Product Drawing	Unit Tag: Chatham HS - Under Cafeteria		Sales Office: D & B Eng. of New Jersey, Inc			DAIKIN
Product:	Project Name: Honeywell-Chatham School		Sales Engineer:			13600 Industrial Park Blvd. Minneapolis, MN 55441
Model: LAH010A	Dec. 09, 2014	Ver/Rev: Sheet: 1 of 1	Scale: NTS	Tolerance: +/- 0.25"	Dwg Units: (in)	www.DaikinApplied.com Software Version: 04.20

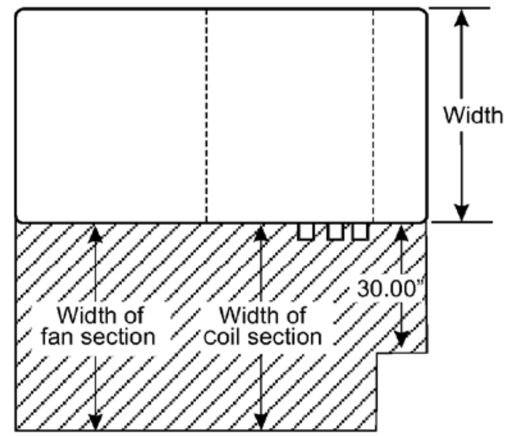


Product Drawing	Unit Tag: Chatham HS - Under Cafeteria		Sales Office: D & B Eng. of New Jersey, Inc			DAIKIN
Product:	Project Name: Honeywell-Chatham School		Sales Engineer:			13600 Industrial Park Blvd. Minneapolis, MN 55441
Model: LAH010A	Dec. 09, 2014	Ver/Rev:	Sheet: 1 of 1	Scale: NTS	Tolerance: +/- 0.25"	Dwg Units: in [mm]	www.DaikinApplied.com Software Version: 04.20

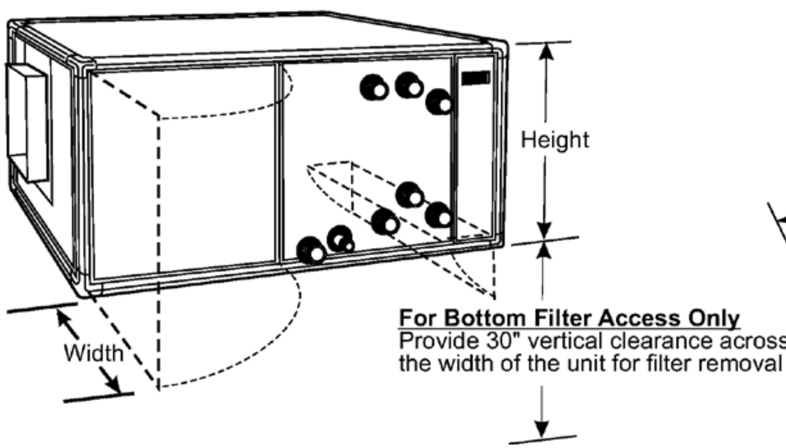
Vertical unit



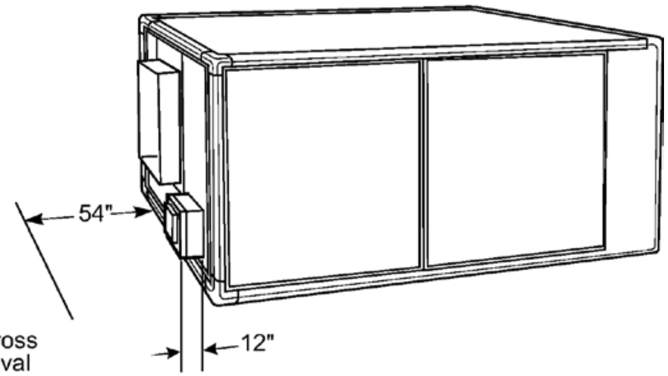
Top view



Horizontal unit



Electric power clearance



Product Drawing	Unit Tag: Chatham HS - Under Cafeteria			Sales Office: D & B Eng. of New Jersey, Inc		
Product:	Project Name: Honeywell-Chatham School			Sales Engineer:		
Model: LAH010A	Dec. 09, 2014	Ver/Rev:	Sheet: 1 of 1	Scale: NTS	Tolerance: +/- 0.25"	Dwg Units: in [mm]

DAIKIN
13600 Industrial Park Blvd. Minneapolis, MN 55441
www.DaikinApplied.com Software Version: 04.20

AIRIUS®

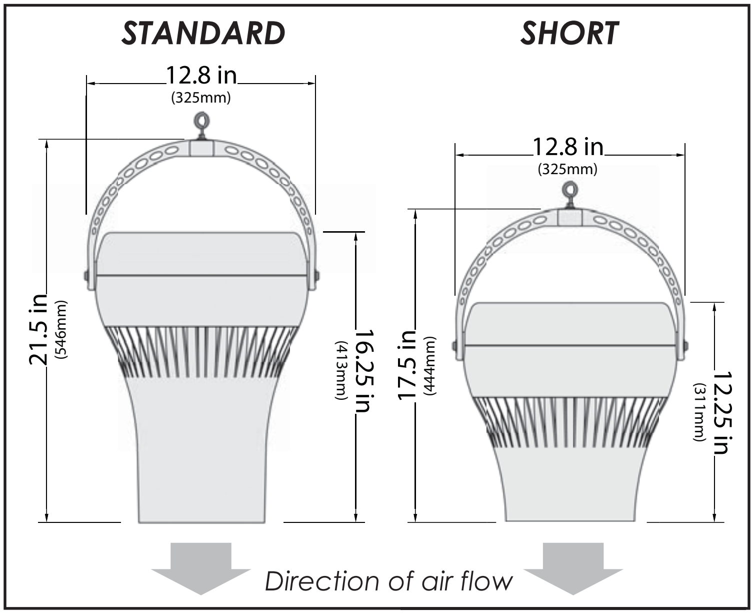
AIR PEAR 25 SUBMITTAL

UP TO 25 FT MOUNTING HEIGHT
MAX COVERAGE 1200 FT ²

Print Form

MODEL	VOLTS 1Ø	HZ	*AMPS	*WATTS	*MAX RPM	*MAX CFM	*dB(A)	WEIGHT	MOUNTING HEIGHT	COVERAGE AREA
25	120	50/60	0.30/0.32	30/35	1500/1650	459/547	50	7 lb/9 lb	Up to 25 ft.	Up to 1200 ft²
25	230	50/60	0.14/0.13	31/33	1450/1650	459/547	50	7 lb/9 lb	Up to 25 ft.	Up to 1200 ft²
25	277	50/60	0.13/0.17	35/45	1500/1650	459/547	50	7 lb/9 lb	Up to 25 ft.	Up to 1200 ft²

*0-static motor data supplied by fan manufacturer. Subject to change at any time.



PROJECT	
ENGINEER	
ARCHITECT	
CONTRACTOR	
SUBMITTED BY	
DATE	
CONFIGURATION	
QUANTITY	

ORDERING LOGIC

Enter part number into the configuration field above

Style	Model	Motor Type	Nozzle Length	Voltage	Color
A (Air Pear)	25	SP (Shaded Pole)	**(Short) SH** **(Standard) STD**	**120** **230** **277**	**(Off White) W** **(Gray) G** **(Black) B**

EXAMPLE: A - 25 - SP - **STD - 120 - W**

- **Color** (W)
- **Voltage (AC)** (120)
- **Nozzle Length** (STD)
- Motor Type (SP)
- Model (25)
- Style (A)

DESTRATIFICATION FAN DESCRIPTION

The patented Air Pear Thermal Equalizer creates uniform air temperatures from floor to ceiling for maximum thermal comfort and energy savings up to 35% in the heating season and up to 25% in the cooling season. Conforms to UL-507, ACAN/CSA-IEC-E60335-1, UL 94 5VA and is ETL listed in USA and Canada.

HOUSING

- *PC/ABS resin*
- *5VA flame resistance rating*

MOTOR

- *Single phase, shaded pole, single speed (variable with optional speed control), axial motor.*
- *Motor is thermally protected. Shutoff is at 230˚ F (110˚ C) & reset is at 195˚ F (90˚ C).*
- *Operating temperature: -4˚ F (-20˚ C) to 158˚ F (70˚ C).*
- *No lubrication required. Bearings are sealed.*
- *6' cord and plug provided for 120V, no plug for 230/227V*

STATOR

- *PC/ABS resin, fixed blade stator*

SAFETY CABLE

- *6' length steel cable (fastened to body)*

WARRANTY

- *Warranty - 3-years parts and workmanship*
- *Money back guarantee - 30 days*
- *Refurbish program after 3-year warranty period*

ACCESSORIES *(additional costs apply)*

Speed Control *(coordinate w/ electrical requirement)*

- ☐ **TRIAC-120-1.5**: *1.5 Amp, 120V, Up to 3 fans*
- ☐ **TRIAC-120-5**: *5 Amp, 120V, Up to 14 fans*
- ☐ **TRIAC-120-15**: *15 Amp, 120V, Up to 45 fans*
- ☐ **TRIAC-230-8**: *8 Amp, 230V, Up to 56 fans*
- ☐ **TRIAC-277-5**: *5 Amp, 277V, Up to 28 fans*

Photohydroionization Cell

- ☐ **PHI-5-C:** *5" (Short nozzle) - adds 9 watts*
- ☐ **PHI-9-C:** *9" (Standard nozzle) - adds 10 watts*

PC/ABS

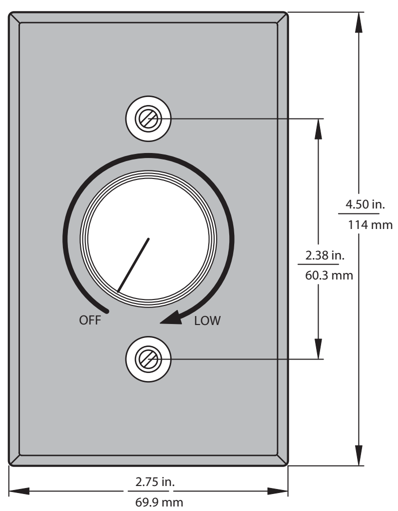
811 South Sherman Street, Longmont, Colorado 80501, Phone: 303.772.2633, Fax: 303.772.8276, info@theairpear.com, www.theairpear.com
May be covered by one or more of the following United States Patents: 7,381,129 B2; D514688 and other patents pending

TRIAC-120-5 SPEED CONTROL SUBMITTAL

FOR CONTROL OF SINGLE OR MULTIPLE FANS

Print Form

MODEL	VOLTAGE	AMPS	FAN QUANTITY ON DEDICATED CIRCUIT					
			MODEL 10	MODEL 15	MODEL 25	MODEL 45-PSP4	MODEL 45-PSP2	MODEL 60-PSP4
TRIAC-120-5	120V	5	37	34	14	11	3	4



PROJECT	
ENGINEER	
ARCHITECT	
CONTRACTOR	
SUBMITTED BY	
DATE	
QUANTITY	

PART NUMBER & QUANTITY

☐ TRIAC-120-5 Qty. _______

TRIAC SPEED CONTROL DESCRIPTION

Airius speed controls are used to vary the speed of shaded pole or permanent split capacitor (PSC) motors (Air Pear or Designer Series 10, 15, 25, 45-P4, 45-P2, or 60-P4). Speed controls for EC motors: refer to the potentiometer submittal. Speed control for EL fans: refer to the FanCenter submittal.

ATTRIBUTES AND CHARACTERISTICS

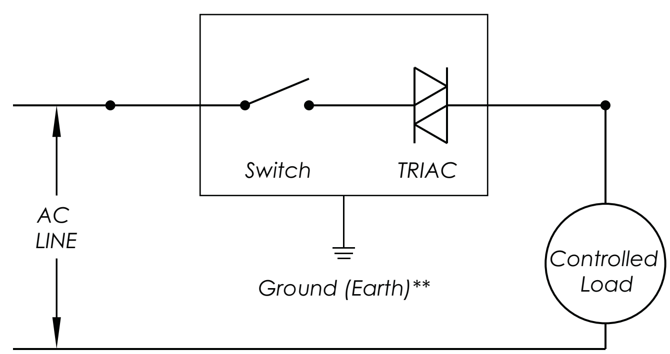
- Built-in On/Off AC line switch
- Minimum speed trimpot
- RFI filter (provides RFI and EMI suppression)
- All models mount in a standard 2” x 4” electrical wall box
- Faceplate (4.5” x 2.75”), knob, screws and wire nuts included
- Simple installation by a qualified electrician
- Adjust top 50% RPM
- Can control multiple fans on a single dedicated circuit

CODE APPROVAL

- UL listing/recognition
- CSA certified

WARRANTY

- Warranty - 1 - years parts and workmanship



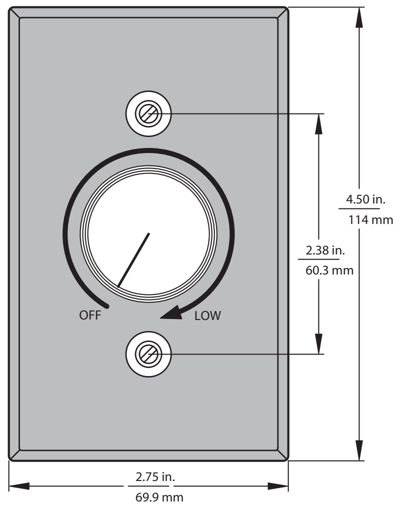
811 South Sherman Street, Longmont, Colorado 80501, Phone: 303.772.2633, Fax: 303.772.8276, info@theairpear.com, www.theairpear.com

TRIAC-120-1.5 SPEED CONTROL SUBMITTAL

FOR CONTROL OF SINGLE OR MULTIPLE FANS

Print Form

			FAN QUANTITY ON DEDICATED CIRCUIT					
MODEL	VOLTAGE	AMPS	MODEL 10	MODEL 15	MODEL 25	MODEL 45-PSP4	MODEL 45-PSP2	MODEL 60-PSP4
TRIAC-120-1.5	120V	1.5	10	9	4	3	1	1



PROJECT	
ENGINEER	
ARCHITECT	
CONTRACTOR	
SUBMITTED BY	
DATE	
QUANTITY	

PART NUMBER & QUANTITY

☐ TRIAC-120-1.5 Qty. _______

TRIAC SPEED CONTROL DESCRIPTION

Airius speed controls are used to vary the speed of shaded pole or permanent split capacitor (PSC) motors (Air Pear or Designer Series 10, 15, 25, 45-P4, 45-P2, or 60-P4). Speed controls for EC motors: refer to the potentiometer submittal. Speed control for EL fans: refer to the FanCenter submittal.

ATTRIBUTES AND CHARACTERISTICS

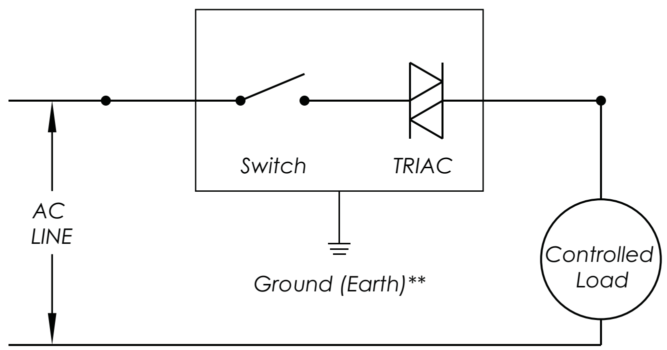
- Built-in On/Off AC line switch
- RFI filter (provides RFI and EMI suppression)
- All models mount in a standard 2" x 4" electrical wall box
- Faceplate (4.5" x 2.75"), knob, screws and wire nuts included
- Simple installation by a qualified electrician
- Off - Max - Hi - Med - Low speeds (4 step)
- Can control multiple fans on a single dedicated circuit

CODE APPROVAL

- UL listing/recognition
- CSA certified

WARRANTY

- Warranty - 1 - years parts and workmanship



811 South Sherman Street, Longmont, Colorado 80501, Phone: 303.772.2633, Fax: 303.772.8276, info@theairpear.com, www.theairpear.com
May be covered by one or more of the following United States Patents: 7,381,129 B2; D514688 and other patents pending

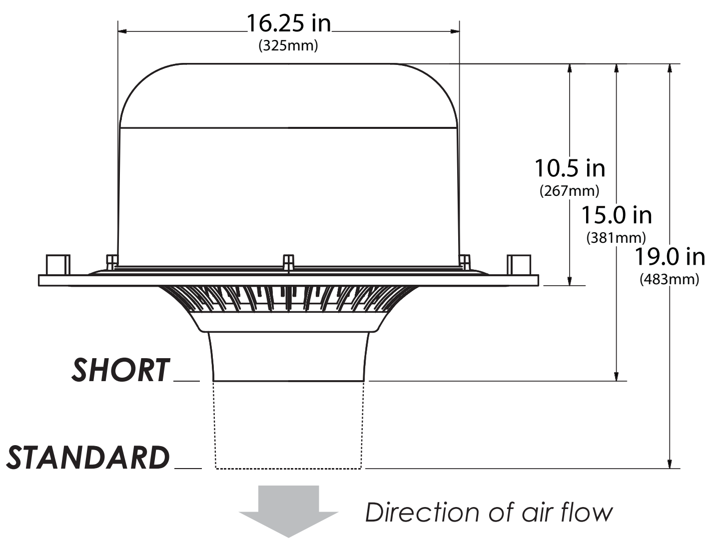
AIR PEAR SUSPENDED 15 SUBMITTAL

UP TO 18 FT MOUNTING HEIGHT
MAX COVERAGE 800 FT ²

Print Form

MODEL	VOLTS 1Ø	HZ	*AMPS	*WATTS	*MAX RPM	*MAX CFM	*dB(A)	WEIGHT	MOUNTING HEIGHT	COVERAGE AREA
15	120	50/60	0.11/0.14	13.5/17	1230/1260	406	36	16 lb	Up to 18 ft.	Up to 800 ft²
15	230	50/60	0.06/0.07	15/17	1230/1260	406	36	16 lb	Up to 18 ft.	Up to 800 ft²

*0-static motor data supplied by fan manufacturer. Subject to change at any time.



PROJECT	
ENGINEER	
ARCHITECT	
CONTRACTOR	
SUBMITTED BY	
DATE	
CONFIGURATION	
QUANTITY	

ORDERING LOGIC
Enter part number into the configuration field above

Style	Model	Motor Type	Nozzle Length	Voltage	Color
S (Suspended)	15	SP (Shaded Pole)	**(Short) SH (Standard) STD**	**120 230**	**(Off White) W (Black) B**

EXAMPLE: S - 15 - SP - **STD - 120 - W**

- **Color**
- **Voltage (AC)**
- **Nozzle Length**
- Motor Type
- Model
- Style

DESTRATIFICATION FAN/AIR TURBINE DESCRIPTION
The patented Air Pear Thermal Equalizer creates uniform air temperatures from floor to ceiling for maximum thermal comfort and energy savings up to 35% in the heating season and up to 25% in the cooling season. Conforms to UL-507, ACAN/CSA-IEC-E60335-1, UL 94 5VA and is ETL listed in USA and Canada.

HOUSING
- *23.8" x 23.8" lay-in ceiling mount*
- *PC/ABS resin*
- *5VA flame resistance rating*

MOTOR
- *Single phase, shaded pole, single speed (variable with optional speed control), axial motor.*
- *Motor is thermally protected. Shutoff is at 230˚ F (110˚ C) & reset is at 195˚ F (90˚ C).*
- *Operating temperature: -4˚ F (-20˚ C) to 158˚ F (70˚ C).*
- *No lubrication required. Bearings are sealed.*
- *A junction box and receptacle are supplied. Electrical contractor will need to provide MC cable and wire directly to j-box/receptacle mounted to side of dome.*

STATOR
- *PC/ABS resin, fixed blade stator*

WARRANTY
- *Warranty - 3-years parts and workmanship*
- *Money back guarantee - 30 days*
- *Refurbish program after 3-year warranty period*

***ACCESSORIES** (additional costs apply)*

***Speed Control** (coordinate w/ electrical requirement)*
- ☐ ***TRIAC-120-1.5**:1.5 Amp, 120V, Up to 9 fans*
- ☐ ***TRIAC-120-5**: 5 Amp, 120V, Up to 34 fans*
- ☐ ***TRIAC-120-15**: 15 Amp, 120V, Up to 105 fans*
- ☐ ***TRIAC-230-8**: 8 Amp, 230V, Up to 113 fans*

Photohydroionization Cell
- ☐ ***PHI-5-C:** 5" (Short nozzle) - adds 9 watts*
- ☐ ***PHI-9-C:** 9" (Standard nozzle) - adds 10 watts*

811 South Sherman Street, Longmont, Colorado 80501, Phone: 303.772.2633, Fax: 303.772.8276, info@theairpear.com, www.theairpear.com
May be covered by one or more of the following United States Patents: 7,381,129 B2; D514688 and other patents pending

AIRIUS®

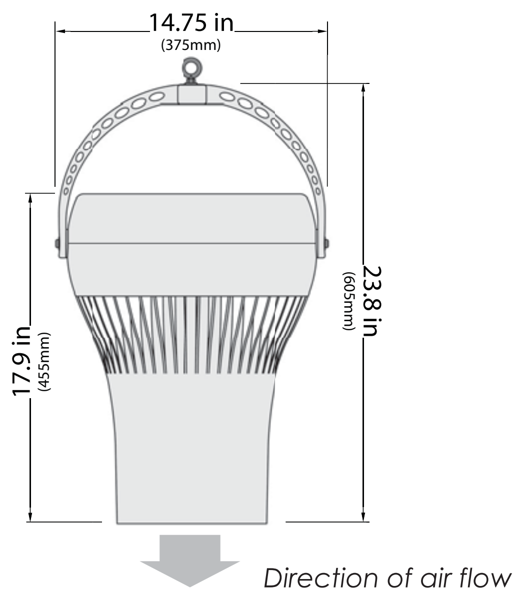
AIR PEAR 45-P4 SUBMITTAL

UP TO 38 FT MOUNTING HEIGHT
MAX COVERAGE 1200 FT ²

Print Form

MODEL	VOLTS 1Ø	HZ	*AMPS	*WATTS	*MAX RPM	*MAX CFM	*dB(A)	WEIGHT	MOUNTING HEIGHT	COVERAGE AREA
45-P4	120	50/60	0.40/0.41	44/46	1400/1650	595/715	58	14 lb	Up to 38 ft.	Up to 1200 ft²
45-P4	230	50/60	0.19/0.2	42/45	1450/1630	595/707	58	14 lb	Up to 38 ft.	Up to 1200 ft²
45-P4	277	50/60	0.19/0.2	42/45	1450/1630	595/707	58	14 lb	Up to 38 ft.	Up to 1200 ft²

*0-static motor data supplied by fan manufacturer. Subject to change at any time.



PROJECT	
ENGINEER	
ARCHITECT	
CONTRACTOR	
SUBMITTED BY	
DATE	
CONFIGURATION	
QUANTITY	

ORDERING LOGIC

Enter part number into the configuration field above

Style	Model	Motor Type	Nozzle Length	Voltage	Color
A (Air Pear)	45	P4 (permanent split capacitor)	(Standard) STD	**120** **230** **277**	**(Off White) W** **(Gray) G** **(Black) B**

EXAMPLE: A - 45 - P4 - STD - **120** - **W**

- **Color**
- **Voltage (AC)**
- Nozzle Length
- Motor Type
- Model
- Style

DESTRATIFICATION FAN DESCRIPTION

The patented Air Pear Thermal Equalizer creates uniform air temperatures from floor to ceiling for maximum thermal comfort and energy savings up to 35% in the heating season and up to 25% in the cooling season. Conforms to UL-507, ACAN/CSA-IEC-E60335-1, UL 94 5VA and is ETL listed in USA and Canada.

HOUSING

- PC/ABS resin
- 5VA flame resistance rating

MOTOR

- Permanent Split Capacitor, single speed (variable with optional speed control), axial motor.
- Motor is thermally protected. Shutoff is at 275˚ F (135˚ C) & reset is at 255˚ F (125˚ C).
- Operating temperature: -13˚ F (-25˚ C) to 158˚ F (70˚ C).
- No lubrication required. Bearings are sealed.
- 6' cord and plug provided for 120V, no plug for 230/277V

STATOR

- PC/ABS resin, fixed blade stator

GUARD GRILLE

- Steel, phosphated and coated in black plastic

SAFETY CABLE

- 6' length steel cable (fastened to body)

WARRANTY

- Warranty - 3 - years parts and workmanship
- Money back guarantee - 30 days
- Refurbish program after 3-year warranty period

ACCESSORIES (additional costs apply)

Speed Control (coordinate w/ electrical requirement)

- ☐ **TRIAC-120-1.5**: 1.5 Amp, 120V, Up to 3 fan
- ☐ **TRIAC-120-5**: 5 Amp, 120V, Up to 11 fans
- ☐ **TRIAC-120-15**: 15 Amp, 120V, Up to 35 fans
- ☐ **TRIAC-230-8**: 8 Amp, 230V, Up to 39 fans
- ☐ **TRIAC-277-5**: 5 Amp, 277V, Up to 24 fans

Photohydroionization Cell

- ☐ **PHI-9-C:** 9" (Standard nozzle) - adds 10 watts

PC/ABS

811 South Sherman Street, Longmont, Colorado 80501, Phone: 303.772.2633, Fax: 303.772.8276, info@theairpear.com, www.theairpear.com
May be covered by one or more of the following United States Patents: 7,381,129 B2; D514688 and other patents pending

Controlling Energy Costs With Best Energy Reduction Tools (BERT)

Executive Summary:

As companies, consumers and the country look for ways to save energy and reduce pollution, increased attention will be focused on new ways of controlling the energy use of the legion of smaller electrical loads which now represent the major source of growth in total energy use. While energy managers have been quick to identify and automate large sources of energy use (like HVAC), controlling many smaller devices spread throughout a building is difficult to do. The promotion of 'good habits' like turning off lights and computers may have short term impacts, but sustaining these types of activities over time has proven to be difficult. This paper describes a new approach to facility energy management that leverages a building's existing WiFi network to control end uses throughout a building. By connecting 'smart plugs' to a web-based software interface, energy managers can program schedules by end-use that control energy consumption during times when facilities are not being used. Case studies of university, office, restaurant and residential applications illustrate a range of ways in which the technology can be used. The end uses described in these cases average a 6 month payback. If widely adopted, the control of 'small use' devices could save approximately 461 million kWh and 632 million pounds of carbon annually.

Section 1: Introduction

As energy prices increase and companies and organizations place increased focus on the environment, facility energy managers are challenged to find ways of controlling the energy use of an ever-widening variety of electronic devices. While most managers have made significant strides increasing the efficiency and control of major end uses like HVAC, a large portion of each facility's bill is spent on 'the little stuff'—computers, lights, and other relatively new electronic devices. This paper describes and documents a new patented technology that utilizes the existing WiFi infrastructure to control devices throughout a facility. Section 2 describes the explosion of electronic devices, which represents both a significant growth area for energy demand as well as a new, untapped opportunity for savings. Section

3 provides an overview of past attempts to control diffuse devices over networks, and provides a glimpse into the future of 'smart' appliances. Section 4 describes a new technology called "BERT", for Best Energy Reduction Technologies. Particular focus is placed on how the software interface allows for the individual control of virtually any device. Section 5 describes how the technology can operate within a university, office, restaurants and in residential applications. Section 6 concludes by documenting the savings potential of the technology in several key sectors, and illustrates the potential for this type of technology to transform how energy use is managed in homes and businesses.

Section 2: The Electronics Explosion: Growth and Savings Opportunity

Despite the increased efficiency of a wide variety of many electronic devices, efficiency gains for many facilities have been countered by a proliferation of new devices. Spending on PCs continues to be strong, growing 22.7% in 2010 according to iSuppli, a company that tracks technology sales. According to the Department of Energy's Building Data Book, total energy use for computers rose 43% between 2006 and 2010. Even more startling is the growth in uncategorized uses, which jumped 663% during the period[1]. The increasing number of peripheral devices, from iPhones, to video conferencing equipment and large format LED and plasma displays all add up. Energy use at work is clearly on the rise, despite the increased efficiency of new equipment. Similar growth is taking place residentially. According to the Nielsen Television Audience Report[2], the number of TV's per household is now 2.86, jumping 43% since 1990. In addition, 88% of homes have a DVD, over 80% of homes have a computer, and of those homes 92% had internet access[3].

A byproduct of the proliferation of devices is phantom load. Phantom load refers to energy that is used when a device is off. This includes energy used by TV's when they're in standby mode (i.e. when they can be turned on with a remote), and energy used by chargers or a laptop's AC adapter. Studies estimate that phantom load now accounts for 6% of all energy use.

This increase in energy consumption has been made worse by increases in price. Recent data from the Department of Energy shows that average electricity prices have increased in all three sectors (commercial, residential, industrial) between 2009-2010[4]. The lifting of rate caps in many states has already lead to dramatic price increases. Electricity rates have already increased 39% in Maryland, 21% in Illinois, and are projected to increase 40-70% in Pennsylvania.

With the increasing number of devices, many facilities managers must rely on people to remember to turn out the lights, or unplug their printers when not in use. However this is easier said than done. A

---

[1] http://buildingsdatabook.eren.doe.gov/docs/DataBooks/2009_BEDB_Updated.pdf

[2] http://blog.nielsen.com/nielsenwire/wp-content/uploads/2009/07/tva_2008_071709.pdf

[3] http://blog.nielsen.com/nielsenwire/online_mobile/home-internet-access-continuing-to-grow-but-big-differences-among-demographics/

[4] http://www.eia.doe.gov/cneaf/electricity/epm/epm_sum.html

study conducted by the Alliance for Efficiency found that the impact of behaviorally-based conservation programs wanes within a year, even when education campaigns are ongoing[5].

Section 3: The Device Control Industry: Past, Present and Future

Home automation and control technologies have been around for years, and have the potential to reduce the energy used by a wide variety of devices. Pioneers such as X10 created a communications protocol that used in-home electric wiring to transmit commands to compatible devices. These technologies have advanced over the years to utilize wireless transmission (for example, X10 now uses 310 MHz radio frequency to transmit commands to specially equipped devices within the home.) While significant effort has been put behind these technologies a host of problems have hindered widespread adoption, including unreliability due to wiring impedance, slow response time, and interference with/from other household appliances and devices. Despite the apparent allure of ubiquitous electrical wiring, X10 lacked the ease, reliability and security needed for the product segment to grow.

Individual manufacturers, such as Lutron, have created proprietary high-end home control products intended to provide high levels of control, allowing the programming of lighting 'schemes', and the integrated control of equipment throughout the home. These high cost end-to-end solutions provide an interesting niche product for high end or specialty customers, but do not appeal to the mass market. At the other end of the market, products like Belkin's Conserve[6] Surge With Timer builds a timer into standard surge strip allowing an individual user to set the strip to turn off during select hours.

More recently, the Zigbee suite of proprietary communications protocols has made an appearance in the home control market. Under the Smart Energy 2.0 initiative, Zigbee proponents have created a data standard that they hope will be adopted by a potentially large AMI and Smart Metering industry. While the potential of this utility-driven segment is large, its success will rely on the installations of millions of Zigbee enabled electric meters and related devices.

Section 4: What Makes BERT different?

BERT provides a deceptively simple solution to the device control dilemma. First, BERT was built on a large, reliable, existing networking technology- WIFI. Building the control platform on the existing network has several key benefits:

1. Ubiquity: Virtually all homes and businesses are wifi-enabled. This means that any building that has wi-fi can easily utilize a "Plug and Play" BERT device.

---

[5] http://www.allianceforwaterefficiency.org/public_education.aspx
[6] http://www.belkin.com/energy/conserve/default.aspx

2. Reliability: WiFi networks have achieved an amazingly high degree of reliability and security. This reliability meaning that the problems of cross-device interference and the lack of security are no longer issues.

3. Cost: Because the wifi network already exists, no special equipment needs to be purchased as would be with proprietary or other standards such as ZigBee. This allows for the lowest total cost solution in the marketplace.

4. Ease of installation and use: The computer-based control software allows devices to be easily programmed or controlled through any computer-enabled device. BERT does not rely on proprietary physical control panels, or specially-wired consoles. Instead BERT takes commands through common MAC, PC or Smart Phone devices consumers and businesses already use.

Figure 4-1 shows how the BERT device works. The Enterprise Application Program (EAP) is installed on one computer on the network, and is used to set schedules, group devices, and monitor activity. On/Off requests are sent through the existing network router using WiFi. Each BERT plug contains a microchip and antenna that communicates with the EAP on a periodic basis. The BERT EAP uses SNMP (Simple Network Management Protocol) to monitor the activity of connected devices (plugs). When a BERT plug receives an “off” command, the module turns off all power supplied to the plug.

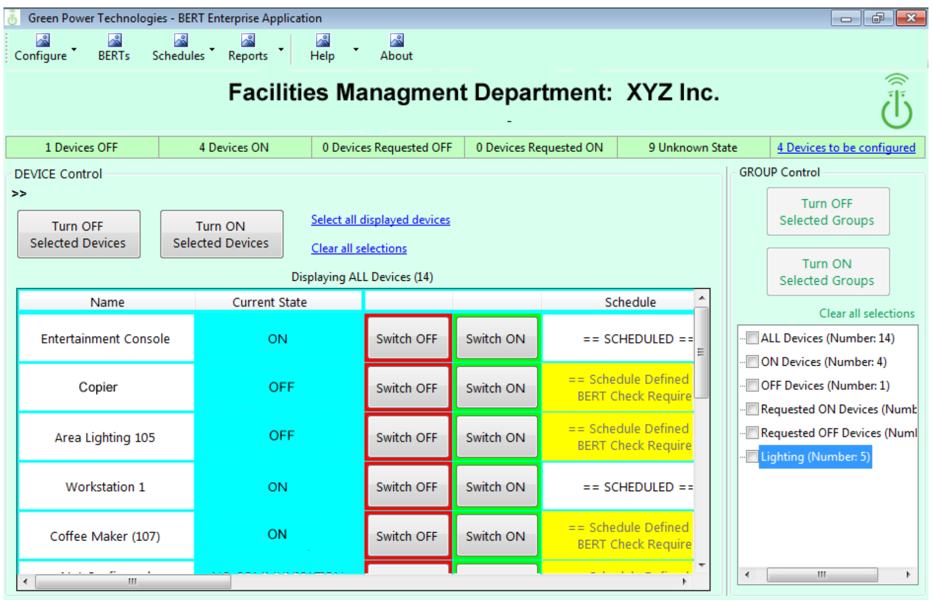
Figure 4-1: BERT System Schematic

The BERT EAP provides a set of tools to configure, schedule and monitor connected BERT devices. The windows based program is installed on a computer within the network (e.g. a facilities manager’s workstation). BERT plug contains a microchip and obtains an IP address from your network. Each BERT device appears on the interface, and individual schedules can be set with multiple on/off periods over a seven day schedule. For example, hallway TV monitors can be programmed to go off at midnight, and on again at 6 am. Multiple TV's can be grouped together to make control and reporting easier. The EAP tracks and reports the status of all devices on the system.

The energy use of each device can also be programmed into the EAP. For example, if the LCD hallway monitor consumes 225 watts of power, then BERT can use this information to track cumulative energy and dollar savings. The BERT reporting interface allows reports for individual devices, groups, or the entire portfolio of devices.

When deviations from standard building schedules occur, devices can be activated in several ways. Most simply, users approaching a BERT device that is it's off state can press a button on the side of the BERT plug and power will be restored to the device. This change of state will be recognized and recorded by the EAP. The device will remain on until the next programmed schedule change. If there are temporary schedule changes for multiple devices, for example if a building is open late for a special event, the facilities manager can turn on/off individual or groups of units remotely. The manager simply selects the designated groups, like Hallway LCD Monitors, and clicks on "Turn On Selected Groups".

Figure 4-2: The BERT EAP Interface



The microprocessors embedded in each BERT plug provide unique protection in the event of a WiFi outage, the shutdown of the management computer, or other interruption. Each BERT unit contains the programmed weekly schedule within the microchip, so if the plug loses contact with the EAP control software it will simply continue to execute its standard schedule.

Section 5: Sample Applications

BERT units can work in a wide variety of applications. This section describes how BERT can operate in university, office, restaurant and residential applications.

University Building:

Temple University's Speakman Hall is an academic building in the middle of campus, and contains a mix of classrooms, public spaces, study areas, and administrative services. The building includes a wide variety of devices that are on 24x7, including hallway announcement TVs, cooled water fountains, office equipment, vending machines, and computer monitors. The building is WiFi enabled. While the University prides itself on having a wide variety of amenities available for students, it also recognizes that many of these amenities use energy round the clock, even when the building is closed during nighttime hours.

Table 5-1: Sample BERT Installation in a University Building

Item Description	Watt Savings	Hours off per day	Number of devices	*Potential energy savings (kWh per year)*
Computer Monitors	65	8	30	5,694
Vending Machine	400	8	2	2,336
Water fountain (cooled)	60	8	24	4,205
Copier	5.26	10	2	38
LCD TV	225	10	12	9,855

Table 5-1 shows modeled energy savings for 70 BERT plugs installed in a single academic building over a 1 year period of time. This application saves 22,128 kWh and $3,983 per year.

Office

An office has 30 workstations (each with a computer, monitor, printer and cell phone charger), a water cooler, copier, and a TV screen in the company lobby. The office manager installs a BERT plug at each workstation, and various other devices. The manager schedules the BERT devices to go off for 12 hours each night, when the office is closed.

Table 5-2: Sample BERT Savings In A Small Office

Item Description	Watt Savings	Hours off per day	Number of devices	*Potential energy savings (kWh)*
Workstation	48.51	12	30	6,374

Water cooler	60	12	1	263
Copier	9.63	10	1	35
LCD TV	225	10	1	821

Table 5-2 shows modeled energy savings for 33 BERT plugs installed in a single office over a 1 year period of time. This application saves 7.493 kWh and $1,349 per year.

Restaurant:

A sports bar features a large number of flat screen TVs so that patrons can view their favorite sporting events from virtually any seat. The restaurant owner configures BERT so that the closing manager can turn off all BERT devices as part of the nightly shut down procedure. BERTS return to service when the opening manager returns in the morning.

Table 5-3: Sample BERT Applications In A Restaurant

Item Description	Watt Savings	Hours off per day	Number of devices	*Potential energy savings (kWh)*
Register Stations	48.51	14	3	744
Bar lighting	65	14	5	1,661
Vending Machines	400	14	4	8,176
LCD TV	225	14	20	22,995

Table 5-3 shows modeled energy savings for 33 BERT plugs installed in a single restaurant over a 1 year period of time. This application saves 33,882 kWh and $6,099 per year in energy.

Residential:

A homeowner buys four BERTS to control a computer workstation, entertainment center, area lighting, and kitchen appliances. The homeowner programs BERTS to be on during the times when family members are typically using the equipment; the coffee maker goes on in the morning, while the computer station is active in both morning and evening hours.

Table 5-4: Sample BERT Residential Application

Item Description	Watt Savings	Hours off per day	Number of devices	*Potential energy savings (kWh)*
Light	60	14	1	307
Entertainment Center	75	16	1	438
Workstation	48	14	1	245
Kitchen	8	20	1	58

Table 5-4 shows modeled energy savings for 4 BERT plugs installed in a single home over a 1 year period of time. This application saves 1,084 kWh and $189 per year in energy.

Section 6: Global Impacts:

The global impacts of the adoption of BERT plugs is significant. For example, one million plugs deployed in applications similar to the ones described above saves 461 million kilowatt hours and over 632 million pounds of carbon per year.

Table 6-1: Potential Energy and Environmental Savings

Number of plugs	1,000,000
Average KWH Savings	461.34
Total KWH Savings	461,335,714
Total Dollar savings	$ 83,040,428
Annual Carbon Savings:	632,029,928 pounds per year

In contrast to existing and emerging technologies described in Section 3, WiFi based devices like BERT provide an immediate opportunity to leverage an enormous existing technology infrastructure to save money, energy and the environment by turning off devices on a controlled, scheduled basis while they are not in use.

A	UPDATED DOCUMENT FORMAT AND STANDARDS. M.E.B. - 9/18/13	N/A	N/A	KDB 9/24/13	DGM 9/30/13	MEH 9/30/13
REV	REVISION DESCRIPTION	B.O.M.	ELEC. ENG	MECH. ENG	CHECKED	APPROVED

REVISION HISTORY

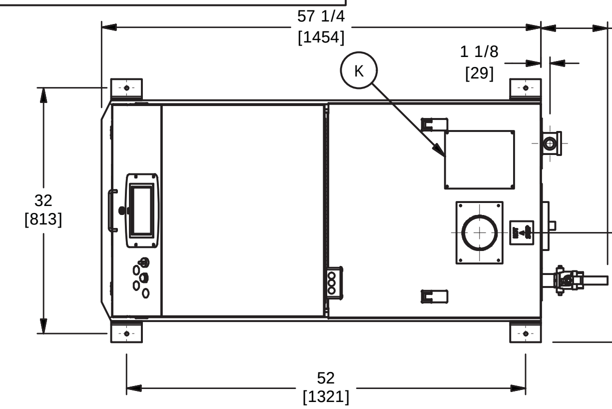
CUSTOMER CONNECTIONS			
ITEM	DESCRIPTION	SIZE	TYPE
A	WATER OUTLET	2"	N.P.T.
B	EXHAUST OUTLET	6"	-
C	AIR INLET	4"	-
D	CONDENSATE DRAIN	3/4"	N.P.T.
E	WATER INLET	2"	N.P.T.
F	FUEL INLET	1 1/4"	N.P.T.
G	CUSTOMER ELECTRICAL CONNECTION 120V/60HZ	-	-
H	CONTROL DISPLAY	-	-
J	SAFETY VALVE CONNECTION (SEE NOTE 3)	3/4"	N.P.T.
K	INSPECTION OPENING FOR FLOW SWITCH	-	-

NOTES:

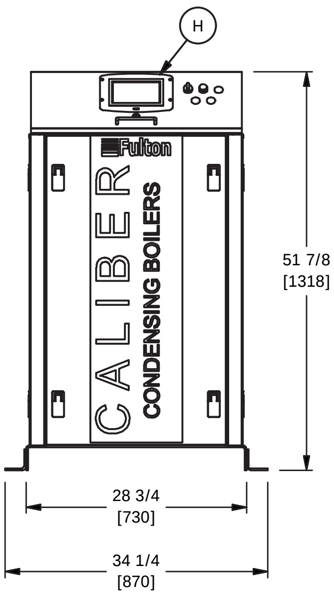
1. CONTROLS ACCESS HOOD REQUIRES A 28" RADIUS SWING HINGED FROM THE REAR OF TOP PANEL. FRONT AND REAR CLEARANCE MINIMUM IS 36". SIDE CLEARANCE MINIMUM BETWEEN ONE SET (2EA) OF BOILERS IS 6"; ALL OTHER SIDE CLEARANCE MINIMUM IS 24".
2. PRESSURE VESSEL IS BUILT TO COMPLY WITH ASME SECTION IV.
3. APPROPRIATE SAFETY RELIEF VALVE AND BUSHING ARE DETERMINED BY TRIM PRESSURE AND ARE SUPPLIED IN THE TRIM KIT TO BE INSTALLED BY OTHERS. INLET AND OUTLET SIZES ARE AS FOLLOWS:

   30# - 3/4" INLET X 1" OUTLET
   60# - 3/4" INLET X 1" OUTLET
   100# - 3/4" INLET X 1" OUTLET
   125# - 3/4" INLET X 1" OUTLET
   160# - 3/4" INLET X 1" OUTLET

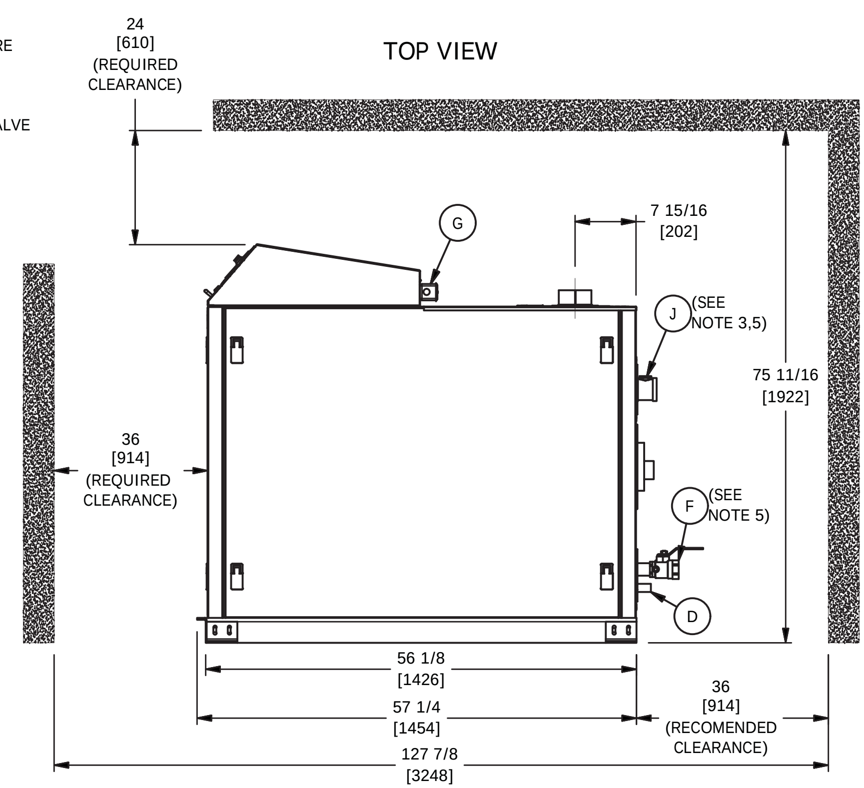
4. ALL DIMENSIONS ARE IN INCHES [MILLIMETERS] AND ARE FOR REFERENCE ONLY. THIS DRAWING IS NOT FOR CONSTRUCTION PURPOSES.
5. REDUCING TEE FOR OUTLET PIPE AND GAS SHUT OFF VALVE ARE SUPPLIED IN THE TRIM KIT TO BE INSTALLED BY OTHERS.



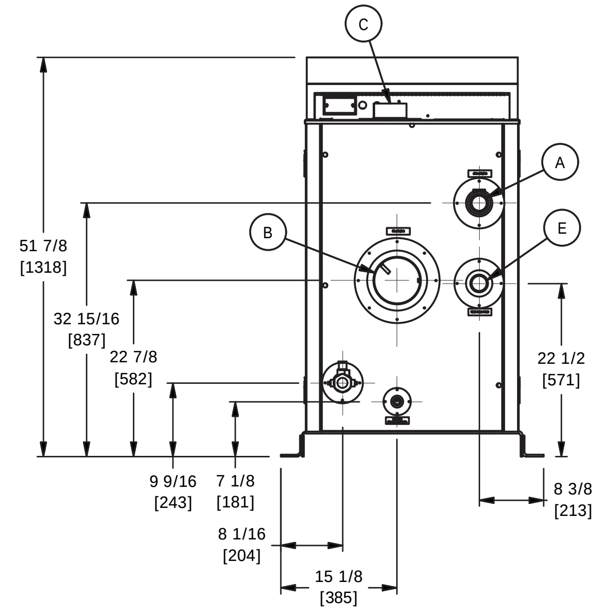
TOP VIEW



FRONT VIEW



RIGHT SIDE VIEW



BACK VIEW

UNLESS OTHERWISE NOTED: DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/4; (2) PLACE DEC. ± .01; (3) PLACE DEC. ± .005; ANGLES ± 2 DEG.; SURFACE FINISH 250 MICRO-INCHES	This design and drawings are proprietary and are the exclusive property of The Fulton Companies. The corporation does not permit their use except with prior written consent.	The items shown in this drawing may be covered by one or more patents of The Fulton Companies. THIRD ANGLE PROJECTION 1 OF 1	DRAWN BY: M.GIGLIOTTI 4/5/2012	MECH. ENG:	JOB NUMBER:	DESCRIPTION: CAL-850 AHRI HYDRONIC BOILER WITH CSD-1 / CSA FUEL TRAIN (4-14" WC NATURAL GAS) PRODUCT DATA END ASSEMBLY DRAWING	The Fulton Companies 972 Centerville Road Pulaski, New York USA 13142
			CHECKED BY:	ELEC. ENG:	PROJECT NAME:		DRAWING NUMBER C91-0008
			B.O.M. REVIEW	APPROVED BY:	PROJECT MANAGER:	SHEET 1 OF 1	REV A

CUSTOMER CONNECTIONS			
ITEM	DESCRIPTION	SIZE	TYPE
A	HOT WATER OUTLET	4"	150# FLG.
B	EXHAUST OUTLET	8"	-----
C	AIR INLET	8"	-----
D	CONDENSATE DRAIN	1"	N.P.T.
E	WATER INLET	4"	150# FLG.
F	NATURAL GAS INLET	1 1/2"	N.P.T.
G	SAFETY RELIEF VALVE	1"	N.P.T.

NOTES:

1. CONTROLS ACCESS DOOR REQUIRES A 34" RADIUS SWING HINGED AT LEFT SIDE OF THE BOILER, FRONT CLEARANCE MINIMUM IS 36", REAR & TOP CLEARANCE MINIMUM IS 24", & SIDE CLEARANCE MINIMUM IS 1".

2. THE PRESSURE VESSEL IS BUILT TO COMPLY WITH ASME SECTION IV.

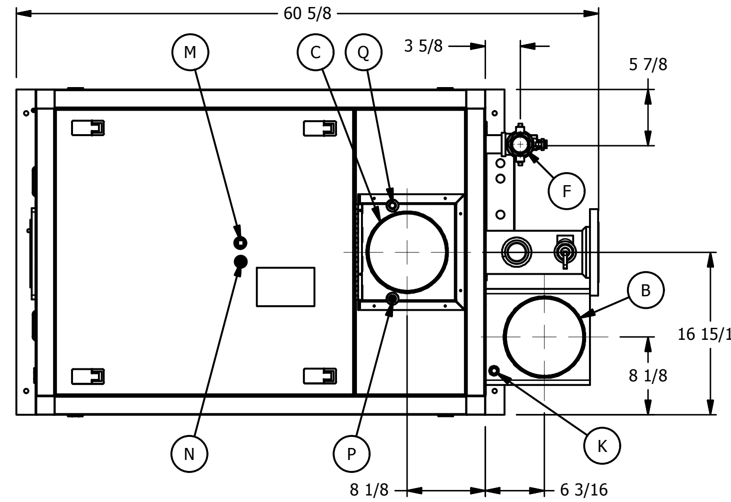
3. APPROPRIATE SAFETY RELIEF VALVE & BUSHING ARE DETERMINED BY TRIM PRESSURE & ARE SUPPLIED IN THE TRIM KIT TO BE INSTALLED BY OTHERS. INLET & OUTLET SIZES ARE AS FOLLOWS:
30# - 1 1/4" INLET x 1 1/2" OUTLET
60# - 1" INLET x 1 1/4" OUTLET
100# - 3/4" INLET x 1" OUTLET
125# - 3/4" INLET x 1" OUTLET
160# - 3/4" INLET x 1" OUTLET

4. DRAIN VALVE & FERNCO COUPLING SUPPLIED IN TRIM KIT & ARE TO BE INSTALLED BY OTHERS.

5. FOR ACCESS TO REAR INSPECTION OPENING & ASME STAMPING AREA, BACK COVER PLATE MUST BE REMOVED.

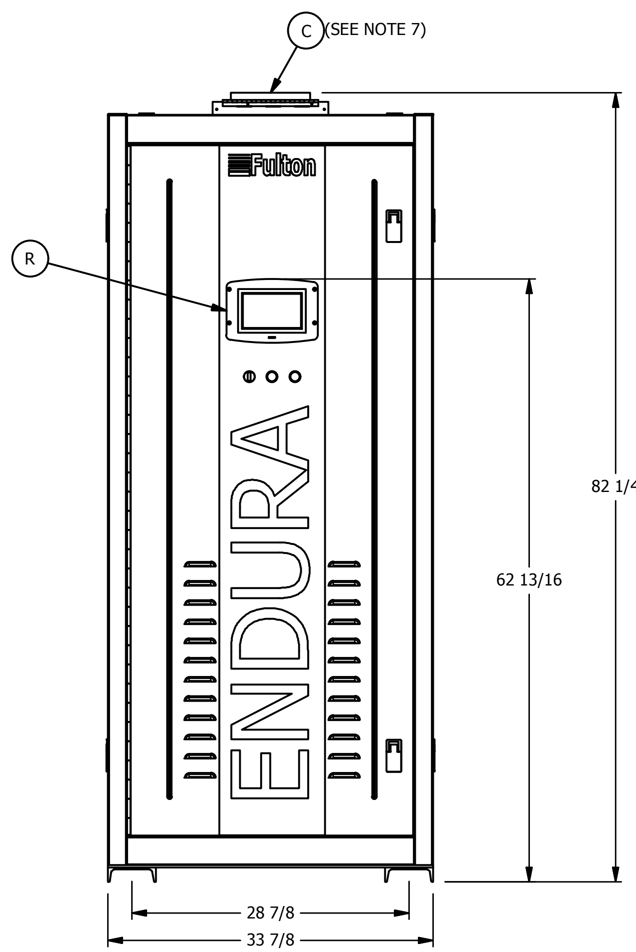
6. ALL DIMENSIONS ARE IN INCHES & ARE FOR REFERENCE ONLY.

7. AIR FILTER HOUSING CAN BE REMOVED AND REINSTALLED IN THE FIELD TO MEET CLEARANCE ISSUES.

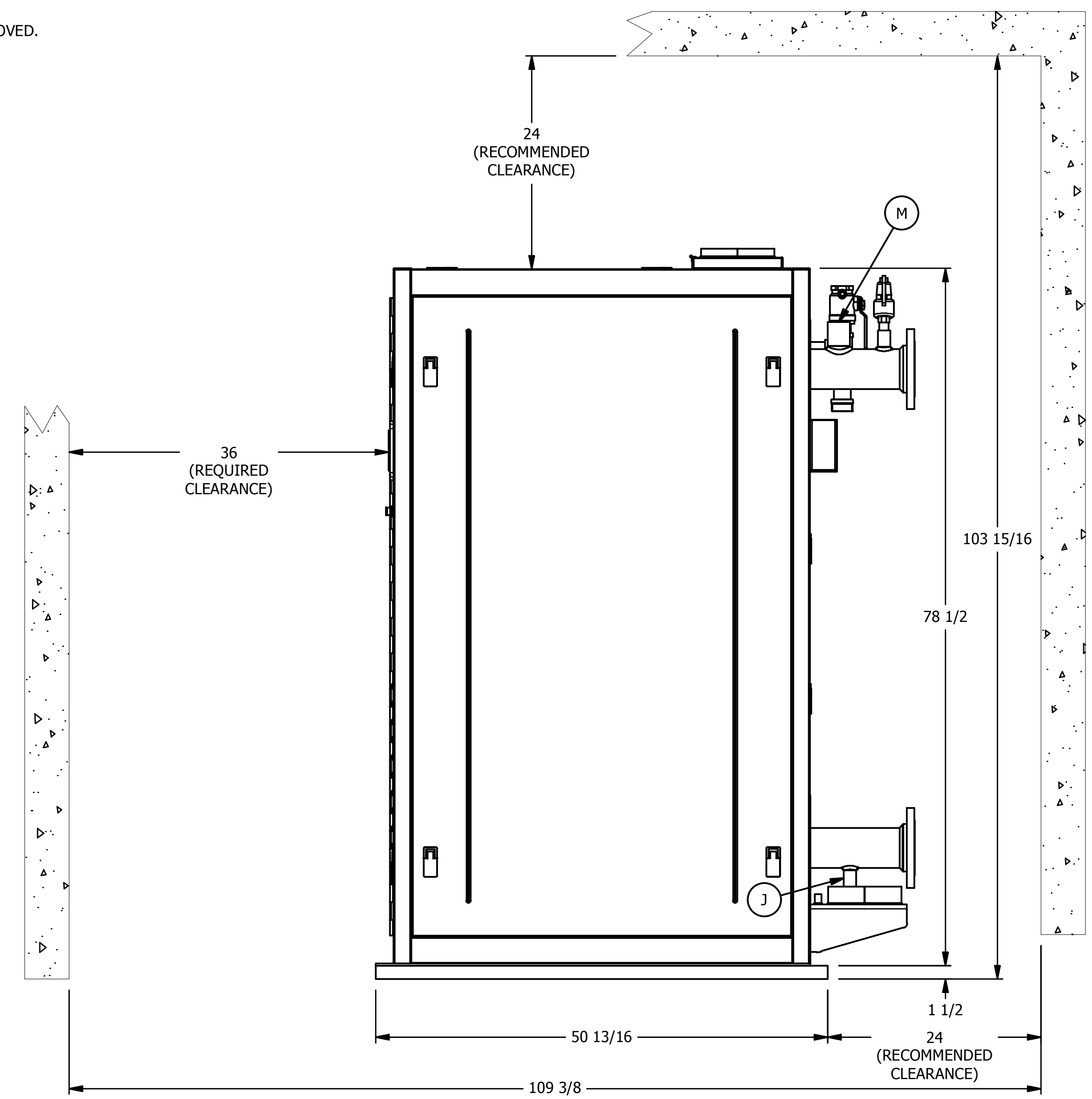


TOP VIEW

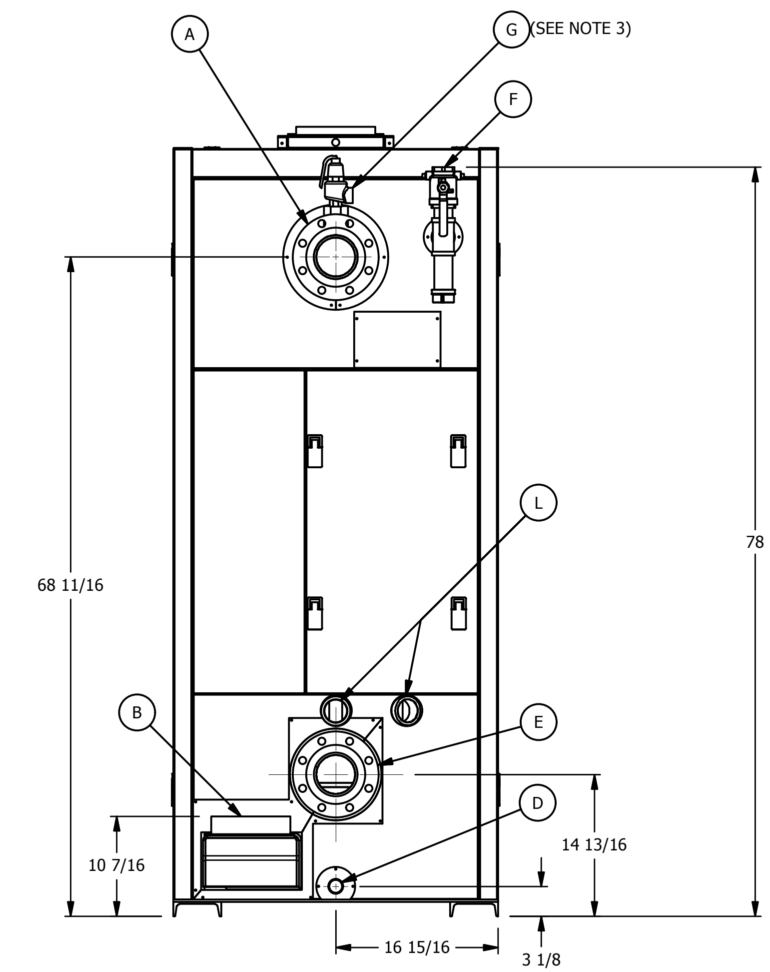
MISC. CALLOUTS			
ITEM	DESCRIPTION	SIZE	TYPE
H	PRESSURE VESSEL DRAIN	3/4"	N.P.T.
J	COMBUSTION ANALYSIS PORT	1/4"	N.P.T.
K	ASME STAMPING AREA	----	----
L	INSPECTION OPENING	2"	N.P.T.
M	LOW WATER PROBE CONNECTION	1/2"	N.P.T.
N	SECOND LOW WATER PROBE CONNECTION (OPTIONAL)	1/2"	N.P.T.
P	OPERATING TEMPERATURE SENSOR CONNECTION	1/2"	N.P.T.
Q	HIGH LIMIT AQUASTAT (MANUAL RESET) CONNECTION (OPTIONAL)	1/2"	N.P.T.
R	CONTROL DISPLAY	----	----



FRONT VIEW



RIGHT SIDE VIEW



BACK VIEW

UNLESS OTHERWISE NOTED: DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/4; (2) PLACE DEC. ± .01; (3) PLACE DEC. ± .005; ANGLES ± 2 DEG. SURFACE FINISH 250 MICRO-INCHES	This design and drawings are proprietary and are the exclusive property of The Fulton Companies. The corporation does not permit their use except with prior written consent.	The items shown in this drawing may be covered by one or more patents of The Fulton Companies. THIRD ANGLE PROJECTION 1 OF 1	DRAWN BY: A. FOX 2/15/2013	MECH. ENG:	JOB NUMBER:	DESCRIPTION: ENDURA EDR-2000K CONDENSING BOILER WITH CSD-1 / CSA NATURAL GAS TRAIN (4 - 28" WC) PRODUCT DATA SUBMITTAL END ASSEMBLY DRAWING
			CHECKED BY:	ELEC. ENG:	PROJECT NAME:	
			B.O.M. REVIEW	APPROVED BY:	PROJECT MANAGER:	SHEET 1 OF 1

The Fulton Companies
972 Centerville Road
Pulaski, New York USA 13142

Fulton

DRAWING NUMBER: E91-0001
REV: -

REV	REVISION DESCRIPTION	B.O.M.	ELEC. ENG	MECH. ENG	CHECKED	APPROVED
-						

REVISION HISTORY

ControLinks™ Fuel Air Control System

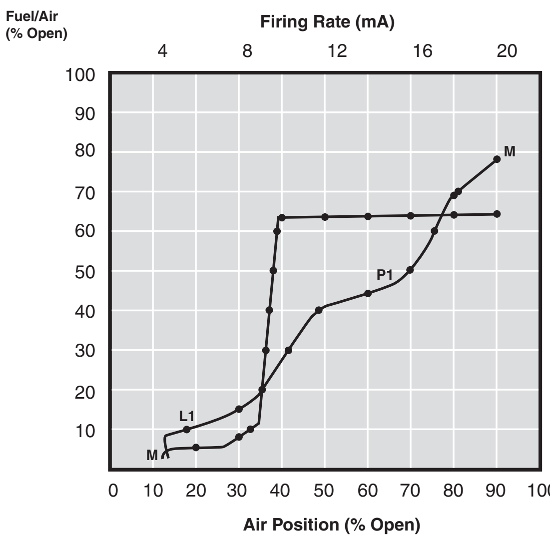
Honeywell

Get superior performance, improved accuracy and fuel efficiency with Honeywell ControLinks™ microprocessor-based fuel air ratio controls on your burner equipment. Control accuracy to 0.1 degrees provides accurate fuel air ratio curves and improves combustion efficiency, which means fuel savings for you. It all adds up to more accuracy and efficiency, as well as less service and downtime.

ControLinks™ Fuel Air Control System

ControLinks™ uses unique air curves and fuel curves, separate light-off points and different minimum and maximum modulation points. Innovative safety features include a unique potentiometer circuit, component anti-swap protection and curve verification algorithms.

Fuel/Air Profile Graph



One-fuel with FGR curve

The new S7999B system display allows you to commission the ControLinks Fuel Air Control System using the touchscreen with four color graphics. This eliminates the need for a laptop or PC for commissioning. Diagnostic information can be accessed for ControLinks and for 7800 SERIES Controls using this display.

To Learn More

For more information about ControLinks Fuel Air Control System, contact your Honeywell Representative, call 1-800-345-6770, ext. 423, or visit customer.honeywell.com.

Automation and Control Solutions

In the U.S.:
Honeywell
1985 Douglas Drive North
Golden Valley, MN 55422-3992

In Canada:
Honeywell Limited
35 Dynamic Drive
Toronto, Ontario M1V 4Z9
www.honeywell.com

63-9165
May 2006

Technical brochures, savings calculator and case studies are also available. Contact your local ControLinks rep for more details.

SYSTEM COMPONENTS:

R7999 FUEL AIR RATIO CONTROL

- Monitors and controls the burner fuel and air ratios to maintain proper combustion
- Provides LED status for power, alarm and motor drives
- Includes fault-annunciating LEDs

ML7999A UNIVERSAL PARALLEL-POSITION ACTUATOR

- Provides 100 lb./in. torque to control combustion air dampers, modulating fuel valves, oil modulation valves and flue gas recirculation (FGR) dampers
- Optimizes burner performance by providing precision potentiometer feedback to the R7999 control

S7999B SYSTEM DISPLAY

- Optional tool that provides an interface for the entire burner/boiler system
- Large, full color, touchscreen display module
- Two additional LEDs indicate CSD power and communications

V5197 Firing Rate Valve

- Accepts 4 – 20 mA signal for firing rate control
- More linear turndown

A7999 PORTABLE COMBUSTION ANALYZER

- Portable diagnostic tool (optional) expedites burner setup

ZM7999 COMMISSIONING SOFTWARE

- Commissioning software via laptop

Q7999 WIRING SUB-BASE

- For ease of installation, all wiring goes to this panel-mounted sub-base

The Following ControLinks Demos And Toolkits Are Also Available:	
Item #	
DSP3822	S7999B System Display Demo
DSP3564	ControLinks Demo
DSP3548	ControLinks Tool Kit

Honeywell

A.O. Smith | Commercial Gas Water Heaters

CYCLONE HE

The Cyclone® HE is a light-duty, power vent, fully condensing commercial gas water heater with an internal helical heat exchanger, similar to the design of A. O. Smith's industry-leading Cyclone® models. This helical heat exchanger helps Cyclone® HE achieve 90% thermal efficiency and deliver outstanding hot water output.

BTX-80

Series 100

GAS-FIRED c UL us LISTED

CSA Low Lead Compliant

AHRI CERTIFIED® www.ahridirectory.org

HELICAL INTERNAL HEAT EXCHANGER
- Completely surrounded by water in tank, provides much greater heat transfer surface than standard straight flue tube
- Operates at 90% thermal efficiency, which saves money on operating costs, increases hot water output compared to standard efficiency water heaters
- Minimizes standby losses by trapping heat in the tank
- Spiral heat exchanger reduces scale and sediment from forming on water-side surface, which can reduce energy efficiency over time

VERSATILE POWER VENT DESIGN
- Vents using inexpensive PVC, CPVC or ABS pipe. Canadian installations require ULC S636 listed PVC or CPVC pipe for venting.
- 2" pipe, vents up to 20 equivalent feet
- 3" pipe, vents up to 60 equivalent feet
- 4" pipe, vents up to 120 equivalent feet

MODULAR BLOWER
- Equipped with 120 volt, 60 Hz electrical system (rating 5 amps or less), 6-foot cord with standard 3-prong connector
- 2" PVC pipe, elbows and condensate drain supplied to connect heat exchanger outlet to blower
- PVC Vent Attenuation Assembly (VAA) supplied for applications where extra-quiet operating environment is essential

HIGH OUPUT WITH SMALL FOOTPRINT
- 22" diameter, combined with 90% efficiency, 50-gallon tank and 76,000 BTU input means Cyclone HE can be installed in less space than a larger 75-gallon unit, with equal or better performance
- Total height is 70-5/8" to top of unit

SIDE-MOUNTED HOT AND COLD RECIRCULATING TAPS
- Allows Cyclone HE to be installed as part of combination space heating/water heating applications, or any system requiring a recirculating hot water loop
- Plugs for the recirculating taps are factory installed

INTELLI-VENT™* GAS CONTROL
- Equipped with long lasting silicon nitride hot surface ignitor – no standing pilot
- Advanced electronics for more precise control of water temperature and easy-to-understand system diagnostics
- 180°F maximum temperature setting

PERMAGLAS® ULTRA COAT™ GLASS LINING
- A. O. Smith exclusive process provides superior protection against corrosion
- Protects all interior tank surfaces including inside and outside of helical heat exchanger

TWO HEAVY-DUTY ANODE RODS
- Provides advanced protection against corrosion

GREEN CHOICE® GAS BURNER
- Patented "Eco-Friendly" design reduces NOx emissions and meets less than 40 ng/j requirements for low NOx

CSA CERTIFIED AND ASME RATED T&P RELIEF VALVE

MAXIMUM HYDROSTATIC WORKING PRESSURE: 150 PSI

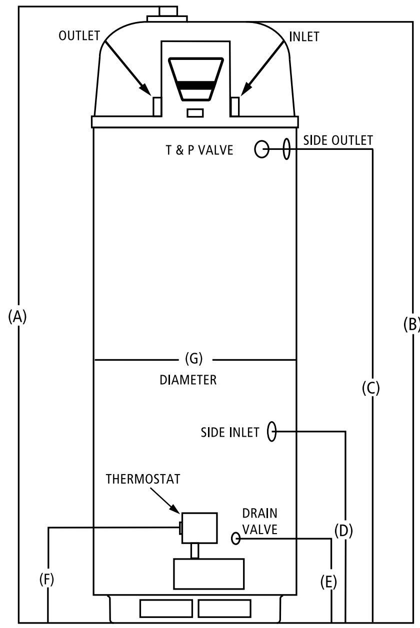
CODES AND STANDARDS
- Design-certified by Underwriters' Laboratories according to ANSI Z21.10.3 - 4.3 CSA standards governing storage-type water heaters
- Meets the thermal efficiency and standby loss requirements of the U.S. Department of Energy and Current Edition of ASHRAE/IESNA 90.1

*Intelli-Vent™ is a registered trademark of Emerson Electric Company

Revised November 2013

AOSCG10100

A.O. Smith | Commercial Gas Water Heaters



FRONT VIEW

THREE-YEAR LIMITED TANK WARRANTY

- For complete warranty details, consult written warranty shipped with heater

SPECIFICATIONS

MODEL NUMBER	BTU INPUT PER HOUR	GALLONS OR LITRES	TANK SIZE	GPH OR LPH	RECOVERY - GALLONS OR LITRES PER HOUR AT DEGREE RISE			LBS. OR KG	SHIPPING WEIGHT
					40°F	100°F	140°F		
					22°C	56°C	78°C		
BTX-80	76,000	Gallons	50	GPH	206	83	59	Lbs.	210
		Litres	189	LPH	780	314	223	Kg	95.3

Manifold Pressure: 4.0 inches w.c. (.99 kPa); All models–Maximum Supply Pressure: 14 inches w.c. (3.48 kPa)
Minimum Supply Pressure Natural Gas: 5.0 inches w.c. (1.24 kPa); Minimum Pressure must be maintained under both load and no-load (dynamic and static) conditions
Approved for installation up to 5300 ft. High alt models available.
Approved for Canada.

Rough-In-Dimensions

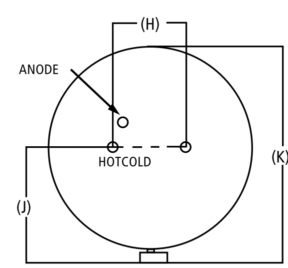
Model	Units	A	B	C	D	E	F	G	H	J	K
BTX-80	Inches	70.62	68.20	51.90	20.90	9.15	12.00	22.00	8.00	15.81	26.92
	cm	179.37	173.23	131.83	53.09	23.24	30.48	55.88	20.32	40.16	68.38

Top/Side Inlet and Outlet: 3/4” NPT
Gas Inlet: 1/2” NPT

Capacity and Gas and Electrical Characteristics

Model	Approximate Capacity		Manifold Pressure			Electrical Characteristics	
	U.S. Gals.	Liters	Gas Type	“WC	kPA	Volts/Hz	Amperes
BTX-80	50	189	Nat.	4.00	0.99	120/60	<5

All models - Maximum Supply Pressure: 14 inches W.C. (3.48kPa)
Minimum Supply Pressure Natural Gas: 5.0 inches W.C. (1.24kPa)
Minimum Pressure must be maintained under both load and no load (static and dynamic) conditions.



TOP VIEW

* INSTALL IN ACCORDANCE WITH LOCAL CODES

SUGGESTED SPECIFICATION

Natural gas water heater(s) shall be A. O. Smith Cyclone HE model # BTX-80, with 90% thermal efficiency, a storage capacity of 50 gallons, an input rating of 76,000 BTUs per hour, a recovery rating of 83 gallons per hour at 100°F rise and a maximum hydrostatic working pressure of 150 psi. Water heater(s) shall be of power vent design, using 2”, 3” or 4” PVC pipe for horizontal and/or vertical vent runs. Water heater(s) shall have: 1: Glasslined steel tank construction and a spiral-shaped heat exchanger placed entirely inside the tank, which shall be glasslined on the flue gas side to protect against acidic condensate. 2: An Intelli-Vent™ gas control system with silicon nitride hot surface ignitor. 3: A 3-year limited warranty against tank leaks. Water heater(s) shall meet the thermal efficiency and standby loss requirements of the U. S. Department of Energy and Current Edition of ASHRAE/IESNA 90.1 and be design-certified by UL (Underwriters Laboratories) according to ANSI Z21.10.3-CSA4.3 standards governing storage tank water heaters.

For Technical Information and Automated Fax Service, call 800-527-1953. A. O. Smith Corporation reserves the right to make product changes or improvements without prior notice.

Intellidyne®
The Power To Save

Refrigeration

Electrical Economizer

The *Intellidyne RU* will reduce electric consumption by 10% when installed on commercial refrigeration and freezer systems. *Intellidyne RU* is easily installed by a qualified installer, maintenance free, and guaranteed to save energy.

ENERGY STAR PARTNER

Features

- Dynamic Cycle Management® (DCM) technology is guaranteed to reduce electricity consumption by at least 10%.
- UL listed, “Energy Management Equipment”.
- Increases savings without replacing or upgrading costly system components.
- LED indicators show operating modes.
- Protects compressor against momentary power outages and short cycling.
- Easy installation by a qualified installer.
- No programming or follow-up visits required.
- Maximum year-round efficiency.
- Reduces maintenance and extends compressor life.
- Fail-safe operation.
- 15-year replacement warranty for breakdowns or defects.

INTELLIDYNE LLC
303 Sunnyside Blvd. Suite 75, Plainview, NY 11803

1-866-216-0777
www.intellidynellc.com

Intellidyne®
The Power To Save

Refrigeration
Electrical Economizer

Specifications

Mounting:
In any position via molded 1/2" electrical fitting
Size:
4"H x 4"W x 2 1/2"D
Operating Humidity:
5% - 95% Non-Condensing
Operating Temperature Range:
-10°F - +120°F
Power Input:
24/115/220 VAC @ 5W
Control Circuit:
24 VAC/DC, 115/220 VAC
Relay Contact:
10A @ 220VAC General Purpose
UL Listed,
"Energy Management Equipment"
Made in U.S.A.

The *Intellidyne RU* is a microprocessor-based, UL listed, electronic control that automatically adjusts the compressor cycles to achieve the greatest efficiency and reduced electrical usage.

The sizing of refrigeration systems is based on a number of factors. When any design considerations are not met, the refrigeration system is oversized for the load and thus less efficient. Intellidyne's patented process analyzes the demands and thermal characteristics of the entire refrigeration system to dynamically modify the compressor cycle pattern. These new patterns result in less frequent and more efficient compressor cycles.

The *Intellidyne RU* improves the electrical efficiency of refrigeration systems by supplementing the antiquated on/off action of the thermostat or pressuretrol with the analysis and control capabilities of a computer.

Intellidyne's patented process uses Dynamic Cycle Management® (DCM) technology to produce electrical energy savings. Our innovative and intelligent algorithms have field proven electrical savings on systems that were properly sized and operating, but also on units that were undersized, and those that had not been properly maintained.

The *Intellidyne RU* works in conjunction with the existing temperature controls, will not void the compressor manufacturer's warranty, and has anti-short-cycling.

Installation by a qualified service technician takes about 45 minutes. The *Intellidyne RU* does not require any programming, adjustments or maintenance.

Economical Efficient Ecological Easy

INTELLIDYNE LLC
303 Sunnyside Blvd. Suite 75, Plainview, NY 11803
1-866-216-0777
www.intellidynellc.com

OPERATION MANUAL and INSTALLATION INSTRUCTIONS for

Form RU2500rev14.0

IntelliCon®-RU

COMMERCIAL REFRIGERATION ENERGY ECONOMIZER

Description

The *IntelliCon®-RU* is a patented microprocessor-based energy-saving device for commercial refrigeration systems. The *IntelliCon®* reduces electric consumption and lowers compressor run-time by actively managing the compressor cycling pattern, in conjunction with the existing compressor controls. Note that the *IntelliCon®* can not cause the compressor to run when the controls are not calling for cooling. The *IntelliCon®-RU* enhances compressor protection by eliminating compressor short-cycling. This unit is compatible with Intellidyne's Remote Display Unit (model RDU). In addition to Status, the RDU will also indicate total compressor run-time and economizer time.

Electric Ratings

Power Input: 24, 115, 220 VAC ± 10%, 5 Watts Max., 50/60Hz
Control Circuit Input: 24,115,220 VAC ± 10%, 0.1A Max. Burden
Relay Contact: Form B, 10A @ 220 VAC

Environmental Conditions

Indoor Use
Maximum Altitude (2000M)
Rated Ambient Temperature 32 - 120˚F. (0 - 49˚C.)
Maximum Rh 90% non-condensing
Mains Supply Voltage Fluctuations ± 10%
Transient Overvoltage Category (III)
Pollution Degree (2)

Operation

After installation, setting the slide switch on the top of the unit to the 'ON' position activates the device. The lights on the front panel indicate the state of operation of the device and will sequence as the device goes through its operating cycle. Each light indicates one of the possible modes of operation, which are:

STANDBY MODE: The refrigeration unit's control system has shut off the compressor after cooling the space to the desired temperature. The *IntelliCon®-RU* is waiting for the next call for the compressor to start. This occurs for a period of time after the compressor has shut down.

ECONOMIZING: The refrigeration unit's compressor control has requested the compressor to start but the *IntelliCon®-RU* has intervened to delay the start based on information it has gathered from the previous run cycle.

COMPRESSOR ON: The compressor is enabled.

ANTI-SHORT-CYCLE: This is an added compressor protection feature of the device, which ensures at least a thirty-second delay between compressor starts. This light will illuminate whenever the compressor has been turned off and will remain on for the thirty-second protection period. The compressor can not be enabled while this light is lit.

During normal operation, the top three lights will cycle from one state to the next and the anti-short-cycle light will come on for thirty-seconds after the compressor is stopped.

Installation

The *IntelliCon®-RU* is electrically installed in series with the refrigeration unit's compressor control as shown in the wiring diagrams on the reverse side. Check and determine the voltages of the compressor control circuit and power circuit prior to installation. **FOR SAFETY, POWER TO THE UNIT MUST BE DISCONNECTED DURING INSTALLATION.**

Positioning

The unit must be protected from the elements and may be mounted on the equipment either vertically or horizontally. The unit should be mounted directly on the existing electric enclosure via the unit's standard ½" electrical fitting or within the enclosure using an accessory mounting bracket. For mounting in the elements, a rain-tight mounting enclosure is available.

Wiring

All wiring and connections must comply with Local and National Electrical Codes. The unit should be wired as shown in the wiring diagrams on the reverse side. It is important to read all of the instructions carefully. Ensure that POWER TO THE UNIT IS OFF DURING INSTALLATION and that all unused leads are individually taped/insulated.

Checkout

Recheck wiring one last time. Set the *IntelliCon®-RU* slide switch to 'Off/Bypass' and restore power to the compressor. Set the slide switch to 'On'. First, as part of the system check, all four (4) lights on the *IntelliCon®-RU* will be briefly lit and then go out. Next, either the 'STANDBY MODE', or the 'ECONOMIZING' light will activate depending upon the operating state of the refrigeration unit controls. The 'ANTI-SHORT-CYCLE' light will come on and remain on for thirty-seconds. This is normal during power-up. After the thirty-second interval, the 'ANTI-SHORT-CYCLE' light will go out. Next, if the 'ECONOMIZER' light is lit, after a short delay the 'COMPRESSOR ON' light will light and the compressor should start. If this happens, the installation is complete.

If the *IntelliCon®-RU* remains in the 'STANDBY MODE' after the 'ANTI-SHORT-CYCLE' light goes out, it will be necessary to simulate a cooling call to verify proper operation. Note the control thermostat or pressuretrol setting and force a compressor call by temporarily resetting the control. Verify that the *IntelliCon®-RU* has changed modes to either 'ECONOMIZING' or 'COMPRESSOR ON'. This indicates the unit is operating normally. *Make sure to return the compressor control to its' previous setting*. If the *IntelliCon®-RU* does not come out of 'STANDBY MODE' when the unit's control is calling for the compressor to run, the unit is probably miswired; see the WIRING NOTE below.

Service and Troubleshooting

After Installation and Checkout, the *IntelliCon®-RU* requires no maintenance and will provide years of trouble free operation.

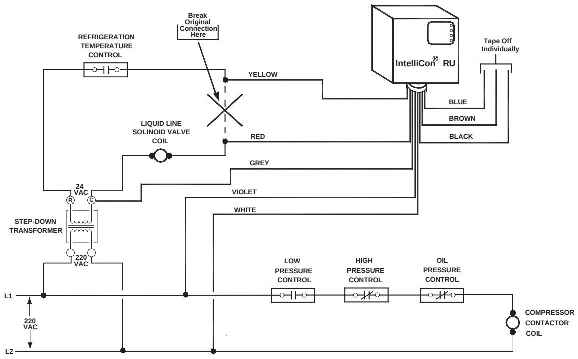
The unit may be bypassed at any time by putting the slide switch to the 'Off/Bypass' position. In this position, the unit has no effect on the system and the compressor will function as it did prior to the *IntelliCon®-RU* installation. This allows service personnel to diagnose problems without the *IntelliCon®-RU* interfering.

IMPORTANT - READ CAREFULLY

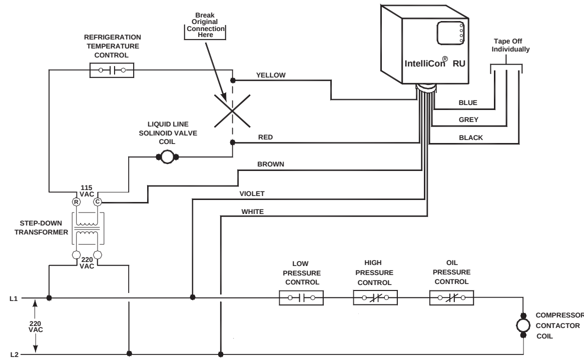
1. **Failure to follow these instructions may result in damage to the system or cause a hazardous condition.**
2. **Installer must be experienced, qualified, and in certain locations, licensed to work on the system that this control is being installed on.**
3. **After installation is complete, follow the check-out procedure as provided in these instructions to confirm proper system operation .**
4. **Intellidyne is not responsible for improper installation or any damages that may result from improper installation.**
5. **Actual wiring may differ from that shown in the diagrams.**
6. **Equipment may have controls not shown.**
7. **Because the *IntelliCon* can operate with different voltages for the power and control circuits, it has separate common wires for these circuits. It is necessary that these wires are connected to the proper commons or the unit will not function properly. *See the wiring diagrams on the reverse side of this sheet for details.***

IMPROPER VOLTAGE SELECTION MAY DAMAGE THE UNIT AND VOID THE WARRANTY.

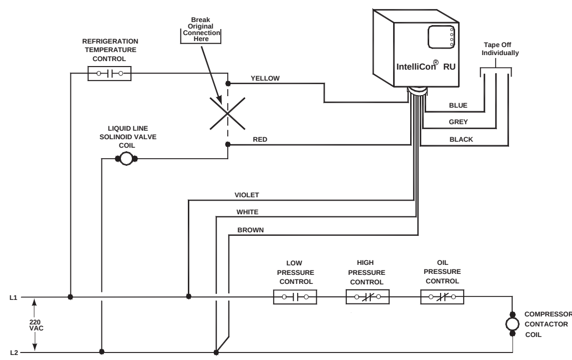
Typical 1Ø or 3Ø Pump-down Type Refrigeration Systems



220 VAC Power, 24 VAC Control

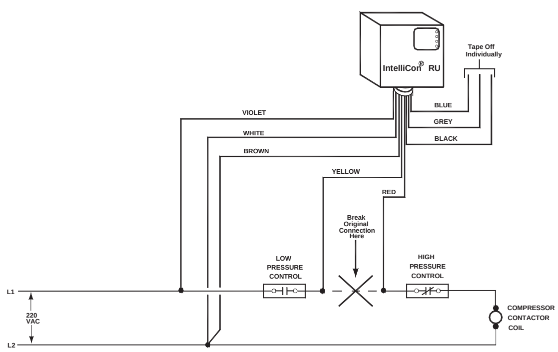


220 VAC Power, 120 VAC Control

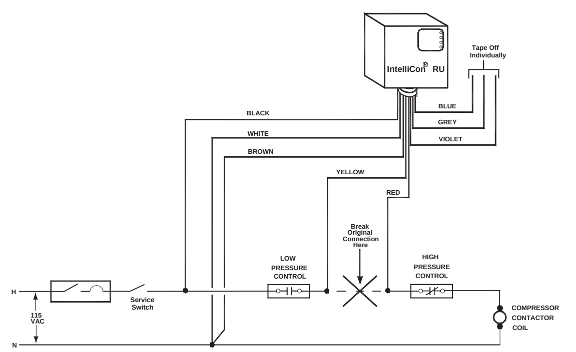


220 VAC Power and Control

Typical 1Ø or 3Ø Pressure Control Type Refrigeration Systems



220 VAC Power and Control



120 VAC Power and Control

TEL

World leaders in airflow controls and monitors

Kitchen Hood Controls (VAV)

Product Brochure

Kitchen Hood Controls (VAV)

20% of energy costs are to condition air

The average food service kitchen exchanges inside air for fresh outside air at least 20 times per hour. It sounds like an effective way to keep a kitchen comfortable and safe, but in most situations it is actually a huge drain on energy resources that provides no real health benefits to employees or guests. Roughly 25% of a food service operations energy costs go to conditioning the outside air brought in during these air exchanges, and according to estimates from the American Gas Association, the U.S. food service industry wastes more than $2 billion each year because of excessive ventilation.

Excessive ventilation

Technology is typically the culprit. Until a few years ago, most kitchen ventilation controls consisted of a manual on/off switch and a magnetic relay or motor starter for each fan. Exhaust and make up fans either operated at 100% speed or not at all, and the whir of the exhaust fan was a common sound in the average commercial kitchen – even when cooking equipment was not in use. Manual two speed systems that relied on cools to switch from low to high speed and vice versa offered some energy savings but were seldom used efficiently.

Variable volume control

The TEL kitchen control system has changed all that. With microprocessor based controls whose sensors automatically regulate fan speed based on cooking load, time of day and hood temperature while minimising energy usage. The TEL system includes a temperature sensor installed in the hood exhaust collar, IP sensors on the ends of the hood that detect the presence of smoke or cooking effluent and variable frequency drives (VFD) that control the speed of the fans.

Variable volume hoods reduce running costs and increase equipment life

If you're not using a variable volume hood it is always at maximum design volume when running. The TEL Kitchen control system detects both smoke and temperature rise, increasing the volume when it is needed. Most kitchen hoods require full exhaust performance for only a small percentage of the day. Varying the speed of the fan as the cooking loads change will save money by reducing ventilation needs.

Temperature Electronics Ltd. Unit 2, Wren Nest Road, Glossop SK13 8HB UK
T. +44 (0) 1457 865 635 **F.** +44 (0) 1457 868 843 **E.** sales@tel-uk.com **w.** www.tel-uk.com

Kitchen Hood Controls (VAV)

Benefits go beyond energy savings

Variable volume can also mean:

A significantly quieter kitchen

Even relatively small decreases in speed can reduce the kitchen noise level. When the fans run at 80% speed, the air noise generated at the grease filters decreases more than 20%, when the fans run at 50% speed, the air noise is virtually eliminated. The result: a more pleasant environment for employees and guests (when the hoods are located near customers).

Reduced HVAC equipment wear

Soft-starting the hood fans with a VFD extends belt life, and reducing the outside air load on the kitchen air conditioning units reduces compressor run time and extends life as well (this can also apply to refrigeration units inside the kitchen). In addition, reducing the makeup air decreases the rate at which the filters become dirty and need to be cleaned or replaced.

Decreased grease entrapment

Excessive fan speeds send grease up the duct, into the fan and out to the building roof, and sometimes, into the atmosphere. Slowing down the exhaust fans and reducing the air duct velocity allows the grease to drain back into the hood and into grease cups, where it can be easily disposed if, which reduces the frequency that the hoods and ducts need to be cleaned.

Sample energy calculation

The following calculation was done based on a Kitchen Hood 16 ft x 4 ft in Allentown,PA using a LPHW heating system without cooling and considers the exhaust and supply air fans running at full speed 14 hours per day, 7 days per week, 52 weeks per year.

Hood air volume	Gas Costs	Electricity
4000 cfm	$ 1.07 / Therm	$ 0.088 per kWh

Calculation 1 Based on 16 Hours/day (6.00am- 10.00pm), 7 days / week, 52 weeks / Year (CAV)

Annual Energy Cost $ 17,760.32

Calculation 2 Based on 16 Hours / day (6.00am- 10.00pm), 7 days / week, 48 weeks / Year with variable exhaust and supply volume (VAV)

Annual Energy Cost $ 8,023.54

Potential Annual Energy Cost Savings $ 9,736.78

Key benefits

a. The exhaust volume for a kitchen hood can be significantly reduced.

b. The energy costs of the input air heating and cooling system may be significantly reduced.

c. The carbon footprint will be reduced.

d. A quieter kitchen - Even relatively small decreases in speed can reduce the kitchen noise level. When the fans run at 80 percent speed, the air noise generated at the grease filters decreases more than 20 percent; when the fans run at 50 percent speed, air noise is virtually eliminated. The result: a more pleasant environment for employees and guests (when the hoods are located near customers).

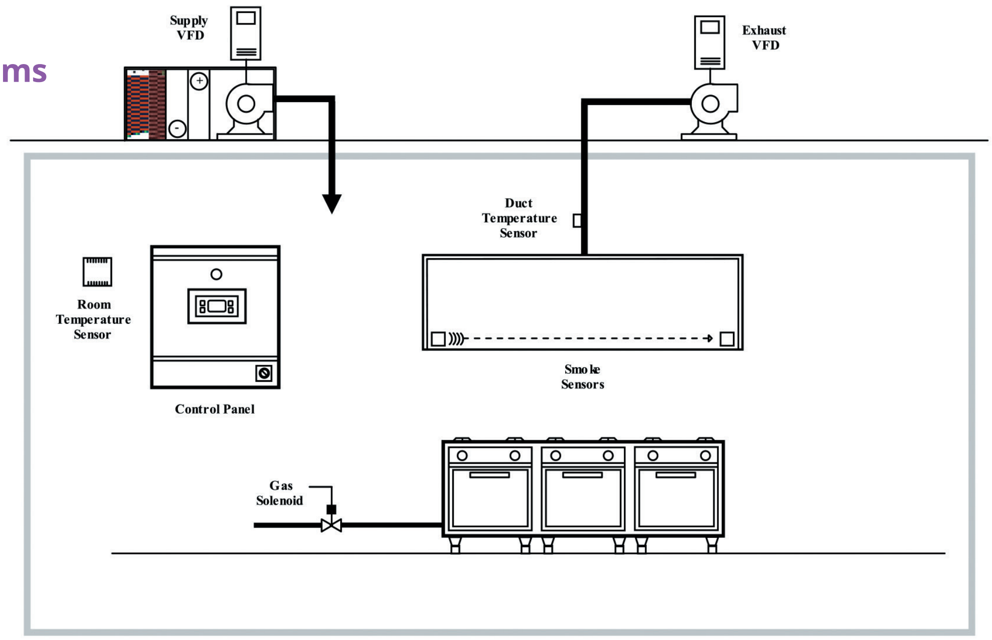
e. Reduced HVAC equipment wear - Soft-starting the hood fans with a VFD extends belt life, reducing the make-up airflow decreases the rate at which the filters become dirty and need to be cleaned or replaced.

f. Decreased grease entrapment - Excessive fan speeds send grease up the duct, into the fan and out to the building roof and, sometimes, even into the atmosphere. Slowing down the exhaust fans and reducing the air duct velocity allows the grease to drain back to the hood and into grease cups, where it can be easily disposed of, which reduces the frequency that the hood and ducts need to be cleaned.

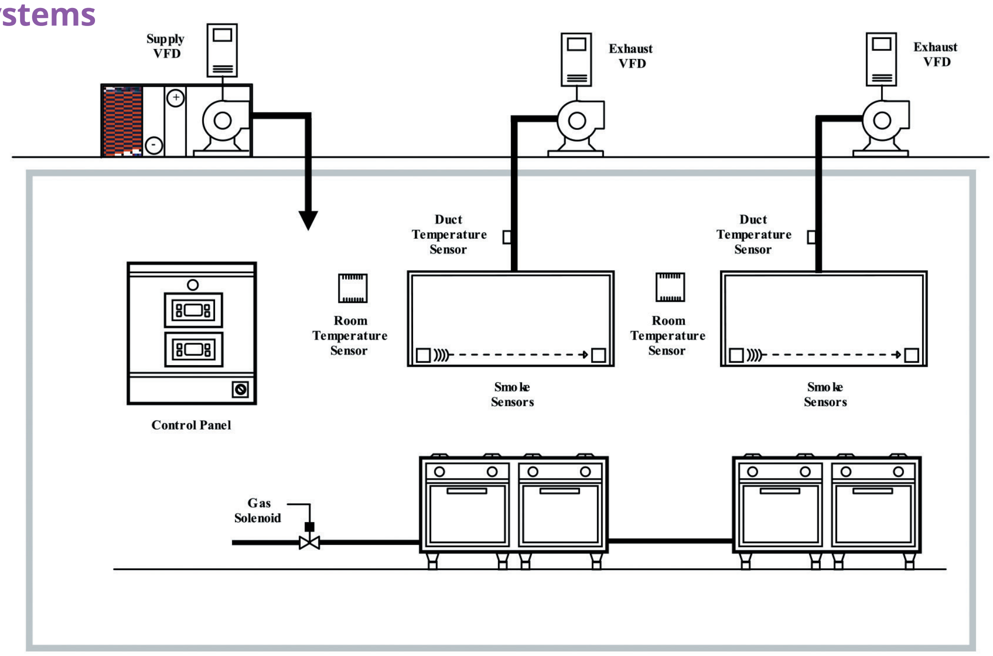
g. The system may be readily linked to a computerized building management system.

Typical Kitchen VAV control system

for single systems



for multiple systems



Kitchen Hood Controls (VAV)

Features

- Single or Multiple Hood control.
- Ventilation On/Off from control panel or Auto On/Off on a time basis (from on board time clock or BMS).
- Up to 3 On/Off time periods per day using on board time clock.
- Can be set for annual time scheduling with holidays and exceptions.
- Measures the duct and room temperatures and uses the differential temperature to control the speed of the exhaust and supply fans to maintain good exhaust with minimum energy consumption.
- Compensates for heat gain in the room from other equipment by controlling to room temperature set point if the room temperature exceeds the set value.
- The smoke detector inside the hood will detect any sudden plumes of smoke and runs the ventilation at maximum speed for a set period of time or until the smoke has cleared.
- Auto Run feature if heat is detected outside of normal hours operation.
- Auto Run On feature to extend the ventilation running period until cooking has finished.
- Remote Emergency pushbutton to override the Automatic controls for a given period of time.
- Max/Auto/Standby operation modes.
- Selectable Metric / Imperial Units
- Modbus RTU and BACnet coms on board for connection to BMS.
- Graphic digital display with indication of ventilation output, temperatures and alarms.
- Pushbutton menu set up with password protection.

Gas interlocking

Cutting off the gas flow in the event of kitchen ventilation failure is now a requirement in most commercial kitchens :-

- On installation of a completely new extraction/ ventilation canopy
- On installation of a new pipe run
- On installation of a new cook line or layout
- When fitting any new or replacing any Category B equipment (Ovens/fryers/grills etc)

The optional Gas Interlock system senses the ventilation system pressure and switches off the gas flow if the ventilation fails. The gas flow is also switched off when the ventilation system is switched off from the Kitchen Hood controller.

The TEL kitchen hood VAV system can be supplied with an integrated Gas Interlock system

green energy hoods
www.greenenergyhoods.com

For further information contact our US distributor
Green Energy Hoods
Office : 941-377-4100

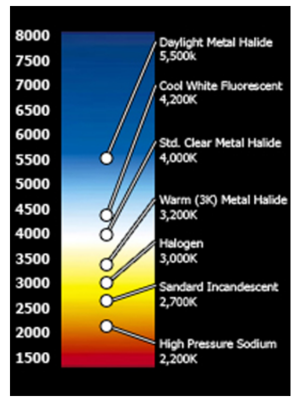
Direct : **Jason Sparbel** **Cell : 920-265-0987**

TEL
www.tel-uk.com

SEESMART®
EARTH FRIENDLY LED SOLUTIONS

Spec Sheet

SKU#	120335
Product Name	HP 154W 4700K LED 120 Deg Aluminum Cone High Bay Light
Description	High Bay, 154W, Open, 4700K, 120-277VAC, 24LED, 120deg AL, HP
Estimated Energy Cost ($/yr)**	319.8
Watts (W)	154
Light Output (Lumens)	12300
Efficacy (Lumens/Watt)	79.87
Color Accuracy (CRI)	80
Color Temperature (K)	4700-4900
Lighting Angle/Type	120
Power Factor	0.95
Working Voltage	120-277VAC
LED Count/Type	24
Lens Reflector Style	Aluminum
Operating Temperature (F)	-22 to 158
Mount/Base Type	Hanging Hook
Dimensions (inches)	0.00 L x 0.00 W x 15.00 H x 20.00 DIA
Weight (pounds)	12
Typically Replaces	250-400W MH/HPS Fixture
Typical Life Expectancy (L70 Hours)	50,000
Approvals / Certifications	UL DLC
Photometric Data Available?	No
IES File Available?	No



Features

Traditional style aluminum housing with integrated ultra-efficient brass and thin-fin aluminum heat sink structure; open loop on top for hook for hanging mounting, can accomodate other mounting methods; anodized aluminum Parabolic reflector cone; constant current solid state long 50,000+ hour life; wide input voltage; high shock & vibration resistance; mercury-free; no noise; instant on/off great with occupancy sensors; IEC directives completed: IEC 60598, IEC 61000-3-2:2005, IEC 61347, UL8750; UL listed and DLC listed.

NOTE: The preliminary performance information provided in this notice is pending verification by an independent testing laboratory. Contact your Seesmart representative for more information about photometric and other performance testing information for this product.

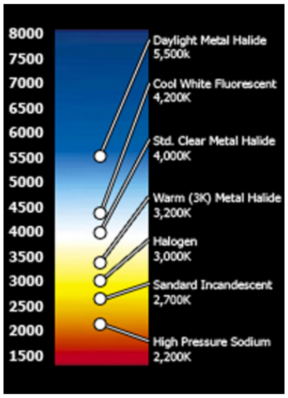
** Calculation based on 3 hours/day, $0.11/kWh. Cost depends on rates and use.

Specifications are valid as of 010-11-19 08:58:30] , but are subject to change.
Confirm latest specifications prior to placing order.

Web: www.seesmartled.com | Tel: 877.578.2536

Spec Sheet

SKU#	120346
Product Name	HP 200W 5500K LED 120 Deg Aluminum Cone High Bay Light
Description	High Bay, 200W, Open, 5500K, 120-277VAC, 32LED, 120deg AL, HP
Estimated Energy Cost ($/yr)**	383
Watts (W)	200
Light Output (Lumens)	16495
Efficacy (Lumens/Watt)	82.48
Color Accuracy (CRI)	78
Color Temperature (K)	5500-5900
Lighting Angle/Type	120
Power Factor	0.95
Working Voltage	120-277VAC
LED Count/Type	32
Lens Reflector Style	Aluminum
Operating Temperature (F)	-22 to 158
Mount/Base Type	Hanging Hook
Dimensions (inches)	0.00 L x 0.00 W x 18.00 H x 20.00 DIA
Weight (pounds)	16
Typically Replaces	250-400W MH/HPS Fixture
Typical Life Expectancy (L70 Hours)	50,000
Approvals / Certifications	UL DLC
Photometric Data Available?	No
IES File Available?	No



Features

Traditional style aluminum housing with integrated ultra-efficient brass and thin-fin aluminum heat sink structure; open loop on top for hook for hanging mounting, can accomodate other mounting methods; anodized aluminum Parabolic reflector cone; constant current solid state long 50,000+ hour life; wide input voltage; high shock & vibration resistance; mercury-free; no noise; instant on/off great with occupancy sensors; IEC directives completed: IEC 60598, IEC 61000-3-2:2005, IEC 61347, UL8750; UL listed and DLC listed.

NOTE: The preliminary performance information provided in this notice is pending verification by an independent testing laboratory. Contact your Seesmart representative for more information about photometric and other performance testing information for this product.

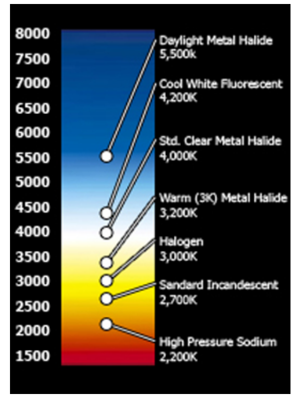
** Calculation based on 3 hours/day, $0.11/kWh. Cost depends on rates and use.

SEESMART™

EARTH FRIENDLY LED SOLUTIONS

Spec Sheet

SKU#	200732R
Product Name	G2 HP 4 Foot 15W NWC Rotatable SEP Rotatable LED Tube Light
Description	Tube Light, 4 Foot, 15 Watt, NWC, 120-277VAC, Rot, SEP, G2, HP
Estimated Energy Cost ($/yr)**	21.65
Watts (W)	15
Light Output (Lumens)	1800
Efficacy (Lumens/Watt)	120
Color Accuracy (CRI)	85
Color Temperature (K)	4000-4500
Lighting Angle/Type	120
Power Factor	0.98
Working Voltage	120-277VAC
LED Count/Type	64
Lens Reflector Style	Clear



Operating Temperature (F)	-20 to 122
Mount/Base Type	Med Bi-Pin
Dimensions (inches)	48.00 L x 0.00 W x 0.00 H x 1.11 DIA
Weight (pounds)	0.9
Typically Replaces	32-45W T8 Fluorescent
Typical Life Expectancy (L70 Hours)	50000
Approvals / Certifications	UL

Photometric Data Available?	No
IES File Available?	No

Features

Strong yet lightweight aluminum heat sink; ultra-bright, long-life 5630 SMD LEDs; polycarbonate lens; no UV, noise, or flickering; constant-current integrated driver; high shock and vibration resistance; mercury-free; single end power configuration; rotatable end cap; UL listed.

NOTE: The preliminary performance information provided in this notice is pending verification by an independent testing laboratory. Contact your Seesmart representative for more information about photometric and other performance testing information for this product.

** Calculation based on 3 hours/day, $0.11/kWh. Cost depends on rates and use.

CR22™

2′x2′ Architectural LED Troffer

Product Description

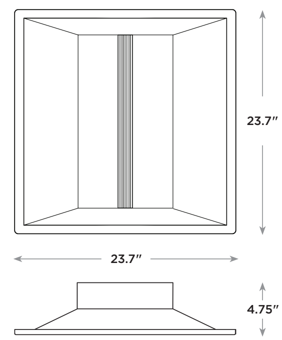
The CR22 Architectural LED troffer delivers up to 100 lumens per watt of exceptional 90 CRI light at both 2000 and 3200 lumen levels. This breakthrough performance is achieved by combining the high efficacy and high-quality light of Cree TrueWhite® Technology with a unique thermal management design. The CR22 High Definition (HD) option delivers enhanced spectrum 80+ CRI color quality. The CR22 product family is available in warm, neutral, cool, or daylight color temperatures and has step, 0-10V, or Lutron EcoSystem® Enabled dimming options. Its compact, lightweight design makes the CR22 perfect for use in commercial new construction or renovated spaces.

Performance Summary

- Utilizes Cree TrueWhite® Technology or High Definition Color
- Active Color Management
- Room-Side Heat Sink
- Assembled in the US & Mexico
- **Efficacy**: 90-100 LPW
- **Delivered Light Output**: 2000, 3200 lumens
- **Input Power**: 22-35 watts
- **CRI**: 90 CRI (Cree TrueWhite® Technology), 80+ CRI (High Definition)
- **CCT**: 3000K, 3500K, 4000K, 5000K
- **Input Voltage**: 120-277 VAC or 347 VAC*
- **Warranty**: 10 Years
- **Lifetime**: Designed to last from 50,000 hours (HD), 75,000 hours (Standard TW), and 100,000 hours (HE TW)
- **Controls**: Step Level to 50%, 0-10V Dimming or Lutron EcoSystem® Enabled to 5%
- **Mounting**: Recessed

*32L- 100 LPW 10V types only- other types require addition of a 347 accessory kit

CR22™



NOTE: Use of Expanded Junction Box will expand the depth to 6.67″ and Emergency Backup will expand the depth to 6.30″. Use of 347V will increase fixture height by 1.4”.

Housings & Accessories

Accessories			
CPLCR Chicago Plenum Field Kit **CPLCR-EM** Chicago Plenum Field Kit-Emergency	**CR-347V** 347 Volt **CR-347V-SD** Step Dimming to 50% **SMK-CR22** Surface Mount Kit	**PW-18/4-06-9T/SS-CR** Power Whip **AC5-18/4-72-PD8-JB** Adjustable Cable	**AC5-72-PD8-JB** Adjustable Cable **EJBCR-5PK** Expanded size junction box for through wiring (5 pack)

Ordering Information

Example: CR22-20L-35K-S

CR22					
Product	**Lumen Output**	**Color Temp**	**Voltage**	**Control**	**Options**
CR22	**20L** 22W 2000 lumens – 90 LPW **32L** 32W 3200 lumens – 100 LPW	**30K** 3000 Kelvin **35K** 3500 Kelvin **40K** 4000 Kelvin **50K** 5000 Kelvin	**Blank** 120-277 Volt (Standard) **34**[6] 347 Volt (Optional)	**S** Step Dimming to 50% **10V** 0-10V Dimming to 5% **LES** Lutron EcoSystem® Enabled to 5%	**HD**[7] High Definition Color - CRI 80+ (35W 3200 lumens - 90 LPW) **EB14**[2,4] Emergency Backup - 1400 lumens **EB14 SMK**[2,3,5] Emergency Backup with surface mount kit - 1400 lumens

1. Reference www.cree.com/lighting for recommended dimming control options. 2. Not available in LES types except 32L LES type. 3. Not available with EB14 option. Use EB14 SMK. 4. EB14 not for use with SMK Kits 5. Includes surface mount kit accessory (SMK-CR24). 6. 347V integrated option only available on 32L 100 LPW 10V fixtures. Wattage increases to 33.5W and fixture height increases by 1.4” over standard 120-277V fixtures. 7. HD only available in 32L. Suggested MSRP for the adder over the standard CR Series fixture for the Lutron EcoSystem® Enabled feature is $49. †See www.cree.com/lighting for warranty terms.

Rev. Date 9/17/2013

Product Specifications

CREE TRUEWHITE® TECHNOLOGY
A revolutionary way to generate high-quality white light, Cree TrueWhite® Technology mixes the light from the highest performing red and unsaturated yellow LEDs. This patented approach delivers an exclusive combination of 90+ CRI, beautiful light characteristics, and lifelong color consistency, all while maintaining high luminous efficacy—a true no compromise solution.

HIGH DEFINITION COLOR
High Definition (HD) Color delivers enhanced spectrum 80+ CRI color quality. HD is derived from color mixed and tuned Cree TrueWhite® Technology.

ROOM-SIDE HEAT SINK
An innovative thermal management system designed to maximize cooling effectiveness by integrating a unique room-side heat sink into the diffusing lens. This breakthrough design creates a pleasing architectural aesthetic while conducting heat away from LEDs in a temperature-controlled environment. This enables the LEDs to consistently run cooler, providing significant boosts to lifetime, efficacy, and color consistency.

LUMEN MAINTENANCE FACTORS
- Reference www.cree.com/lighting for detailed lumen maintenance factors.

CONSTRUCTION & MATERIALS
- Durable 20-gauge steel housing with standard troffer access plate for electrical installation.
- Field replaceable light engine integrates LEDs, driver, power supply, thermal management, and optical mixing components.
- One-piece lower reflector finished with a textured high reflectance white polyester powder coating creates a comfortable visual transition from the lens to the ceiling plane.
- Provided t-bar clips and holes for mounting support wires enable recessed or suspended installation.
- Individual fixtures may be mounted end to end for a continuous row of illumination.

  NOTE: Reference www.cree.com/lighting for detailed instructions on field replacement of the light engine.

OPTICAL SYSTEM
- Unique combination of reflective and refractive optical components achieves a uniform, comfortable appearance while eliminating pixelation and color fringing.
- Components work together to optimize distribution, balancing the delivery of high illuminance levels on horizontal surfaces with an ideal amount of light on walls and vertical surfaces. This increases the perception of spaciousness.
- Diffusing lens integrated with upward-facing LED strip eliminates direct view of LEDs while lower reflector balances brightness of lens with the ceiling to create a low-glare high angle appearance.

ELECTRICAL SYSTEM
- Integral, high-efficiency driver and power supply.
- Power Factor = 0.9 nominal
- Input Power: Stays constant over life.
- Input Voltage: 120-277V, 347V- 50/60Hz
- Battery Backup: Consult factory.
- Temperature Rating: Designed to operate in temperatures 0-35 C and below room side and plenum side.
- Total Harmonic Distortion: < 20%

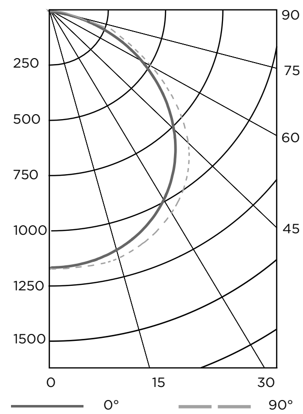
CONTROLS
- Step dimming to 50% comes standard.*
- Optional continuous dimming to 5% with 0-10V DC control protocol.*
- Optional Lutron EcoSystem® Enabled option allows seamless integration with Lutron EcoSystem controls.*

REGULATORY & VOLUNTARY QUALIFICATIONS
- UL924 (EB14 option).
- cULus Listed.
- DLC qualified.**
- Suitable for damp locations.
- Designed for Indoor use.

*Reference www.cree.com/lighting for recommended dimming controls and wiring diagrams.
**Please refer to DLC QPL list for most current information.

Photometry

CR22 BASED ON LTL REPORT TEST #: 24292



Coefficients Of Utilization

RCC %:	80			
RW %:	70	50	30	10
RCR: 0	119	119	119	119
1	110	105	101	98
2	100	92	85	80
3	91	81	73	67
4	84	72	63	57
5	77	64	55	49
6	71	58	49	43
7	66	52	44	38
8	61	48	39	33
9	57	44	36	30
10	53	40	32	27

Effective Floor Cavity Reflectance: 20%

Average Luminance Table (cd/m2)

Vertical Angle	Horizontal Angle 0°	45°	90°
0°	3864	3864	3864
45°	3575	3864	3972
55°	3164	3656	3758
65°	2498	3133	3347
75°	1620	2348	2051
85°	366	252	168

Zonal Lumen Summary

Zone	Lumens	% Lamp	Luminaire
0-30	923	N/A	28.1%
0-40	1527	N/A	46.5%
0-60	2704	N/A	82.5%
0-90	3280	N/A	100%

Reference www.cree.com/lighting for detailed photometric data.

Application Reference

Open Space					
Spacing	**Lumens**	**Wattage**	**LPW**	**w/ft²**	**Average fc**
8 x 8	2000L	22W	90	0.35	28
	3200L	32W	100	0.55	44
8 x 10	2000L	22W	90	0.28	23
	3200L	32W	100	0.44	37
10 x 10	2000L	22W	90	0.22	20
	3200L	32W	100	0.35	31
10 x 12	2000L	22W	90	0.19	16
	3200L	32W	100	0.29	25

9′ ceiling: 80/50/20 reflectances; 2.5′ workplane, open room LLF: 1.0 Initial.
Open Space: 50′ x 40′ x 10′

Rev. Date 9/17/2013

US: www.cree.com/lighting T (800) 236-6800 F (262) 504-5415
Canada: www.cree.com/canada T (800) 473-1234 F (800) 890-7507

CR24™

2′x4′ Architectural LED Troffer

Product Description

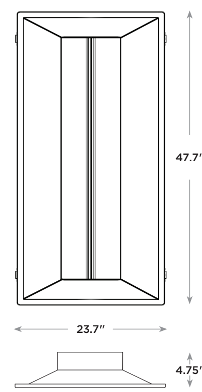
The CR24 Architectural LED High Efficiency (HE) troffer delivers up to 130 lumens per watt of exceptional 90 CRI light at 4000 lumens. This breakthrough performance is achieved by combining the high efficacy and high-quality light of Cree TrueWhite® Technology with a unique thermal management design. The CR24 High Definition (HD) option delivers enhanced spectrum 80+ CRI color quality. The CR24 product family is available in warm, neutral, cool, or daylight color temperatures and has step, 0-10V, or Lutron EcoSystem® Enabled dimming options. Its compact, lightweight design makes the CR24 perfect for use in commercial new construction or renovated spaces.

Performance Summary

- Utilizes Cree TrueWhite® Technology or High Definition Color Quality
- Active Color Management
- Room-Side Heat Sink
- Assembled in the US & Mexico
- **Efficacy**: 90-130 LPW
- **Delivered Light Output**: 2200, 3100, 4000, 5000 lumens
- **Input Power**: 22-50 watts
- **CRI**: 90 CRI (Cree TrueWhite® Technology), 80+ CRI (High Definition)
- **CCT**: 3000K, 3500K, 4000K, 5000K
- **Input Voltage**: 120-277 VAC or 347 VAC*
- **Warranty**: 10 years
- **Lifetime**: Designed to last from 50,000 hours (HD), 75,000 hours (Standard TW), and 100,000 hours (HE TW)
- **Controls**: Step Level to 50%, 0-10V Dimming or Lutron EcoSystem Enabled to 5%[1]
- **Mounting**: Recessed

*40L 100 LPW 10V types only - other types require addition of a 347 accessory kit

CR24™



NOTE: Use of Expanded Junction Box will expand the depth to 6.67″ and Emergency Backup will expand the depth to 6.30″. Use of 347V will increase fixture height by 1.4″.

Housings & Accessories

Accessories			
CPLCR Chicago Plenum Field Kit	**CR-347V** 347 Volt	**PW-18/4-06-9T/SS-CR** Power Whip	**AC5-72-PD8-JB** Adjustable Cable
CPLCR-EM Chicago Plenum Field Kit-Emergency	**CR-347V-SD** Step Dimming to 50%	**AC5-18/4-72-PD8-JB** Adjustable Cable	**EJBCR-5PK** Expanded size junction box for through wiring (5 pack)
	SMK-24 Surface Mount Kit		

Ordering Information

Example: CR24-40L-35K-S

CR24					
Product	**Lumen Output**	**Color Temp**	**Voltage**	**Control**	**Options**
CR24	**22L** 22W — 2200 lumens – 100 LPW **31L** 34W — 31L 3100 lumens – 90 LPW **40L** 40W — 40L 4000 lumens – 100 LPW **40L HE** — 40L HE 30.5W — 4000 lumens – 130 LPW (30K) 32W — 4000 lumens – 125 LPW (35K) 33W — 4000 lumens – 120 LPW (40K) 34.5W — 4000 lumens – 115 LPW (50K) **50L** 50W — 50L 5000 lumens – 100 LPW	**30K** 3000 Kelvin **35K** 3500 Kelvin **40K** 4000 Kelvin **50K** 5000 Kelvin	**Blank** 120-277 Volt (Standard) **34**[6] 347 Volt (Optional)	**S** Step Dimming to 50% **10V** 0-10V Dimming to 5% **LES** Lutron EcoSystem® Enabled to 5%	**HD**[7] High Definition Color - CRI 80+ (44W 4000 lumens - 90 LPW) **EB14**[2,4] Emergency Backup - 1400 lumens **EB14 SMK**[2,3,5] Emergency Backup with surface mount kit - 1400 lumens

1. Reference www.cree.com/lighting for recommended dimming control options. 2. Not available in 50L. Not available in LES types except 40L LES type. 3. Not available with EB14 option. Use EB14 SMK. 4. EB14 not for use with SMK Kits 5. Includes surface mount kit accessory (SMK-CR24). 6. 347V integrated option only available on 40L 100 LPW 10V fixtures. Wattage increases to 42W and fixture height increases by 1.4″ over standard 120-277V fixtures. 7. HD only available in 40L.
†See www.cree.com/lighting for warranty terms.

Rev. Date 9/17/2013

US: www.cree.com/lighting T (800) 236-6800 F (262) 504-5415
Canada: www.cree.com/canada T (800) 473-1234 F (800) 890-7507

Product Specifications

CREE TRUEWHITE® TECHNOLOGY
A revolutionary way to generate high-quality white light, Cree TrueWhite® Technology mixes the light from the highest performing red and unsaturated yellow LEDs. This patented approach delivers an exclusive combination of 90+ CRI, beautiful light characteristics, and lifelong color consistency, all while maintaining high luminous efficacy—a true no compromise solution.

HIGH DEFINITION COLOR
High Definition (HD) Color delivers enhanced spectrum 80+ CRI color quality. HD is derived from color mixed and tuned Cree TrueWhite® Technology.

ROOM-SIDE HEAT SINK
An innovative thermal management system designed to maximize cooling effectiveness by integrating a unique room-side heat sink into the diffusing lens. This breakthrough design creates a pleasing architectural aesthetic while conducting heat away from LEDs in a temperature-controlled environment. This enables the LEDs to consistently run cooler, providing significant boosts to lifetime, efficacy, and color consistency.

LUMEN MAINTENANCE FACTORS
- Reference www.cree.com/lighting for detailed lumen maintenance factors.

CONSTRUCTION & MATERIALS
- Durable 20-gauge steel housing with standard troffer access plate for electrical installation.
- Field replaceable light engine integrates LEDs, driver, power supply, thermal management, and optical mixing components.
- One-piece lower reflector finished with a textured high reflectance white polyester powder coating creates a comfortable visual transition from the lens to the ceiling plane.
- Provided t-bar clips and holes for mounting support wires enable recessed or suspended installation.
- Individual fixtures may be mounted end to end for a continuous row of illumination.

  NOTE: Reference www.cree.com/lighting for detailed instructions on field replacement of the light engine.

OPTICAL SYSTEM
- Unique combination of reflective and refractive optical components achieves a uniform, comfortable appearance while eliminating pixelation and color fringing.
- Components work together to optimize distribution, balancing the delivery of high illuminance levels on horizontal surfaces with an ideal amount of light on walls and vertical surfaces. This increases the perception of spaciousness.
- Diffusing lens integrated with upward-facing LED strip eliminates direct view of LEDs while lower reflector balances brightness of lens with the ceiling to create a low-glare high angle appearance.

ELECTRICAL SYSTEM
- Integral, high-efficiency driver and power supply.
- Power Factor = 0.9 nominal
- Input Power: Stays constant over life.
- Input Voltage: 120-277V, 347V- 50/60Hz
- Battery Backup: Consult factory.
- Temperature Rating: Designed to operate in temperatures 0-35 C and below room side and plenum side.
- Total Harmonic Distortion: < 20%

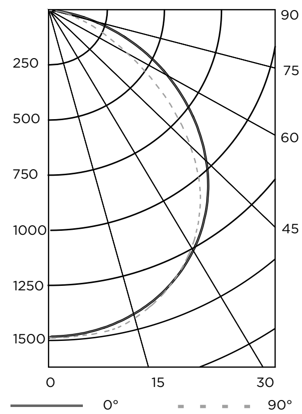
CONTROLS
- Step dimming to 50% comes standard.*
- Optional continuous dimming to 5% with 0-10V DC control protocol.*
- Optional Lutron EcoSystem® Enabled option allows seamless integration with Lutron EcoSystem controls.*

REGULATORY & VOLUNTARY QUALIFICATIONS
- UL924 (EB14 option).
- cULus Listed.
- DLC qualified.**
- Suitable for damp locations.
- Designed for Indoor use.

*Reference www.cree.com/lighting for recommended dimming controls and wiring diagrams.
**Please refer to DLC QPL list for most current information.

Photometry

CR24-4000L BASED ON LTL REPORT TEST #: 22421
Fixture photometry has been conducted by a NVLAP accredited testing laboratory in accordance with IESNA LM-79-08. IESNA LM-79-08 specifies the entire luminaire as the source resulting in a fixture efficiency of 100%.



Coefficients Of Utilization

RCC %:	80			
RW %:	70	50	30	0
RCR: 0	119	119	119	119
1	109	105	101	97
2	100	92	85	79
3	91	80	72	66
4	83	71	63	56
5	76	64	55	48
6	71	57	48	42
7	65	52	43	37
8	61	47	39	33
9	57	43	35	30
10	53	40	32	27

Effective Floor Cavity Reflectance: 20%

Average Luminance Table (cd/m2)

Vertical Angle	Horizontal Angle 0°	45°	90°
0°	2174	2174	2174
45°	1976	2116	2152
55°	1807	2018	2074
65°	1553	1889	1879
75°	1149	1501	1119
85°	424	62	62

Zonal Lumen Summary

Zone	Lumens	% Lamp	Luminaire
0-30	1,115	27.9%	27.9%
0-40	1,835	45.9%	45.9%
0-60	3,245	81.1%	81.1%
0-90	4,000	100%	100%

Reference www.cree.com/lighting for detailed photometric data.

Application Reference

Open Space					
Spacing	Lumens	Wattage	LPW	w/ft²	Average fc
8 x 8	2200L	22W	100	0.35	30
	4000L	40W	100	0.69	54
	4000L	30.5W	130	0.56	54
	5000L	50W	100	0.78	68
8 x 10	2200L	22W	100	0.28	25
	4000L	40W	100	0.55	45
	4000L	30.5W	130	0.45	45
	5000L	50W	100	0.62	57
10 x 10	2200L	22W	100	0.22	21
	4000L	40W	100	0.44	38
	4000L	30.5W	130	0.36	38
	5000L	50W	100	0.50	48
10 x 12	2200L	22W	100	0.19	17
	4000L	40W	100	0.37	30
	4000L	30.5W	130	0.30	30
	5000L	50W	100	0.42	38

9′ ceiling: 80/50/20 reflectances; 2.5′ workplane, open room. LLF: 1.0 Initial.
Open Space: 50′ x 40′ x 10′

Rev. Date 9/17/2013

CMG Lighting

Commercial Series

PAR30

Family	Product	Field	Color Temp	Finish
DL	P30F	38 60	27K 30K	WH BL

Beam Angle 50%	17º	35º
Field Angle 10%	38º	60º
Power Consumption	12 Watts	
Equivalent Source	75W	60W
Power Factor	>0.80	
Dimming Range*	20-100%	
Color Temperature	2700K (Warm White) 3000K (Natural White)	
CRI	80+	
Lumen Output	550 lm (2700K) 600 lm (3000K)	
Lumens/Watt (Typ)	54	
CBCP	5050	1400
Operating Temp	-20 ~ +40°C	
Storage Temp	-40 ~ +60°C	
AC Input Voltage	120 Volts 60Hz	
Lumen Maintenance	L70 >25,000 hrs	
LED	Lumileds	
Environmental	Contains no lead or mercury No UV or IR emissions	
Warranty	3 years	
Use	Indoor applications	
Weight	300 grams ±5	
Dimensions	3.75"W x 3.75"H	
Base	E26	

Architectural Grade High Power 12 Watt Dimmable Led Replacement Lamp

Produces 60-75 Watts of Incandescent Halogen Light

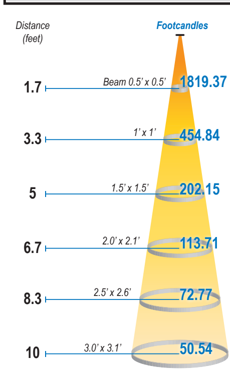
LM-79 and LM-80 Tested

- Robust electronics mounted to a layered (redundant) heat dissipation substrate
- Proprietary optics deliver light to the task
- **Finishes: White, Black, Custom**
- Instant On, No Warm Up, No Flicker
- May Be Controlled by Peripheral Systems and Sensors
- Reduced waste – contractor and earth-friendly packaging for roll-outs and projects

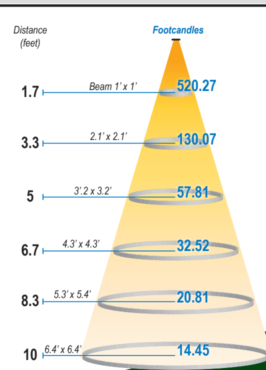
Life Rating Reduced +/- 15% When Used in IC Housings.

Do Not Use in Enclosed Fixtures. Not for use in damp locations.

*Compatible dimmer models:
Lutron TG-600PH-LA; S-600PE; S-600; TGLV-600PR-WH; CT-600PR; D-600PH; MRF2-6ELV; HW/LP-RPM-4A-120; HW/LP-RPM-4U-120; GP (Harrier) Card; HxD-5NE; RRD-6NA; PHPM-WBX with DVF-103P; PHPM-PA with QSG-6D; **Leviton** 6633-P; PRI06; **Legrand** LS1000PWV (consult factory for updated list)



17° beam angle



35° beam angle

CMG Lighting

Commercial Series

PAR38

Family	Product	Field	Color Temp	Finish
DL	P38F	38 60	27K 30K	WH BL

Beam Angle 50%	17º	35º
Field Angle 10%	38º	60º
Power Consumption	17 Watts	
Equivalent Source	90W	
Power Factor	>0.80	
Dimming Range*	20-100%	
Color Temperature	2700K (Warm White) 3000K (Natural White)	
CRI	80+	
Lumen Output	800 lm (2700K) 860 lm (3000K)	
Lumens/Watt (Typ)	57	54
CBCP	7100	1990
Operating Temp	-20 ~ +40°C	
Storage Temp	-40 ~ +60°C	
AC Input Voltage	120 Volts 60Hz	
Lumen Maintenance	L70 >25,000 hrs	
LED	Lumileds	
Environmental	Contains no lead or mercury No UV or IR emissions	
Warranty	3 years	
Use	Indoor applications	
Weight	500 grams ±5	
Dimensions	4.75"W x 4.75"H	
Base	E26	

RoHS

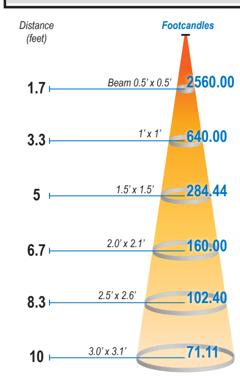
Architectural Grade High Power
17 Watt Dimmable Led Replacement Lamp

Produces 90 Watts of Incandescent Halogen Light

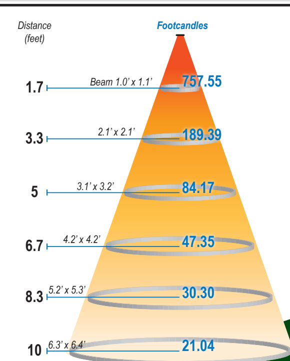
LM-79 and LM-80 Tested

- Robust electronics mounted to a layered (redundant) heat dissipation substrate
- Proprietary optics deliver light to the task
- **Finishes: White, Black, Custom**
- Instant On, No Warm Up, No Flicker
- May Be Controlled by Peripheral Systems and Sensors
- Reduced waste – contractor and earth-friendly packaging for roll-outs and projects

Life Rating Reduced +/- 15% When Used in IC Housings.
Do Not Use in Enclosed Fixture. Not for use in damp locations.
*Compatible dimmer models:
Lutron TG-600PH-LA, S-600PE; S-600; CT-603PG; TGLV-600PR-WH; CT-600PR; D-600PH; MRF-2-6ELV; HW/LP-RPM-4A-120; HW/LP-RPM-4U-120; GP (Harrier) Card; HxD-5NE; **Grafik** Eye QS Main Unit Family; RRD-6NA; PHPM-PA with QSG-6D; **Leviton** 6633-P; PRI06; **Legrand** LS1000PWV (consult factory for updated list)



17° beam angle



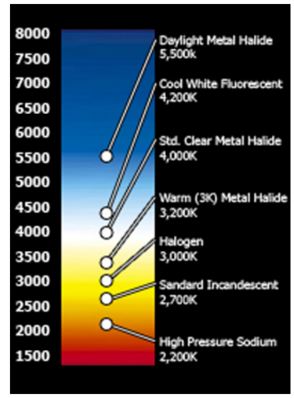
35° beam angle

1201 N. Fourth St., Watertown, WI 53098 • 1-877-260-6425 • www.CMGlighting.com

SEESMART®
EARTH FRIENDLY LED SOLUTIONS

Spec Sheet

SKU#	200711
Product Name	G2 HP 2 Foot 8W NWM SEP LED Tube Light
Description	Tube Light, 2 Foot, 8 Watt, NWM, 120-277VAC, SEP, G2, HP
Estimated Energy Cost ($/yr)**	13.45
Watts (W)	8
Light Output (Lumens)	800
Efficacy (Lumens/Watt)	100
Color Accuracy (CRI)	87
Color Temperature (K)	4000-4500
Lighting Angle/Type	120
Power Factor	0.98
Working Voltage	120-277VAC
LED Count/Type	32
Lens Reflector Style	Milky
Operating Temperature (F)	-20 to 122
Mount/Base Type	Med Bi-Pin
Dimensions (inches)	24.00 L x 0.00 W x 0.00 H x 1.11 DIA
Weight (pounds)	0.4
Typically Replaces	20W T8 Fluorescent
Typical Life Expectancy (L70 Hours)	50,000
Approvals / Certifications	UL
Photometric Data Available?	No
IES File Available?	No



Features

Strong yet lightweight aluminum heat sink; ultra-bright, long-life 5630 SMD LEDs; polycarbonate lens; no UV, noise, or flickering; constant-current integrated driver; high shock and vibration resistance; mercury-free; single end power configuration; UL listed.

NOTE: The preliminary performance information provided in this notice is pending verification by an independent testing laboratory. Contact your Seesmart representative for more information about photometric and other performance testing information for this product.

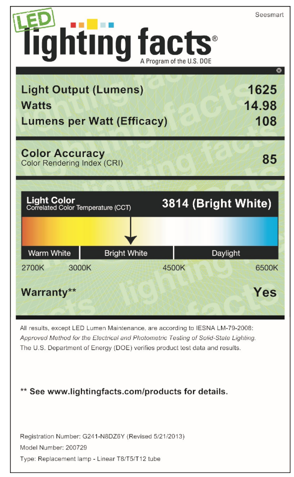
** Calculation based on 3 hours/day, $0.11/kWh. Cost depends on rates and use.

SEESMART™

EARTH FRIENDLY LED SOLUTIONS

Spec Sheet

SKU#	200729
Product Name	G2 HP 4 Foot 15W NWM SEP LED Tube Light
Description	Tube Light, 4 Foot, 15 Watt, NWM, 120-277VAC, SEP, G2, HP
Estimated Energy Cost ($/yr)**	21.65
Watts (W)	15
Light Output (Lumens)	1625
Efficacy (Lumens/Watt)	108.33
Color Accuracy (CRI)	85
Color Temperature (K)	4000-4500
Lighting Angle/Type	120
Power Factor	0.98
Working Voltage	120-277VAC
LED Count/Type	64
Lens Reflector Style	Milky
Operating Temperature (F)	-20 to 122
Mount/Base Type	Med Bi-Pin
Dimensions (inches)	48.00 L x 0.00 W x 0.00 H x 1.11 DIA
Weight (pounds)	0.9
Typically Replaces	32-45W T8 Fluorescent
Typical Life Expectancy (L70 Hours)	50,000
Approvals / Certifications	UL DLC
Photometric Data Available?	Yes
IES File Available?	Yes


Seesmart

LED lighting facts®
A Program of the U.S. DOE

Light Output (Lumens)	1625
Watts	14.98
Lumens per Watt (Efficacy)	108
Color Accuracy Color Rendering Index (CRI)	85
Light Color Correlated Color Temperature (CCT)	3814 (Bright White)
Warranty**	Yes

Warm White | Bright White | Daylight
2700K 3000K 4500K 6500K

All results, except LED Lumen Maintenance, are according to IESNA LM-79-2008: *Approved Method for the Electrical and Photometric Testing of Solid-State Lighting.* The U.S. Department of Energy (DOE) verifies product test data and results.

** See www.lightingfacts.com/products for details.

Registration Number: G241-N8DZ6Y (Revised 5/21/2013)
Model Number: 200729
Type: Replacement lamp - Linear T8/T5/T12 tube

<u>Features</u>

Strong yet lightweight aluminum heat sink; ultra-bright, long-life 5630 SMD LEDs; polycarbonate lens; no UV, noise, or flickering; constant-current integrated driver; high shock and vibration resistance; mercury-free; single end power configuration; UL listed.

NOTE: The preliminary performance information provided in this notice is pending verification by an independent testing laboratory. Contact your Seesmart representative for more information about photometric and other performance testing information for this product.

** Calculation based on 3 hours/day, $0.11/kWh. Cost depends on rates and use.

ONLINE CERTIFICATIONS DIRECTORY

OOLV2.E350939
Lamps, Self-ballasted, Light-emitting-diode Type - Component

Page Bottom

Lamps, Self-ballasted, Light-emitting-diode Type - Component

See General Information for Lamps, Self-ballasted, Light-emitting-diode Type - Component

SEESMART INC E350939
4139 GUARDIAN ST
SIMI VALLEY, CA 93063 USA

LED Tube Lamps, Model(s) 200200-200205, 200212-200217

Self-Ballasted LED Tube Lamps, Model(s) 200124 (A), 200125 (A), 200126 (A), 200127 (A), 200128 (A), 200129 (A), 200130 (A), 200131 (A), 200132 (A), 200133 (A), 200134 (A), 200135 (A), 200136 (A), 200137 (A), 200138 (A), 200139 (A), 200140 (A), 200141 (A), 200142 (A), 200143 (A), 200144 (A), 200145 (A), 200146 (A), 200147 (A), 200148 (A), 200149 (A), 200150 (A), 200151 (A), 200152 (A), 200153 (A), 200154 (A), 200155 (A), 200156 (A), 200157 (A), 200158 (A), 200159 (A), 200160 (A), 200161 (A), 200162 (A), 200163 (A), 200164 (A), 200506 (A), 200507 (A), 200508 (A), 200509 (A), 200510 (A), 200511 (A), 200512 (A), 200513 (A), 200514 (A), 200515 (A), 200516 (A), 200517 (A), 200518 (A), 200519 (A), 200520 (A), 200521 (A), 200522 (A), 200523 (A), 200524 (A), 200525 (A), 200526 (A), 200527 (A), 200528 (A), 200529 (A), 200530 (A), 200531 (A), 200532 (A), 200533 (A), 200534 (A), 200535 (A), 200536 (A), 200537 (A), 200538 (A), 200539 (A), 200540 (A), 200541 (A), 200542 (A), 200543 (A), 200544 (A), 200545 (A), 200546 (A), 200547 (A), 200548 (A), 200549 (A), 200550 (A), 200551 (A), 200552 (A), 200553 (A), TP-Tube10-8FT

(A) - May end with the letter A-Z.

Marking: Company name and model designation.
Last Updated on 2012-09-18

Questions? Print this page Terms of Use Page Top

ONLINE CERTIFICATIONS DIRECTORY

OOLV8.E350939
Lamps, Self-ballasted, Light-emitting-diode Type Certified for Canada - Component

Page Bottom

Lamps, Self-ballasted, Light-emitting-diode Type Certified for Canada - Component

See General Information for Lamps, Self-ballasted, Light-emitting-diode Type Certified for Canada - Component

SEESMART INC E350939
4139 GUARDIAN ST
SIMI VALLEY, CA 93063 USA

Self-Ballasted LED Tube Lamps, Model(s) 200124 (A), 200125 (A), 200126 (A), 200127 (A), 200128 (A), 200129 (A), 200130 (A), 200131 (A), 200132 (A), 200133 (A), 200134 (A), 200135 (A), 200136 (A), 200137 (A), 200138 (A), 200139 (A), 200140 (A), 200141 (A), 200142 (A), 200143 (A), 200144 (A), 200145 (A), 200146 (A), 200147 (A), 200148 (A), 200149 (A), 200150 (A), 200151 (A), 200152 (A), 200153 (A), 200154 (A), 200155 (A), 200156 (A), 200157 (A), 200158 (A), 200159 (A), 200160 (A), 200161 (A), 200162 (A), 200163 (A), 200164 (A), 200506 (A), 200507 (A), 200508 (A), 200509 (A), 200510 (A), 200511 (A), 200512 (A), 200513 (A), 200514 (A), 200515 (A), 200516 (A), 200517 (A), 200518 (A), 200519 (A), 200520 (A), 200521 (A), 200522 (A), 200523 (A), 200524 (A), 200525 (A), 200526 (A), 200527 (A), 200528 (A), 200529 (A), 200530 (A), 200531 (A), 200532 (A), 200533 (A), 200534 (A), 200535 (A), 200536 (A), 200537 (A), 200538 (A), 200539 (A), 200540 (A), 200541 (A), 200542 (A), 200543 (A), 200544 (A), 200545 (A), 200546 (A), 200547 (A), 200548 (A), 200549 (A), 200550 (A), 200551 (A), 200552 (A), 200553 (A), TP-Tube10-8FT

(A) - May end with the letter A-Z.

Marking: Company name, model designation and Recognized Component Mark for Canada, c RU .
Last Updated on 2012-09-18

Questions? Print this page Terms of Use Page Top

OOQA2.E354920
Light-emitting-diode Arrays, Modules and Controllers - Component

Page Bottom

Light-emitting-diode Arrays, Modules and Controllers - Component

See General Information for Light-emitting-diode Arrays, Modules and Controllers - Component

SEESMART INC E354920
4139 GUARDIAN ST
SIMI VALLEY, CA 93063 USA

LED modules, Models 270206, 270203, 270200, 270215.

Marking: Company name, model designation and the Recognized Component Mark .
Last Updated on 2012-04-27

Questions? Print this page Terms of Use Page Top

ONLINE CERTIFICATIONS DIRECTORY

OOQA8.E354920
Light-emitting-diode Arrays, Modules and Controllers Certified for Canada - Component

Page Bottom

Light-emitting-diode Arrays, Modules and Controllers Certified for Canada - Component

See General Information for Light-emitting-diode Arrays, Modules and Controllers Certified for Canada - Component

SEESMART INC
4139 GUARDIAN ST
SIMI VALLEY, CA 93063 USA

E354920

LED modules, Models 270206, 270203, 270200, 270215.

Marking: Company name, model designation and the Recognized Component Mark for Canada c RU.
Last Updated on 2012-04-27

Questions? Print this page Terms of Use Page Top

ONLINE CERTIFICATIONS DIRECTORY

IFAR.E355293
Light-emitting-diode Retrofit Luminaire Conversion Kits

Page Bottom

Light-emitting-diode Retrofit Luminaire Conversion Kits

See General Information for Light-emitting-diode Retrofit Luminaire Conversion Kits

SEESMART INC
4139 GUARDIAN ST
SIMI VALLEY, CA 93063 USA

E355293

Retrofit Kit Model/Part No.	Retrofitted Luminaire Type or Model/Part No.	Light Source	Rating
LED retrofit luminaire conversion kit			
Model 240001	Enclosed type IC Recessed or Surface Mounted 2'x4' or larger Fluorescent Luminaire	Replaceable-type T8 self-ballasted LED lamp	120 V ac, 0.23 A Max.
Model 200212-200217	Permanently-connected fluorescent	Replaceable-type T8 self-ballasted LED lamp	Rated 100-277 V, 47-63Hz, 0.16 A
Model 200200-200205	Permanently-connected fluorescent	Replaceable-type T8 self-ballasted LED lamp	Rated 100-277 V, 47-63Hz, 0.3 A
SKU #200704-200706	Recessed Type-IC or surface mounted, Max. 4 lamps per fluorescent luminaire	LED Tube Lamps	120-240V, 50/60Hz, 0.2A, 11W
SKU #200700-200703	Recessed Type-IC or surface mounted, Max. 4 lamps per fluorescent luminaire	LED Tube Lamps	120-240V, 50/60Hz, 0.3A, 22W
200722 200723 200724 200725 200726 200727	Permanently-connected fluorescent or incandescent	Non-replaceable type LED Array with driver	100~277Vac, 50/60 Hz, 110 mA,12 W
200728 200729 200730 200731 200732 200733 200734 200735 200736	Permanently-connected fluorescent or incandescent	Non-replaceable type LED Array with driver	100~277Vac, 50/60 Hz, 150 mA,15 W
200737 200738 200739 200740 200741 200742 200743 200744 200745	Permanently-connected fluorescent or incandescent	Non-replaceable type LED Array with driver	100~277Vac, 50/60 Hz, 180 mA,18 W
200746 200747 200748 200749 200750 200751 200752 200753	Permanently-connected fluorescent or incandescent	Non-replaceable type LED Array with driver	100~277Vac, 50/60 Hz, 220 mA,22 W

200754 200755 200756 200757 200758 200759 200760 200761 200762 200763			

Last Updated on 2012-12-19

Questions? Print this page Terms of Use Page Top

ONLINE CERTIFICATIONS DIRECTORY

IFAM.E349191
Light-emitting-diode Surface-mounted Luminaires

Page Bottom

Light-emitting-diode Surface-mounted Luminaires

See General Information for Light-emitting-diode Surface-mounted Luminaires

SEESMART INC
4139 GUARDIAN ST
SIMI VALLEY, CA 93063 USA

E349191

LED surface-mounted luminaire, Model(s) SKU #280065-280066, SKU #280067-280070, SKU #280071-280074

LED surface-mounted luminaires, Model(s) 190033, 190034, 190042, 190043, 190035, 190036, 190044, 190045, 190037, 190038, 190046, 190047, 190039, 190040, 190048, 190049, 190087 (A), 190088 (A), 190089 (A), 190090 (A), 190091 (A), 190092 (A), 190093 (A), 190094 (A), 190095 (A), 190096 (A), 190097 (A), 190098 (A), 190099 (A), 190100 (A), 190101 (A), 190102 (A), 190103 (A), 190104 (A), 190105 (A), 190106 (A), 190107 (A), 190108 (A), 190109 (A), 190110 (A), 190111 (A), 190112 (A), 190113 (A), SKU# 120001

Light-emitting-diode surface-mounted Luminaires, Model(s) SKU #120365-120370, SKU #120389-120400, SKU #120371-120376, SKU #120335-120343, SKU #120353-120358, SKU #120344-120352, SKU #120359-120364, SKU #120377-120388

(A) - May end with the letter A-Z.

Last Updated on 2012-12-10

Questions? Print this page Terms of Use Page Top

ONLINE CERTIFICATIONS DIRECTORY

IFAM7.E349191
Light-emitting-diode Surface-mounted Luminaires Certified for Canada

Page Bottom

Light-emitting-diode Surface-mounted Luminaires Certified for Canada

See General Information for Light-emitting-diode Surface-mounted Luminaires Certified for Canada

SEESMART INC E349191
4139 GUARDIAN ST
SIMI VALLEY, CA 93063 USA

LED surface-mounted luminaire, Model(s) SKU #280065-280066, SKU #280067-280070, SKU #280071-280074

LED surface-mounted luminaires, Model(s) 190033, 190034, 190042, 190043, 190035, 190036, 190044, 190045, 190037, 190038, 190046, 190047, 190039, 190040, 190048, 190049, 190105 (A), 190106 (A), 190107 (A), 190108 (A), 190109 (A), 190110 (A), 190111 (A), 190112 (A), 190113 (A)

Light-emitting-diode surface-mounted Luminaires, Model(s) SKU #120365-120370, SKU #120389-120400, SKU #120371-120376, SKU #120335-120343, SKU #120353-120358, SKU #120344-120352, SKU #120359-120364, SKU #120377-120388

(A) - May end with the letter A-Z.

Last Updated on 2012-12-10

Questions? Print this page Terms of Use Page Top

ONLINE CERTIFICATIONS DIRECTORY

IEUQ.E324248
Luminaire Conversions, Retrofit

Page Bottom

Luminaire Conversions, Retrofit

See General Information for Luminaire Conversions, Retrofit

SEESMART INC E324248

4139 GUARDIAN ST

SIMI VALLEY, CA 93063 USA

LED tube lamps, Cat. Nos. 200124 (A), 200125 (A), 200126 (A), 200127 (A), 200128 (A), 200129 (A), 200130 (A), 200131 (A), 200132 (A), 200133 (A), 200134 (A), 200135 (A), 200136 (A), 200137 (A), 200138 (A), 200139 (A), 200140 (A), 200141 (A), 200142 (A), 200143 (A), 200144 (A), 200145 (A), 200146 (A), 200147 (A), 200148 (A), 200149 (A), 200150 (A), 200151 (A), 200152 (A), 200153 (A), 200154 (A), 200155 (A), 200156 (A), 200157 (A), 200158 (A), 200159 (A), 200160 (A), 200161 (A), 200162 (A), 200163 (A), 200164 (A), TP-Tube10-8FT, 200506 (A), 200507 (A), 200508 (A), 200509 (A), 200510 (A), 200511 (A), 200512 (A), 200513 (A), 200514 (A), 200515 (A), 200516 (A), 200517 (A), 200518 (A), 200519 (A), 200520 (A), 200521 (A), 200522 (A), 200523 (A), 200524 (A), 200525 (A), 200526 (A), 200527 (A), 200528 (A), 200529 (A), 200530 (A), 200531 (A), 200532 (A), 200533 (A), 200534 (A), 200535 (A), 200536 (A), 200537 (A), 200538 (A), 200539 (A), 200540 (A), 200541 (A), 200542 (A), 200543 (A), 200544 (A), 200545 (A), 200546 (A), 200547 (A), 200548 (A), 200549 (A), 200550 (A), 200551 (A), 200552 (A), 200553 (A).

(A) May end with the letter A through Z.

Last Updated on 2012-11-16

Questions? Print this page Terms of Use Page Top

ONLINE CERTIFICATIONS DIRECTORY

IEUQ7.E324248
Luminaire Conversions, Retrofit Certified for Canada

Page Bottom

Luminaire Conversions, Retrofit Certified for Canada

See General Information for Luminaire Conversions, Retrofit Certified for Canada

SEESMART INC E324248

4139 GUARDIAN ST

SIMI VALLEY, CA 93063 USA

LED tube lamps, Cat. Nos. 200124 (A), 200125 (A), 200126 (A), 200127 (A), 200128 (A), 200129 (A), 200130 (A), 200131 (A), 200132 (A), 200133 (A), 200134 (A), 200135 (A), 200136 (A), 200137 (A), 200138 (A), 200139 (A), 200140 (A), 200141 (A), 200142 (A), 200143 (A), 200144 (A), 200145 (A), 200146 (A), 200147 (A), 200148 (A), 200149 (A), 200150 (A), 200151 (A), 200152 (A), 200153 (A), 200154 (A), 200155 (A), 200156 (A), 200157 (A), 200158 (A), 200159 (A), 200160 (A), 200161 (A), 200162 (A), 200163 (A), 200164 (A), TP-Tube10-8FT, 200506 (A), 200507 (A), 200508 (A), 200509 (A), 200510 (A), 200511 (A), 200512 (A), 200513 (A), 200514 (A), 200515 (A), 200516 (A), 200517 (A), 200518 (A), 200519 (A), 200520 (A), 200521 (A), 200522 (A), 200523 (A), 200524 (A), 200525 (A), 200526 (A), 200527 (A), 200528 (A), 200529 (A), 200530 (A), 200531 (A), 200532 (A), 200533 (A), 200534 (A), 200535 (A), 200536 (A), 200537 (A), 200538 (A), 200539 (A), 200540 (A), 200541 (A), 200542 (A), 200543 (A), 200544 (A), 200545 (A), 200546 (A), 200547 (A), 200548 (A), 200549 (A), 200550 (A), 200551 (A), 200552 (A), 200553 (A).

(A) May end with the letter A through Z.

Last Updated on 2012-09-10

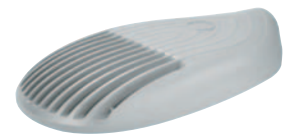
Questions? Print this page Terms of Use Page Top

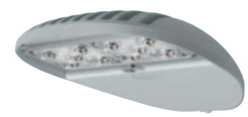
XSP2™

XSP Series LED Street Light – Horizontal Tenon – Type III

Product Description

Designed from the ground up as a totally optimized LED street light system, the XSP Series delivers incredible efficiency and is designed to provide L70 lifetime over 100,000 hours without sacrificing application performance. Beyond substantial energy savings and reduced maintenance, Cree achieves better optical control with our NanoOptic® Precision Delivery Grid™ optic than a traditional cobra head luminaire. The Cree XSP Series LED Street Light is the best alternative for traditional street lighting with better payback and better performance.





Performance Summary

Utilizes BetaLED® Technology

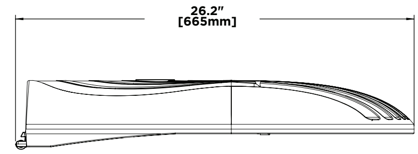
NanoOptic Precision Delivery Grid optic

CRI: Minimum 70 CRI

CCT: 4000K (+/- 300K), 5700K (+/- 500K)

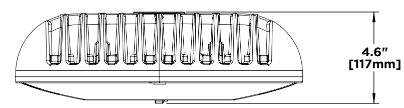
Warranty: 10 years on luminaire/limited 10 years on Colorfast DeltaGuard® finish

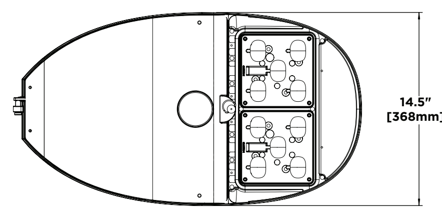
Made in the U.S.A. of U.S. and imported parts



Accessories

Field Installed Accessories
XA-SP2BLS Backlight Control Shield - Provides 1/2 Mounting Height Cutoff **XA-SP2BRDSPK** Bird Spikes





Ordering Information

Example: BXSPA032A-USF

BXSP	A	0			A	–			
Product	**Version**	**Mounting**	**Optic**	**Modules**	**Input Power**	**–**	**Voltage**	**Color Options**	**Options**
BXSP	**A**	**0** Horizontal Tenon	**3** Type III **H** Type III w/ BLS	**2** Standard 4000K **B** Standard 5700K **H** High Efficacy 4000K* **P** High Efficacy 5700K*	**A** 101W	–	**U** Universal 120–277V **V** Universal 347–480V**	**S** Silver (Standard) **T** Black **Z** Bronze **B** Platinum Bronze **W** White	**A ROAM® Controls** - Installation of ROAM dimming control module only. Services provided by others. - Includes R option **F Fuse** - When code dictates fusing, use time delay fuse - Not available with V voltage **K Occupancy Control** - Refer to Occupancy Control spec sheet for details **N Utility Label and NEMA Photocell Receptacle** - Includes Q option - Refer to Field Adjustble Output spec sheet for details **Q Field Adjustable Output** - Refer to Field Adjustable Output spec sheet for details **R NEMA Photocell Receptacle** - Photocell by others **U Utility** - Includes exterior wattage label that indicates the maximum available wattage of the luminaire - Includes Q option - Refer to Field Adjustable Output spec sheet for details

* Available Q3 2012. Preliminary data shown.

** 347–480V utilizes magnetic step-down transformer. For input power for 347–480V, refer to the Lumen Output, Electrical, and Lumen Maintenance data table below.

BetaLED TECHNOLOGY   RoHS   c UL us

Rev. Date: 9/14/2012

CREE®

Product Specifications

CONSTRUCTION & MATERIALS

- Die cast aluminum housing
- Tool-less entry
- Mounts on 1.25" IP (1.66" [42mm] O.D.) or 2" IP (2.375" [60mm] O.D.) horizontal tenon (minimum 8" [203mm] in length) and is adjustable +/- 5˚ to allow for fixture leveling (includes two axis T-level to aid in leveling)
- Designed with 0–10V dimming capabilities. Controls by others
- Exclusive Colorfast DeltaGuard® finish features an E-Coat epoxy primer with an ultradurable powder topcoat, providing excellent resistance to corrosion, ultraviolet degradation and abrasion. Standard is silver. Black, bronze, platinum bronze and white are also available

ELECTRICAL SYSTEM

- **Input Voltage:** 120–277V or 347–480V, 50/60Hz
- Class 2 output
- **Power Factor:** > 0.9 at full load
- **Total Harmonic Distortion:** < 20% at full load
- Integral 10kV surge suppression protection standard
- To address inrush current, slow blow fuse or type C/D breaker should be used

REGULATORY & VOLUNTARY QUALIFICATIONS

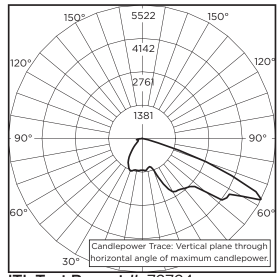
- cULus Listed
- Suitable for wet locations
- Product qualified on the DesignLights Consortium ("DLC") Qualified Products List ("QPL"). Exceptions apply when N, U, or Q options are ordered - see Field Adjustable Output spec sheet for details.
- Certified to ANSI C136.31-2001, 3G bridge and overpass vibration standards
- 10kV surge suppression protection tested in accordance with IEEE/ANSI C62.41.2
- Meets CALTrans 611 Vibration testing and GR-63-CORE Section 4.4.1/5.4.2 C62.41.2
- Luminaire and finish endurance tested to withstand 5,000 hours of elevated ambient salt fog conditions as defined in ASTM Standard B 117
- RoHS Compliant
- Meets Buy American requirements within ARRA

PATENTS

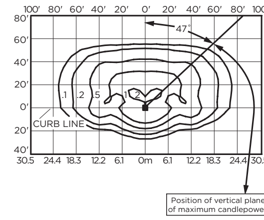
- Visit website for patents that cover these products: Patents http://www.cree.com/patents

Photometry

All published luminaire photometric testing performed to IESNA LM-79-08 standards by Independent Testing Laboratories, a NVLAP certified laboratory.



ITL Test Report #: 72724
BXSPA*32A-U
Initial Delivered Lumens: 7,406



BXSPA*32A-U
Mounting Height: 25' (7.6m)
Initial Delivered Lumens: 7,000
Initial FC at grade.

Lumen Output, Electrical, and Lumen Maintenance Data

Type 3 Distribution

Module	Input Power Designator	4000K Initial Delivered Lumens	4000K BUG Ratings** Per TM-15-11	5700K Initial Delivered Lumens	5700K BUG Ratings** Per TM-15-11	System Watts 120–277V	TOTAL CURRENT 120V	TOTAL CURRENT 208V	TOTAL CURRENT 240V	TOTAL CURRENT 277V	System Watts 347–480V	TOTAL CURRENT 347V	TOTAL CURRENT 480V	50K Hours Calculated Lumen Maintenance Factor @ 15˚C (59˚F)***
Standard	A	7,000	B2 U0 G1	7,700	B2 U0 G2	101	0.84	0.50	0.44	0.39	106	0.31	0.22	91%
High Efficacy*	A	9,612	B2 U0 G2	10,680	B2 U0 G2	101	0.84	0.50	0.44	0.39	106	0.31	0.22	91%

Type 3 Distribution w/ BLS

Module	Input Power Designator	4000K Initial Delivered Lumens	4000K BUG Ratings** Per TM-15-11	5700K Initial Delivered Lumens	5700K BUG Ratings** Per TM-15-11	System Watts 120–277V	TOTAL CURRENT 120V	TOTAL CURRENT 208V	TOTAL CURRENT 240V	TOTAL CURRENT 277V	System Watts 347–480V	TOTAL CURRENT 347V	TOTAL CURRENT 480V	50K Hours Calculated Lumen Maintenance Factor @ 15˚C (59˚F)***
Standard	A	6,130	TBD	6,742	TBD	101	0.84	0.50	0.44	0.39	106	0.31	0.22	91%
High Efficacy*	A	8,417	TBD	9,352	TBD	101	0.84	0.50	0.44	0.39	106	0.31	0.22	91%

* Available Q3 2012. Preliminary data shown.
** For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit www.iesna.org/PDF/Erratas/TM-15-11BugRatingsAddendum.pdf
*** Projected L_{70} (6K) Hours: >36,000. For recommended lumen maintenance factor data see TD-13

EPA and Weight

Input Power Designator	Weight 120–277V	Weight 347–480V	EPA 1@90	EPA 2@90	EPA 2@180	EPA 3@90	EPA 4@90
A	26 lbs (12kg)	29 lbs (13.2kg)	0.692	1.140	1.384	1.832	2.280

www.cree.com/lighting T (800) 236-6800 F (262) 504-5415

sensorswitch®

WSD

WALL SWITCH DECORATOR SENSOR
LINE VOLTAGE • PASSIVE INFRARED (PIR)

SPECIFICATIONS

FEATURES
- PIR Occupancy Detection
- Self-Contained Relay - No Power Pack Needed
- Interchangeable Hot & Load Wires - Impossible to Wire Backwards
- No Neutral Connection Required
- Small Motion Detection to 20 ft (6.10 m)
- Self-Grounding Mounting Strap
- No Minimum Load
- Push-Button Programmable w/o Removing the Switch Plate
- Adjustable Time Delay
- 3-way & 4-way Switching
- Green LED Indicator

PHYSICAL SPECS
SIZE 4.2”H x 1.8”W x 1.5”D (10.67cm x 4.57cm x 3.81cm)
WEIGHT 5 oz
MOUNTING Single Gang Switch Box
MOUNTING HEIGHT 30-48 in (76.2-121.9 cm)
COLORS White, Ivory, Gray Almond, Black

ELECTRICAL SPECS
MAXIMUM LOAD
800 W @ 120 VAC
1200 W @ 277 VAC
1500 W @ 347 VAC
MINIMUM LOAD None
MOTOR LOAD 1/4 HP
FREQUENCY 50/60 Hz (timers are 1.2x for 50 Hz)

ENVIRONMENTAL SPECS
OPERATING TEMP
14º to 160º F (-10º to 71º C)
STORAGE TEMP
-14º to 160º F (-26º to 71º C)
RELATIVE HUMIDITY
20 to 90% non-condensing

OTHER
UL and CUL Listed
Title 24 Compliant
5 Year Warranty
Made in the U.S.A.

The **WSD** is a stylish, easy to install, and simple to use Wall Switch Decorator style Passive Infrared (PIR) sensor. It is ideal for private offices, copy rooms, closets, or any small enclosed space without obstructions. A user programmable time delay ensures that once the room is vacated the sensor will time out and turn off the lights. Additionally, the **WSD** sensor has several On Modes and Switch Modes that can be programmed using the front push-button. For rooms with obstructions, the Dual Technology **WSD PDT** Series sensor is recommended.

SENSOR OPERATION & MODES
The sensor detects changes in the infrared energy given off by occupants as they move within the field-of-view. When occupancy is detected, a self-contained relay switches the connected lighting load on. The sensor is line powered and switches line voltage (see specifications). A timer, factory set at 10 minutes, keeps the lights on during brief periods of inactivity. This timer is push-button programmable from 30 seconds to 20 minutes, and resets every time occupancy is re-detected. This state-of-the-art design requires no field calibration or sensitivity adjustments.

ON MODES
AUTOMATIC ON **(default)** - Lights come on when occupancy is detected.

MANUAL ON - Requires the occupant manually turn on lights via the push-button.

REDUCED TURN ON - Sensor is initially set to only detect large motions, effectively ignoring PIR signals reflected off of surfaces, while still sensing occupants when they enter the room. Once lights are on, the sensor returns to maximum sensitivity.

SWITCH MODES
PREDICTIVE OFF MODE **(default)** - This mode allows occupants to turn lights off via the switch without losing the convenience of having the lights automatically turn on when they re-enter the room. Pressing the switch turns the lights off and temporarily disables the occupancy detection in the sensor. After a short exit time delay, the occupancy detection reactivates and monitors for an additional grace period. If no occupancy is detected, the zone will remain in Automatic On operation. If occupancy is detected, the zone will go to a Permanent Off mode, requiring the switch to be pressed again in order to turn the lights on and restore the sensor to Automatic On operation.

PERMANENT OFF - Pressing the switch turns the lights and the sensor off. Lights will not come on until switch is pressed again.

SWITCH DISABLE - Prevents user from manually turning off the lights via the push-button. Button can still be utilized for programming.

OPTIONS

VANDAL-RESISTANT LENS (V)
- Ideal for high abuse or public areas, where occupants simply come and go
- Decreases detection range by 50%

INHIBIT PHOTOCELL (P)
- Auto set-point calibration
- Photocell prevents lights from turning on if adequate daylight is available, but does not turn lights off

347 VAC (347)
- Allows sensor to be powered from and switch 347 VAC
- Wall Plate Provided

COLOR
- White, Ivory, Gray, Almond, Black
- Wall Plate Provided

LOW TEMP/HIGH HUMIDITY (LT)
- Sensor is corrosion resistant
- Operates down to -40º F/C

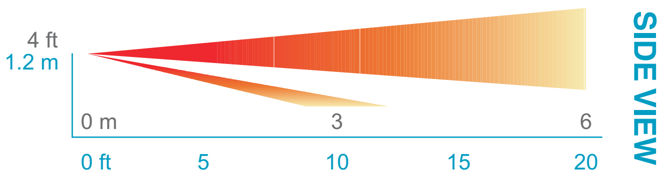
ORDERING INFO
WSD [LENS] [PHOTOCELL] [VOLTAGE] [COLOR] [TEMP/HUMIDITY]

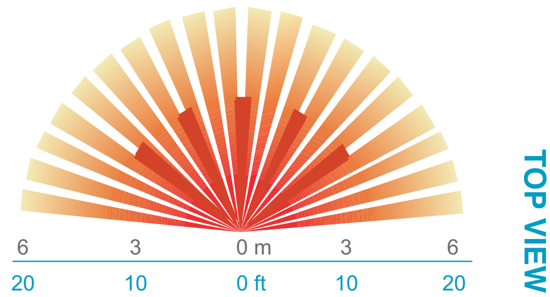
LENS	PHOTOCELL	VOLTAGE	COLOR	TEMP/HUMIDITY
Blank = None	**Blank = None**	**Blank = 120/277 VAC**	**WH = White**	**Blank = Standard**
V = Vandal Resistant	**P = Photocell**	**347 = 347 VAC**	**IV = Ivory**	**LT = Low Temp**
			GY = Gray	
			AL = Almond	
			BK = Black	

COVERAGE PATTERN

WSD WALL SWITCH DECORATOR LENS

- Small motion (e.g. hand movements) detection up to 20 ft (6.10 m)
- Large motion (e.g. walking) detection up to 50 ft (15.24 m)
- Wall-to-Wall coverage





WIRING (DO NOT WIRE HOT)

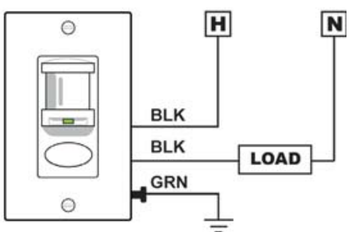
STANDARD WIRING

BLACK* - Line Input
BLACK* - Load Output
} *BLACK wires can be reversed
GREEN SCREW - Ground (required connection)

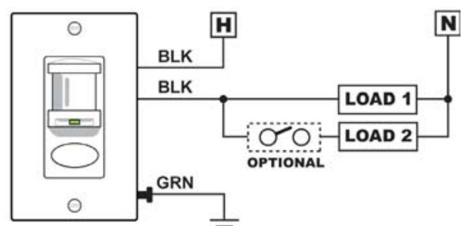
347 VAC OPTION (347)

Black wires are replaced w/ Red wires

STANDARD CONFIGURATION



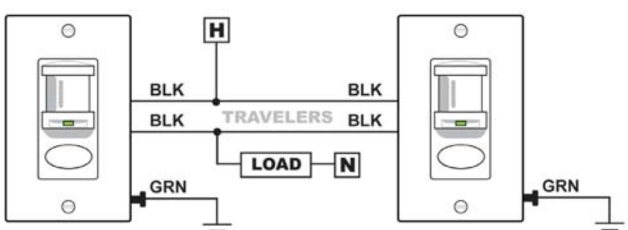
BI-LEVEL CONFIGURATION

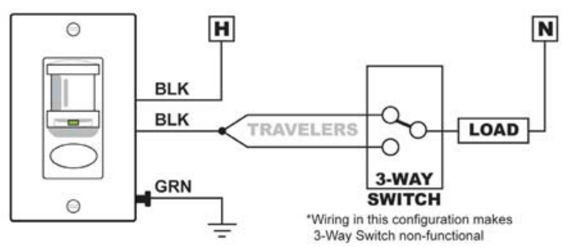


Note: Connection to Ground required for sensor to function

3-WAY CONFIGURATIONS

Travelers are used to wire sensors (or sensor and 3-way switch) i





Note: Connection to Ground required for sensor to function

WARNING

Fire Hazard Caution: Maximum Lamps 1500 Watts, Type 347 VAC.
Attention: Risque d'incendie : Pauissance Maximales Des Lampes 1500 Watts, Type 347 VAC.
Warning: The units are intended to be installed by a qualified person with properly rated branch circuit protectors as per applicable local and national regulations (CEC, NEC).

sensorswitch®
An AcuityBrands Company

WARRANTY: Sensor Switch, Inc. warrants these products to be free of defects in manufacture and workmanship for a period of 60 months. Sensor Switch, Inc., upon prompt notice of such defect, will, at its option, provide a Returned Material Authorization number and repair or replace returned product.
LIMITATIONS AND EXCLUSIONS: This Warranty is in full lieu of all other representation and expressed and implied warranties (including the implied warranties of merchantability and fitness for use) and under no circumstances shall Sensor Switch, Inc. be liable for any incidental or consequential property damages or losses.

900 Northrop Road, Wallingford, CT 06492 • 1.800.PASSIVE • FX 203.269.9621 • www.sensorswitch.com

sensorswitch®

WSD PDT

WALL SWITCH DECORATOR SENSOR

LINE VOLTAGE • PASSIVE DUAL TECHNOLOGY (PDT)

SPECIFICATIONS

FEATURES

Patented Dual Technology with PIR / Microphonics™ Detection
Self-Contained Relay - No Power Pack Needed
Interchangeable Hot & Load Wires - Impossible to Wire Backwards
No Neutral Connection Required
Small Motion Detection to 20 ft (6.10 m)
Self-Grounding Mounting Strap
No Minimum Load
Push-Button Programmable w/o Removing the Switch Plate
Adjustable Time Delay
3-way & 4-way Switching
Green LED Indicator

PHYSICAL SPECS

SIZE 4.2"H x 1.8"W x 1.5"D (10.67cm x 4.57cm x 3.81cm)
WEIGHT 5 oz
MOUNTING Single Gang Switch Box
MOUNTING HEIGHT 30-48 in (76.2-121.9 cm)
COLORS White, Ivory, Gray, Almond, Black

ELECTRICAL SPECS

MAXIMUM LOAD
800 W @ 120 VAC
1200 W @ 277 VAC
1500 W @ 347 VAC
MINIMUM LOAD None
MOTOR LOAD 1/4 HP
FREQUENCY 50/60 Hz (timers are 1.2x for 50 Hz)

ENVIRONMENTAL SPECS

OPERATING TEMP
14º to 160º F (-10º to 71º C)
STORAGE TEMP
-14º to 160º F (-26º to 71º C)
RELATIVE HUMIDITY
20 to 90% non-condensing

OTHER

UL and CUL Listed
Title 24 Compliant
5 Year Warranty
Made in the U.S.A.

The **WSD PDT** Series is a Wall Switch Decorator style Passive Dual Technology (PDT) occupancy sensor. The combination of Passive Infrared and patented Microphonics™ detection allows this sensor to literally see & hear occupants. It is ideal for restrooms with stalls, private offices where occupant turns their back to the sensor, or rooms with obstructions.

SENSOR OPERATION & MODES

Passive Dual Technology (PDT) sensors first see motion using Passive Infrared (PIR) and then engage Microphonics™ to hear sounds that indicate continued occupancy. This patented technology uses Automatic Gain Control (AGC) to dynamically self-adapt a sensor to its environment by filtering out constant background noise and detecting only noises typical of human activity. When occupancy is detected, a self-contained relay switches the connected lighting load on. The sensor is line powered and can switch line voltage (see specifications). A timer, factory set at 10 minutes, keeps the lights on during brief periods of inactivity. This timer is push-button programmable from 30 seconds to 20 minutes, and is reset every time occupancy is re-detected. If needed, a 10 second grace period also allows the lights to be voice reactivated after shutting off. This state-of-the-art design requires no field calibration or sensitivity adjustments.

ON MODES

AUTOMATIC ON **(default)** - Lights come on when occupancy is detected.

MANUAL ON - Requires the occupant manually turn on lights via the push-button.

REDUCED TURN ON - Sensor is initially set to only detect large motions, effectively ignoring PIR signals reflected off of surfaces, while still sensing occupants when they enter the room. Once lights are on, the sensor returns to maximum sensitivity.

SWITCH MODES

PREDICTIVE OFF MODE **(default)** - This mode allows occupants to turn lights off via the switch without losing the convenience of having the lights automatically turn on when they re-enter the room. Pressing the switch turns the lights off and temporarily disables the occupancy detection in the sensor. After a short exit time delay, the occupancy detection reactivates and monitors for an additional grace period. If no occupancy is detected, the zone will remain in Automatic On operation. If occupancy is detected, the zone will go to a Permanent Off mode, requiring the switch to be pressed again in order to turn the lights on and restore the sensor to Automatic On operation.

PERMANENT OFF - Pressing the switch turns the lights and the sensor off. Lights will not come on until switch is pressed again.

SWITCH DISABLE - Prevents user from manually turning off the lights via the push-button. Button can still be utilized for programming.

OPTIONS

VANDAL-RESISTANT LENS (V)

- Ideal for high abuse or public areas, where occupants simply come and go
- Decreases detection range by 50%

INHIBIT PHOTOCELL (P)

- Auto set-point calibration
- Photocell prevents lights from turning on if adequate daylight is available, but does not turn lights off

347 VAC (347)

- Allows sensor to be powered from and switch 347 VAC
- Wall Plate Included

COLOR

- White, Ivory, Gray, Almond, Black
- Wall Plate Included

LOW TEMP/HIGH HUMIDITY (LT)

- Sensor is corrosion resistant
- Operates down to -4º F(-20ºC)

ORDERING INFO

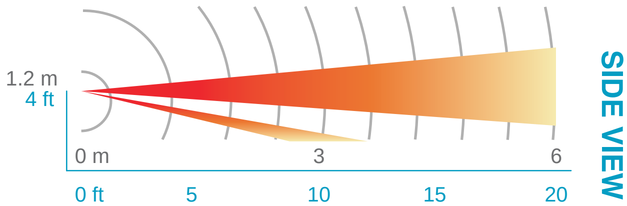
WSD PDT [LENS] [PHOTOCELL] [VOLTAGE] [COLOR] [TEMP/HUMIDITY]

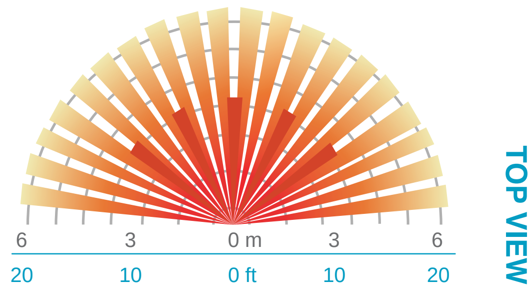
LENS	PHOTOCELL	VOLTAGE	COLOR	TEMP/HUMIDITY
Blank = None **V = Vandal Resistant**	**Blank = None** **P = Photocell**	**Blank = 120/277 VAC** **347 = 347 VAC**	**WH = White** **IV = Ivory** **GY = Gray** **AL = Almond** **BK = Black**	**Blank = Standard** **LT = Low Temp**

COVERAGE PATTERN

WSD WALL SWITCH DECORATOR LENS W/ MICROPHONICS™

- Small motion (e.g. hand movements) detection up to 20 ft (6.10 m)
- Large motion (e.g. walking) detection up to 50 ft (15.24 m)
- Wall-to-Wall coverage
- Microphonics™ provides overlapping detection of human activity over the complete PIR coverage area
- Advanced filtering is utilized to prevent non-occupant noises from keeping the lights on





WIRING (DO NOT WIRE HOT)

STANDARD WIRING

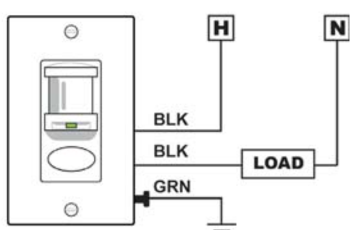
BLACK* - Line Input
BLACK* - Load Output
} *BLACK wires can be reversed

GREEN SCREW - Ground (required connection)

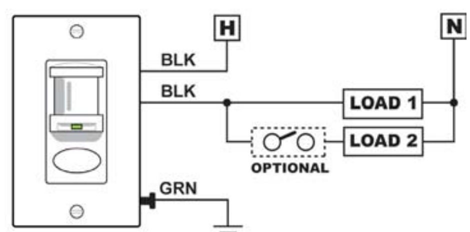
347 VAC OPTION (347)

Black wires are replaced w/ Red wires

STANDARD CONFIGURATION



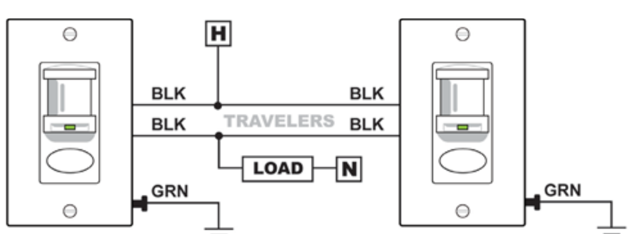
BI-LEVEL CONFIGURATION

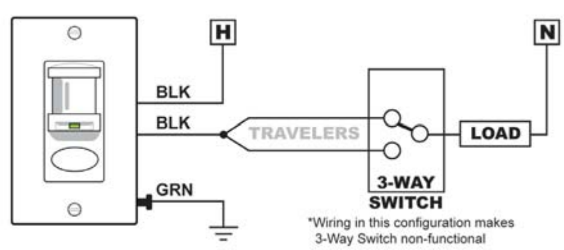


Note: Connection to Ground required for sensor to function

3-WAY WIRING CONFIGURATIONS

Travelers are used to wire sensors (or sensor and 3-way switch) in parallel.





Note: Connection to Ground required for sensor to function

WARNING

Fire Hazard Caution: Maximum Lamps 1500 Watts, Type 347 VAC.
Attention: Risque d'incendie : Pauissance Maximales Des Lampes 1500 Watts, Type 347 VAC.
Warning: The units are intended to be installed by a qualified person with properly rated branch circuit protectors as per applicable local and national regulations (CEC, NEC).

sensorswitch®
An Acuity Brands Company

WARRANTY: Sensor Switch, Inc. warrants these products to be free of defects in manufacture and workmanship for a period of 60 months. Sensor Switch, Inc., upon prompt notice of such defect, will, at its option, provide a Returned Material Authorization number and repair or replace returned product.
LIMITATIONS AND EXCLUSIONS: This Warranty is in full lieu of all other representation and expressed and implied warranties (including the implied warranties of merchantability and fitness for use) and under no circumstances shall Sensor Switch, Inc. be liable for any incidental or consequential property damages or losses.

900 Northrop Road, Wallingford, CT 06492 • 1.800.PASSIVE • FX 203.269.9621 • www.sensorswitch.com

sensorswitch®

CM 10

EXTENDED RANGE 360º SENSOR
CEILING MOUNT • LOW VOLTAGE • PASSIVE INFRARED (PIR)

SPECIFICATIONS

FEATURES
100% Digital PIR Detection, Excellent RF Immunity
360º Coverage Pattern
Push-Button Programmable
Adjustable Time Delays
No Field Calibration or Sensitivity Adjustments Required
Convenient Test Mode
100 hr Lamp Burn-in Timer
Green LED Indicator

LAMPMAXIMIZER® TECHNOLOGY
- Protects Lamp Life while Maximizing Energy Savings
- Minimum On Timer (15 min default)
- Occ. Time Delay (10 min defatult)
- LampMaximizer+ Mode - Optimizes Lamp Life & Energy Savings (disabled by default)
- Switch Counter (in 1000's)
- Total Lamp On Time (in khrs)

PHYSICAL SPECS
SIZE 4.55" Dia. (11.56 cm)
1.55" Deep (3.94 cm)
WEIGHT 6 oz
MOUNTING
Ceiling Tile Surface
3.5" Octagon Box
Single Gang Handy Box
COLOR White

ELECTRICAL SPECS
OPERATING VOLTAGE
12-24 VAC/VDC
CURRENT DRAW
Standard, 4 mA
w/ **R** option, 16 mA
DIMMING LOAD Sinks < 20mA;
~40 Ballasts @ .5mA each
RECOMMENDED POWER PACK
PP20

ENVIRONMENTAL SPECS
OPERATING TEMP
14º to 160º F (-10º to 71º C)
STORAGE TEMP
-14º to 160º F (-26º to 71º C)
RELATIVE HUMIDITY
20 to 90% non-condensing
SILICONE FREE
ROHS COMPLIANT

OVERVIEW
The **CM 10** Series Extended Range 360º occupancy sensor incorporates Passive Infrared (PIR) technology into an attractive and economical sensor to provide maximum viewing from the ceiling. When mounted at 9 ft (2.74 m), this sensor views up to 28 ft (8.53 m) in all directions. Its circular coverage pattern is designed for walking motions; making it ideal for T-shaped intersections in corridors, or other areas where wall mounting a sensor is not practical. A long hallway, for example, may require a **HW13** Series Hallway sensor at each end, with **CM 10**'s mounted in the center to fill in the distance. Low ceiling heights are also best covered by the **CM 10**. For example, when mounted at only 7 ft (2.13 m), the height of pick aisles in many distribution centers, the **CM 10** provides a 32 ft (9.75 m) diameter pattern of coverage. In applications where detection of minor motion is also required, use the **CM PDT 10** Series Dual Technology sensor.

SENSOR OPERATION
The sensor detects changes in the infrared energy given off by occupants as they move within the field-of-view. When occupancy is detected, a DC output goes high and can drive up to 200 mA of connected load. The sensor is powered with 12-24 VAC/VDC and typically operates with a **PP20** or **MP20** power pack, enabling complete 20 Amp circuits to be controlled. This innovative sensor requires no field calibration or sensitivity adjustments.

LAMPMAXIMIZER®
This sensor also contains patent pending LampMaximizer technology that allows users to aggressively target energy savings while still protecting lamp life. A minimum on timer, factory set at 15 minutes, helps preserve lamp life by eliminating all lamp cycles shorter than lamp warranties specify.

A standard occupancy time delay is also present that ensures lights turn off (assuming minimum on timer has elapsed) if no occupancy is detected. This timer is factory set at 10 minutes to promote energy savings, but is adjustable between 30 seconds and 20 minutes. These adjustments can be done manually, through the units push-button, or automatically every two weeks through an advanced mode, called LampMaximizer+, that determines the optimum time delay in order to maximize both lamp life and energy savings. Additionally, this sensor maintains statistics on total lamp on time and number of cycles.

OPTIONS

LOW VOLTAGE RELAY (R)
- Enables sensors to interface with other systems (e.g., BMS, lighting panels)
- Provides dry contact closure via a SPDT, 1 Amp, 40 Volt relay
- Only one relay needed per zone
- Changes state when all connected sensors register unoccupied
- Relay requires sensor power to function

OCCUPANCY CONTROLLED DIMMING (D)
- Provides dimming output to control 0-10 VDC dimmable ballasts
- Provides a second occupancy time-out period that enables the lights to go to a dim setting before turning off
- Adjustable max/min dim setting
- Only one sensor per zone needs to have dimming output

PHOTOCELL (P)
- Auto set-point calibration
- Two selectable modes of operation
- On/Off mode: Photocell has full control during periods of occupancy
- Inhibit mode: Photocell can prevent lights from turning on if adequate daylight is available, but cannot turn lights off

PHOTOCELL W/ DIMMING (ADC)
- Photocell within sensor maintains total room light level by controlling levels of 0-10 VDC dimmable ballasts
- Photocell also has full on/off control during periods of occupancy
- Provides a second occupancy time-out period that enables the lights to go to a dim setting before turning off

Note: LampMaximizer+ features not available with ADC option

LOW TEMP/HIGH HUMIDITY (LT)
- Sensor is corrosion resistant to moisture
- Operates down to -40º F/C

C UL US LISTED

TITLE 24
MADE in U.S.A.
5 YEAR WARRANTY

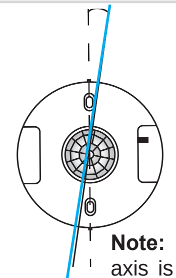
ORDERING INFO
CM 10 [RELAY] [DIMMING/PHOTOCELL] [TEMP/HUMIDITY]

RELAY	DIMMING / PHOTOCELL *CHOOSE ONE ONLY*	TEMP/HUMIDITY
Blank = None	Blank = None	Blank = Standard
R = Low Voltage Relay	D = Occupancy Controlled Dimming	LT = Low Temp
	P = Photocell	
	ADC = Photocell w/ Dimming	

COVERAGE PATTERN

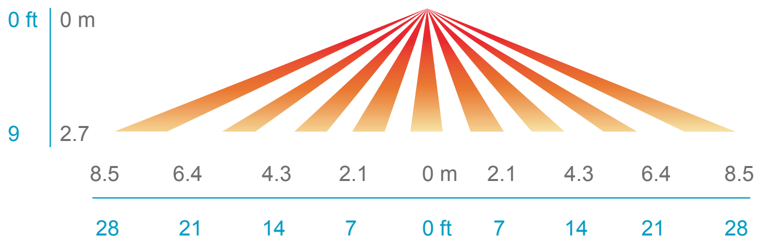
10 EXTENDED RANGE LENS

- Best choice for large motion (e.g. walking) detection
- Viewing angle of 67º in a 360º conical shaped pattern
- Provides 28 ft (8.53 m) radial coverage when mounted to standard 9 ft (2.74 m) ceiling
- 7 to 15 ft (2.13 to 4.57 m) mounting heights provide 16 to 36 ft (4.88 to 10.97 m) radial coverage

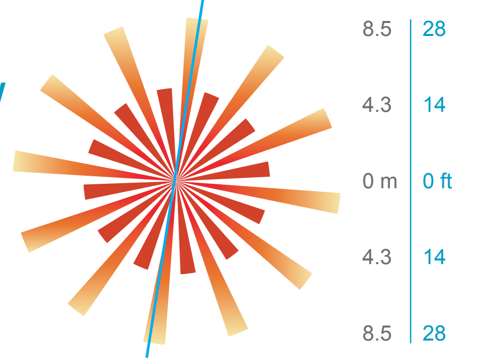


Note: Sensor's screw axis is offset 7.5º from a long detection segment

SIDE VIEW



TOP VIEW



WIRING (DO NOT WIRE HOT)

STANDARD WIRING

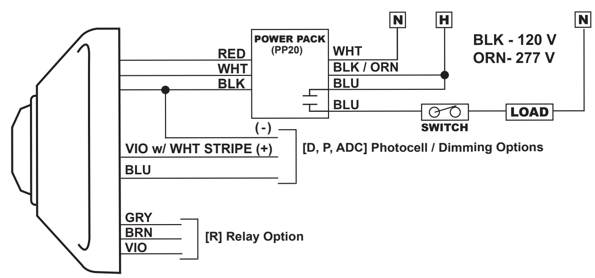
RED - Power Input (12-24 VAC/VDC)
BLACK - Common
WHITE - Occupancy State (high VDC for occupied)

PHOTOCELL/DIMMING OPTIONS (D, P, ADC)

BLUE - Direct output to power pack for providing photocell control and/or secondary dim time out. Output is high VDC with occupancy & low light. Output also held high during secondary dim time out. For multi-level control, use two power packs and connect White wire to primary load and Blue to daylight load.

VIOLET w/ WHITE STRIPE - Connect to 0-10 VDC control wire (typically Violet) from 0-10 VDC dimmable ballast

GRAY from Ballast - Connect to sensor Black wire

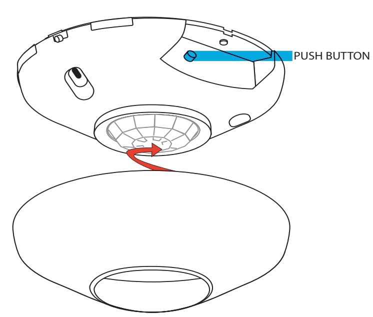


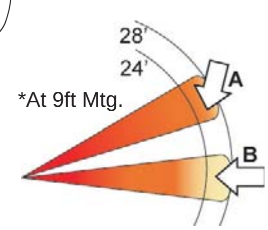
RELAY OPTION (R)

GRAY / BROWN - Connected during occupied state
VIOLET / BROWN - Connected during unoccupied state
Note: Relay is energized during unoccupied state

INSTALLATION

- Mount sensor directly to a ceiling tile or a metallic grid (two self-tapping screws provided).
- Sensor's mounting holes also align with 3.5" octagon or single gang handy box (screws not provided).
- Sensor will detect motions crossing segments more effectively than motions parallel to beams.
- For optimal detection, position sensor such that segments are crossed upon entrance and unable to view outside the space.





A: When walking across beam, detection will occur at approximately 28 feet. (8.53 m)
B: When walking into beam, detection will occur at approximately 24 feet. (7.32 m)

PROGRAMMING

Refer to instruction card IC7.001 for default settings and directions on programming the sensor via the push-button.

sensorswitch® An Acuity Brands Company

TS-CM-001A

sensorswitch®

WV PDT 16

WIDE VIEW SENSOR
CORNER MOUNT • LOW VOLTAGE • DUAL TECHNOLOGY (PDT)

SPECIFICATIONS

FEATURES
PIR Occupancy Detection
120º by 40 ft (12.19 m) Coverage for Small Motion
Adjustable Time Delay
100 Hr. Lamp Burn-In Timer Mode
Green LED Indicator

PHYSICAL SPECS
SIZE 3.0” H x 3.6” W x 1.75” D (7.62 cm x 9.14 cm x 4.45 cm)
WEIGHT 5 oz
MOUNTING Directly to corner or to ceiling using **WV BR** bracket
COLOR White

ELECTRICAL SPECS
OPERATING VOLTAGE
12-24 VAC/VDC
CURRENT DRAW
Standard, 4 mA
w/ **R** option, 16 mA
RECOMMENDED POWER PACK
PP20

ENVIRONMENTAL SPECS
OPERATING TEMP
14º to 160º F (-10º to 71º C)
STORAGE TEMP
-14º to 160º F (-26º to 71º C)
RELATIVE HUMIDITY
20 to 90% non-condensing

OTHER
UL and CUL Listed
Title 24 Compliant
5 Year Warranty
Made in the U.S.A.

Classrooms are the ideal application for the **WV PDT 16** Dual Technology Wide View Sensor. Installed in the corner of the room along the entrance wall, this inconspicuous sensor provides line of sight PIR detection of small movements up to 40 ft (12.19 m) away, and combines overlapping Microphonics™ for detection around obstructions. Many classrooms are filled with shelving, projects, or lab benches. Total coverage of the room is always maintained no matter how cluttered the space becomes. The **WV PDT 16** is also used in corridors due to its ability to view up to 70 ft (21.34 m) for walking motions, or large open storage areas where obstructions may block the PIR’s ability to view. For large lecture halls, multiple **WV PDT 16**s may be wired together, or along with any other low voltage sensors.

SENSOR OPERATION
The sensor has Passive Dual Technology (PDT), which first sees motion using Passive Infrared (PIR), and then engages Microphonics™ to hear sounds that indicate continued occupancy. This patented technology uses Automatic Gain Control (AGC) to dynamically self-adapt the sensor to its environment by filtering out constant background noise and detecting only noises typical of human activity. When occupancy is detected, a DC output goes high and can drive up to 200 mA of connected load. The sensor is powered with 12-24 VAC/VDC and typically operates with a **PP20** or **MP20** power pack, enabling complete 20 Amp circuits to be controlled. An internal timer, factory set at 10 minutes, keeps the lights on during brief periods of inactivity. This timer is push-button programmable from 30 seconds to 20 minutes, and is reset every time occupancy is re-detected. This state-of-the-art sensor requires no field calibration or adjustment.

OPTIONS

LOW VOLTAGE RELAY (R)
- Enables sensors to interface with other systems (e.g., BMS, lighting panels)
- Provides dry contact closure via a SPDT, 1 Amp, 40 Volt relay
- Only one relay needed per zone
- Changes state when all connected sensors register unoccupied
- Relay requires sensor power to function

PHOTOCELL (P)
- Auto set-point calibration
- Two selectable modes of operation
- On/Off mode: Photocell has full control during periods of occupancy
- Inhibit mode: Photocell can prevent lights from turning on if adequate daylight is available, but cannot turn lights off

LOW TEMP/HIGH HUMIDITY (LT)
- Sensor is corrosion resistant to moisture
- Operates down to -4º F/ 20º C

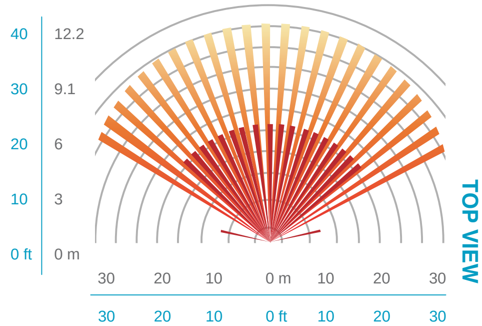
ORDERING INFO
WV PDT 16 [RELAY] [PHOTOCELL] [TEMP/HUMIDITY]

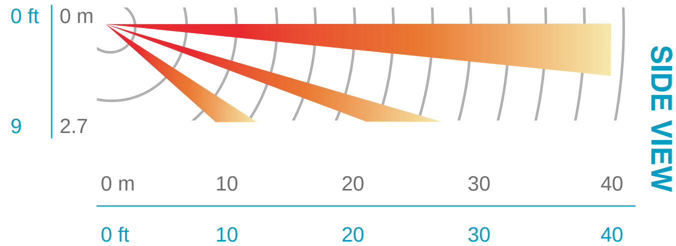
RELAY	PHOTOCELL	TEMP/HUMIDITY
Blank = None	**Blank = None**	**Blank = Standard**
R = Low Voltage Relay	**P = Photocell**	**LT = Low Temp**

COVERAGE PATTERN

16 WIDE VIEW LENS WITH MICROPHONICS™

- Small motion (e.g. hand movements) detection up to 40 ft (12.19 m).
- Large motion (e.g. walking) detection up to 70 ft (21.34 m).
- Designed for 8 to 10 ft (2.44 to 3.05 m) high mounting in room corner.
- Microphonics™ provides overlapping detection of human activity over the complete PIR coverage area. Advanced filtering is also utilized to prevent non-occupant noises from keeping the lights on.

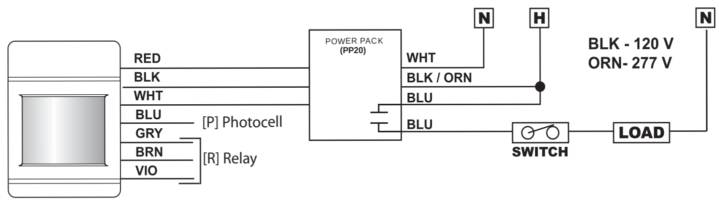




WIRING (DO NOT WIRE HOT)

STANDARD WIRING

RED - Power Input (12-24 VAC/VDC)
BLACK - Common
WHITE - Output (high VDC for occupancy)



RELAY OPTION (R)

GRAY/BROWN - Connected during occupied state
VIOLET/BROWN - Connected during unoccupied state
Note: Relay is energized during unoccupied state.

PHOTOCELL OPTION (P)

BLUE - Use in place of White ouput wire. Photocell output is high VDC with occupancy & low light. For multi-level control, use two power packs and connect White to primary load and Blue to daylight load.

INSTALLATION

- Sensor has rear enclosure, which is beveled so as to be corner mounted at 8-10 ft (2.44-3.05 m); see tilt settings below.
- Mount in corner above entrance door or in a corner along the same wall as the entrance. .
- For mounting heights above 10 ft (3.05 m), use the **WV BR** and mount sensor to angled side to provide an intial 30º look down.

TILT ADJUSTMENT

Mounting Height	Position
7' - 8'	Vertical
8' - 9'	Center
9' - 10'	Forward
Above 10'	Use **WV BR**

CEILING MOUNT BRACKET (WV BR)

The **WV BR** Ceiling Mount Bracket allows the **WV PDT 16** to be mounted in the corner of the area from the ceiling for conditions where mounting to the wall is not possible.

PROGRAMMING

Refer to included instruction card for default settings and directions on programming the sensor via the push-button.

sensorswitch
An AcuityBrands Company

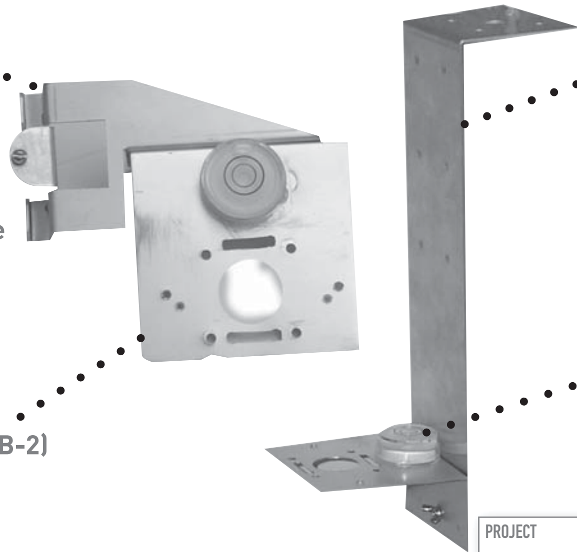
900 Northrop Road, Wallingford, CT 06492 • 1.800.PASSIVE • FX 203.269.9621 • www.sensorswitch.com

MB Sensor Mounting Brackets

Brushed aluminum construction

Mounting plates adjustable to preset angles

HID fixture bracket (MB-2)



Multiple mounting options with MB-1

Compatible with most WattStopper occupancy sensors

Built-in bubble level for accurate installation

PROJECT
LOCATION/TYPE

Product Overview

Description

The MB-1 and MB-2 are durable mounting brackets used to install occupancy sensors in a variety of settings. Both brackets include adjustable plates that allow sensor rotation to achieve the desired angle for optimal coverage. The brackets also include built-in bubble levels that afford the installer reliable guides to ensure the bracket is correctly positioned before adjusting the sensor. The MB-1 and MB-2 are constructed of aluminum with a clear powder coating finish.

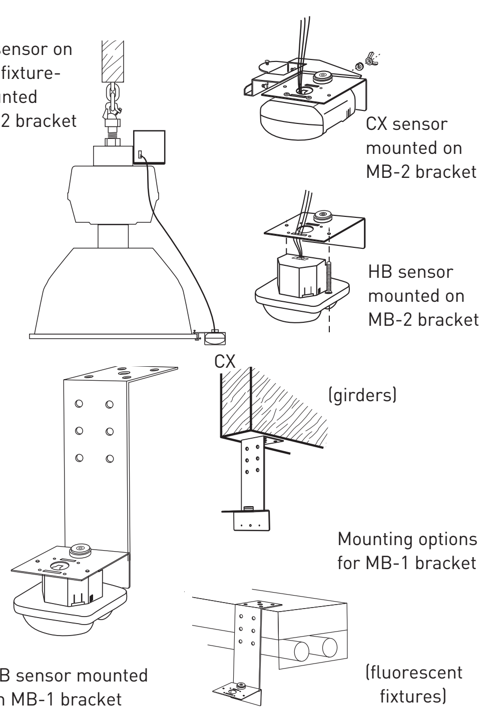
MB-1

The MB-1 bracket enables users to mount sensors to a variety of structures, including fluorescent fixtures, walls, shelves, and girders. Among the many sensors compatible for use with the MB-1 bracket are the WPIR, CX, CI, and HB sensors. The MB-1 features an L-shaped bracket and a sensor mounting plate. When installed, this mounting plate can be rotated to direct the sensor toward the floor or along an aisle way at up to a 33° angle. In addition, the L-shaped bracket can be molded or reshaped to provide other mounting options.

MB-2

With the MB-2, sensors can be attached directly to High Intensity Discharge (HID) fixtures, mounting to the bottom rim of the HID reflector bell and secured to the rim with three clamping screws. Sensors recommended for use with the MB-2 bracket include the CX, CI and HB sensors. The MB-2 includes a J-shaped bracket and a sensor mounting plate. The MB-2 also comes with extension wires that can be used, if needed, to connect the attached sensor to the DM HID controller.

Bracket Diagrams



Ordering Information

	Catalog No.	Description
☐	MB-1	L-Plate Industrial Mounting Bracket
☐	MB-2	J-Plate HID Mounting Bracket

Pub. No. 8904 rev. 10/2009

120/277 VOLT
POWER PACKS AND SLAVE PACKS

PP-20
PP-20-2P
SP-20

Plenum Rated

TYPICAL APPLICATIONS
- Used with Low Voltage Sensors
- Multiple Sensors
- Multiple Loads
- AC Switching Only

HIGHLIGHTS
- Dual Voltage Transformer
- Self-Contained Relay
- Patented Relay Circuit Protection (Tested to over 400,000 cycles)
- Powers up to 14 sensors

SPECIFICATIONS
- Size:(1/2” inch chase nipple not inc.)
  PP-20-2P: $4^{1}/_{8}$ x 3” x $1^{7}/_{8}$”
  PP-20 & SP-20: 3” x $2^{1}/_{4}$” x $1^{7}/_{8}$”
- Mounting: 1/2” inch chase nipple
- Operating Voltage: 120, 240, or 277 VAC (Single Phase only)
- Each Relay: 20 Amps
- 1 HP Motor Load
- Output Voltage: 15 VDC, 150 mA at 120 or 277 VAC
- Class II: 18 AWG, up to 2,000 ft.
- Plenum Rated
- Relative Humidity: 20 to 90% non-condensing
- Operating Temp: 14º to 160º F
- Storage Temp: -14º to 160º F
- UL and CUL Listed
- 5 Year Warranty
- Made in U.S.A.

LOW TEMP/HI HUMIDITY(-LT)
- Conformally Coated PCB
- Operates down to -40º F
- Corrosion resistant from moisture

PLENUM CONSIDERATIONS
Most local codes allow for small plastic controls in Return Air Plenums; *Some Do Not!* To meet local code, the Power Pack can be mounted inside an adjacent (Deep) junction box as shown below.

Power Packs are the heart of the Low Voltage Sensor System. The *PP-20* transforms 120, 240 or 277 Volts (single phase) to class II 15 VDC to power the remote sensors. Utilizing Patented Relay Circuit Protection the *PP-20* also switches the lighting load "On" and "Off": Tested to over 400,000 cycles at rated load! Although Plenum Rated, the elongated mounting nipple allows for the *PP-20* to be mounted either directly thru a 1/2” inch knockout in a junction box, or to be located inside an adjacent box for specific local code requirements. Up to 14 sensors may be connected to one *PP-20*. Multi-circuit control can be handled by multiple *PP-20's*, or 2-Pole Power Packs (*PP-20-2P*) and Slave Packs (*SP-20*) may be configured. *PP-20's* can be wired continuously hot (line side), or on the switch leg (load side) without nuisance delays upon turn "On".

LOW VOLTAGE OPERATION AND TEST
The Low Voltage Wires or Terminal is color coded Red (15 VDC), Black (Common), and White (Occupancy Signal). With no sensors connected, using a small wire, connect the Red terminal to the White. The lights should turn "On". Remove the connection and the lights should turn "Off". With the sensors connected, the Red and Black wires provide DC power to the remote sensors, and when there is occupancy detected, the White wire produces a 15 VDC signal from the sensor to the power pack initiating the lights to "On". Upon initial power up, the Sensors automatically send an "On" signal until the sensors have stabilized and "Timed Out".

SIZING OF THE SYSTEM - VARIOUS COMBINATIONS
Combining Power Packs provides for additional power to drive remote devices. Maximum numbers of remote sensors are shown below based on the Power Pack/Slave Pack being used. *Maximum number of "Relays" is 30.*

	Sensors	Sensors with Relay
1 PP-20	14	8
1 PP-20-2P	7	6
1 PP-20 w/SP-20	7	6
1 PP-20-2P w/SP-20	5	5
2 PP-20	28	16
2 PP-20-2P	14	12

Note 1: Only three relays may be controlled with one Power Pack. If more than three circuits are required, multiple Power Packs must be used.

Note 2: Only one "Sensor with Relay" is required in most cases. See Technical Datasheet on Low Voltage Sensors with -R Interface Option.

SYSTEMS CONSIDERATIONS
The local override switch may be upstream or downstream of a *PP-20*. However, if an *SP-20* Auxiliary Relay or a *PP-20-2P* controller is being used, the switch(es) should be downstream on the load side of the relay. If power is disconnected to the Power Pack all subsequent relays will open, turning off all of the loads. If wiring the local switches before the Power Pack and Slave Pack, use multiple *PP-20's*, one for each circuit. This will allow for one circuit to remain powered, keeping the system operational when the other is turned off. When controlling a dimming circuit, *PP-20* must be wired before dimmer, or *SP-20* may be wired after dimmer.

INTERFACING WITH ELECTRONIC CONTROL SYSTEMS
The Relay Switching System is designed to switch Alternating Currents Only. The relay will not switch DC signal inputs to EMS or Lighting Control Systems. Use model #MP-20, or "-R" for signal relay located in Low Voltage Sensor Heads.

CATALOG INFORMATION

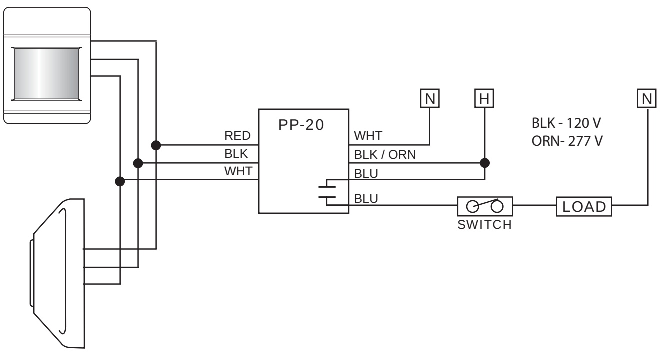
MODEL#	DESCRIPTION	OUTPUT VOLTAGE	OUTPUT CURRENT
PP-20	Power Pack with 20 Amp Relay	15 to 24 VDC	70 to 110 mA
PP-20-2P	Power Pack with two 20 Amp Relays	15 to 24 VDC	35 to 70 mA
SP-20	Slave Pack with 20 Amp Relay	N/A	40 mA (consumption)

**Add suffix -LT for Low Temp/Hi Humidity

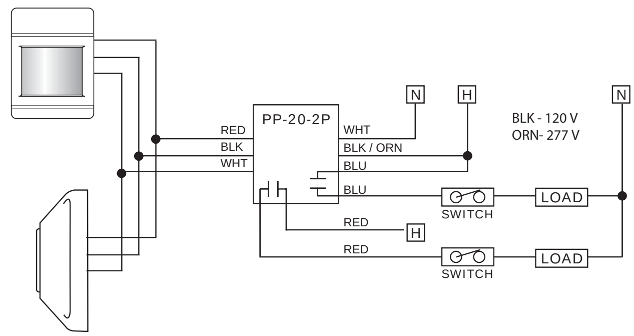
TYPICAL WIRING DIAGRAMS - DO NOT WIRE HOT

NOTE: The Power Pack must be connected to a single phase Hot and Neutral System. For 120 VAC, connect the Black wire to Hot, White wire to Neutral, and Cap off the Orange wire. For 240-277 VAC, connect the Orange to Hot, White to Neutral, and Cap off the Black wire. *Never connect both the Black and Orange wires!* Low Voltage wire can be 18 to 22 AWG; shielding is not necessary. Class II terminal Block on *PP-20-2P* only accepts one conductor per terminal of 18 AWG stranded or smaller.

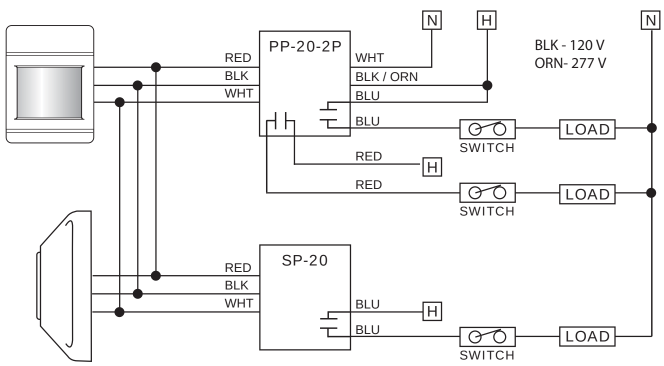
Multiple Sensors Controlling One Circuit



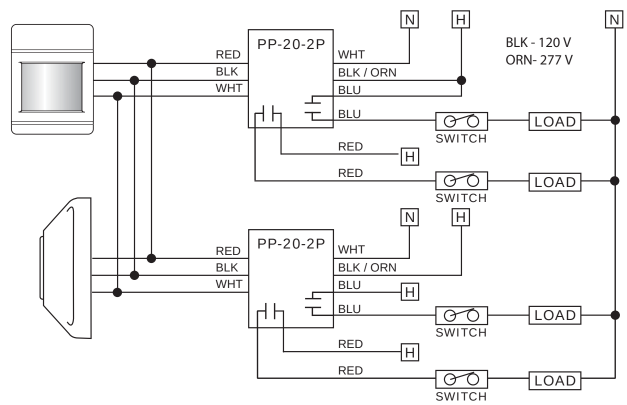
Multiple Sensors Controlling Two Circuits



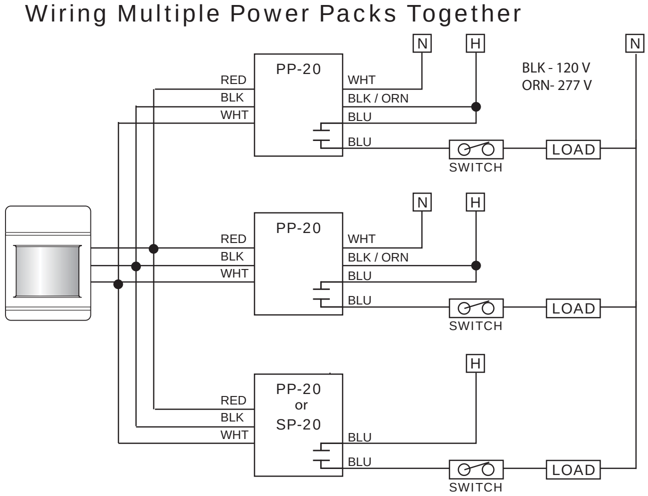
Multiple Sensors Controlling Three Circuits



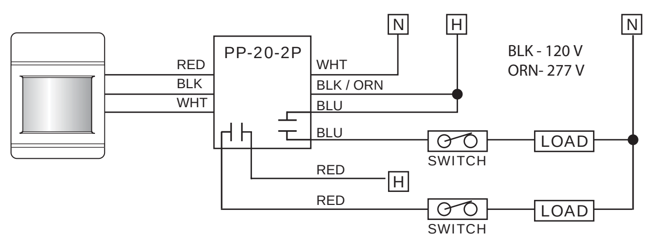
Multiple Sensors Controlling Four Circuits



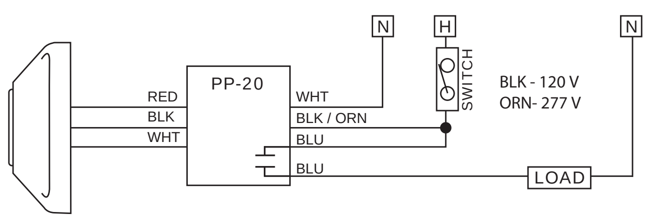
Wiring Multiple Power Packs Together



One Sensor Controlling Two Circuits



One Sensor Controlling One Circuit



SENSOR SWITCH, INC.
900 Northrop Rd., Wallingford, CT 06492
(203) 265-2842 info@sensorswitch.com
www.sensorswitch.com

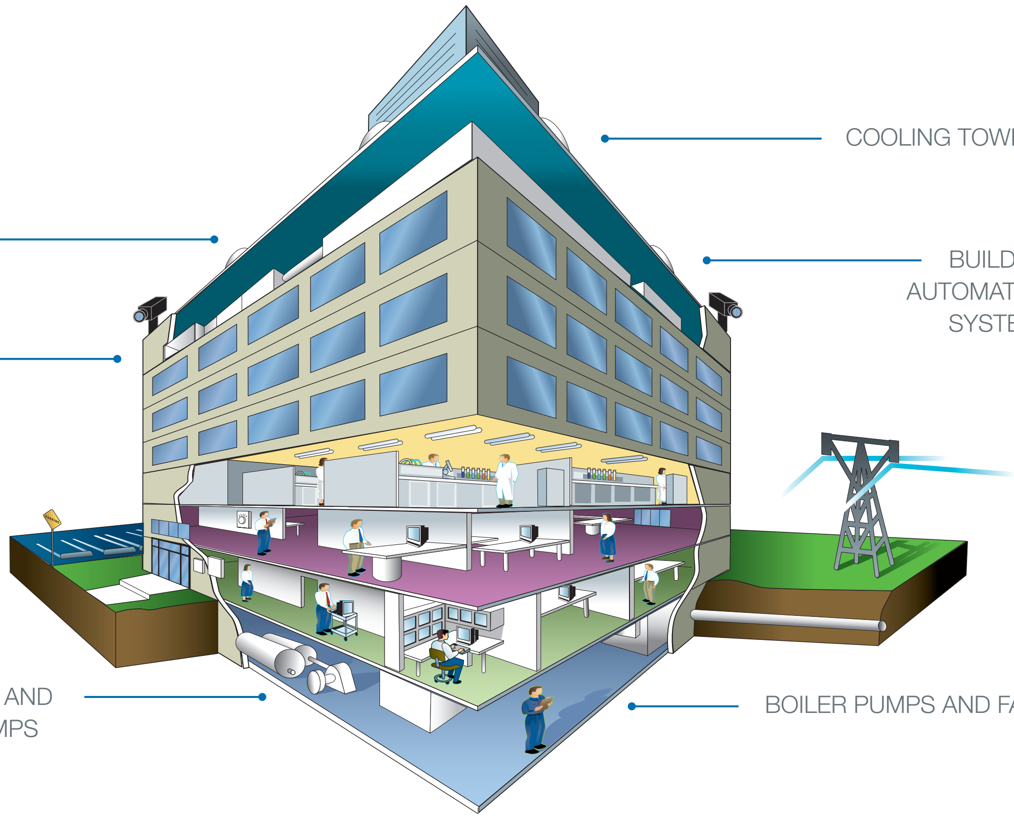
SmartVFD HVAC and BYPASS

Honeywell

The Smart Choice for Energy Savings.

Saving Energy the Smart Way

Buildings consume more than 70 percent of the electricity produced in North America — and roughly half of that is used to circulate air and water. Honeywell SmartVFD HVAC, BYPASS and COMPACT variable frequency drives maximize energy savings by modulating the speed of fans and pumps. VFDs achieve these savings by operating within a building's control system or independently through its internal PID capabilities. Additionally, Honeywell's VFDs are loaded with labor-saving features such as startup wizards, PC programming, and an intuitive graphical interface that allows for faster, more accurate commissioning and reliable maintenance over the life of the drive.



BACKED BY HONEYWELL

Already among the leading names in HVAC variable frequency drives, Honeywell is pleased to deliver the SmartVFD HVAC line — the third generation of Honeywell VFDs. Designed specifically for commercial applications and backed by more than a century of Honeywell's control expertise, you can count on Honeywell's SmartVFD HVAC and BYPASS to deliver long-term service and energy savings for your customer. You simply can't find a commercial building control name with a more proven record than Honeywell.

Honeywell

The Smart Choice for Efficient Investment

It's a common myth that any VFD can easily be applied in a commercial application, but many VFDs are not the right tool for the job. The Honeywell SmartVFD HVAC and BYPASS are designed specifically for commercial buildings to deliver the energy savings that building owners and facility managers need with 98 percent energy efficiency, minimal labor and a fast ROI.

SMARTVFD HVAC – SMART INSTALLATION, SMART COMMISSIONING AND SMART COMMUNICATION

The Honeywell SmartVFD HVAC meets UL and cUL standards which makes installation and commissioning easy for you and energy savings easy for your customers:

Easy Communication

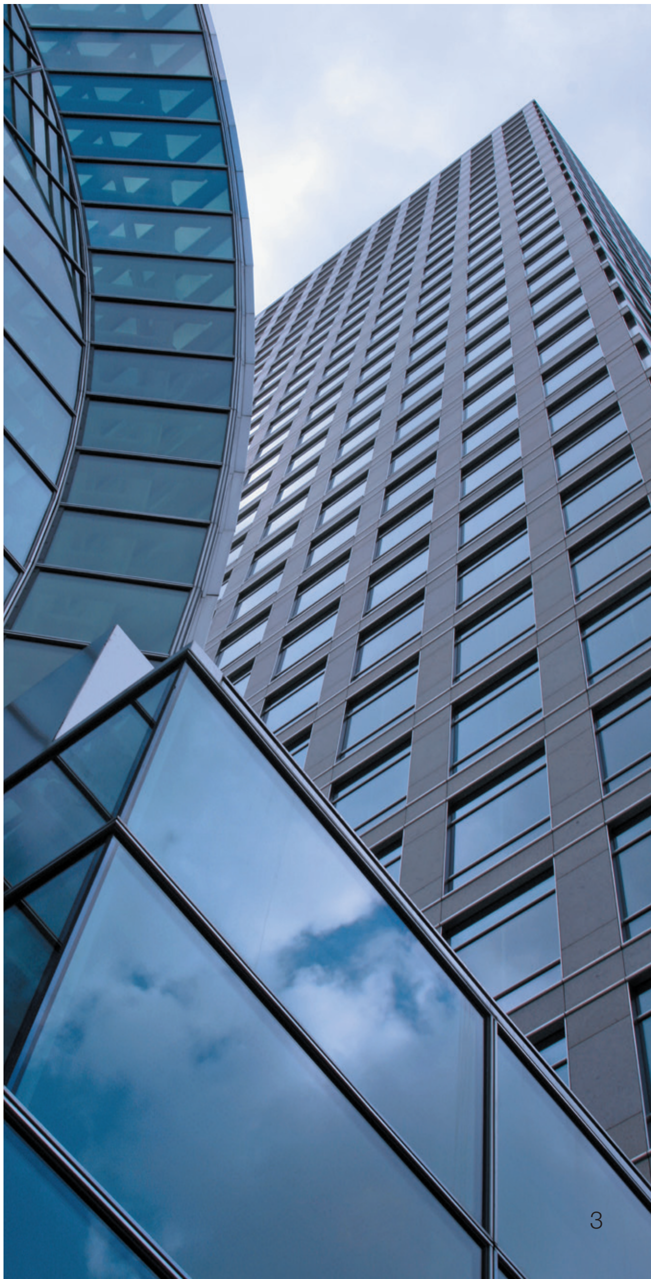
- Start-up Wizards — Set the clock and tell the VFD whether you have a pump or a fan, enter nominal motor information, and you are up and running. PID and multi-pumps wizards are also built in.
- PC Software Wizards — Commissioning, programming and troubleshooting are all a snap with the PC Software Wizards.
- Graphic Interface — The easy-to-use keypad and interface deliver menu-driven programming and monitoring for fast, uniform commissioning. It's also easy for the building owner or manager to learn and use, helping to reduce service calls. Every parameter has a built-in help feature to provide assistance while programming.
- Built-In Communications — With BACnet®, N2 and Modbus built in, your customers will enjoy a lower total installed cost and reliable communications with the building management system.
- Built-In PLC — PC based tools eliminate the need for an expensive external controller.

Built-in Protection

- DC Choke for harmonic protection.
- Standard RFI Filter — Ensures that EMC/RFI requirements are met.
- Bypass Options — Meet specifications and system critical applications with a comprehensive bypass offering.

Smart Software

- Real-Time Clock — Battery included.
- Fire Mode to improve fire safety in the building.
- Motor Switch Ride-Through — Easy, fault-free maintenance.
- Hand-Off-Auto (HOA) control built into the keypad.
- Plenum rated for install flexibility.
- 100 KA Short Circuit Current Rating (SCCR) rated.



Smart Benefits with Easy Commissioning

Honeywell SmartVFD HVAC doesn't just work in the laboratory — it works in the field. From the variety of network protocols that make integration easy, to the guided Startup and PID wizards, the design and technology of SmartVFDs make them true HVAC drives. Intuitive menus assist with commissioning, programming, troubleshooting and overall operation.

COMMUNICATION STANDARD

Integrating Honeywell SmartVFD HVAC into a building management system is a breeze. There's no need for extra cards because it offers a wide range of communications protocols right out of the box, including:

- RS485 – BACnet®, Modbus and N2
- Ethernet – BACnet/IP and Modbus/TCP
- Available options – LonWorks® and DeviceNet

HIGH-RESOLUTION GRAPHIC DISPLAY

It's not just easy on the eyes, it's also easy to use. The menu driven display shows the minimum, maximum and actual values for all parameters and allows easy uploading and downloading of parameters, and has multiple help functions and the manual built-in. In addition, there is a Local/Remote button on the keypad for built in HOA control.

DETERMINE ROOT CAUSE OF FAULTS

With the SmartVFD HVAC, troubleshooting involves very little trouble. The built in, diagnostic screen provides a description for every fault, and the actual values and references are stored at the time of the fault for easy review and problem resolution.

MONITOR SYSTEM PERFORMANCE

The data needed to analyze usage and make adjustments for maximum energy savings is right at your fingertips. Actual electricity consumption in kWh can be monitored using the VFD PC Wizard, and can be conveniently displayed in bar graphs. At any time, the user can see the actual power consumption currently in use — a great tool for managing energy savings.

Honeywell

Smart Configurations

For system critical applications, you must be able to select a bypass that meets the requirements of the specification. The SmartVFD BYPASS is easy to specify, select, install and commission. The SmartVFD BYPASS is UL certified and is the perfect complement to the advanced capabilities of the SmartVFD family — a combination that is both simple and smart.

SMARTVFD BYPASS CONFIGURATIONS

Our five configurations make it easy for you to select the right bypass to complete your drive package. All bundles are available in NEMA 1, NEMA 12 and ventilated NEMA 3R HOA (HAND OFF AUTO).

SmartVFD Disconnect Only

- Adds a fused disconnect to the VFD.

SmartVFD 2-Contactor Bypass

Provides an economical means of bypassing the VFD.

- Freeze/Fire/Smoke Interlock

SmartVFD 3-Contactor Bypass

Commission, service or replace the VFD without affecting the operation of the motor.

- Fused Disconnect
- Freeze/Fire/Smoke Interlock
- VFD is isolated from power with motor running in BYPASS mode
- TEST position powers the VFD without sending power to the motor

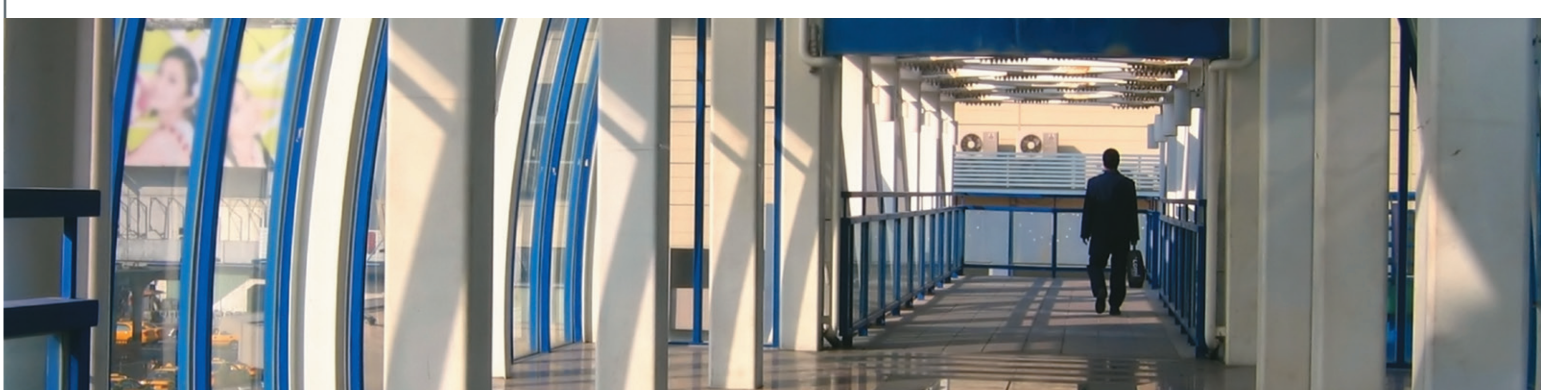
SmartVFD 3-Contactor Bypass with Auto-Bypass

The package adds the control capabilities below to the standard three contactor bypass.

- Any VFD fault will automatically send the bypass to BYPASS mode
- A contact closure sends the bypass to BYPASS mode
- Dry contacts indicate when the bypass is in BYPASS mode, alerting the building management system

SLEEKER. SMALLER. SMARTER.

As the latest evolution of the Honeywell VFD line, the SmartVFD BYPASS is sleeker, smaller, lighter and less expensive.



Smart Selection

HVFDSD 3 C 0100 G 1 0 0

Product Family
HVFDSD = Honeywell SmartVFD HVAC
HVFDSB = Honeywell SmartVFD BYPASS

Input Phase
3 = Three Phase (3~in, 3~out)

Nominal Voltage
A = 208/230 Vac Drive Alone, 208 Vac Bypass
B = 230 Vac Bypass
C = 480 Vac
D = 575 Vac

Nominal Horsepower
0007 = .75 Horse Power
0010 = 1 Horse Power
0100 = 10 Horse Power

Options
0 = Drive Only or No Special Options
1 = Auto-Bypass

Contactors
0 = Drive Only
1 = Disconnect Only
2 = Two Contactor Bypass
3 = Three Contactor Bypass

Enclosure Type
1 = NEMA 1
2 = NEMA 12
3 = NEMA 3R

Interface
G = Graphic KeyPad

PICK THE RIGHT VFD FOR THE APPLICATION

- Drives are typically sized to match the horsepower rating of the motor, which will be accurate 95 percent of the time. But for the greatest accuracy, drives should be sized based upon the Full Load Amps or current draw of the motor. The VFD must have a slightly larger current rating maximum.
- The environment the drive will operate in is critical for selection. Honeywell offers NEMA 1, NEMA 12 (for dusty, dirtier environments) and NEMA 3R enclosures (for falling water or rain situations).
- Because of the complexity of VFDs, a clean, conditioned space with temperatures between 14° F and 104° F provides an environment for ideal operation. Heaters are an option in order to keep your VFD at its recommended temperature.
- Honeywell SmartVFD HVAC has a model range from 1.5-250 HP for 460 Vac, 0.75-125 HP for 208/230 Vac.
- Honeywell SmartVFD offers a standard 3-year warranty from the date of purchase.

Find all SmartVFD selection information on the following pages

SmartVFD HVAC Drive Alone

	HP	AMPS	Frame	NEMA 1 Drive Alone	NEMA 12 Drive Alone	NEMA 3R Drive Alone
460 Vac	1.5	3.4	4	HVFDSD3C0015G100	HVFDSD3C0015G200	HVFDSD3C0015G300
	2	4.8	4	HVFDSD3C0020G100	HVFDSD3C0020G200	HVFDSD3C0020G300
	3	5.6	4	HVFDSD3C0030G100	HVFDSD3C0030G200	HVFDSD3C0030G300
	4	8	4	HVFDSD3C0040G100	HVFDSD3C0040G200	HVFDSD3C0040G300
	5	9.6	4	HVFDSD3C0050G100	HVFDSD3C0050G200	HVFDSD3C0050G300
	7.5	12	4	HVFDSD3C0075G100	HVFDSD3C0075G200	HVFDSD3C0075G300
	10	16	5	HVFDSD3C0100G100	HVFDSD3C0100G200	HVFDSD3C0100G300
	15	23	5	HVFDSD3C0150G100	HVFDSD3C0150G200	HVFDSD3C0150G300
	20	31	5	HVFDSD3C0200G100	HVFDSD3C0200G200	HVFDSD3C0200G300
	25	38	6	HVFDSD3C0250G100	HVFDSD3C0250G200	HVFDSD3C0250G300
	30	46	6	HVFDSD3C0300G100	HVFDSD3C0300G200	HVFDSD3C0300G300
	40	61	6	HVFDSD3C0400G100	HVFDSD3C0400G200	HVFDSD3C0400G300
	50	72	7	HVFDSD3C0500G100	HVFDSD3C0500G200	HVFDSD3C0500G300
	60	87	7	HVFDSD3C0600G100	HVFDSD3C0600G200	HVFDSD3C0600G300
	75	105	7	HVFDSD3C0750G100	HVFDSD3C0750G200	HVFDSD3C0750G300
	100	140	8	HVFDSD3C1000G100	HVFDSD3C1000G200	HVFDSD3C1000G300
	125	170	8	HVFDSD3C1250G100	HVFDSD3C1250G200	HVFDSD3C1250G300
	150	205	8	HVFDSD3C1500G100	HVFDSD3C1500G200	HVFDSD3C1500G300
	200	261	9	HVFDSD3C2000G100	HVFDSD3C2000G200	-
	250	310	9	HVFDSD3C2500G100	HVFDSD3C2500G200	-
	HP	AMPS	Frame	NEMA 1 Drive Alone	NEMA 12 Drive Alone	NEMA 3R Drive Alone
208/ 230 Vac	.75	3.7	4	HVFDSD3A0007G100	HVFDSD3A0007G200	HVFDSD3A0007G300
	1	4.8	4	HVFDSD3A0010G100	HVFDSD3A0010G200	HVFDSD3A0010G300
	1.5	6.6	4	HVFDSD3A0015G100	HVFDSD3A0015G200	HVFDSD3A0015G300
	2	8	4	HVFDSD3A0020G100	HVFDSD3A0020G200	HVFDSD3A0020G300
	3	11	4	HVFDSD3A0030G100	HVFDSD3A0030G200	HVFDSD3A0030G300
	5	18	5	HVFDSD3A0050G100	HVFDSD3A0050G200	HVFDSD3A0050G300
	7.5	24	5	HVFDSD3A0075G100	HVFDSD3A0075G200	HVFDSD3A0075G300
	10	31	5	HVFDSD3A0100G100	HVFDSD3A0100G200	HVFDSD3A0100G300
	15	48	6	HVFDSD3A0150G100	HVFDSD3A0150G200	HVFDSD3A0150G300
	20	62	6	HVFDSD3A0200G100	HVFDSD3A0200G200	HVFDSD3A0200G300
	25	75	7	HVFDSD3A0250G100	HVFDSD3A0250G200	HVFDSD3A0250G300
	30	88	7	HVFDSD3A0300G100	HVFDSD3A0300G200	HVFDSD3A0300G300
	40	105	7	HVFDSD3A0400G100	HVFDSD3A0400G200	HVFDSD3A0400G300
	50	140	8	HVFDSD3A0500G100	HVFDSD3A0500G200	HVFDSD3A0500G300
	60	170	8	HVFDSD3A0600G100	HVFDSD3A0600G200	HVFDSD3A0600G300
	75	205	8	HVFDSD3A0750G100	HVFDSD3A0750G200	HVFDSD3A0750G300
	100	261	9	HVFDSD3A1000G100	HVFDSD3A1000G200	-
	125	310	9	HVFDSD3A1250G100	HVFDSD3A1250G200	-

SmartVFD HVAC NEMA 1 Disconnect and SmartVFD BYPASS

	HP	AMPS	Frame	NEMA 1 Fused Disconnect	NEMA 1 2-Contactor Bypass	NEMA 1 3-Contactor Bypass	NEMA 1 3-Cont. Bypass + Auto-Bypass
460 Vac	1.5	3.4	4	HVFDSB3C0015G110	HVFDSB3C0015G120	HVFDSB3C0015G130	HVFDSB3C0015G131
	2	4.8	4	HVFDSB3C0020G110	HVFDSB3C0020G120	HVFDSB3C0020G130	HVFDSB3C0020G131
	3	5.6	4	HVFDSB3C0030G110	HVFDSB3C0030G120	HVFDSB3C0030G130	HVFDSB3C0030G131
	4	8	4	HVFDSB3C0040G110	HVFDSB3C0040G120	HVFDSB3C0040G130	HVFDSB3C0040G131
	5	9.6	4	HVFDSB3C0050G110	HVFDSB3C0050G120	HVFDSB3C0050G130	HVFDSB3C0050G131
	7.5	12	4	HVFDSB3C0075G110	HVFDSB3C0075G120	HVFDSB3C0075G130	HVFDSB3C0075G131
	10	16	5	HVFDSB3C0100G110	HVFDSB3C0100G120	HVFDSB3C0100G130	HVFDSB3C0100G131
	15	23	5	HVFDSB3C0150G110	HVFDSB3C0150G120	HVFDSB3C0150G130	HVFDSB3C0150G131
	20	31	5	HVFDSB3C0200G110	HVFDSB3C0200G120	HVFDSB3C0200G130	HVFDSB3C0200G131
	25	38	6	HVFDSB3C0250G110	HVFDSB3C0250G120	HVFDSB3C0250G130	HVFDSB3C0250G131
	30	46	6	HVFDSB3C0300G110	HVFDSB3C0300G120	HVFDSB3C0300G130	HVFDSB3C0300G131
	40	61	6	HVFDSB3C0400G110	HVFDSB3C0400G120	HVFDSB3C0400G130	HVFDSB3C0400G131
	50	72	7	HVFDSB3C0500G110	HVFDSB3C0500G120	HVFDSB3C0500G130	HVFDSB3C0500G131
	60	87	7	HVFDSB3C0600G110	HVFDSB3C0600G120	HVFDSB3C0600G130	HVFDSB3C0600G131
	75	105	7	HVFDSB3C0750G110	HVFDSB3C0750G120	HVFDSB3C0750G130	HVFDSB3C0750G131
	100	140	8	HVFDSB3C1000G110	HVFDSB3C1000G120	HVFDSB3C1000G130	HVFDSB3C1000G131
	125	170	8	HVFDSB3C1250G110	HVFDSB3C1250G120	HVFDSB3C1250G130	HVFDSB3C1250G131
	150	205	8	HVFDSB3C1500G110	HVFDSB3C1500G120	HVFDSB3C1500G130	HVFDSB3C1500G131
	HP	AMPS	Frame	NEMA 1 Fused Disconnect	NEMA 1 2-Contactor Bypass	NEMA 1 3-Contactor Bypass	NEMA 1 3-Cont. Bypass + Auto-Bypass
208 Vac	.75	3.7	4	HVFDSB3A0007G110	HVFDSB3A0007G120	HVFDSB3A0007G130	HVFDSB3A0007G131
	1	4.8	4	HVFDSB3A0010G110	HVFDSB3A0010G120	HVFDSB3A0010G130	HVFDSB3A0010G131
	1.5	6.6	4	HVFDSB3A0015G110	HVFDSB3A0015G120	HVFDSB3A0015G130	HVFDSB3A0015G131
	2	8	4	HVFDSB3A0020G110	HVFDSB3A0020G120	HVFDSB3A0020G130	HVFDSB3A0020G131
	3	11	4	HVFDSB3A0030G110	HVFDSB3A0030G120	HVFDSB3A0030G130	HVFDSB3A0030G131
	5	18	5	HVFDSB3A0050G110	HVFDSB3A0050G120	HVFDSB3A0050G130	HVFDSB3A0050G131
	7.5	24	5	HVFDSB3A0075G110	HVFDSB3A0075G120	HVFDSB3A0075G130	HVFDSB3A0075G131
	10	31	5	HVFDSB3A0100G110	HVFDSB3A0100G120	HVFDSB3A0100G130	HVFDSB3A0100G131
	15	48	6	HVFDSB3A0150G110	HVFDSB3A0150G120	HVFDSB3A0150G130	HVFDSB3A0150G131
	20	62	6	HVFDSB3A0200G110	HVFDSB3A0200G120	HVFDSB3A0200G130	HVFDSB3A0200G131
	25	75	7	HVFDSB3A0250G110	HVFDSB3A0250G120	HVFDSB3A0250G130	HVFDSB3A0250G131
	30	88	7	HVFDSB3A0300G110	HVFDSB3A0300G120	HVFDSB3A0300G130	HVFDSB3A0300G131
	40	105	7	HVFDSB3A0400G110	HVFDSB3A0400G120	HVFDSB3A0400G130	HVFDSB3A0400G131
	50	140	8	HVFDSB3A0500G110	HVFDSB3A0500G120	HVFDSB3A0500G130	HVFDSB3A0500G131
	60	170	8	HVFDSB3A0600G110	HVFDSB3A0600G120	HVFDSB3A0600G130	HVFDSB3A0600G131
	75	205	8	HVFDSB3A0750G110	HVFDSB3A0750G120	HVFDSB3A0750G130	HVFDSB3A0750G131
	HP	AMPS	Frame	NEMA 1 Fused Disconnect	NEMA 1 2-Contactor Bypass	NEMA 1 3-Contactor Bypass	NEMA 1 3-Cont. Bypass + Auto-Bypass
230 Vac	.75	3.7	4	HVFDSB3B0007G110	HVFDSB3B0007G120	HVFDSB3B0007G130	HVFDSB3B0007G131
	1	4.8	4	HVFDSB3B0010G110	HVFDSB3B0010G120	HVFDSB3B0010G130	HVFDSB3B0010G131
	1.5	6.6	4	HVFDSB3B0015G110	HVFDSB3B0015G120	HVFDSB3B0015G130	HVFDSB3B0015G131
	2	8	4	HVFDSB3B0020G110	HVFDSB3B0020G120	HVFDSB3B0020G130	HVFDSB3B0020G131
	3	11	4	HVFDSB3B0030G110	HVFDSB3B0030G120	HVFDSB3B0030G130	HVFDSB3B0030G131
	5	18	5	HVFDSB3B0050G110	HVFDSB3B0050G120	HVFDSB3B0050G130	HVFDSB3B0050G131
	7.5	24	5	HVFDSB3B0075G110	HVFDSB3B0075G120	HVFDSB3B0075G130	HVFDSB3B0075G131
	10	31	5	HVFDSB3B0100G110	HVFDSB3B0100G120	HVFDSB3B0100G130	HVFDSB3B0100G131
	15	48	6	HVFDSB3B0150G110	HVFDSB3B0150G120	HVFDSB3B0150G130	HVFDSB3B0150G131
	20	62	6	HVFDSB3B0200G110	HVFDSB3B0200G120	HVFDSB3B0200G130	HVFDSB3B0200G131
	25	75	7	HVFDSB3B0250G110	HVFDSB3B0250G120	HVFDSB3B0250G130	HVFDSB3B0250G131
	30	88	7	HVFDSB3B0300G110	HVFDSB3B0300G120	HVFDSB3B0300G130	HVFDSB3B0300G131
	40	105	7	HVFDSB3B0400G110	HVFDSB3B0400G120	HVFDSB3B0400G130	HVFDSB3B0400G131
	50	140	8	HVFDSB3B0500G110	HVFDSB3B0500G120	HVFDSB3B0500G130	HVFDSB3B0500G131
	60	170	8	HVFDSB3B0600G110	HVFDSB3B0600G120	HVFDSB3B0600G130	HVFDSB3B0600G131
	75	205	8	HVFDSB3B0750G110	HVFDSB3B0750G120	HVFDSB3B0750G130	HVFDSB3B0750G131

SmartVFD HVAC NEMA 12 Disconnect and SmartVFD BYPASS

	HP	AMPS	Frame	NEMA 12 Fused Disconnect	NEMA 12 2-Contactor Bypass	NEMA 12 3-Contactor Bypass	NEMA 12 3-Cont. Bypass + Auto-Bypass
460 Vac	1.5	3.4	4	HVFDSB3C0015G210	HVFDSB3C0015G220	HVFDSB3C0015G230	HVFDSB3C0015G231
	2	4.8	4	HVFDSB3C0020G210	HVFDSB3C0020G220	HVFDSB3C0020G230	HVFDSB3C0020G231
	3	5.6	4	HVFDSB3C0030G210	HVFDSB3C0030G220	HVFDSB3C0030G230	HVFDSB3C0030G231
	4	8	4	HVFDSB3C0040G210	HVFDSB3C0040G220	HVFDSB3C0040G230	HVFDSB3C0040G231
	5	9.6	4	HVFDSB3C0050G210	HVFDSB3C0050G220	HVFDSB3C0050G230	HVFDSB3C0050G231
	7.5	12	4	HVFDSB3C0075G210	HVFDSB3C0075G220	HVFDSB3C0075G230	HVFDSB3C0075G231
	10	16	5	HVFDSB3C0100G210	HVFDSB3C0100G220	HVFDSB3C0100G230	HVFDSB3C0100G231
	15	23	5	HVFDSB3C0150G210	HVFDSB3C0150G220	HVFDSB3C0150G230	HVFDSB3C0150G231
	20	31	5	HVFDSB3C0200G210	HVFDSB3C0200G220	HVFDSB3C0200G230	HVFDSB3C0200G231
	25	38	6	HVFDSB3C0250G210	HVFDSB3C0250G220	HVFDSB3C0250G230	HVFDSB3C0250G231
	30	46	6	HVFDSB3C0300G210	HVFDSB3C0300G220	HVFDSB3C0300G230	HVFDSB3C0300G231
	40	61	6	HVFDSB3C0400G210	HVFDSB3C0400G220	HVFDSB3C0400G230	HVFDSB3C0400G231
	50	72	7	HVFDSB3C0500G210	HVFDSB3C0500G220	HVFDSB3C0500G230	HVFDSB3C0500G231
	60	87	7	HVFDSB3C0600G210	HVFDSB3C0600G220	HVFDSB3C0600G230	HVFDSB3C0600G231
	75	105	7	HVFDSB3C0750G210	HVFDSB3C0750G220	HVFDSB3C0750G230	HVFDSB3C0750G231
	100	140	8	HVFDSB3C1000G210	HVFDSB3C1000G220	HVFDSB3C1000G230	HVFDSB3C1000G231
	125	170	8	HVFDSB3C1250G210	HVFDSB3C1250G220	HVFDSB3C1250G230	HVFDSB3C1250G231
	150	205	8	HVFDSB3C1500G210	HVFDSB3C1500G220	HVFDSB3C1500G230	HVFDSB3C1500G231
	HP	AMPS	Frame	NEMA 12 Fused Disconnect	NEMA 12 2-Contactor Bypass	NEMA 12 3-Contactor Bypass	NEMA 12 3-Cont. Bypass + Auto-Bypass
208 Vac	.75	3.7	4	HVFDSB3A0007G210	HVFDSB3A0007G220	HVFDSB3A0007G230	HVFDSB3A0007G231
	1	4.8	4	HVFDSB3A0010G210	HVFDSB3A0010G220	HVFDSB3A0010G230	HVFDSB3A0010G231
	1.5	6.6	4	HVFDSB3A0015G210	HVFDSB3A0015G220	HVFDSB3A0015G230	HVFDSB3A0015G231
	2	8	4	HVFDSB3A0020G210	HVFDSB3A0020G220	HVFDSB3A0020G230	HVFDSB3A0020G231
	3	11	4	HVFDSB3A0030G210	HVFDSB3A0030G220	HVFDSB3A0030G230	HVFDSB3A0030G231
	5	18	5	HVFDSB3A0050G210	HVFDSB3A0050G220	HVFDSB3A0050G230	HVFDSB3A0050G231
	7.5	24	5	HVFDSB3A0075G210	HVFDSB3A0075G220	HVFDSB3A0075G230	HVFDSB3A0075G231
	10	31	5	HVFDSB3A0100G210	HVFDSB3A0100G220	HVFDSB3A0100G230	HVFDSB3A0100G231
	15	48	6	HVFDSB3A0150G210	HVFDSB3A0150G220	HVFDSB3A0150G230	HVFDSB3A0150G231
	20	62	6	HVFDSB3A0200G210	HVFDSB3A0200G220	HVFDSB3A0200G230	HVFDSB3A0200G231
	25	75	7	HVFDSB3A0250G210	HVFDSB3A0250G220	HVFDSB3A0250G230	HVFDSB3A0250G231
	30	88	7	HVFDSB3A0300G210	HVFDSB3A0300G220	HVFDSB3A0300G230	HVFDSB3A0300G231
	40	105	7	HVFDSB3A0400G210	HVFDSB3A0400G220	HVFDSB3A0400G230	HVFDSB3A0400G231
	50	140	8	HVFDSB3A0500G210	HVFDSB3A0500G220	HVFDSB3A0500G230	HVFDSB3A0500G231
	60	170	8	HVFDSB3A0600G210	HVFDSB3A0600G220	HVFDSB3A0600G230	HVFDSB3A0600G231
	75	205	8	HVFDSB3A0750G210	HVFDSB3A0750G220	HVFDSB3A0750G230	HVFDSB3A0750G231
	HP	AMPS	Frame	NEMA 12 Fused Disconnect	NEMA 12 2-Contactor Bypass	NEMA 12 3-Contactor Bypass	NEMA 12 3-Cont. Bypass + Auto-Bypass
230 Vac	.75	3.7	4	HVFDSB3B0007G210	HVFDSB3B0007G220	HVFDSB3B0007G230	HVFDSB3B0007G231
	1	4.8	4	HVFDSB3B0010G210	HVFDSB3B0010G220	HVFDSB3B0010G230	HVFDSB3B0010G231
	1.5	6.6	4	HVFDSB3B0015G210	HVFDSB3B0015G220	HVFDSB3B0015G230	HVFDSB3B0015G231
	2	8	4	HVFDSB3B0020G210	HVFDSB3B0020G220	HVFDSB3B0020G230	HVFDSB3B0020G231
	3	11	4	HVFDSB3B0030G210	HVFDSB3B0030G220	HVFDSB3B0030G230	HVFDSB3B0030G231
	5	18	5	HVFDSB3B0050G210	HVFDSB3B0050G220	HVFDSB3B0050G230	HVFDSB3B0050G231
	7.5	24	5	HVFDSB3B0075G210	HVFDSB3B0075G220	HVFDSB3B0075G230	HVFDSB3B0075G231
	10	31	5	HVFDSB3B0100G210	HVFDSB3B0100G220	HVFDSB3B0100G230	HVFDSB3B0100G231
	15	48	6	HVFDSB3B0150G210	HVFDSB3B0150G220	HVFDSB3B0150G230	HVFDSB3B0150G231
	20	62	6	HVFDSB3B0200G210	HVFDSB3B0200G220	HVFDSB3B0200G230	HVFDSB3B0200G231
	25	75	7	HVFDSB3B0250G210	HVFDSB3B0250G220	HVFDSB3B0250G230	HVFDSB3B0250G231
	30	88	7	HVFDSB3B0300G210	HVFDSB3B0300G220	HVFDSB3B0300G230	HVFDSB3B0300G231
	40	105	7	HVFDSB3B0400G210	HVFDSB3B0400G220	HVFDSB3B0400G230	HVFDSB3B0400G231
	50	140	8	HVFDSB3B0500G210	HVFDSB3B0500G220	HVFDSB3B0500G230	HVFDSB3B0500G231
	60	170	8	HVFDSB3B0600G210	HVFDSB3B0600G220	HVFDSB3B0600G230	HVFDSB3B0600G231
	75	205	8	HVFDSB3B0750G210	HVFDSB3B0750G220	HVFDSB3B0750G230	HVFDSB3B0750G231

SmartVFD HVAC NEMA 3R Disconnect and SmartVFD BYPASS

	HP	AMPS	Frame	NEMA 3R Fused Disconnect	NEMA 3R 2-Contactor Bypass	NEMA 3R 3-Contactor Bypass	NEMA 3R 3-Cont. Bypass + Auto-Bypass
460 Vac	1.5	3.4	4	HVFDSB3C0015G310	HVFDSB3C0015G320	HVFDSB3C0015G330	HVFDSB3C0015G331
	2	4.8	4	HVFDSB3C0020G310	HVFDSB3C0020G320	HVFDSB3C0020G330	HVFDSB3C0020G331
	3	5.6	4	HVFDSB3C0030G310	HVFDSB3C0030G320	HVFDSB3C0030G330	HVFDSB3C0030G331
	4	8	4	HVFDSB3C0040G310	HVFDSB3C0040G320	HVFDSB3C0040G330	HVFDSB3C0040G331
	5	9.6	4	HVFDSB3C0050G310	HVFDSB3C0050G320	HVFDSB3C0050G330	HVFDSB3C0050G331
	7.5	12	4	HVFDSB3C0075G310	HVFDSB3C0075G320	HVFDSB3C0075G330	HVFDSB3C0075G331
	10	16	5	HVFDSB3C0100G310	HVFDSB3C0100G320	HVFDSB3C0100G330	HVFDSB3C0100G331
	15	23	5	HVFDSB3C0150G310	HVFDSB3C0150G320	HVFDSB3C0150G330	HVFDSB3C0150G331
	20	31	5	HVFDSB3C0200G310	HVFDSB3C0200G320	HVFDSB3C0200G330	HVFDSB3C0200G331
	25	38	6	HVFDSB3C0250G310	HVFDSB3C0250G320	HVFDSB3C0250G330	HVFDSB3C0250G331
	30	46	6	HVFDSB3C0300G310	HVFDSB3C0300G320	HVFDSB3C0300G330	HVFDSB3C0300G331
	40	61	6	HVFDSB3C0400G310	HVFDSB3C0400G320	HVFDSB3C0400G330	HVFDSB3C0400G331
	50	72	7	HVFDSB3C0500G310	HVFDSB3C0500G320	HVFDSB3C0500G330	HVFDSB3C0500G331
	60	87	7	HVFDSB3C0600G310	HVFDSB3C0600G320	HVFDSB3C0600G330	HVFDSB3C0600G331
	75	105	7	HVFDSB3C0750G310	HVFDSB3C0750G320	HVFDSB3C0750G330	HVFDSB3C0750G331
	100	140	8	HVFDSB3C1000G310	HVFDSB3C1000G320	HVFDSB3C1000G330	HVFDSB3C1000G331
	125	170	8	HVFDSB3C1250G310	HVFDSB3C1250G320	HVFDSB3C1250G330	HVFDSB3C1250G331
	150	205	8	HVFDSB3C1500G310	HVFDSB3C1500G320	HVFDSB3C1500G330	HVFDSB3C1500G331
	HP	AMPS	Frame	NEMA 3R Fused Disconnect	NEMA 3R 2-Contactor Bypass	NEMA 3R 3-Contactor Bypass	NEMA 3R 3-Cont. Bypass + Auto-Bypass
208 Vac	.75	3.7	4	HVFDSB3A0007G310	HVFDSB3A0007G320	HVFDSB3A0007G330	HVFDSB3A0007G331
	1	4.8	4	HVFDSB3A0010G310	HVFDSB3A0010G320	HVFDSB3A0010G330	HVFDSB3A0010G331
	1.5	6.6	4	HVFDSB3A0015G310	HVFDSB3A0015G320	HVFDSB3A0015G330	HVFDSB3A0015G331
	2	8	4	HVFDSB3A0020G310	HVFDSB3A0020G320	HVFDSB3A0020G330	HVFDSB3A0020G331
	3	11	4	HVFDSB3A0030G310	HVFDSB3A0030G320	HVFDSB3A0030G330	HVFDSB3A0030G331
	5	18	5	HVFDSB3A0050G310	HVFDSB3A0050G320	HVFDSB3A0050G330	HVFDSB3A0050G331
	7.5	24	5	HVFDSB3A0075G310	HVFDSB3A0075G320	HVFDSB3A0075G330	HVFDSB3A0075G331
	10	31	5	HVFDSB3A0100G310	HVFDSB3A0100G320	HVFDSB3A0100G330	HVFDSB3A0100G331
	15	48	6	HVFDSB3A0150G310	HVFDSB3A0150G320	HVFDSB3A0150G330	HVFDSB3A0150G331
	20	62	6	HVFDSB3A0200G310	HVFDSB3A0200G320	HVFDSB3A0200G330	HVFDSB3A0200G331
	25	75	7	HVFDSB3A0250G310	HVFDSB3A0250G320	HVFDSB3A0250G330	HVFDSB3A0250G331
	30	88	7	HVFDSB3A0300G310	HVFDSB3A0300G320	HVFDSB3A0300G330	HVFDSB3A0300G331
	40	105	7	HVFDSB3A0400G310	HVFDSB3A0400G320	HVFDSB3A0400G330	HVFDSB3A0400G331
	50	140	8	HVFDSB3A0500G310	HVFDSB3A0500G320	HVFDSB3A0500G330	HVFDSB3A0500G331
	60	170	8	HVFDSB3A0600G310	HVFDSB3A0600G320	HVFDSB3A0600G330	HVFDSB3A0600G331
	75	205	8	HVFDSB3A0750G310	HVFDSB3A0750G320	HVFDSB3A0750G330	HVFDSB3A0750G331
	HP	AMPS	Frame	NEMA 3R Fused Disconnect	NEMA 3R 2-Contactor Bypass	NEMA 3R 3-Contactor Bypass	NEMA 3R 3-Cont. Bypass + Auto-Bypass
230 Vac	.75	3.7	4	HVFDSB3B0007G310	HVFDSB3B0007G320	HVFDSB3B0007G330	HVFDSB3B0007G331
	1	4.8	4	HVFDSB3B0010G310	HVFDSB3B0010G320	HVFDSB3B0010G330	HVFDSB3B0010G331
	1.5	6.6	4	HVFDSB3B0015G310	HVFDSB3B0015G320	HVFDSB3B0015G330	HVFDSB3B0015G331
	2	8	4	HVFDSB3B0020G310	HVFDSB3B0020G320	HVFDSB3B0020G330	HVFDSB3B0020G331
	3	11	4	HVFDSB3B0030G310	HVFDSB3B0030G320	HVFDSB3B0030G330	HVFDSB3B0030G331
	5	18	5	HVFDSB3B0050G310	HVFDSB3B0050G320	HVFDSB3B0050G330	HVFDSB3B0050G331
	7.5	24	5	HVFDSB3B0075G310	HVFDSB3B0075G320	HVFDSB3B0075G330	HVFDSB3B0075G331
	10	31	5	HVFDSB3B0100G310	HVFDSB3B0100G320	HVFDSB3B0100G330	HVFDSB3B0100G331
	15	48	6	HVFDSB3B0150G310	HVFDSB3B0150G320	HVFDSB3B0150G330	HVFDSB3B0150G331
	20	62	6	HVFDSB3B0200G310	HVFDSB3B0200G320	HVFDSB3B0200G330	HVFDSB3B0200G331
	25	75	7	HVFDSB3B0250G310	HVFDSB3B0250G320	HVFDSB3B0250G330	HVFDSB3B0250G331
	30	88	7	HVFDSB3B0300G310	HVFDSB3B0300G320	HVFDSB3B0300G330	HVFDSB3B0300G331
	40	105	7	HVFDSB3B0400G310	HVFDSB3B0400G320	HVFDSB3B0400G330	HVFDSB3B0400G331
	50	140	8	HVFDSB3B0500G310	HVFDSB3B0500G320	HVFDSB3B0500G330	HVFDSB3B0500G331
	60	170	8	HVFDSB3B0600G310	HVFDSB3B0600G320	HVFDSB3B0600G330	HVFDSB3B0600G331
	75	205	8	HVFDSB3B0750G310	HVFDSB3B0750G320	HVFDSB3B0750G330	HVFDSB3B0750G331

Smart Selection

VFD Pricing/Job Estimating Tools

For additional tools you can use for the selection and pricing of VFDs, click on the "Commercial Components Estimating Tools" link at ***customer.honeywell.com.***

NEMA 1

Frame Size	HP And Voltage		Configuration	Dimensions (in)			Weight (lb)
	208/230 VAC	460 VAC		W	H	D	
4	0.75-3 HP	1.5-7.5 HP	Drive alone	5	12.9	7.5	13.2
			Disconnect	8.9	31.9	10.3	33
			2-Contactor	8.9	31.9	9.6	38
			3-Contactor	8.9	38.9	10.3	44
			3-Contactor with Auto-Bypass	8.9	38.9	10.3	46
5	5 HP 7.5 HP 10 HP	10 HP 15 HP 20 HP	Drive alone	5.7	16.5	8.4	22
			Disconnect	8.9	34.7	10.3	43
			2-Contactor	8.9	34.7	9.6	48/50/50
			3-Contactor	8.9	41.7	10.3/10.3/10.8	55.5/57/59.5
			3-Contactor with Auto-Bypass	8.9	41.7	10.3/10.3/10.8	56/57.5/60
6	15 HP 20 HP	25 HP 30 HP 40 HP	Drive alone	7.7	21.9	9	44.1
			Disconnect	12.4	45.1	11.3	50
			2-Contactor	12.4	45.1	10.1	55/59
			3-Contactor	12.4	55.2	11.3	94.5/98.5/105.5
			3-Contactor with Auto-Bypass	12.4	55.2	11.3	96.5/100.5/107.5
7	25 HP 30 HP 40 HP	50 HP 60 HP 75 HP	Drive alone	9.3	25.4	10.2	82.7
			Disconnect	20.8	51.5	13.2	100
			2-Contactor	20.8	51.5	12.2	169/179/189
			3-Contactor	20.8	59	13.2	175/184/195
			3-Contactor with Auto-Bypass	20.8	59	13.2	177/186/197
8	50 HP 60 HP 75 HP	100 HP 125 HP 150 HP	Drive alone	11.4	38	13.5	154.3
			Disconnect	25	60	16.2	200
			2-Contactor	25	60	15.2	250/265/280
			3-Contactor	25	70	16.2	285/295/331
			3-Contactor with Auto-Bypass	25	70	16.2	287/297/333
9	100-125 HP	200-250 HP	Drive alone	18.9	45.3	14.4	238.1

NEMA 12

Frame Size	HP And Voltage		Configuration	208/230 Vac Dimensions (in) & Weight (lb)				460 Vac Dimensions (in) & Weight (lb)			
	208/230 VAC	460 VAC		W	H	D	lb	W	H	D	lb
4	0.75-3 HP	1.5HP-7.5 HP	Drive alone	5	12.9	7.5	13.2	5	12.9	7.5	13.2
			Disconnect	12	37.5	11	40	12	37.5	11	40
			2-Contactor	16	37.5	11	55	16	37.5	11	53
			3-Contactor	16	37.5	11	55	16	37.5	11	53
			3-Contactor with Auto-Bypass	16	37.5	11	55	16	37.5	11	53
5	5-10 HP	10 HP 15 HP 20 HP	Drive alone	5.7	16.5	8.4	22	5.7	16.5	8.4	22
			Disconnect	12	41	11	72	12	41	11	72
			2-Contactor	16	41/41/45	11	70/70/84	16	41/41/45	11	64/64/76
			3-Contactor	16	41/41/45	11	70/70/84	16	41/41/45	11	64/64/76
			3-Contactor with Auto-Bypass	16	41/41/45	11	70/70/84	16	41/41/45	11	64/64/76
6	15-20 HP	25 HP 30 HP 40 HP	Drive alone	7.7	21.9	9	44.1	7.7	21.9	9	44.1
			Disconnect	12	46.5	13	120	12/12/16	46.5	13	120/120/136
			2-Contactor	16/20	50.5/54.5	13	125/140	16/16/20	50.5/50.5/54.5	13	120/120/136
			3-Contactor	16/20	50.5/54.5	13	125/140	16/16/20	50.5/50.5/54.5	13	120/120/136
			3-Contactor with Auto-Bypass	16/20	50.5/54.5	13	125/140	16/16/20	50.5/50.5/54.5	13	120/120/136
7	25-40 HP	50 HP 60 HP 75 HP	Drive alone	9.3	25.4	10.2	82.7	9.3	25.4	10.2	82.7
			Disconnect	16	50.5	13.5	145/160/175	16	50.5	13.5	145/160/175
			2-Contactor	20/24/30	58.5/65.5/70.5	13.5	160/175/200	20/24/30	58.5/65.5/70.5	13.5	150/165/193
			3-Contactor	20/24/30	58.5/65.5/70.5	13.5	160/175/200	20/24/30	58.5/65.5/70.5	13.5	150/165/193
			3-Contactor with Auto-Bypass	20/24/30	58.5/65.5/70.5	13.5	160/175/200	20/24/30	58.5/65.5/70.5	13.5	150/165/193
8	50-75 HP	100 HP 125 HP 150 HP	Drive alone	11.4	38	13.5	154.3	11.42	38.03	13.5	154.3
			Disconnect	Contact Customer Care				Contact Customer Care			
			2-Contactor								
			3-Contactor								
			3-Contactor with Auto-Bypass								
9	100-125 HP	180-220 HP	Drive alone	18.9	45.3	14.4	238.1	14.37	45.27	18.9	238.1

NEMA 3R

Frame Size	HP And Voltage		Configuration	Dimensions (in)			Weight (lb)
	208/230 VAC	460 VAC		W	H	D	
4	0.75-3 HP	1.5-7.5 HP	Drive alone	20.5	20	10.5	39
			Disconnect	20.5	20	12	43
			2-Contactor	24.5	24	10.5	49
			3-Contactor	24.5	24	12	54
			3-Contactor with Auto-Bypass	24.5	24	12	54
5	5-10 HP	10-20 HP	Drive alone	20.5	24	10.5	58
			Disconnect	20.5	24	12	61
			2-Contactor	24.5	24	10.5	72
			3-Contactor	28.5	30	12	78
			3-Contactor with Auto-Bypass	28.5	30	12	78
6	15-20 HP	25-40 HP	Drive alone	28.5	36	10.5	80
			Disconnect	28.5	36	12	88
			2-Contactor	28.5	36	10.5	118
			3-Contactor	34.5	36	12	124
			3-Contactor with Auto-Bypass	34.5	36	12	124
7	25-40 HP	50-75 HP	Drive alone	28.5	48	12.5	130
			Disconnect	28.5	48	14	149
			2-Contactor	28.5	48	12.5	185
			3-Contactor	40.5	48	14	193
			3-Contactor with Auto-Bypass	40.5	48	14	193
8	50-75 HP	100-150 HP	Drive alone	40.5	60	12.5	299
			Disconnect	40.5	60	14	340
			2-Contactor	40.5	60	12.5	430
			3-Contactor	40.5	60	14	440
			3-Contactor with Auto-Bypass	40.5	60	14	440

Honeywell SmartVFD HVAC and SmartVFD BYPASS are smaller, sleeker and require a smaller footprint than other manufacturers. They are specifically designed for your HVAC application.

Smart Accessories

SmartVFD Accessories

Accessory	Description	Drive Used with
32006630-001/U	LON Communication Card (NXOPTC4)	SMART
HVFDSDOPT1AI2AO/U	1 x AI, 2 x AO (isolated, D- and E- slot compatible)	SMART
HVFDSDOPT1RO5DI/U	1 x RO, 5 x DI (42-240 VAC, D- and E- slot compatible)	SMART
HVFDSDREP2RO1T/U	2 x RO + Thermistor (B- slot compatible)	SMART
HVFDSDOPT2RO1T/U	2 x RO + Thermistor (D- and E- slot compatible)	SMART
HVFDSDOPT3RO/U	3 x RO (D- and E- slot compatible)	SMART
HVFDSDBATTERY/U	Battery Package, 5 pcs, for Real Time Clock	SMART
HVFDSDREP3RO/U	3 x RO (B- slot compatible)	SMART
HVFDSDOPT6DI/U	6 x DI / DO Programmable (D- and E- slot compatible)	SMART
HVFDSDTRAINER/U	SmartVFD HVAC Training Demonstration Kit	SMART
HVFDSDGRAPHICKP/U	SmartVFD HVAC Replacement Graphical Keypad	SMART
HVFDSDMOUNTKIT/U	SmartVFD HVAC Panel Mount Kit for NEMA 12 Install 3 Meter Cable	SMART
HVFDSDNEMA12FR4/U	SmartVFD HVAC NEMA 12 Kit Frame 4	SMART
HVFDSDNEMA12FR5/U	SmartVFD HVAC NEMA 12 Kit Frame 5	SMART
HVFDSDNEMA12FR6/U	SmartVFD HVAC NEMA 12 Kit Frame 6	SMART
HVFDSDFLANGEFR4/U	SmartVFD HVAC Flange Mounting Kit for Frame 4	SMART
HVFDSDFLANGEFR5/U	SmartVFD HVAC Flange Mounting Kit for Frame 5	SMART
HVFDSDFLANGEFR6/U	SmartVFD HVAC Flange Mounting Kit for Frame 6	SMART
HVFDSDFLANGEFR7/U	SmartVFD HVAC Flange Mounting Kit for Frame 7	SMART
HVFDSDFANFR4/U	SmartVFD HVAC Frame 4 Replacement Fan	SMART
HVFDSDFANFR5/U	SmartVFD HVAC Frame 5 Replacement Fan	SMART
HVFDSDFANFR6/U	SmartVFD HVAC Frame 6 Replacement Fan	SMART
HVFDSDFANFR7/U	SmartVFD HVAC Frame 7 Replacement Fan	SMART
HVFDSDINSTALLFR4/U	SmartVFD HVAC Replacement Installation Accessories Frame 4	SMART
HVFDSDINSTALLFR5/U	SmartVFD HVAC Replacement Installation Accessories Frame 5	SMART
HVFDSDINSTALLFR6/U	SmartVFD HVAC Replacement Installation Accessories Frame 6	SMART
HVFDCABLE/U	SmartVFD Compact Commissioning Cable and USB Adaptor	COMPACT & SMART

See the Big Picture

With an optional Micro Communication Adapter (MCA), you can turn your computer into a window to easily setup, operate, monitor and diagnose your SmartVFD drives. Just download the free PC Tool software from customer.honeywell.com, then use the adapter to connect to the drive.

PROGRAMMING AND COMMISSIONING

You'll have it all at your fingertips:

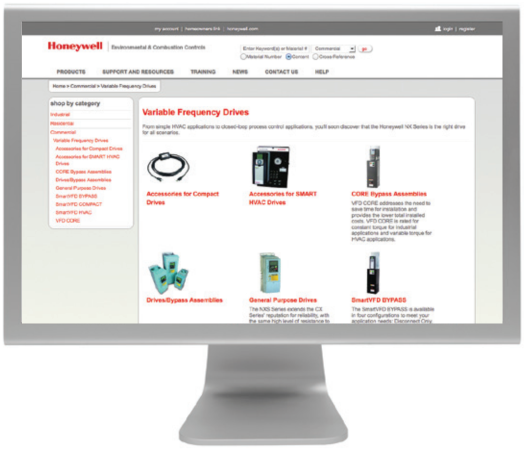
- Upload and download parameters to the SmartVFD drive for viewing and editing with maximum, minimum and default values for each parameter
- Directly control the drive to run it through its paces
- Save parameters for offline editing
- Directly control the drive speed in real time

MONITORING AND DIAGNOSTICS

See it all onscreen:

- Monitor parameters in real time
- Save screen shots and export values to a spreadsheet
- Pause a real-time monitoring window to capture accurate data
- For diagnostic assistance, view detailed active faults, the fault history (up to 40 stored faults), and I/O states

Smart Contacts and Websites



Honeywell Take-Off Service

1. Submit your information in one of the following ways:
   a) E-mail to takeoff.service@honeywell.com (preferred)
   b) Fax toll-free to 1-877-880-3386

2. Include your desired turn-around time

3. Take-Off Service staff will send you a confirmation that your e-mail or fax was received. We always attempt to have your request finished as soon as possible. Please note, however, that the quality of the submitted information largely determines the turn-around time. We will work closely with you to ensure that we have enough information to move forward as quickly as possible.

4. Following take-off completion, a final product schedule spreadsheet will be returned to you that includes:
- Complete product schedule
- Base Price
- Directions on how to order Honeywell products
- Links to product submittals
- Quote identification number

Main VFD Website
customer.honeywell.com/VFD

VFD Technical Hotline
763-954-6464 or
888-516-9347 option 4
techmail@honeywell.com

VFD for Consulting Engineer Site
specifyhoneywell.com/product.resources

Literature Ordering for VFD
literature.honeywell.com

Honeywell Promotional Materials
honeywell.promocollection.com

Buildings University Online and Face-to-Face Training
customer.honeywell.com/buildingsuniversity

New Product and Programs Website
beyondinnovation.honeywell.com

Learn More
For more information on Honeywell Variable Frequency Drives, contact your local Honeywell distributor, your Honeywell sales representative, call 1-800-466-3993 or visit **customer.honeywell.com/VFD**.

Automation and Control Solutions
In the U.S.:
Honeywell
1985 Douglas Drive North
Golden Valley, MN 55422-3992

In Canada:
Honeywell Limited
35 Dynamic Drive
Toronto, Ontario M1V 4Z9

In Latin America:
Honeywell
9315 N.W. 112th Avenue
Miami, FL 33178
www.honeywell.com

Follow us on Twitter:
@honeywellcpro
twitter

YouTube:
@honeywellcpro
YouTube

Honeywell

67-7505 PM
February 2013

Honeywell Enovate® Blowing Agent

Spray Foam Roofing for Commercial Buildings

Honeywell

Protect Your Commercial Building With a Spray Foam Roof Formulated With Enovate® Blowing Agent

Insulate and Waterproof Using Advanced Wind Resistance and Energy-Efficient Technology

Roof insulation and waterproofing systems formulated with Enovate provide improved dimensional stability and compression strength when compared to other roof systems. The U.S. government's National Institute of Standards and Technology (NIST) agency documents spray foam roof systems' excellent performance compared to other type roof systems after hurricanes Katrina and Rita.*

Honeywell is a leading supplier of blowing agents for closed-cell spray foam. Blowing agents make foam expand during application. Trapped in the foam cells, they are the main factor in determining thermal insulation performance.

Spray foam roofing systems formulated with non-flammable, non-ozone depleting Honeywell Enovate® Blowing Agent (HFC-245fa) offer superior thermal performance and moisture protection. Spray foam roof systems are both FM (Factory Mutual) and UL (Underwriters Laboratory) listed.

Contractor Benefits

Polyurethane spray foam roofing systems that use Enovate blowing agent provide contractors with the highest quality roofing material and technology on the market today.

Both the NRCA (National Roofing Contractors Association) and SPFA (Spray Polyurethane Foam Alliance) feature spray foam roofs in their low-slope roofing design and application guidelines.

Spray foam roof systems are lightweight and adaptable to uniquely-shaped structures and difficult-to-flash penetrations. They can be finished in a variety of colors and textures.

A spray foam roof is watertight within 30 seconds of being applied to a dry, clean substrate. In addition, it is a monolithic seamless roof system, reducing the chance of leaks and contractor call-backs.

Spray foam roof systems are fully adhered, with no penetrating fasteners, therefore attaching easily to all types of decks and substrates.

Building Owner Benefits

Polyurethane spray foam roof systems that use Honeywell's Enovate blowing agent can save building owners both time and money.

Spray foam roof systems are backed by manufacturers' warranties for up to 20 years. Another beneficial feature of spray foam roofs is their sustainable nature; they can be re-coated at the end of their warranty period to extend the warranty and the life of the roof investment. Spray foam roofs are an excellent choice for those seeking Leadership in Energy and Environmental Design (LEED) Green Building Rating System certification.

Spray foam roofs are fast and easy to apply, allowing the building owner to experience minimal business interruption and inconvenience during installation.

The unique physical performance characteristics of polyurethane spray foam roof systems provide the building owner with added protection from severe weather, such as storms, hail, and high winds.

Polyurethane spray foam offers the highest performance of any roof system,

reducing both heating and cooling costs. Spray foam roofs also eliminate thermal transfer in and out of the building at insulation joints and mechanical fasteners.

The use of a highly reflective white coating in conjunction with closed-cell spray foam may save the building owner additional energy costs associated with heating and cooling. The improved reflectivity and emissivity properties of the roof insulation system can lower the surface temperature of the roof. This has the added benefit of reducing urban heat island effect. Spray foam roof manufacturers are listed on the ENERGYSTAR® Roof Products Program. Studies at Oak Ridge National Labs (ORNL) and Lawrence Berkeley National Laboratory (LBNL) document the energy and reflective performance and savings from spray foam roof systems.

NOTE: Because spray foam formulations vary from manufacturer to manufacturer, interested building designers, contractors and owners should consult the spray foam specification sheets to understand the exact properties. Savings vary. Find out why in the seller's fact sheet on R-values. Higher R-values mean greater insulating power.

* NIST Technical Note 1476 - Performance of Physical Structures in Hurricane Katrina and Hurricane Rita: A Reconnaissance Report - June 2006

Honeywell Performance Materials and Technologies

Honeywell Fluorine Products
101 Columbia Road
Morristown, NJ 07962-1053
www.honeywellbuildingenvelope.com
building.envelope@honeywell.com
12-01-EBA

October 2012
Printed in U.S.A.

Honeywell

Honeywell Enovate® 245fa

Technical information

Honeywell

Introduction

Honeywell Enovate® 245fa blowing agent (HFC-245fa, 1,1,1,3,3,-pentafluoropropane) is a liquid hydrofluorocarbon, which has been developed as a blowing agent for rigid insulating foams. It is a replacement for HCFC-141b and other fluorocarbon and non-fluorocarbon blowing agents. Enovate is a nonflammable liquid having a boiling point slightly below room temperature. It has a zero Ozone Depletion Potential (ODP) and it is not considered a Volatile Organic Compound (VOC) in the US. The physical properties of Enovate are summarized in Table 1 below.

Table 1: Physical Properties of Enovate.

Molecular Formula		$CF_3CH_2CHF_2$
Molecular Weight		134.0
Boiling Point	(°F)	59.5
	(°C)	15.3
Liquid Density	(g/cc) @ 20°C	1.32
Freezing Point	(°F)	<-160
	(°C)	<-107
Vapor Pressure:	(PSIA @ 68°F)	17.8
	(kPa @ 20°C)	123
Vapor Thermal Conductivity		@ 40°C
	(BTU in / $ft^2hr°F$)	0.097
	(mW/mK)	14.0
Water Solubility (in Enovate)		1600 ppm
Flash Point *		None
Vapor Flame Limits **		None

*Flashpoint by ASTM D 3828-87; ASTM D1310-86

**Flame Limits measured at ambient temperature and pressure using ASTME681-85 with electrically heated match ignition, spark ignition and fused wire ignition; ambient air.

Toxicity

Enovate® is currently listed on the US EPA TSCA Inventory, the European EINECS Inventory, and the Japanese MITI Inventory. Extensive toxicity testing indicates that Enovate is of low toxicity. Overall results from a series of genetic studies indicate that Enovate is non-mutagenic and non-teratogenic. The American Industrial Hygiene Association has established a Workplace Environmental Exposure Level (WEEL) of 300 ppm. Anyone who uses or handles Enovate should carefully review the MSDS and product label prior to use.

Table 2: Regulatory and Environmental Information on Enovate®

CAS Number	460-73-1
ELINCS Number	419-170-6
Ozone Depletion Potential	0
US VOC status	Exempt
Exposure guidelines	
ACGIH TLV	None
OSHA PEL	None
WEEL (AIHA) TWA 8 hrs	300 ppm
TSCA Inventory Status	Listed
SNAP Approval	All Foam Applications

Environmental

Enovate® blowing agent is a fluorinated hydrocarbon. Treatment or disposal of wastes generated by use of this product may be of concern depending on the nature of the wastes and the means of discharge, treatment or disposal. Enovate is not considered a "hazardous waste" by the Resource Conservation and Recovery Act if discarded unused. Care should be taken to avoid releases into the environment.

Applications

Enovate Enovate has been evaluated in a variety of foam systems and applications. Its superior thermal insulating characteristics, physical properties and compatibility with other materials make it ideal as a blowing agent for rigid polyurethane foams. Enovate replaces HCFC-141b in rigid polyurethane foam-blowing applications. Foams formulated with Enovate generally have thermal properties equivalent to those of HCFC-141b foams and better dimensional stability and compressive strength properties. The US EPA has given SNAP approval for the use of Enovate as a replacement in all foam applications.

Miscibility

As reflected in the statistics below, Enovate has exhibited acceptable miscibility in a wide range of polyols. To determine miscibility a mixture containing 40 wt. % Enovate and 60 wt.% polyol is prepared in a calibrated miscibility tube. The mixture is thoroughly mixed at an elevated temperature. The tube is then placed in a constant temperature bath for 24 hours. The height of the polyol and the Enovate is measured and the miscibility is calculated.

Miscibility of Enovate® in Polyols @70 °F (21 °C)

Polyol	% Miscible
POLYETHERS	
(Sucrose)	
Dow Voranol® 360	>40.0
(Sucrose- Amine)	
Huntsman Rubinol® R 170	>40
Huntsman Rubinol® P 180	>40
(Aromatic-Amine)	
Huntsman Rubinol® R 144	>40
Huntsman Rubinol® R159	21
(TDA)	
BASF Pluracol® -824	35.4
Dow Voranol® 490	>40
POLYESTER	
Invista Terate® 2541	23.3
Invista Terate® 2541L	27.9
Invista Terate® 2031	18.8
Invista Terate® 2542	21.5
Invista Terate® 5521	23.0
Invista Terate® 254	23.4
Stepan Stepanol® 2352	32.3
Great Lakes PHT 4 Diol®	6.2

Stability

Laboratory tests indicate that Enovate® blowing agent has a high degree of thermal and hydrolytic stability. In sealed tube studies the material showed no signs of decomposition after six (6) weeks of exposure to temperatures ranging from 75°C to 200°C in the presence and absence of water (at 300 ppm), and in the presence and absence of metals (3003 aluminum and/or 316 stainless steel). A separate study was also conducted with cold rolled steel rod exposed to Enovate in the presence and absence of air and water for a period of two (2) to six (6) weeks at temperatures ranging from 25°C to 100°C. Again, Enovate did not show any signs of decomposition.

Compatibility

Enovate blowing agent is non-reactive and non-corrosive toward all commonly used metals in polyurethane processing equipment. This includes carbon steel, stainless steel, copper and brass. There is a concern with use of aluminum in contact with any halogenated material, which includes Enovate, due to the reactive nature of aluminum, particularly if aluminum fines are present and if the oxide layer on the surface of the aluminum is removed.

In general, Enovate is less aggressive toward plastics and elastomers than is HCFC-141b. Gaskets and seals that were changed to accommodate HCFC-141b should be compatible with Enovate. Honeywell has evaluated plastics and elastomers for use with Enovate. Table 3 below reports the findings of this study. Elastomers that may find application in both static conditions (for example, gasketing between flanges) versus dynamic conditions (for example, seals on rotating shafts) may have varying degrees of suitability in use.

Table 3: Materials Compatibility

Plastics				
Application	**% Weight Delta**	**% Length Delta**	**% Width Delta**	**%Thickness Delta**
Acetal	Negligible	Negligible	Negligible	Negligible
Acrylic	Dissolving			
HDPE	Negligible	Negligible	Negligible	Negligible
Nylon	Negligible	Negligible	Negligible	Negligible
Polycarbonate	Negligible	Negligible	Negligible	Negligible
Polyetherimide	Negligible	Negligible	Negligible	Negligible
Polypropylene	Negligible	Negligible	Negligible	Negligible
PET	Negligible	Negligible	Negligible	Negligible
PVC	Negligible	Negligible	Negligible	Negligible
PVDF	Negligible	Negligible	Negligible	Negligible
PTFE	Negligible	Negligible	Negligible	Negligible

Elastomers				
Application	**% Weight Delta**	**% Length Delta**	**% Width Delta**	**% Thickness Delta**
Butyl Rubber	Negligible	Negligible	Negligible	Negligible
Fluoroelastomer	76.5	24.8	26.9	27.7
EPDM	Negligible	Negligible	Negligible	Negligible
Epichlorohydrin	10.4	3.7	3.4	2.5
EthylenePropylene	1.2	0.8	Negligible	Negligible
Neoprene	Negligible	Negligible	Negligible	Negligible
Nitrile Rubber	4.2	Negligible	Negligible	Negligible
Silicone	6.0	Negligible	Negligible	2.4
Urethane	20.5	2.3	5.0	9.1

Notes: Fluoroelastomer: "Viton A": Trademark of DuPont Dow Elastomers
Nitrile Rubber: "Buna N"
PTFE: "Teflon": Trademark of the E. I. du Pont de Nemours and Company
PVDF: "Kynar": Trademark of Arkema Inc.
Polyetherimide: "Ultem": Trademark of The General Electric Company

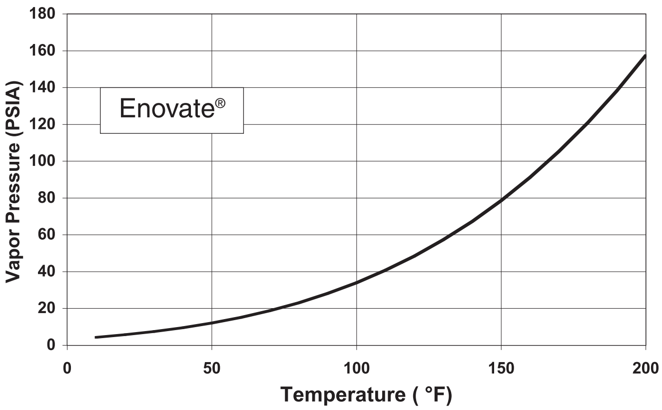
Storage & Handling

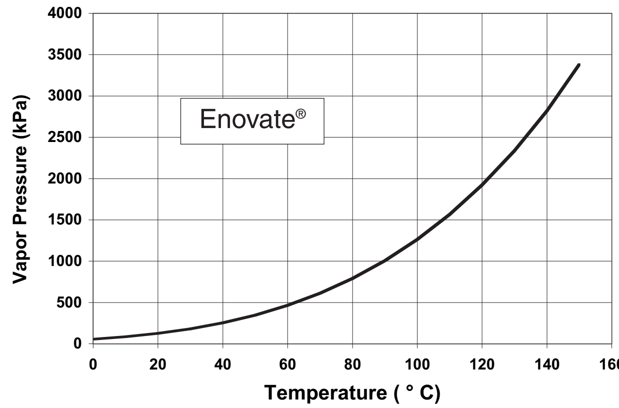
Enovate® should be stored in a cool, well-ventilated area. The material should only be stored in an approved cylinder. Please consult Honeywell's Technical Service Department prior to storage of the material in anything other than its original shipping cylinder to insure that the new container meets all safety requirements. The container and its fittings should be protected from physical damage. It should neither be punctured or dropped, nor exposed to open flames, excessive heat or direct sunlight. The container's valves should be tightly closed after use and when the container is empty.

Based on experience with other HFCs, Enovate should not be mixed with either air or oxygen at pressures above atmospheric pressure. If pressurization is required in your application, the use of nitrogen is recommended.

For additional information on use of cylinders please consult the appropriate handling, storage and unloading bulletin (available from a Honeywell Technical Service Representative)

Temperture vs. Pressure

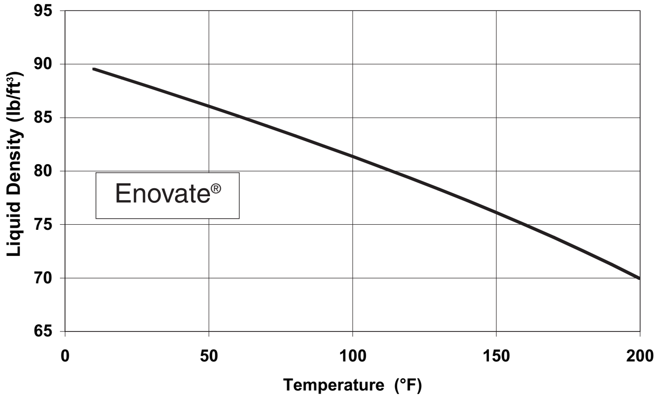


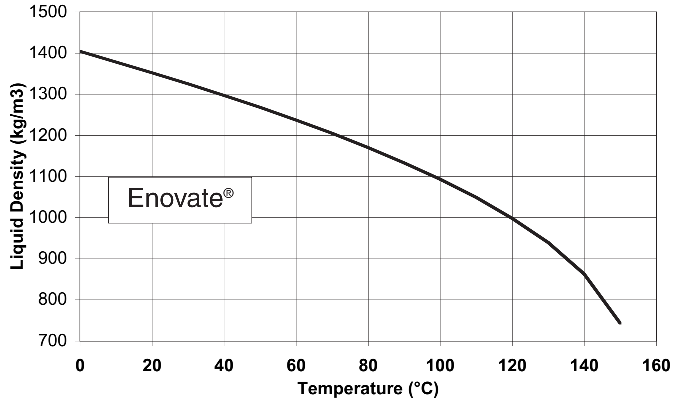


Temperature (°F)	Pressure (psia)	Temperature (°F)	Pressure (psia)
10	4.3	110	40.7
20	5.7	120	48.4
30	7.4	130	57.2
40	9.5	140	67.2
50	12	150	78.5
60	15.1	160	91.1
70	18.7	170	105.2
80	23	180	120.9
90	28.1	190	138.2
100	33.9	200	157.4

Temperature (°C)	Pressure (kPa)	Temperature (°C)	Pressure (kPa)
0	54	80	789
10	83	90	1004
20	124	100	1261
30	179	110	1565
40	252	120	1921
50	345	130	2335
60	464	140	2817
70	610	150	3380

Density vs. Temperture



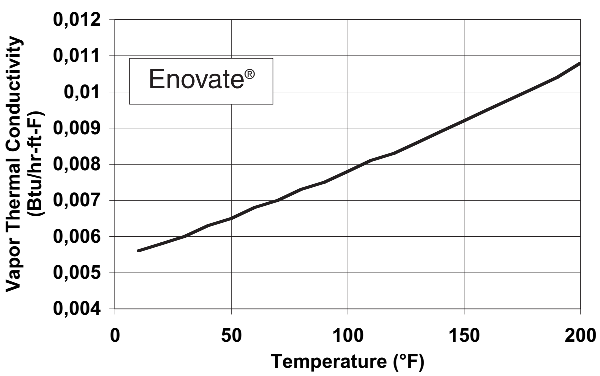


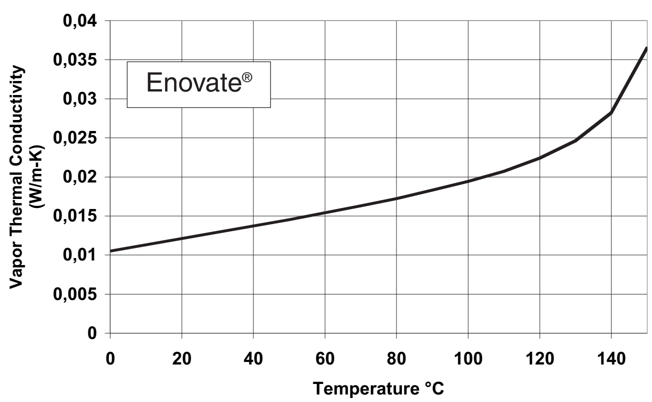
Density vs. Temperture (continued)

Temperature (°F)	Liquid Density (lb/ft^3)	Temperature (°F)	Liquid Density (lb/ft^3)
10	89.5	110	80.4
20	88.7	120	79.3
30	87.8	130	78.3
40	86.9	140	77.2
50	86.1	150	76.1
60	85.2	160	75.0
70	84.2	170	73.8
80	83.3	180	72.6
90	82.3	190	71.3
100	81.4	200	69.9

Temperature (°C)	Liquid Density (kg/m)	Temperature (°C)	Liquid Density (kg/m)
0	1404	100	1093
10	1378	110	1049
20	1352	120	998
30	1325	130	939
40	1297	140	863
50	1268	150	743
60	1237		
70	1205		
80	1170		
90	1133		

Vapor Thermal Conductivity vs. Temperature





Temperature (°F)	Vapor Thermal Conductivity (Btu/hr-ft-F)	Temperature (°F)	Vapor Thermal Conductivity (Btu/hr-ft-F)
10	0.0056	110	0.0081
20	0.0058	120	0.0083
30	0.0060	130	0.0086
40	0.0063	140	0.0089
50	0.0065	150	0.0092
60	0.0068	160	0.0095
70	0.0070	170	0.0098
80	0.0073	180	0.0101
90	0.0075	190	0.0104
100	0.0078	200	0.0108

Temperature (°C)	Vapor Thermal Conductivity (W/m-k)	Temperature (°C)	Vapor Thermal Conductivity (W/m-k)
0	0.0105	80	0.0172
10	0.0113	90	0.0183
20	0.0121	100	0.0194
30	0.0129	110	0.0207
40	0.0137	120	0.0224
50	0.0145	130	0.0246
60	0.0154	140	0.0282
70	0.0163	150	0.0365

Honeywell Performance Materials and Technologies
101 Columbia Road
Morristown, NJ 07962
Phone: 800-631-8138
Outside US: +1 973-455-2000
Fax: 973-455-6394
www.honeywell.com/enovate

September 2012
Printed in U.S.A.

Honeywell

Packaged Rooftop System

Job Information	*Technical Data Sheet*
Job Name	Honeywell-Chatham School District
Date	12/9/2014
Submitted By	Jennifer Olivo
Software Version	04.50
Unit Tag	Chatham HS- RTU-1-A2

Unit Overview

Model Number	Voltage	Design Cooling Capacity	AHRI 360 Standard Efficiency		ASHRAE 90.1
			EER	IEER	
MPS020B	208/60/3	254342 Btu/hr	11.1	11.4	2010 Compliant

Unit

Model Number:	MPS020B
Model Type:	Cooling, Standard Efficiency
Heat Type:	None
Application:	Constant volume
Altitude:	0 ft
Approval	cULus

Physical

Unit Dimensions and Weights

Unit Length	Unit Height	Unit Width	Unit Weight
152.0 in	57.0 in	86.0 in	2341 lb

Unit Construction

Exterior:	Powder Coat Galvanized	**Doors:**	Fan, Filter, Coil, Control Panel, and Economizer section
Insulation:	3/4" foil face with mechanical fasteners, R value of 3.6	**Drain Pan Material**	Polymer
Liners:	Single wall construction		

Unit Electrical Data

Voltage	SCCR	MCA	MROPD
208/60/3 V	5 kAIC	109.0 A	125A

Return/Outside/Exhaust Air

Outside Air Option

Type:	Factory Installed Econ, vertical return, DDC Controls

Draw Through Filters

Type	Face Area ft^2	Face Velocity ft/min	Air Pressure Drop inH_2O
2" Disposable	27.8	336	Included In Fan Performance

DAIKIN

Cooling Coil

Fins per Inch	Rows	Face Area ft²	Face Velocity ft/min	Air Pressure drop inH_2O
13	3	26.7	350	Included In Fan Performance

Cooling Performance

Total Capacity Btu/hr	Sensible Capacity Btu/hr	Entering Air Temperature		Leaving Air Temperature		Ambient Air Temp °F
		Dry Bulb °F	Wet Bulb °F	Dry Bulb °F	Wet Bulb °F	
254342	197860	80.0	67.0	60.4	58.4	95.0

Fan Section

Type	Fan Wheel Diameter	Quantity	Vibration Isolation
Twin FC	18 in	2	Rigid

Fan Performance

Air Flow	External Static Pressure	Design Fan Speed	Drive Package Speed	Brake Horsepower	Altitude
9333 CFM	0.50 inH_2O	899 RPM	847	5.8 HP	0 ft

Motor

Horsepower	Type	Efficiency	Full Load Current
7.5 HP	Open drip proof, EPAct	80.0	22.3 A

Drives

Type	Service Factor
Adjustable Sheave	120%

Condensing Section

Compressor

Type	Quantity	Total Power	Capacity Control	Refrigerant Type
Scroll	2	18.8 kW	2 steps	R410A

Compressor Amps:

Compressor 1	33.3 A
Compressor 2	33.3 A

Compressor Options: LP, HP switch, Low Ambient

Condenser Coil

Type	Fins Per Inch	Rows	Fin Material	Refrigerant Valves
Copper tube	22	2	Aluminum	None

Condenser Fan Motors

Number of Motors	Full Load Current
6	1.2 A

AHRI 360 Certified Data at AHRI 360 Standard Conditions

Net Capacity	Efficiency		ASHRAE 90.1
234000 Btu/hr	11.1 EER	11.4 IEER	2010 Compliant

Internal Static Pressure Drop Calculation

External Static Pressure:	0.50
Internal Static Pressure:	0.53
Total Static Pressure:	1.03 inH_2O

Options

Electrical	
Field Connection:	Power Block
Power Options:	None
Controls	
Temperature Controls:	DDC controls, field installed BACnet card

Warranty

Parts Warranty:	Standard one year
Compressor Warranty:	Standard five year

AHRI Certification

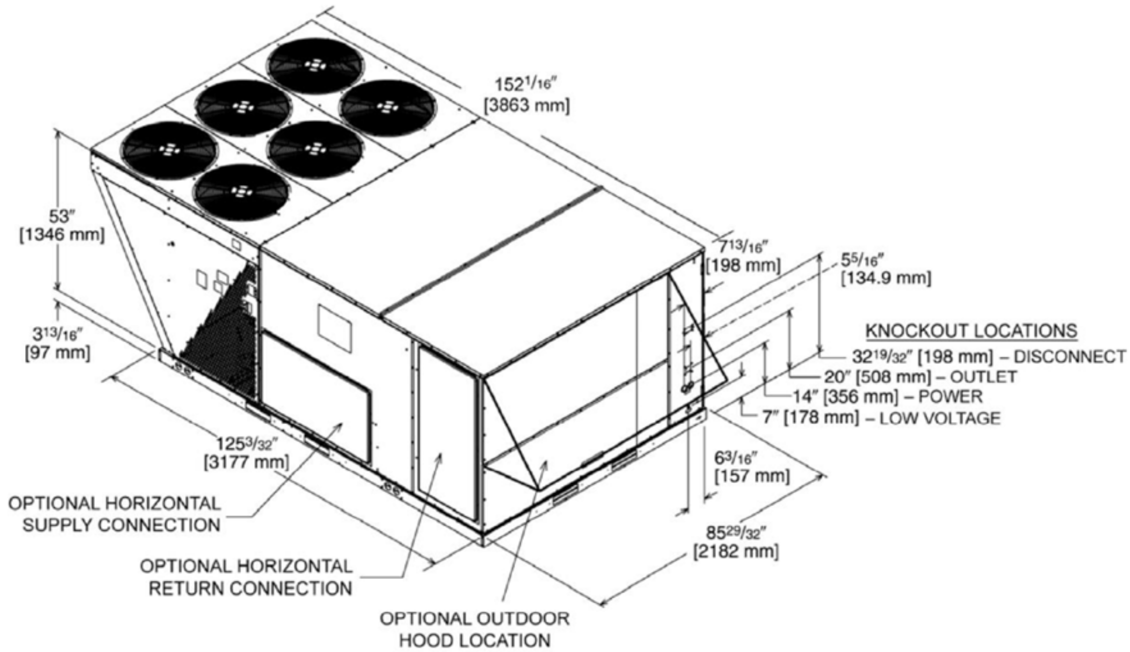
All equipment is rated and certified in accordance with AHRI 340/360

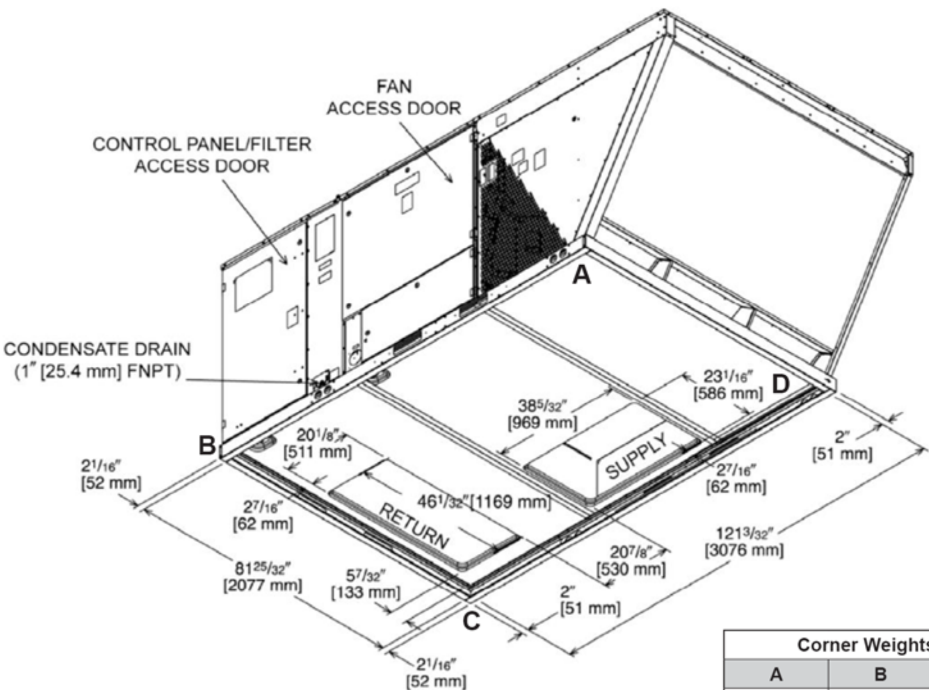
Notes

As a standalone component, unit meets or exceeds the requirements of ASHRAE 90.1.2010. The approving authority is responsible for compliance of multi-component building systems.

Accessories

Part Number	Description
910108514	Maverick I Rooftop Comm Mod, BACnet IP-MS/TP
113117801	Space sensor w/setpoint adjust, tenant override
RXKG-CBH14	14" Roof curb, 15-25 ton, R410A





Corner Weights by Percentage

A	B	C	D
32	27	16	24

Corner Weights Measured at Base of Unit

Product Drawing	Unit Tag: Chatham HS- RTU-1-A2			DAIKIN		
Product:	Project Name: Honeywell-Chatham School			13600 Industrial Park Blvd. Minneapolis, MN 55441		
Model: MPS020B	Sales Office: D & B Eng. of New Jersey, Inc			www.DaikinApplied.com Software Version: 04.50		
Sales Engineer:	Dec. 09, 2014	Ver/Rev:	Sheet 1 of 1	Scale: NTS	Tolerance: +/-0.25″	Dwg Units: in [mm]

No change to this drawing may be made unless approved in writing by Daikin Applied. Purchaser must determine that the equipment is fit and sufficient for the job specifications.

Rebel™ Packaged Rooftop System

Job Information	*Technical Data Sheet*
Job Name	Honeywell-Chatham School District
Date	12/9/2014
Submitted By	Jennifer Olivo
Software Version	03.10
Unit Tag	Chatham HS-RTU-1-A3

Unit Overview

Model Number	Voltage V/Hz/Phase	Design Cooling Capacity Btu/hr	AHRI360 Standad Efficiency		ASHRAE 90.1
			EER	IEER	
DPS006A	208/60/3	73415	11.4	19.3	2010 Compliant

Unit

Model Number:	DPS006A
Model Type:	Heat Pump
Heat Type:	None
Application:	Variable Air Volume, Single Zone
Outside Air:	0-100% Economizer with Drybulb Control
Altitude:	0 ft
Approval	cETLus

Physical

Dimensions and Weight

Length	Height	Width	Weight
67.0 in	40.8 in	87.0 in	1359 lb

Corner Weights

L1	L2	L3	L4
258 lb	248 lb	418 lb	435 lb

Construction

Exterior	Insulation and Liners	Air Opening Location	
		Return	Supply
Painted Galvanized Steel	1" Injected Foam, R-7, Galvanized Steel Liner	Bottom	Bottom

Electrical

MCA	MROPD	SCCR
29.6 A	40 A	5 kAIC

Return/Outside/Exhaust Air

Outside Air Option

Type	Damper Pressure Drop	Exhaust Air Type
0-100% Econ with Dry Bulb Control	0.07 inH$_2$O	Barometric Relief

Filter Section

Physical

Type	Quantity / Size	Face Area	Face Velocity	Air Pressure Drop
Combo 2"/4" rack with 2" Merv 8	4 / 16 in x 16 in x 2 in	7.1 ft^2	338.0 ft/min	0.18

DX Cooling Coil

Physical

Coil Type	Fins per Inch	Rows	Face Area	Face Velocity	Air Pressure drop	Drain Pan Material
Cu Tube/ Al Fin	16	4	6.0 ft²	397.4 ft/min	0.59 inH_2O	Stainless Steel

Cooling Performance

Capacity		Refrigerant Type	Indoor Air Temperature				Ambient Air Temperature °F
			Entering		Leaving		
Total Btu/hr	Sensible Btu/hr		Dry Bulb °F	Wet Bulb °F	Dry Bulb °F	Wet Bulb °F	
73415	58570	R410A	80.0	67.0	57.7	57.4	95.0

Heating Performance

Total Capacity Btu/hr	Refrigerant Type	Indoor Air Temperature Dry Bulb		Ambient Air Temperature °F
		Entering °F	Leaving °F	
65701	R410A	70.0	95.0	47.0

Fan Section

Fan

Type	Fan Wheel Diameter
SWSI AF	16 in

Performance

Airflow	Total Static Pressure	Fan Speed	Brake Horsepower	Altitude
2400 CFM	1.3 inH_2O	1681 rpm	0.88 HP	0 ft

Motor				Drive
Type	Horsepower	Efficiency	FLA	Type
ECM Motor	4.0	Premium	8.8 A	Direct Drive

Condensing Section

Compressor

Type	Quantity	Total Power	Capacity Control	Compressor Isolation
Inverter Scroll	1	3.9 kW	Mod Control with Inverter Compressors	Rubber in Shear

Compressor Amps:

Compressor 1	15.0 A

Compressor Options: Suction and Discharge Isolation Valves

Condenser Coil

Type	Fins per Inch	Fin Material
Copper Tube	16	Aluminum

Coil Options: Vandal Guard

Condenser Fan Motors

Number of Motors	Full Load Current
1	2.0 A

AHRI 360 Certified Data at AHRI 360 Standard Conditions

Net Capacity	EER	IEER	Heat Net Capacity at 47°F	COP at 47°F	Heat Net Capacity at 17°F	COP at 17°F
69000 Btu/hr	11.4	19.3	64000 Btu/hr	3.74	39000 Btu/hr	2.56

Internal Pressure Drop Calculation

External Static Pressure:	0.50 inH_2O
Filter:	0.18 inH_2O
Outside Air:	0.07 inH_2O
DX Coil:	0.36 inH_2O
Total Static Pressure:	1.34 inH_2O

Sound

	Sound Power (db)							
Frequency	**63 Hz**	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**	**8 kHz**
Inlet	72	70	78	73	75	69	64	58
Discharge	72	73	81	78	81	75	72	66
Radiated	82	82	78	75	73	68	61	54

Options

Electrical	
Field Connection:	Non-Fused Disconnect Switch
Powered Receptacle:	Field powered 115V GFI outlet
Power Options:	Phase Failure Monitor
Controls	
Communication Card:	BACnet/MSTP card, Factory installed

Warranty

Parts:	Standard One Year
Compressor:	Additional Four Year, Five Year Total

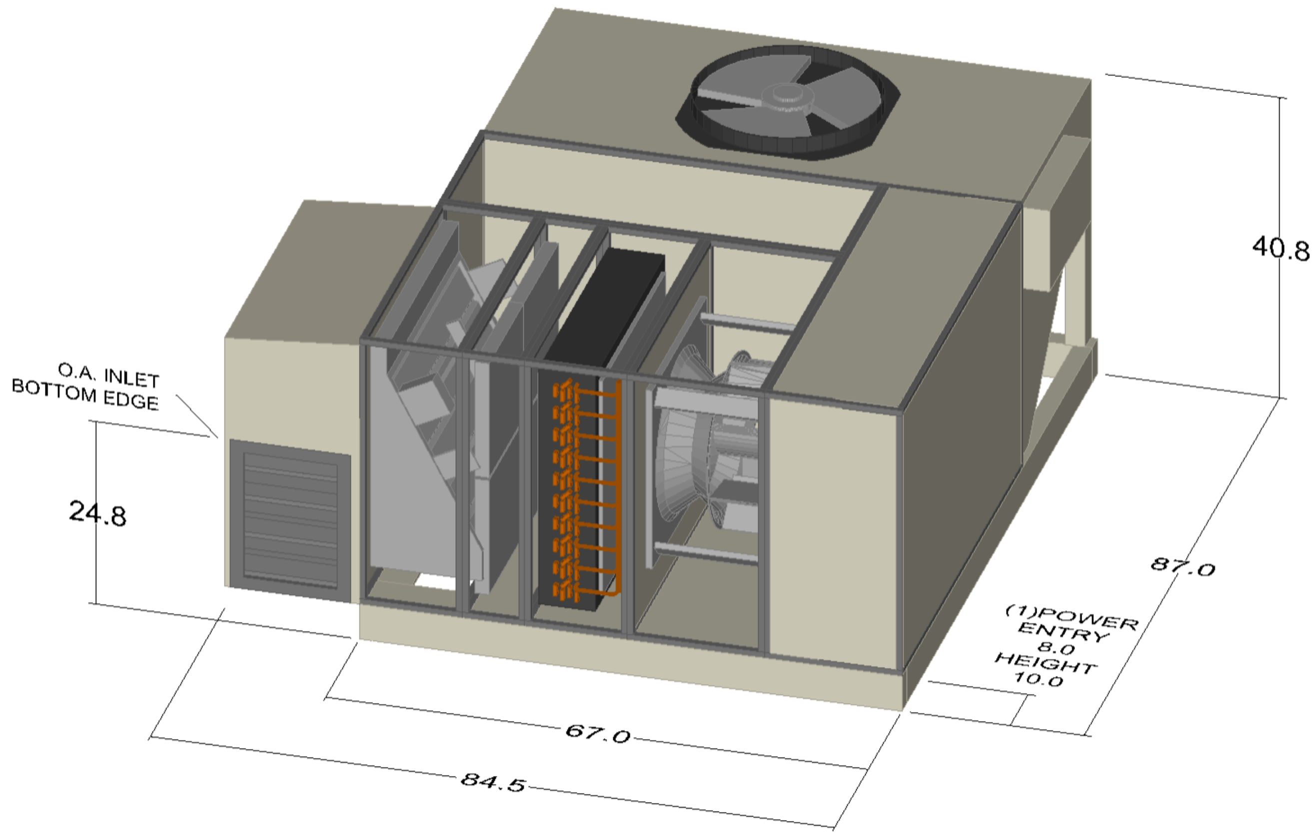
AHRI Certification

All equipment is rated and certified in accordance with AHRI 360.

Notes

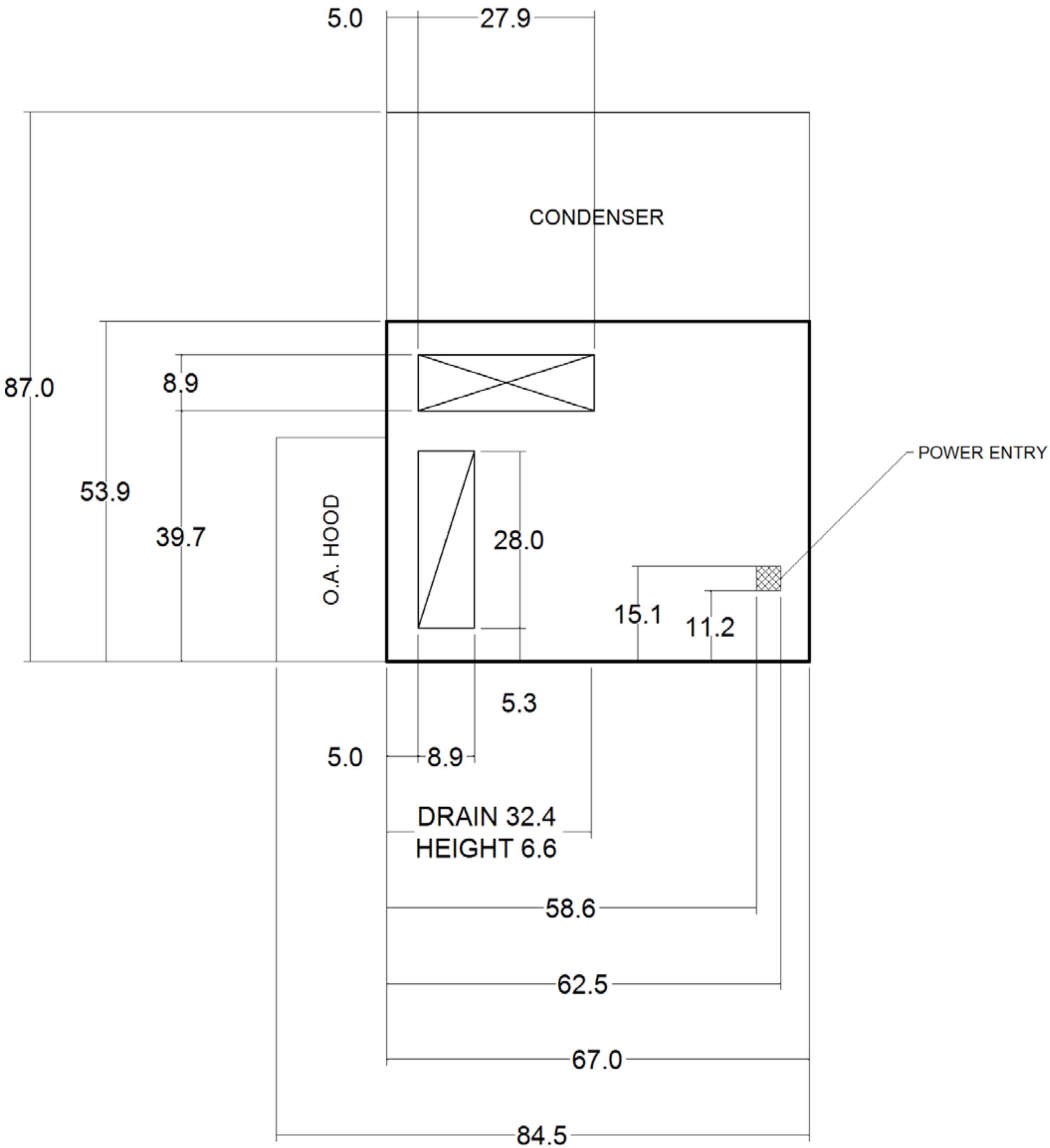
Accessories

Optional	
Part Number	**Description**
910119550	24" Roof Curb, Size 003 - 006
910143408	DDC Space Sensor with Setpoint Adj and Tenant Over



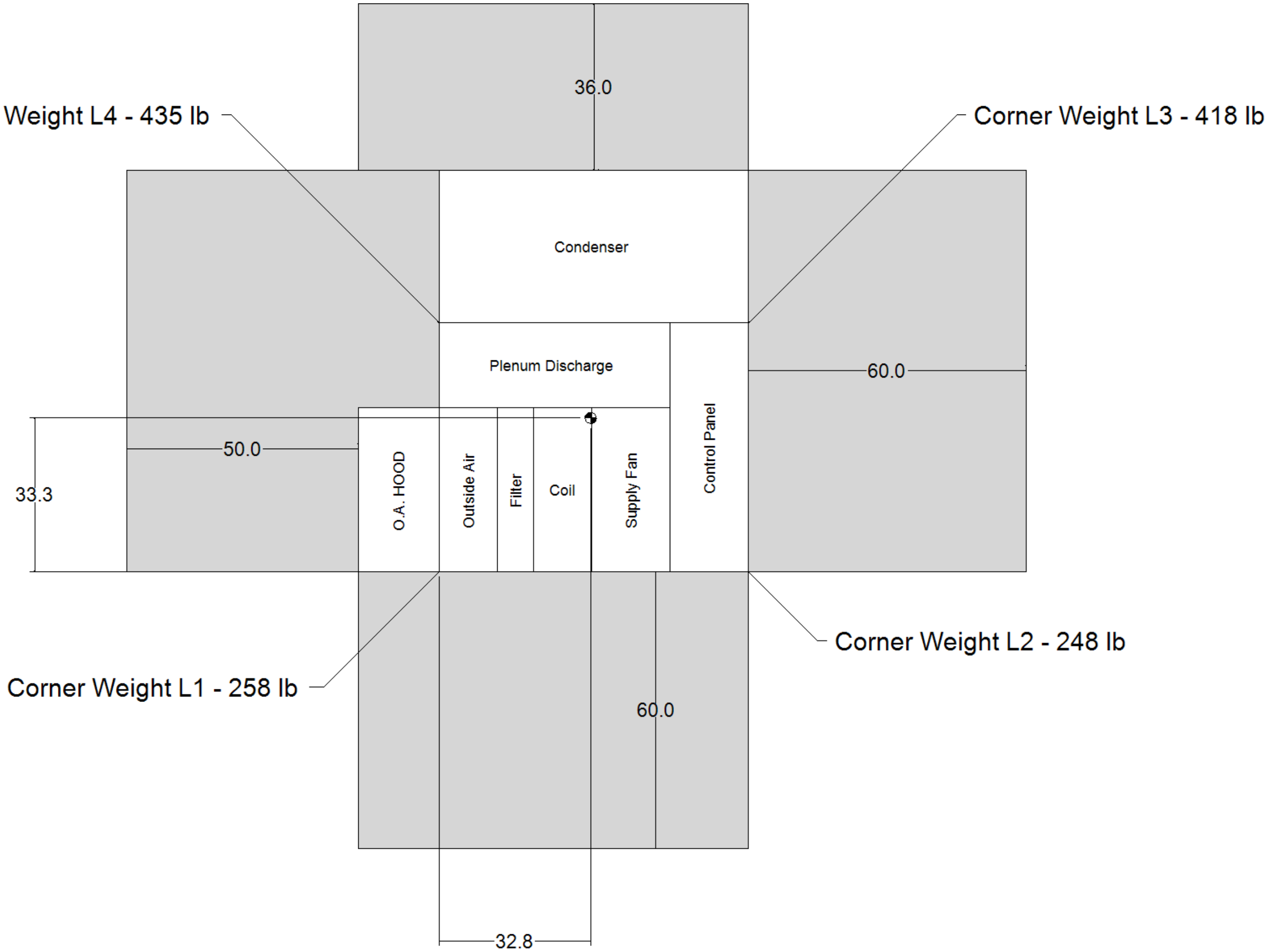
Notes:
(1) Recommended location for optional field cut side power connection.

Product Drawing	Unit Tag: Chatham HS-RTU-1-A3			Sales Office: D & B Eng. of New Jersey, Inc			DAIKIN
Product:	Project Name: Honeywell-Chatham School			Sales Engineer:			13600 Industrial Park Blvd. Minneapolis, MN 55441
Model: DPS006A	Dec. 09, 2014	Ver/Rev:	Sheet: 1 of 1	Scale: NTS	Tolerance: +/- 0.25”	Dwg Units: in [mm]	www.DaikinApplied.com Software Version: 03.10



PLAN VIEW - OPENINGS & OVERALL

Product Drawing	Unit Tag: Chatham HS-RTU-1-A3			DAIKIN 13600 Industrial Park Blvd. Minneapolis, MN 55441 www.DaikinApplied.com Software Version: 03.10		
Product:	Project Name: Honeywell-Chatham School					
Model: DPS006A	Sales Office: D & B Eng. of New Jersey, Inc					
Sales Engineer:	Dec. 09, 2014	Ver/Rev:	Sheet 1 of 1	Scale: NTS	Tolerance: +/-0.25"	Dwg Units: in [mm]



PLAN VIEW - CG, CORNER WEIGHTS, SERVICE CLEARANCE

Notes:
(1) Center of Gravity Height = 20.8
(2) Total Weight = 1359 lb

Product Drawing	Unit Tag: Chatham HS-RTU-1-A3			Sales Office: D & B Eng. of New Jersey, Inc			DAIKIN
Product:	Project Name: Honeywell-Chatham School			Sales Engineer:			13600 Industrial Park Blvd. Minneapolis, MN 55441
Model: DPS006A	Dec. 09, 2014	Ver/Rev:	Sheet: 1 of 1	Scale: NTS	Tolerance: +/- 0.25"	Dwg Units: in [mm]	www.DaikinApplied.com Software Version: 03.10

Rebel™ Packaged Rooftop System

DAIKIN

Job Information	Technical Data Sheet
Job Name	Honeywell-Chatham School District
Date	12/9/2014
Submitted By	Jennifer Olivo
Software Version	03.10
Unit Tag	Chatham HS-RTU-1-A8

Unit Overview

Model Number	Voltage V/Hz/Phase	Design Cooling Capacity Btu/hr	AHRI360 Standad Efficiency		ASHRAE 90.1
			EER	IEER	
DPS007A	208/60/3	91466	12.3	20.1	2010 Compliant

Unit

Model Number:	DPS007A
Model Type:	Heat Pump
Heat Type:	None
Application:	Variable Air Volume, Single Zone
Outside Air:	0-100% Economizer with Drybulb Control
Altitude:	0 ft
Approval	cETLus

Physical

Dimensions and Weight

Length	Height	Width	Weight
91.0 in	55.8 in	96.5 in	1996 lb

Corner Weights

L1	L2	L3	L4
329 lb	281 lb	639 lb	747 lb

Construction

Exterior	Insulation and Liners	Air Opening Location	
		Return	Supply
Painted Galvanized Steel	1" Injected Foam, R-7, Galvanized Steel Liner	Bottom	Bottom

Electrical

MCA	MROPD	SCCR
32.5 A	40 A	5 kAIC

Return/Outside/Exhaust Air

Outside Air Option

Type	Damper Pressure Drop	Exhaust Air Type
0-100% Econ with Dry Bulb Control	0.07 inH_2O	Barometric Relief

Filter Section

Physical

Type	Quantity / Size	Face Area	Face Velocity	Air Pressure Drop
Combo 2"/4" rack with 2" Merv 8	6 / 18 in x 24 in x 2 in	18.0 ft^2	166.7 ft/min	0.05

DX Cooling Coil

Physical

Coil Type	Fins per Inch	Rows	Face Area	Face Velocity	Air Pressure drop	Drain Pan Material
Cu Tube/ Al Fin	15	3	14.0 ft^2	214.0 ft/min	0.14 inH_2O	Stainless Steel

Cooling Performance

Capacity		Refrigerant Type	Indoor Air Temperature				Ambient Air Temperature °F
			Entering		Leaving		
Total Btu/hr	Sensible Btu/hr		Dry Bulb °F	Wet Bulb °F	Dry Bulb °F	Wet Bulb °F	
91466	73370	R410A	80.0	67.0	57.6	57.4	95.0

Heating Performance

Total Capacity Btu/hr	Refrigerant Type	Indoor Air Temperature Dry Bulb		Ambient Air Temperature °F
		Entering °F	Leaving °F	
78856	R410A	70.0	94.0	47.0

Fan Section

Fan

Type	Fan Wheel Diameter
SWSI AF	14 in

Performance

Airflow	Total Static Pressure	Fan Speed	Brake Horsepower	Altitude
3000 CFM	0.8 inH_2O	2254 rpm	1.03 HP	0 ft

Motor				Drive
Type	Horsepower	Efficiency	FLA	Type
ECM Motor	2.3	Premium	5.0 A	Direct Drive

Condensing Section

Compressor

Type	Quantity	Total Power	Capacity Control	Compressor Isolation
Inverter Scroll + Fixed Scroll	2	5.0 kW	Mod Control with Inverter Compressors	Rubber in Shear

Compressor Amps:

Compressor 1	11.9 A
Compressor 2	8.6 A

Compressor Options: Suction and Discharge Isolation Valves

Condenser Coil

Type	Fins per Inch	Fin Material
Copper Tube	16	Aluminum

Coil Options: Vandal Guard

Condenser Fan Motors

Number of Motors	Full Load Current
2	4.0 A

AHRI 360 Certified Data at AHRI 360 Standard Conditions

Net Capacity	EER	IEER	Heat Net Capacity at 47°F	COP at 47°F	Heat Net Capacity at 17°F	COP at 17°F
88000 Btu/hr	12.3	20.1	78000 Btu/hr	3.70	47000 Btu/hr	2.44

Internal Pressure Drop Calculation

External Static Pressure:	0.50 inH_2O
Filter:	0.05 inH_2O
Outside Air:	0.07 inH_2O
DX Coil:	0.12 inH_2O
Total Static Pressure:	0.77 inH_2O

Sound

	Sound Power (db)							
Frequency	**63 Hz**	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**	**8 kHz**
Inlet	77	76	84	79	81	80	75	70
Discharge	77	79	87	84	87	86	83	78
Radiated	85	85	81	78	76	71	64	57

Options

Electrical	
Field Connection:	Non-Fused Disconnect Switch
Powered Receptacle:	Field powered 115V GFI outlet
Power Options:	Phase Failure Monitor
Controls	
Communication Card:	BACnet/MSTP card, Factory installed

Warranty

Parts:	Standard One Year
Compressor:	Additional Four Year, Five Year Total

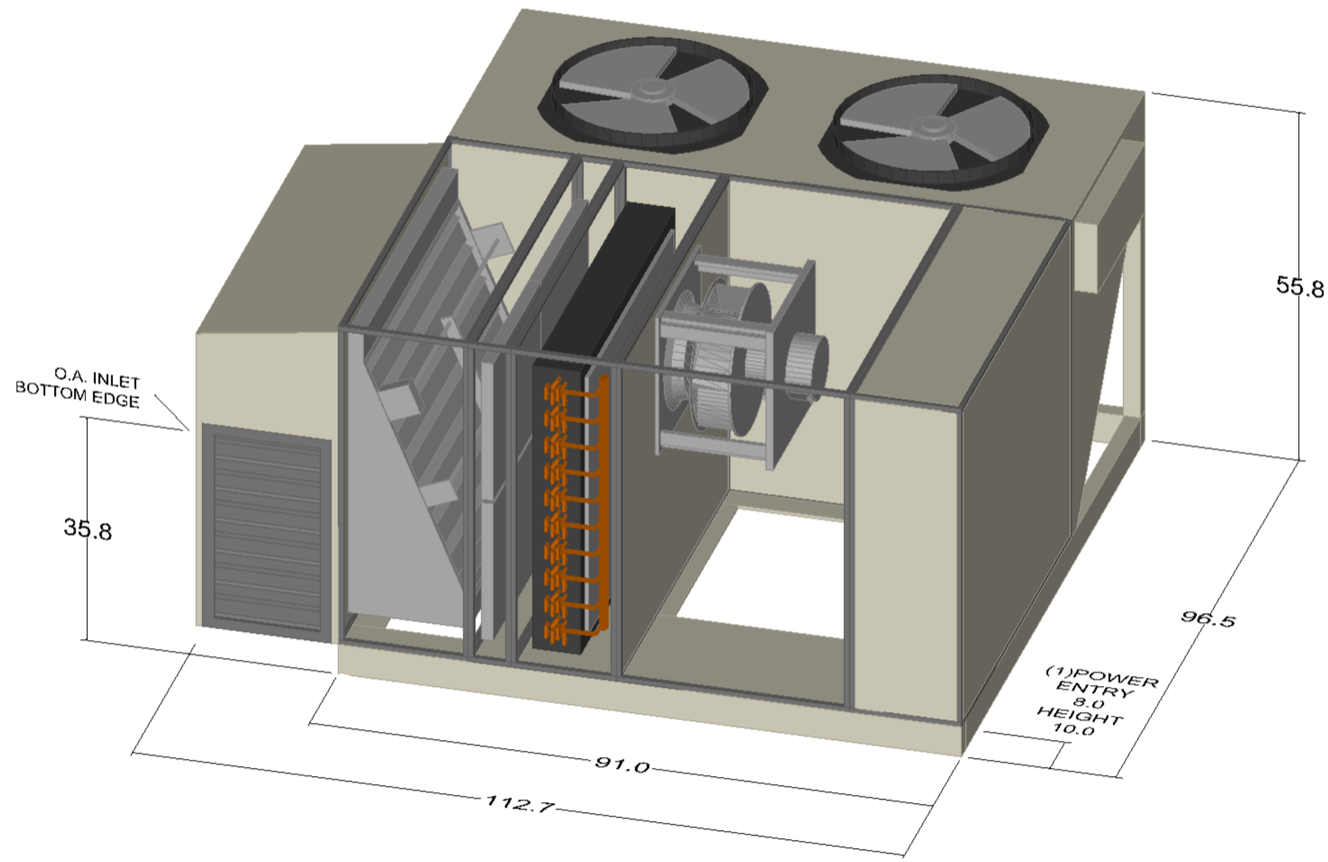
AHRI Certification

All equipment is rated and certified in accordance with AHRI 360.

Notes

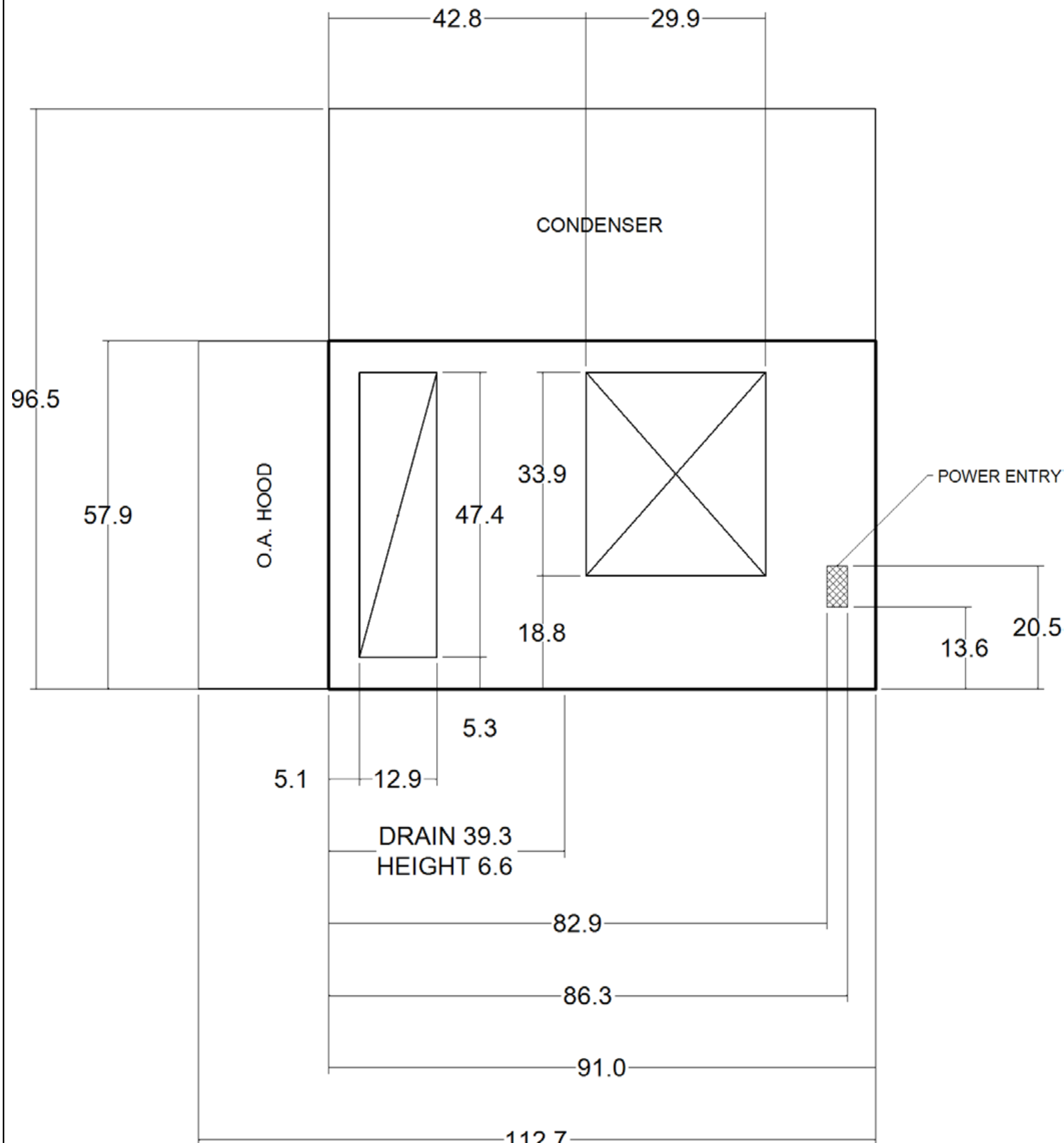
Accessories

Optional	
Part Number	**Description**
910143408	DDC Space Sensor with Setpoint Adj and Tenant Over
910119532	24" Roof Curb, Size 007 - 015



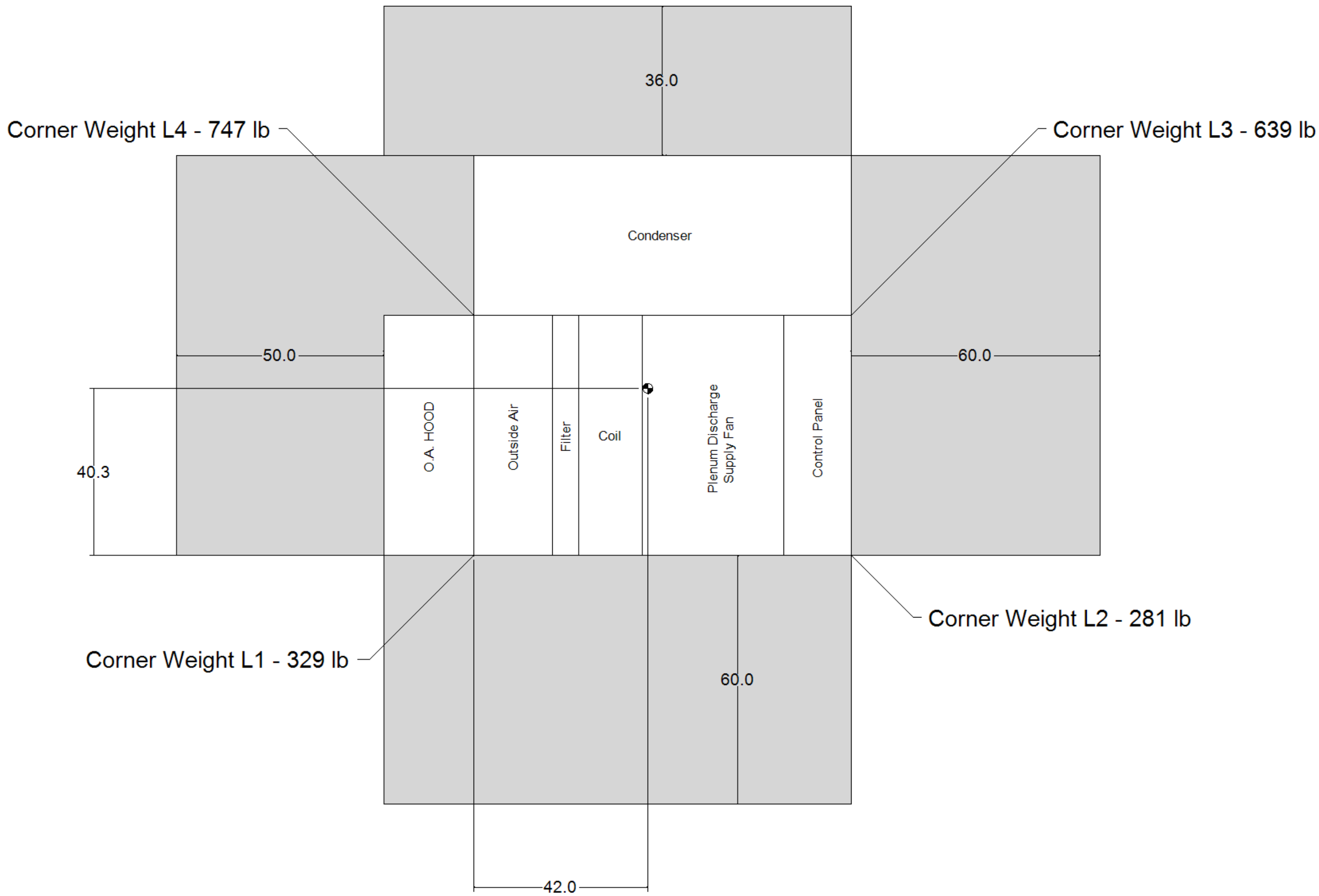
Notes:
(1) Recommended location for optional field cut side power connection.

Product Drawing	Unit Tag: Chatham HS-RTU-1-A8			Sales Office: D & B Eng. of New Jersey, Inc			DAIKIN
Product:	Project Name: Honeywell-Chatham School			Sales Engineer:			13600 Industrial Park Blvd. Minneapolis, MN 55441
Model: DPS007A	Dec. 09, 2014	Ver/Rev:	Sheet: 1 of 1	Scale: NTS	Tolerance: +/- 0.25"	Dwg Units: in [mm]	www.DaikinApplied.com Software Version: 03.10



PLAN VIEW - OPENINGS & OVERALL

Product Drawing	Unit Tag: Chatham HS-RTU-1-A8		DAIKIN		
Product:	Project Name: Honeywell-Chatham School		13600 Industrial Park Blvd. Minneapolis, MN 55441		
Model: DPS007A	Sales Office: D & B Eng. of New Jersey, Inc		www.DaikinApplied.com Software Version: 03.10		
Sales Engineer:	Dec. 09, 2014	Ver/Rev:	Sheet 1 of 1	Scale: NTS	Tolerance: +/-0.25” Dwg Units: in [mm]



PLAN VIEW - CG, CORNER WEIGHTS, SERVICE CLEARANCE

Notes:
(1) Center of Gravity Height = 28.3
(2) Total Weight = 1996 lb

Product Drawing	Unit Tag: Chatham HS-RTU-1-A8			Sales Office: D & B Eng. of New Jersey, Inc			DAIKIN
Product:	Project Name: Honeywell-Chatham School			Sales Engineer:			13600 Industrial Park Blvd. Minneapolis, MN 55441
Model: DPS007A	Dec. 09, 2014	Ver/Rev:	Sheet: 1 of 1	Scale: NTS	Tolerance: +/- 0.25”	Dwg Units: in [mm]	www.DaikinApplied.com Software Version: 03.10

Job Information	Technical Data Sheet
Job Name	Honeywell-Chatham School District
Date	12/9/2014
Submitted By	Jennifer Olivo
Software Version	03.10
Unit Tag	Chatham HS-RTU-2-AC1

Unit Overview

Model Number	Voltage V/Hz/Phase	Design Cooling Capacity Btu/hr	AHRI 210 Standard Efficiency		ASHRAE 90.1
			EER	SEER	
DPS003A	208/60/3	36312	13.1	16.5	2010 Compliant

Unit

Model Number:	DPS003A
Model Type:	Heat Pump
Heat Type:	None
Application:	Variable Air Volume, Single Zone
Outside Air:	0-100% Economizer with Drybulb Control
Altitude:	0 ft
Approval	cETLus

Physical

Dimensions and Weight

Length	Height	Width	Weight
67.0 in	40.8 in	87.0 in	1304 lb

Corner Weights

L1	L2	L3	L4
244 lb	235 lb	405 lb	420 lb

Construction

Exterior	Insulation and Liners	Air Opening Location	
		Return	Supply
Painted Galvanized Steel	1" Injected Foam, R-7, Galvanized Steel Liner	Bottom	Bottom

Electrical

MCA	MROPD	SCCR
19.6 A	25 A	5 kAIC

Return/Outside/Exhaust Air

Outside Air Option

Type	Damper Pressure Drop	Exhaust Air Type
0-100% Econ with Dry Bulb Control	0.02 inH_2O	Barometric Relief

Filter Section

Physical

Type	Quantity / Size	Face Area	Face Velocity	Air Pressure Drop
Combo 2"/4" rack with 2" Merv 8	4 / 16 in x 16 in x 2 in	7.1 ft^2	169.0 ft/min	0.04

DX Cooling Coil

Physical

Coil Type	Fins per Inch	Rows	Face Area	Face Velocity	Air Pressure drop	Drain Pan Material
Cu Tube/ Al Fin	16	3	4.8 ft²	342.9 ft/min	0.19 inH$_2$O	Stainless Steel

Cooling Performance

Capacity		Refrigerant Type	Indoor Air Temperature				Ambient Air Temperature °F
			Entering		Leaving		
Total Btu/hr	Sensible Btu/hr		Dry Bulb °F	Wet Bulb °F	Dry Bulb °F	Wet Bulb °F	
36312	29408	R410A	80.0	67.0	57.6	57.5	95.0

Heating Performance

Total Capacity Btu/hr	Refrigerant Type	Indoor Air Temperature Dry Bulb		Ambient Air Temperature °F
		Entering °F	Leaving °F	
32249	R410A	70.0	94.6	47.0

Fan Section

Fan

Type	Fan Wheel Diameter
SWSI AF	16 in

Performance

Airflow	Total Static Pressure	Fan Speed	Brake Horsepower	Altitude
1200 CFM	0.8 inH$_2$O	1104 rpm	0.25 HP	0 ft

Motor				Drive
Type	Horsepower	Efficiency	FLA	Type
ECM Motor	4.0	Premium	8.8 A	Direct Drive

Condensing Section

Compressor

Type	Quantity	Total Power	Capacity Control	Compressor Isolation
Inverter Scroll	1	2.3 kW	Mod Control with Inverter Compressors	Rubber in Shear

Compressor Amps:

Compressor 1	7.7 A

Compressor Options: Suction and Discharge Isolation Valves

Condenser Coil

Type	Fins per Inch	Fin Material
Copper Tube	16	Aluminum

Coil Options: Vandal Guard

Condenser Fan Motors

Number of Motors	Full Load Current
1	0.9 A

AHRI 210 Certified Data at AHRI 210 Standard Conditions

Net Capacity	EER	SEER	Heat Net Capacity at 47°F	COP at 47°F	Heat Net Capacity at 17°F	COP at 17°F
34500 Btu/hr	13.1	16.5	32100 Btu/hr	4.12	20400 Btu/hr	2.68

Internal Pressure Drop Calculation

External Static Pressure:	0.50 inH_2O
Filter:	0.04 inH_2O
Outside Air:	0.02 inH_2O
DX Coil:	0.16 inH_2O
Total Static Pressure:	0.75 inH_2O

Sound

	Sound Power (db)							
Frequency	**63 Hz**	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**	**8 kHz**
Inlet	67	65	73	68	70	64	59	53
Discharge	67	68	76	73	76	70	67	61
Radiated	82	82	78	75	73	68	61	54

Options

Electrical	
Field Connection:	Non-Fused Disconnect Switch
Powered Receptacle:	Field powered 115V GFI outlet
Power Options:	Phase Failure Monitor
Controls	
Communication Card:	BACnet/MSTP card, Factory installed

Warranty

Parts:	Standard One Year
Compressor:	Additional Four Year, Five Year Total

AHRI Certification

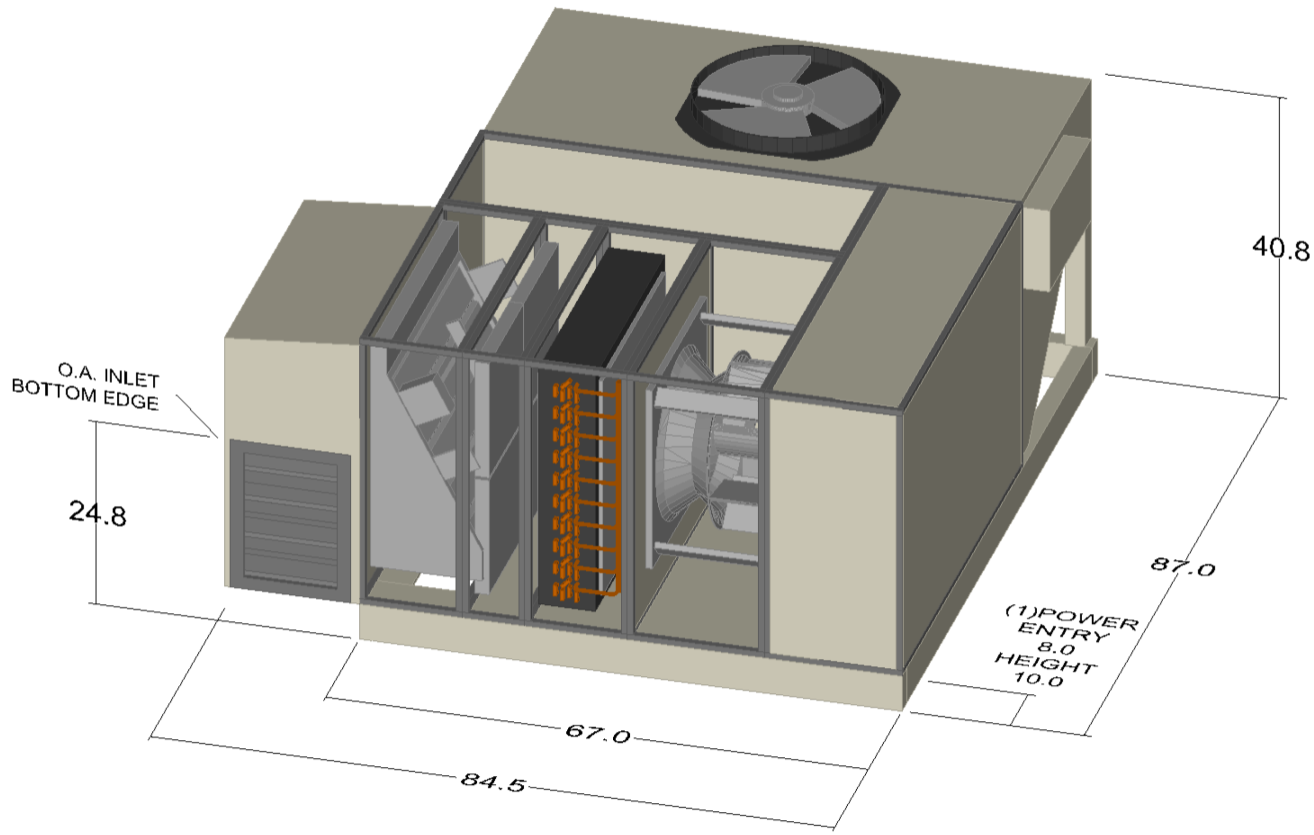
All equipment is rated and certified in accordance with AHRI 360.

Notes

Accessories

Optional

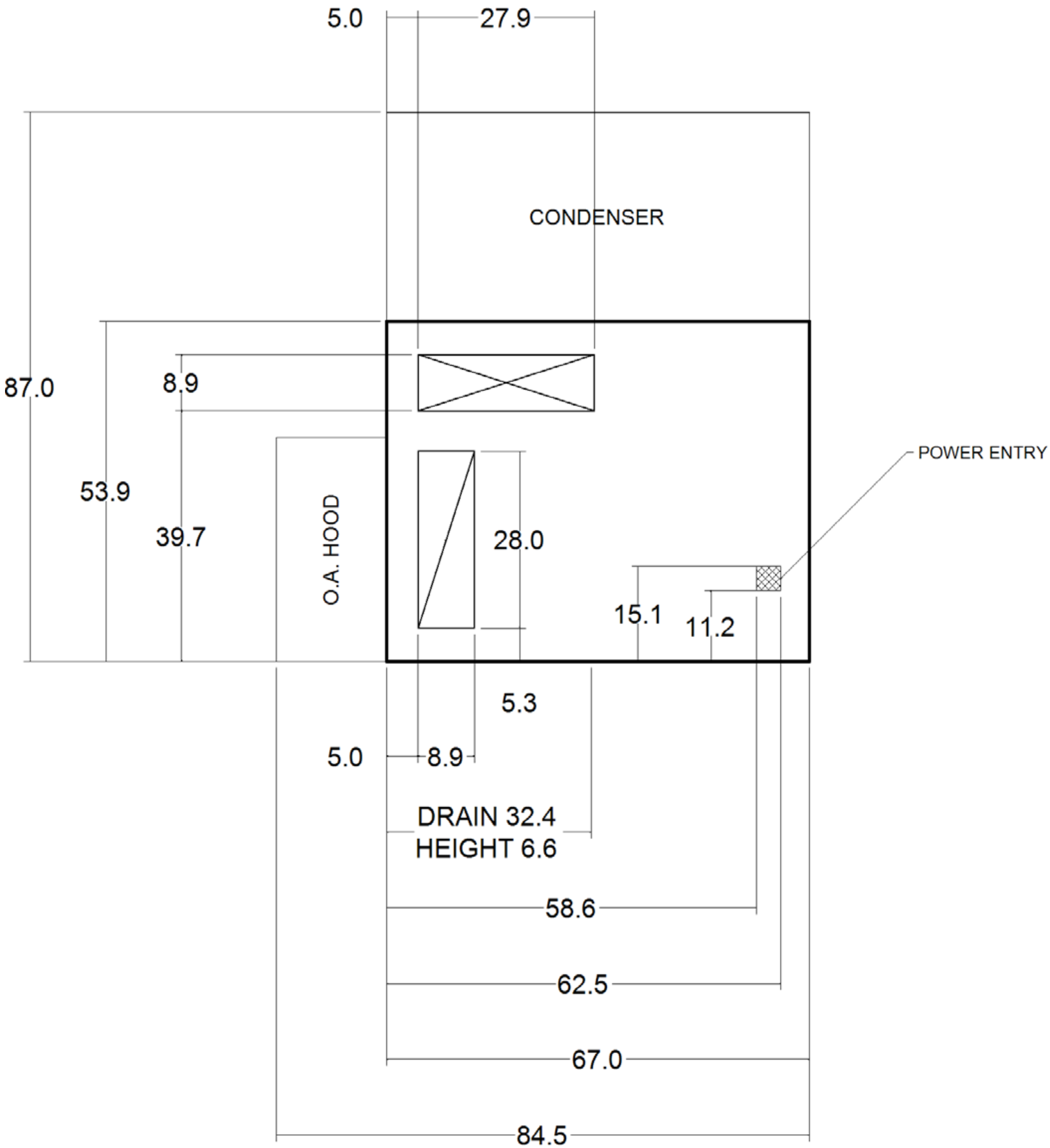
Part Number	Description
910119550	24" Roof Curb, Size 003 - 006
910143408	DDC Space Sensor with Setpoint Adj and Tenant Over



Notes:
(1) Recommended location for optional field cut side power connection.

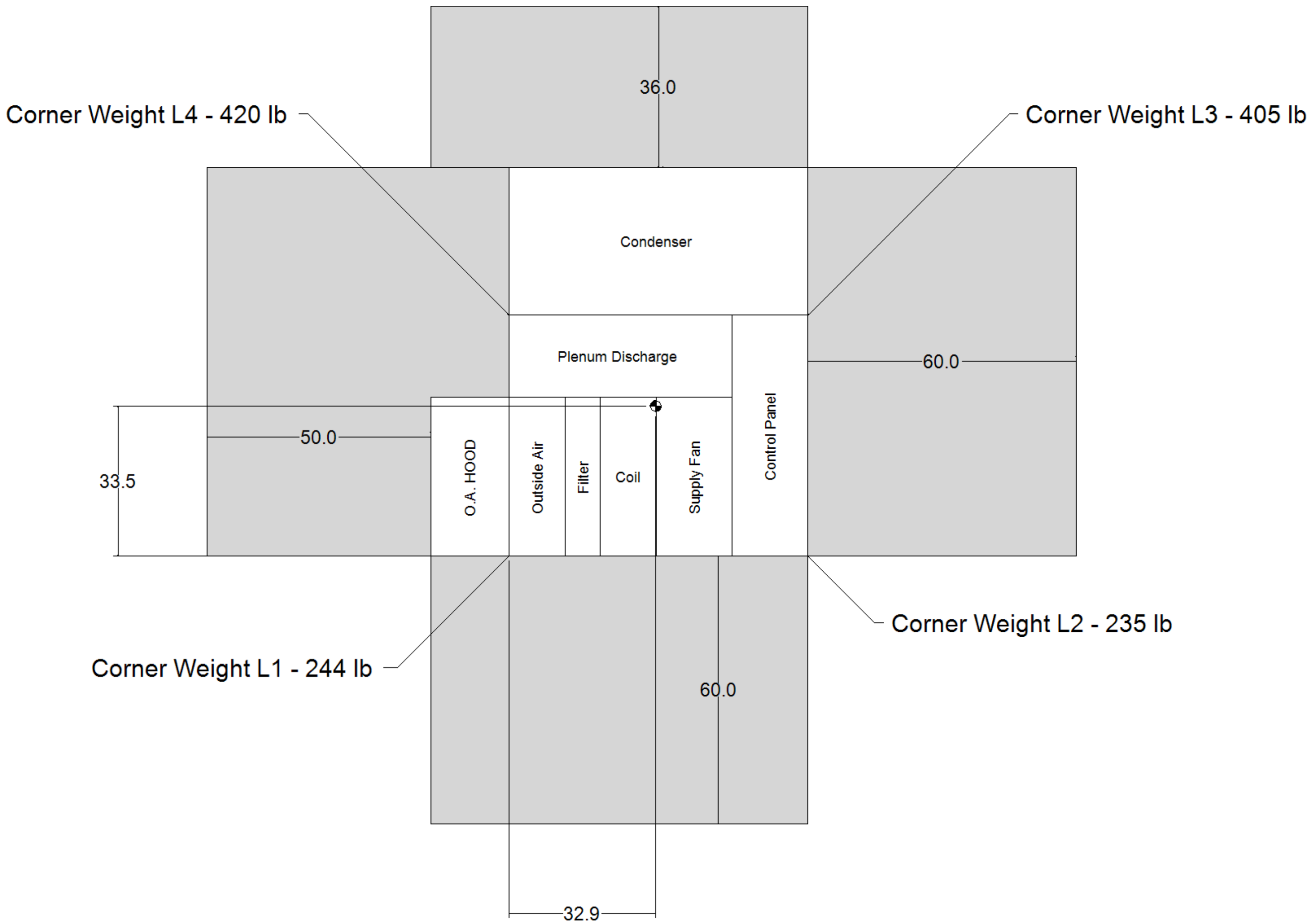
Product Drawing	Unit Tag: Chatham HS-RTU-2-AC1			Sales Office: D & B Eng. of New Jersey, Inc		
Product:	Project Name: Honeywell-Chatham School			Sales Engineer:		
Model: DPS003A	Dec. 09, 2014	Ver/Rev:	Sheet: 1 of 1	Scale: NTS	Tolerance: +/- 0.25"	Dwg Units: in [mm]

DAIKIN
13600 Industrial Park Blvd. Minneapolis, MN 55441
www.DaikinApplied.com Software Version: 03.10



PLAN VIEW - OPENINGS & OVERALL

Product Drawing	Unit Tag: Chatham HS-RTU-2-AC1			DAIKIN		
Product:	Project Name: Honeywell-Chatham School			13600 Industrial Park Blvd. Minneapolis, MN 55441		
Model: DPS003A	Sales Office: D & B Eng. of New Jersey, Inc			www.DaikinApplied.com Software Version: 03.10		
Sales Engineer:	Dec. 09, 2014	Ver/Rev:	Sheet 1 of 1	Scale: NTS	Tolerance: +/-0.25”	Dwg Units: in [mm]



PLAN VIEW - CG, CORNER WEIGHTS, SERVICE CLEARANCE

Notes:
(1) Center of Gravity Height = 20.8
(2) Total Weight = 1304 lb

Product Drawing	Unit Tag: Chatham HS-RTU-2-AC1			Sales Office: D & B Eng. of New Jersey, Inc			DAIKIN
Product:	Project Name: Honeywell-Chatham School			Sales Engineer:			13600 Industrial Park Blvd. Minneapolis, MN 55441
Model: DPS003A	Dec. 09, 2014	Ver/Rev:	Sheet: 1 of 1	Scale: NTS	Tolerance: +/- 0.25”	Dwg Units: in [mm]	www.DaikinApplied.com Software Version: 03.10

DAIKIN

Job Information	*Technical Data Sheet*
Job Name	Honeywell-Chatham School District
Date	12/9/2014
Submitted By	Jennifer Olivo
Software Version	03.10
Unit Tag	Chatham HS-RTU-2-AC2

Unit Overview

Model Number	Voltage V/Hz/Phase	Design Cooling Capacity Btu/hr	AHRI 210 Standard Efficiency		ASHRAE 90.1
			EER	SEER	
DPS003A	208/60/3	36312	13.1	16.5	2010 Compliant

Unit

Model Number:	DPS003A
Model Type:	Heat Pump
Heat Type:	None
Application:	Variable Air Volume, Single Zone
Outside Air:	0-100% Economizer with Drybulb Control
Altitude:	0 ft
Approval	cETLus

Physical

Dimensions and Weight

Length	Height	Width	Weight
67.0 in	40.8 in	87.0 in	1304 lb

Corner Weights

L1	L2	L3	L4
244 lb	235 lb	405 lb	420 lb

Construction

Exterior	Insulation and Liners	Air Opening Location	
		Return	Supply
Painted Galvanized Steel	1" Injected Foam, R-7, Galvanized Steel Liner	Bottom	Bottom

Electrical

MCA	MROPD	SCCR
19.6 A	25 A	5 kAIC

Return/Outside/Exhaust Air

Outside Air Option

Type	Damper Pressure Drop	Exhaust Air Type
0-100% Econ with Dry Bulb Control	0.02 inH_2O	Barometric Relief

Filter Section

Physical

Type	Quantity / Size	Face Area	Face Velocity	Air Pressure Drop
Combo 2"/4" rack with 2" Merv 8	4 / 16 in x 16 in x 2 in	7.1 ft^2	169.0 ft/min	0.04

DX Cooling Coil

Physical

Coil Type	Fins per Inch	Rows	Face Area	Face Velocity	Air Pressure drop	Drain Pan Material
Cu Tube/ Al Fin	16	3	4.8 ft²	342.9 ft/min	0.19 inH_2O	Stainless Steel

Cooling Performance

Capacity		Refrigerant Type	Indoor Air Temperature				Ambient Air Temperature °F
			Entering		Leaving		
Total Btu/hr	Sensible Btu/hr		Dry Bulb °F	Wet Bulb °F	Dry Bulb °F	Wet Bulb °F	
36312	29408	R410A	80.0	67.0	57.6	57.5	95.0

Heating Performance

Total Capacity Btu/hr	Refrigerant Type	Indoor Air Temperature Dry Bulb		Ambient Air Temperature °F
		Entering °F	Leaving °F	
32249	R410A	70.0	94.6	47.0

Fan Section

Fan

Type	Fan Wheel Diameter
SWSI AF	16 in

Performance

Airflow	Total Static Pressure	Fan Speed	Brake Horsepower	Altitude
1200 CFM	0.8 inH_2O	1104 rpm	0.25 HP	0 ft

Motor				Drive
Type	Horsepower	Efficiency	FLA	Type
ECM Motor	4.0	Premium	8.8 A	Direct Drive

Condensing Section

Compressor

Type	Quantity	Total Power	Capacity Control	Compressor Isolation
Inverter Scroll	1	2.3 kW	Mod Control with Inverter Compressors	Rubber in Shear

Compressor Amps:

Compressor 1	7.7 A

Compressor Options: Suction and Discharge Isolation Valves

Condenser Coil

Type	Fins per Inch	Fin Material
Copper Tube	16	Aluminum

Coil Options: Vandal Guard

Condenser Fan Motors

Number of Motors	Full Load Current
1	0.9 A

AHRI 210 Certified Data at AHRI 210 Standard Conditions

Net Capacity	EER	SEER	Heat Net Capacity at 47°F	COP at 47°F	Heat Net Capacity at 17°F	COP at 17°F
34500 Btu/hr	13.1	16.5	32100 Btu/hr	4.12	20400 Btu/hr	2.68

Internal Pressure Drop Calculation

External Static Pressure:	0.50 inH_2O
Filter:	0.04 inH_2O
Outside Air:	0.02 inH_2O
DX Coil:	0.16 inH_2O
Total Static Pressure:	0.75 inH_2O

Sound

	Sound Power (db)							
Frequency	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Inlet	67	65	73	68	70	64	59	53
Discharge	67	68	76	73	76	70	67	61
Radiated	82	82	78	75	73	68	61	54

Options

Electrical	
Field Connection:	Non-Fused Disconnect Switch
Powered Receptacle:	Field powered 115V GFI outlet
Power Options:	Phase Failure Monitor
Controls	
Communication Card:	BACnet/MSTP card, Factory installed

Warranty

Parts:	Standard One Year
Compressor:	Additional Four Year, Five Year Total

AHRI Certification

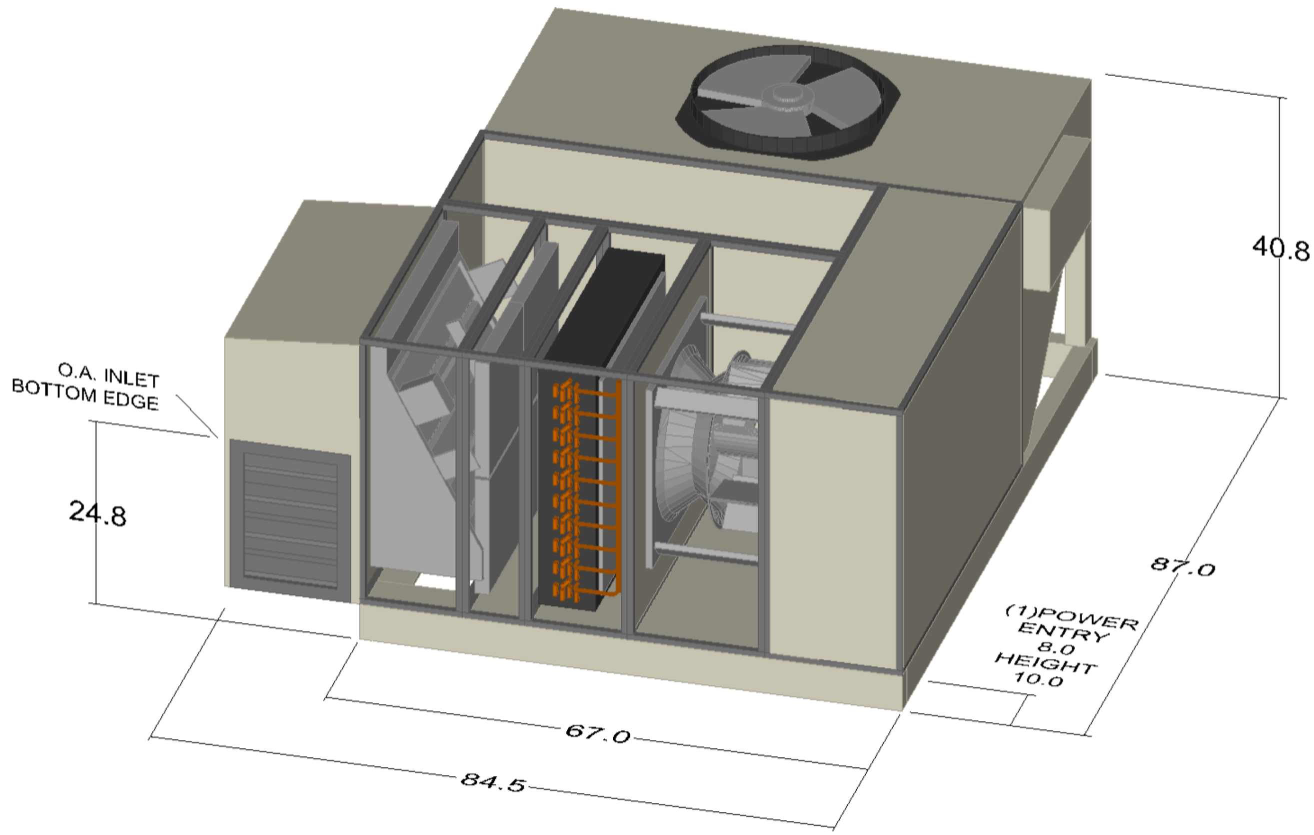
All equipment is rated and certified in accordance with AHRI 360.

Notes

Accessories

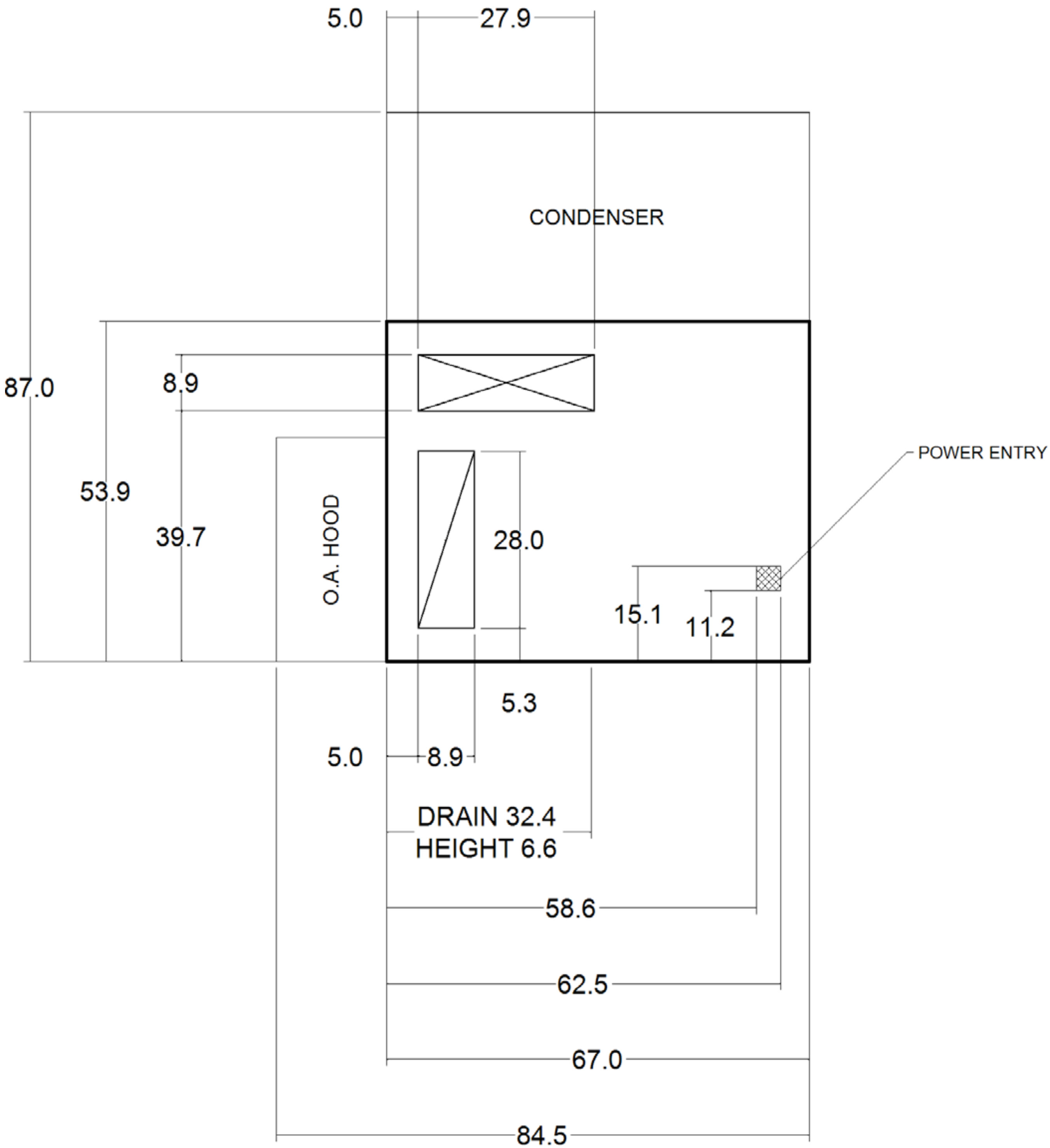
Optional

Part Number	Description
910119550	24" Roof Curb, Size 003 - 006
910143408	DDC Space Sensor with Setpoint Adj and Tenant Over



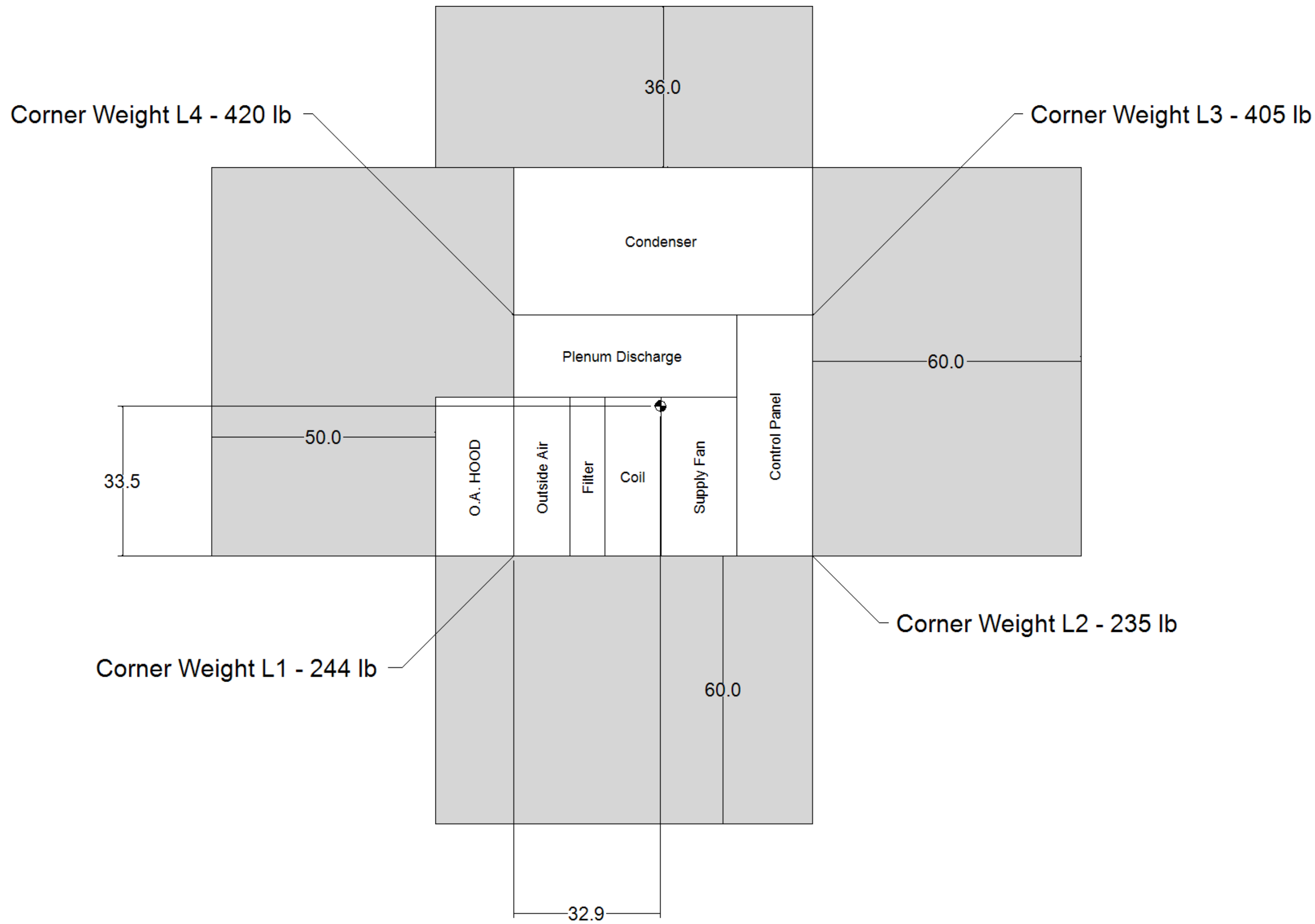
Notes:
(1) Recommended location for optional field cut side power connection.

Product Drawing	Unit Tag: Chatham HS-RTU-2-AC2			Sales Office: D & B Eng. of New Jersey, Inc			DAIKIN
Product:	Project Name: Honeywell-Chatham School			Sales Engineer:			13600 Industrial Park Blvd. Minneapolis, MN 55441
Model: DPS003A	Dec. 09, 2014	Ver/Rev:	Sheet: 1 of 1	Scale: NTS	Tolerance: +/- 0.25"	Dwg Units: in [mm]	www.DaikinApplied.com Software Version: 03.10



PLAN VIEW - OPENINGS & OVERALL

Product Drawing	Unit Tag: Chatham HS-RTU-2-AC2			DAIKIN 13600 Industrial Park Blvd. Minneapolis, MN 55441 www.DaikinApplied.com Software Version: 03.10		
Product:	Project Name: Honeywell-Chatham School					
Model: DPS003A	Sales Office: D & B Eng. of New Jersey, Inc					
Sales Engineer:	Dec. 09, 2014	Ver/Rev:	Sheet 1 of 1	Scale: NTS	Tolerance: +/-0.25”	Dwg Units: in [mm]



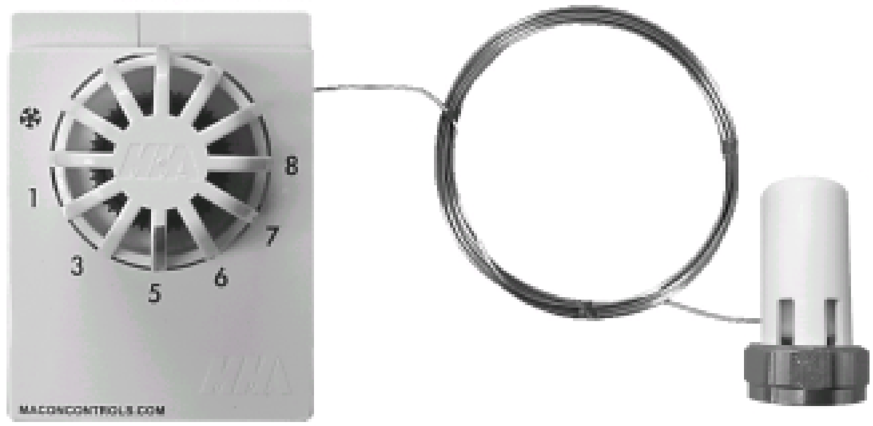
PLAN VIEW - CG, CORNER WEIGHTS, SERVICE CLEARANCE

Notes:
(1) Center of Gravity Height = 20.8
(2) Total Weight = 1304 lb

Product Drawing	Unit Tag: Chatham HS-RTU-2-AC2			Sales Office: D & B Eng. of New Jersey, Inc		
Product:	Project Name: Honeywell-Chatham School			Sales Engineer:		
Model: DPS003A	Dec. 09, 2014	Ver/Rev:	Sheet: 1 of 1	Scale: NTS	Tolerance: +/- 0.25"	Dwg Units: in [mm]

DAIKIN
13600 Industrial Park Blvd. Minneapolis, MN 55441
www.DaikinApplied.com Software Version: 03.10

REMOTE SENSOR THERMOSTAT
ENTL B46000



Operation

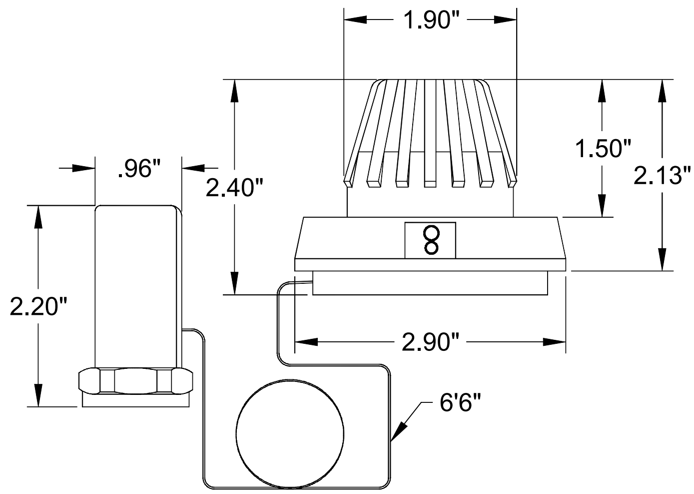
The sensor is wax-filled and the wax volume varies according to ambient temperature. The volume changes are transmitted to the valve stem via a liquid capillary system. The valve body has a return spring which closes the valve when the stem is under low pressure. When the force from the sensor and the return spring are balanced to the room temperature selected, the valve disc stops in that position to allow a certain amount of water or steam to flow through the valve. Temperature changes cause the valve disc to change position and thereby continuously modulate the flow so that the room temperature is maintained at the desired temperature. The unit is secured against damage from over pressure by a pressure absorbing spring.

Features

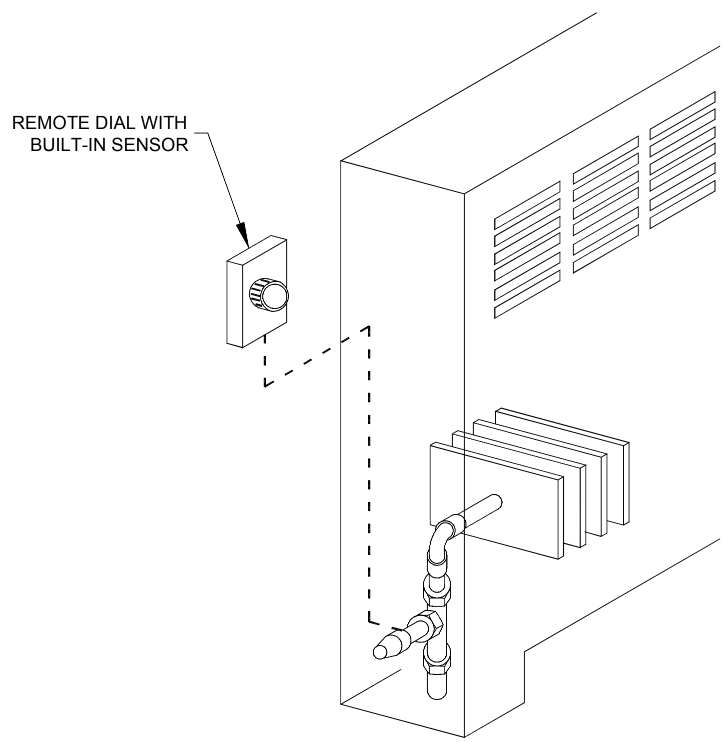
- Combined remote dial/sensor
- Brass sensor, High sensitivity
- Fiberglass valve plug shaft
- Stainless steel capillary tube, 6'6" standard length
- Longer capillary available, consult factory
- Fits all Macon NT series valves
- Replaces the valve-mounted sensors on built-in convectors, etc., and where the valve-mounted sensor is exposed to draft from windows or doors
- Fully automatic - nonelectric, no wiring
- Small dimensions
- Manufactured to exacting standards using exceptionally high quality materials
- Each sensor is tested and re-checked to achieve exact settings before leaving the factory
- Note that changing of the actuator can be accomplished without draining the system
- All Macon thermostats can be locked at or limited to a specific temperature or temperature range
- Simple one-trade installation
- All Macon valves and thermostats conform to ASHRAE Standard 102P-1983 and European Standard EN 215/1215. We are also ISO 9001 certified (1994) and ISO 14001 certified (1998).

Tunstall
118 Exchange Street · Chicopee, MA 01013
www.tunstall-inc.com
Phone (413) 594-8695 · Fax (413) 598-8109
www.maconcontrols.com

MACON SPECIFICATIONS
ENTL - B46000



DATA
Temp. Range: 46° - 80°F
Hysteresis: 0.9°F
Heat Transfer: 1.1°F (Valve Housing Sensor)
Dead Time: 0.8 Minutes
Max. Differential Pressure: 20 psi
Suggested Differential Pressure = 0.5 to 2.9 psi
Max. Water Temp.: 250°F
Max. Storage & Ambient Temp.: 122°F
Max. Steam Pressure: 15 psig
Max. Movement: 0.125
Nominal Opening: 0.018 (3.6°F)
Long Term Test: 5000 cycles (1.3°F)



DIAL SETTINGS:
0 = Off
* = 46°F (Frost Protection)
1 = 54°F
3 = 61°F
5 = 68°F
6 = 72°F
7 = 76°F
8 = 80°F

Tunstall
118 Exchange Street · Chicopee, MA 01013
www.tunstall-inc.com
Phone (413) 594-8695 · Fax (413) 598-8109
www.maconcontrols.com

DIRECT MOUNT OPERATOR
MTW

see reverse for
min/max field adjustment

The Macon MTW thermostatic valve will help you balance your heating system. The MTW operator has one of the most accurate sensors for individual radiator temperature control. The problem of overheating, underheating and wide temperature swings can now be controlled.

The MTW thermostatic valve by Macon Controls conserves energy by regulating temperature. Fuel costs can be reduced up to 30%!

The MTW is a self-acting adjustable non-electric thermostatic operactor. It has anti-freeze position, adjustable max./min. temperature, selected temperature locking feature and can be shutoff completely if required. Each MTW thermostatic operator is individually calibrated and conform to ASHRAE standardization rules for temperature regulation. The MTW's smooth shape and narrow air gaps gives a nice operation and makes it easy to keep clean. Can be mounted on all Macon NT series valves. Millions are in use throughout the world.

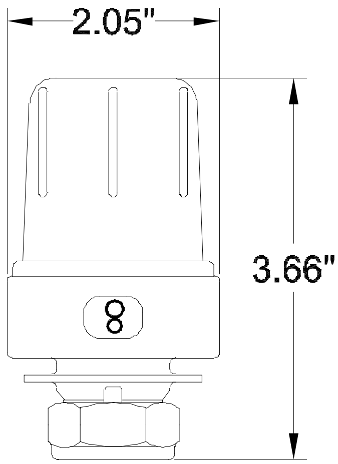
Tunstall

118 Exchange Street · Chicopee, MA 01013
www.tunstall-inc.com

Phone (413) 594-8695 · Fax (413) 598-8109
www.maconcontrols.com

MACON SPECIFICATIONS

MTW



<u>Maximum & minimum setting</u>

Maximum setting

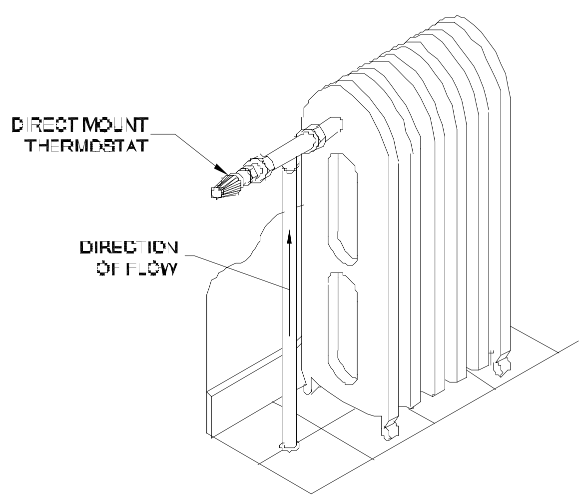
1. Turn the wheel to maximum and a red mark will occur in the indicating window (located opposite the dial setting window).
2. Push the mark in while turning the wheel to desired temperature according to below chart.
3. When reached desired temperature let go of the mark and the maximum temperature limit is set.

Minimum setting

1. Turn the wheel to minimum and a blue mark will occur in the indicating window (located opposite the dial setting window).
2. Push the mark in while turning the wheel to desired temperature according to below chart.
3. When reached desired temperature let go of the mark and the minimum temperature limit is set.

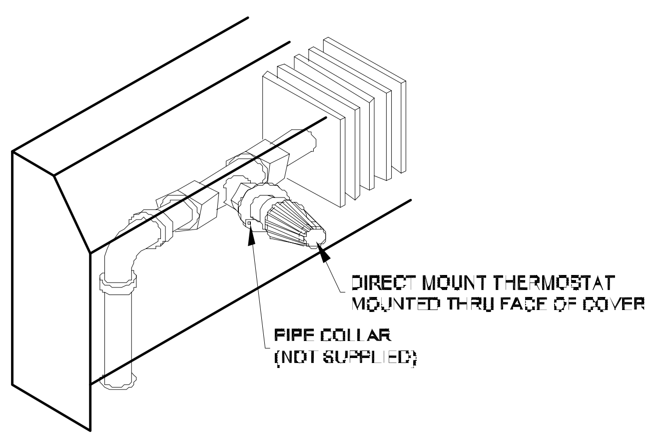
DATA

Temp. Range: 46° - 82°F
Hystersis: 0.9°F
Heat Transfer: 1.1°F (Valve Housing Sensor)
Dead Time: 0.8 Minutes
Max. Differential Pressure: 20 psi
Suggested Differential Pressure = 0.5 to 2.9 psi
Max. Water Temp.: 250°F
Max. Storage & Ambient Temp.: 122°F
Max. Steam Pressure: 15 psig
Max. Movement: 0.125
Nominal Opening: 0.018 (3.6°F)
Long Term Test: 5000 cycles (1.3°F)



DIAL SETTINGS:

0 = Off
* = 46°F (Frost Protection)
1 = 54°F
3 = 61°F
5 = 68°F
6 = 72°F
7 = 76°F
8 = 80°F
9 = 82°F



REMOTE SENSOR THERMOSTAT
MTWZ

*see reverse for
min/max field adjustment*

Operation

The sensor on the MTWZ is wax-filled and the wax volume varies according to ambient temperature. The volume changes are transmitted to the valve stem via a liquid capillary system. The valve body has a return spring which closes the valve when the stem is under low pressure. When the force from the sensor and the return spring are balanced to the room temperature selected, the valve disc stops in that position to allow a certain amount of water or steam to flow through the valve. Ambient temperature changes cause the valve disc to change position and thereby continuously modulate the flow so that the room temperature is maintained at the desired temperature. The unit is secured against damage from over-pressure by a built-in pressure absorbing spring.

Features and Benefits

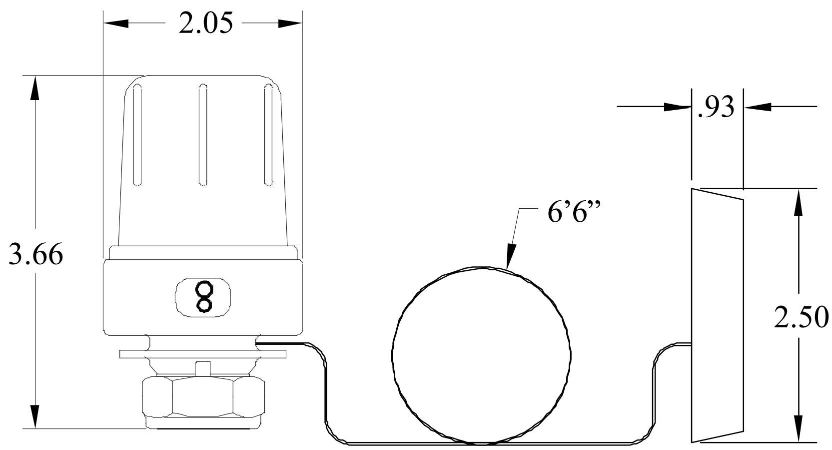
- Valve-mounted setting knob and remote temperature sensor
- Brass sensor, High sensitivity
- Fiberglass valve plug shaft
- Stainless steel capillary tube, 6'6" standard length
- Longer capillary available, consult factory
- Fits all Macon NT series valves
- Replaces the valve-mounted sensors on built-in convectors, etc., and where the valve-mounted sensor is exposed to draft from doors and windows
- Fully automatic - nonelectric, no wiring
- Manufactured to exacting standards using exceptionally high quality materials
- Each sensor is tested and re-checked to achieve exact settings before leaving the factory
- Note that changing the actuator can be accomplished without draining the system
- All Macon thermostats can be locked at or limited to a specific temperature or temperature range
- Simple one-trade installation
- Sensor guard furnished at no extra cost
- All Macon valves and thermostats conform to ASHRAE Standard 102P-1983 and European Standard EN 215/1215. We are also ISO 9001 certified (2002) and ISO 14001 certified (2002).

Tunstall

118 Exchange Street · Chicopee, MA 01013
www.tunstall-inc.com

Phone (413) 594-8695 · Fax (413) 598-8109
www.maconcontrols.com

MACON SPECIFICATIONS
MTWZ



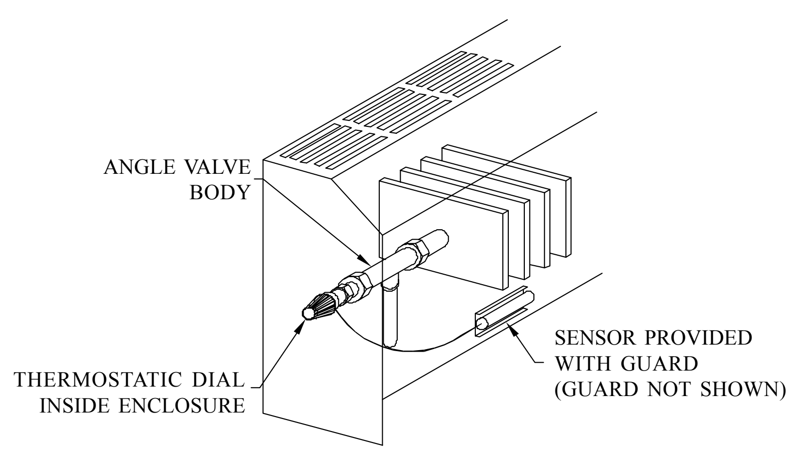
DATA
Temp. Range: 46° - 82°F
Hysteresis: 0.9°F
Heat Transfer: 1.1°F (Valve Housing Sensor)
Dead Time: 0.8 Minutes
Max. Differential Pressure: 20 psi
Suggested Differential Pressure = 0.5 to 2.9 psi
Max. Water Temp.: 250°F
Max. Storage & Ambient Temp.: 122°F
Max. Steam Pressure: 15 psig
Max. Movement: 0.125 inches
Long Term Test: 5000 cycles (1.3°F)

Each unit is factory pre-set per the dial settings listed.
If field adjustments are necessary see below.

Maximum setting
1. Turn the wheel to maximum and a red mark will occur in the indicating window (located opposite the dial setting window).
2. Push the mark in while turning the wheel to desired temperature according to chart below.
3. When desired temperature is reached, let go of the mark and the maximum temperature limit is set.

Minimum setting
1. Turn the wheel to minimum and a blue mark will occur in the indicating window (located opposite the dial setting window).
2. Push the mark in while turning the wheel to desired temperature according to chart below.
3. When desired temperature is reached, let go of the mark and the minimum temperature limit is set.

DIAL SETTINGS:
* = 46°F (Frost Protection)
1 = 54°F
3 = 61°F
5 = 68°F
6 = 72°F
7 = 76°F
8 = 80°F
9 = 82°F



Tunstall
118 Exchange Street · Chicopee, MA 01013
www.tunstall-inc.com
Phone (413) 594-8695 · Fax (413) 598-8109
www.maconcontrols.com

Bulletin: MTWZ204
Non-Electric Operators

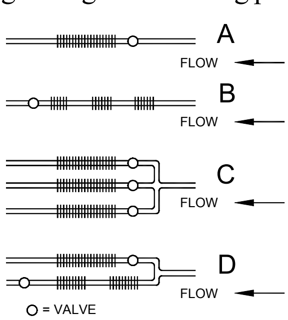
VALVES FOR NT SERIES OPERATORS

Operation

The *Macon* valve is designed to save energy by controlling hot water or low pressure steam heat in freestanding radiators, convectors, baseboards, fan coil units and the like in a loop, a zone or a unit. The valve, coupled with a *Macon* operator, provides a reliable automatic modulating unit. As room temperature drops, the *Macon* valve opens to allow more hot water or steam to flow through the radiator, thus allowing more heat into the room. When the room approaches the selected temperature, the operator causes the valve to begin closing off the flow of hot water or steam. This continued monitoring of the temperature is fully automatic, using no electricity whatsoever. The *Macon* valve can be equipped with any wide variety of *Macon* operators.

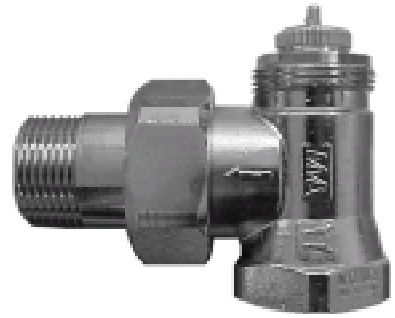
Features

- Compact dimensions
- Replaceable insert
- Stainless steel spindle
- Individual room control
- Easy one-trade installation
- Fuel savings up to 30%
- Prevents over- and under-heating
- Helps balance the heating system
- Same valve used for hot water or low pressure steam
- All NPT are forged brass nickel-plated
- Minimizes or eliminates expansion noises
- Suitable for nearly any hydronic heating application
- Operators can be changed without draining the system
- Shipped with a protective cap that can be used to control heating during the installing period



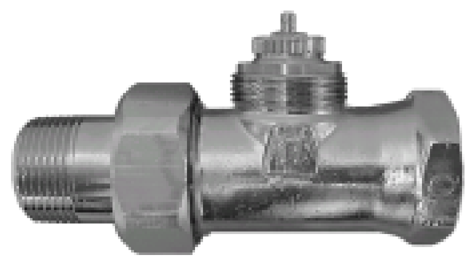
VALVE LOCATION IN SINGLE AND MULTIZONE HEATING SYSTEMS.

Vertical angle valve with straight nipple. NPT - female inlet, male union outlet.



N10637 - 1/2”
N10657 - 3/4”
N10677 - 1”
N10697 - 1-1/4”

Straight valve with straight nipple. NPT - female inlet, male union outlet.



N10737 - 1/2”
N10757 - 3/4”
N10777 - 1”
N10797 - 1-/4”

Horizontal angle valve with straight nipple. NPT - female inlet, male union outlet.

N10837 - 1/2”
N10857 - 3/4”
N10877 - 1”
N10897 - 1-1/4”

Sweat valve with female inlet and outlet

N10930 - 1/2”
N10950 - 3/4”
N10970 - 1”

Fail closed valves also available, consult factory.
All Macon valves and thermostats conform to ASHRAE Standard 102P-1983 and European Standard EN 215/1215. We are also ISO 9001 certified (1994) and ISO 14001 certified (1998).

Tunstall
118 Exchange Street · Chicopee, MA 01013
www.tunstall-inc.com
Phone (413) 594-8695 · Fax (413) 598-8109
www.maconcontrols.com

DATA - Macon Valves for NT Series

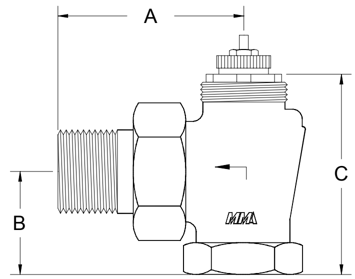
Vertical Angle NPT
1/2”, 3/4”, 1”, 1-1/4”

Straight NPT
1/2”, 3/4”, 1”, 1-1/4”

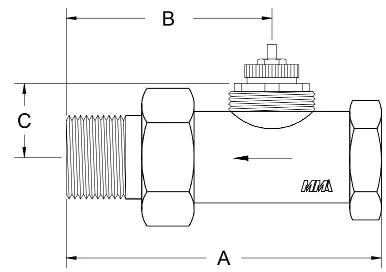
Horizontal Angle NPT
1/2”, 3/4”, 1”, 1-1/4”

Straight Female Sweat
1/2”, 3/4”, 1”

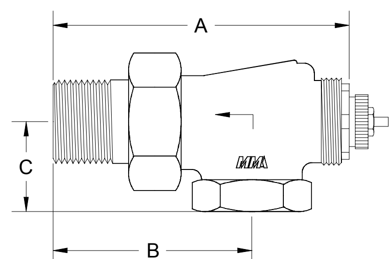
Disc Material: EPDM
Body Styles: Straightway or angle
Maximum steam pressure: 15 psig
Maximum static pressure: 145 PSI
Maximum water temperature: 250°F
Body tappings: Female inlet, male union outlet, Female sweat
Body Material: Forged brass, NPT valves are nickel-plated
Max. Differential pressure: 20 psi H_2O, refer to thermostat specs
Suggested Differential Pressure = 0.5 to 2.9 psi
Overall Height: Add thermostat dimensions less 1/4”



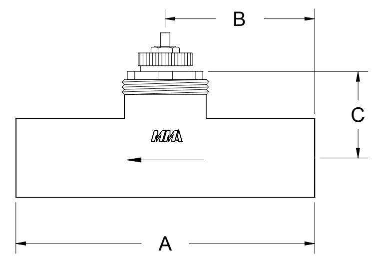
Vertical Angle



Straightway



Horizontal Angle



Sweat

Macon NT Series Valves are in an open position when no operator is attached.

CV: 1/2” = 1.8
3/4” = 2.5
1” = 2.74
1-1/4” = 3.5

DIMENSIONS

VERTICAL ANGLE

BODY #	SIZE	A	B	C
N10637	1/2"	2-1/4"	1"	1-3/4"
N10657	3/4"	2-1/2"	1-1/8"	2-1/8"
N10677	1"	3"	1-3/8"	2-1/4"
N10697	1-1/4"	3-1/4"	1-3/4"	2-3/4"

STRAIGHTWAY

BODY #	SIZE	A	B	C
N10737	1/2"	3-1/2"	2-1/16"	1"
N10757	3/4"	4"	2-1/2"	1"
N10777	1"	4-5/8"	2-15/16"	1"
N10797	1-1/4"	5-1/4"	3-3/8"	1-1/8"

HORIZONTAL ANGLE

BODY #	SIZE	A	B	C
N10837	1/2"	3-3/8"	2-3/16"	1-1/2"
N10857	3/4"	3-3/4"	2-1/2"	1-1/4"
N10877	1"	4-3/16"	3"	1-3/8"
N10897	1-1/4"	4-3/4"	3-1/4"	1-7/8"

SWEAT VALVES

BODY #	SIZE	A	B	C
N10930	1/2"	2-3/16"	1-3/32"	1"
N10950	3/4"	2-11/16"	1-11/32"	7/8"
N10970	1"	3-5/32"	1-9/16"	1"

Tunstall
118 Exchange Street · Chicopee, MA 01013
www.tunstall-inc.com
Phone (413) 594-8695 · Fax (413) 598-8109
www.maconcontrols.com

Bulletin: NTV202
Valves

Tunstall Capsule
Thermostatic Traps
Thermal-Disc Traps
F&T Traps
F&T Repair Kits
Inverted Bucket Traps
Pressure Action Pump
Inlet Orifice
Heat Exchangers
Mixing Valves
Miscellaneous
Literature Downloads
Questions / Comments
Steam Trap Team
Reps & Distributors
Tunstall Corporation
Links

Tunstall®

Tunstall Steam Trap Capsules®
Typical Specification

Quality Engineering

Typical Specification

Thermostatic steam trap repair units shall be Tunstall Steam Trap Capsule® (1-800-423-5578) or approved equal. Capsules to be rated for Vac to 125 psig working pressure. Due to the extended life of high pressure bellows units on low pressure applications, only high pressure bellows units will be acceptable.

Capsule to be made entirely of corrosion resistant stainless steel with TIG welded construction. The actuator shall be a ten plate stainless steel bellows, with heat treated hardened ball bearing close off mechanism. Bellows shall be entirely enclosed in a protective stainless steel capsule to prevent damage from water hammer and debris build-up.

The replacement capsule shall include integral welded stainless steel seat able to fit directly into the condensate portion of the steam trap body. Diaphragm, Nozzle, Orifice, Venturi, Quick Fix, Wafer, Nugget or low pressure units are not acceptable.

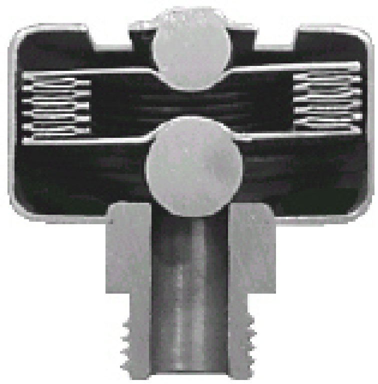
The replacement Tunstall unit must be of universal design, able to retrofit the existing thermostatic steam traps.

New covers may be necessary and shall be provided as required.

Typical Examples

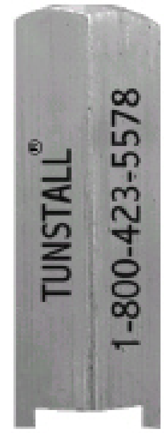
TF (Class 1) Post & Spring Style

TC (Class 2) Post & Spring Style



TC (Class 2) Thread Style Cut Away
Available in Class 1 & Class 2

Top View



TC Tool

Toll Free:1-800-423-5578
Give Us A Call To Cross Reference Any Manufacturers Unit.
Tunstall Corporation - 118 Exchange Street - Chicopee, MA 01013
Phone:(413)594-8695 - Fax:(413)598-8109

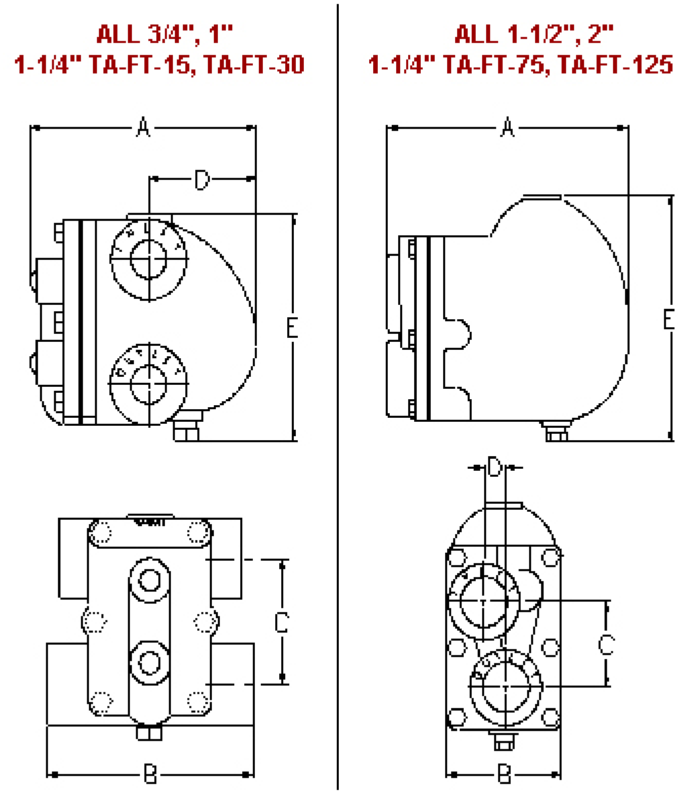
Tunstall®

Series TA-FT Engineering Specifications

CAPACITIES

lbs. Condensate per hour

			DIFFERENTIAL PRESSURE (PSI)														
Model	Size NPT	PSIG Orifice	¼	½	1	2	5	10	15	20	25	30	40	50	75	100	125
TA-FT3-15	¾"	.218	279	369	489	650	785	1000	1075								
TA-FT4-15	1"	.218	279	369	489	650	785	1000	1075								
TA-FT5-15	1¼"	.312	600	770	980	1240	1640	2000	2340								
TA-FT6-15	1½"	.500	1100	1700	2400	3300	5000	6600	7600								
TA-FT8-15	2"	.625	2300	2800	3600	4650	6900	9000	10900								
TA-FT3-30	¾"	.218	279	369	489	650	785	1000	1075	1210	1300	1370					
TA-FT4-30	1"	.218	279	369	489	650	785	1000	1075	1210	1300	1370					
TA-FT5-30	1¼"	.228	375	500	690	910	1200	1500	1680	1800	1900	2000					
TA-FT6-30	1½"	.390	1000	1300	1700	2300	3400	4600	5500	6000	6600	7000					
TA-FT8-30	2"	.500	1300	1800	2500	3400	5200	6800	7800	8600	9300	10000					
TA-FT3-75	¾"	.166	160	213	280	365	520	700	795	875	930	970	1120	1230	1450		
TA-FT4-75	1"	.166	160	213	280	365	520	700	795	875	930	970	1120	1230	1450		
TA-FT5-75	1¼"	.312	550	725	960	1300	1900	2650	3050	3400	3700	4000	4400	4750	5400		
TA-FT6-75	1½"	.312	550	725	960	1300	1900	2650	3050	3400	3700	4000	4400	4750	5400		
TA-FT8-75	2"	.421	850	1100	1500	2000	3100	4150	4750	5200	5500	5800	6400	6800	7700		
TA-FT3-125	¾"	.125	100	135	175	230	330	415	500	585	620	685	750	830	970	1110	1190
TA-FT4-125	1"	.125	100	135	175	230	330	415	500	585	620	685	750	830	970	1110	1190
TA-FT5-125	1¼"	.246	400	520	680	890	1300	1700	2050	2300	2500	2700	3000	3200	3800	4200	4500
TA-FT6-125	1½"	.246	400	520	680	890	1300	1700	2050	2300	2500	2700	3000	3200	3800	4200	4500
TA-FT8-125	2"	.332	550	675	880	1225	1950	2600	3000	3250	3500	3800	4200	4600	5500	6100	6600



		DIMENSIONS (Inches)					
Model	**Size**	**A**	**B**	**C**	**D**	**E**	**Weight (lbs.)**
TA-FT3-15	¾"	6.25	5.50	3.31	3.00	5.75	9
TA-FT4-15	1"	6.25	5.50	3.31	3.00	5.75	9
TA-FT5-15	1¼"	6.25	5.75	3.00	3.81	5.75	9½
TA-FT6-15	1½"	8.50	4.25	3.00	0.70	8.40	18
TA-FT8-15	2"	9.81	4.94	4.94	0.12	9.12	26
TA-FT3-30	¾"	6.25	5.50	3.31	3.00	5.75	9
TA-FT4-30	1"	6.25	5.50	3.31	3.00	5.75	9
TA-FT5-30	1¼"	6.25	5.75	3.00	3.81	5.75	9½
TA-FT6-30	1½"	8.50	4.25	3.00	0.70	8.40	18
TA-FT8-30	2"	9.81	4.94	4.94	0.12	9.12	26
TA-FT3-75	¾"	6.25	5.50	3.31	3.00	5.75	9
TA-FT4-75	1"	6.25	5.50	3.31	3.00	5.75	9
TA-FT5-75	1¼"	8.50	4.25	3.00	0.70	8.40	18
TA-FT6-75	1½"	8.50	4.25	3.00	0.70	8.40	18
TA-FT8-75	2"	9.81	4.94	4.94	0.12	9.12	26
TA-FT3-125	¾"	6.25	5.50	3.31	3.00	5.75	9
TA-FT4-125	1"	6.25	5.50	3.31	3.00	5.75	9

TA-FT5-125	1¼"	8.50	4.25	3.00	0.70	8.40	18
TA-FT6-125	1½"	8.50	4.25	3.00	0.70	8.40	18
TA-FT8-125	2"	9.81	4.94	4.94	0.12	9.12	26

Toll Free:1-800-423-5578
Give Us A Call To Cross Reference Any Manufacturers Unit.
Tunstall Corporation - 118 Exchange Street - Chicopee, MA 01013
Phone:(413)594-8695 - Fax:(413)598-8109

Thermostatic Radiator Steam Traps
Series TA

Tunstall® Established 1958

Operation

Tunstall Associates, Inc. produces a complete line of thermostatic radiator steam traps with ratings up to 125 psi. Each unit is tested and inspected before leaving the factory guaranteeing years of trouble free service. All units are "normally open" to expel air and water and will "close" at saturated steam temperature thereby preventing steam from entering into condensate return lines. Each Tunstall Steam Trap features the Tunstall Capsule® which has become the best steam trap replacement bellows available today.

Features

- Chrome-plated heavy duty forged brass
- TIG welded stainless steel Tunstall Capsule® with balanced pressure stainless steel bellows
- Calibrated, inspected and tested
- Ratings from 25" Hg vacuum to 125 psi
- Available in 1/2" & 3/4" straight or angle, 1/2" x 3/4" angle, 1/2" vertical and 1" angle patterns

Tunstall Capsule®

Benefits

- Simple installation
- Corrosion resistant stainless steel internals
- Extended life on low pressure applications

Applications

- Cast Iron Radiators
- Finned Tube Radiation
- Convectors
- Air Coils
- Sterilizers
- Drips

Typical Specification

Furnish and install Tunstall Thermostatic Steam Traps as shown or as specified on plans and in accordance with manufacturer's instructions, sizes 1/2", 3/4" or 1". The trap body and cover shall be forged brass and provided with an entirely stainless steel Tunstall Capsule®. Rating shall be ______ lbs/hr at ______ PSIG pressure differential. Each unit shall be guaranteed for 2 years from date of installation.

The Tunstall Capsule® professionally upgrades all thermostatic steam traps. Refer to catalog #795 or www.tunstall-inc.com for more detailed information.

Tunstall Associates, Inc.
118 Exchange Street · Chicopee, MA 01013

Phone (413) 594-8695 · Fax (413) 598-8109
www.tunstall-inc.com

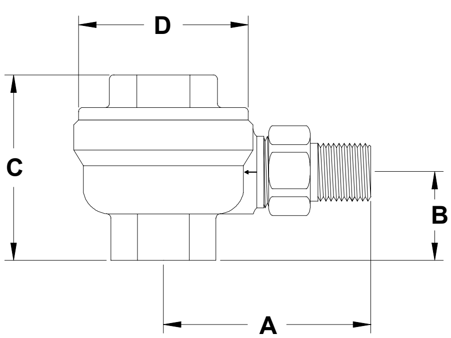
TUNSTALL THERMOSTATIC STEAM TRAPS SERIES "TA"

Engineering Specifications

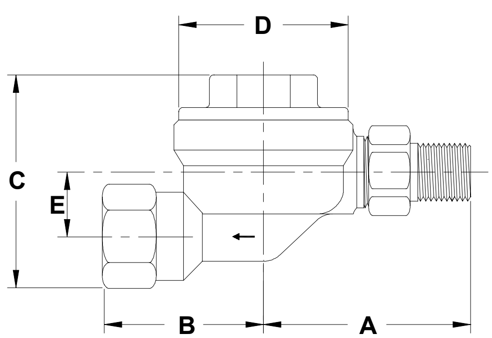
CAPACITIES*

			DIFFERENTIAL PRESSURE (PSI)									
			Square Feet EDR**							lbs Condensate per hour***		
Model	**Size NPT**	**PSIG Orifice**	**1/2**	**1**	**1-1/2**	**2**	**5**	**10**	**25**	**50**	**75**	**125**
TA-1/2-A	1/2"	5/16	120	165	200	230	3320	500	825	1400	1700	1950
TA-3/4-A	3/4"	5/16	230	330	400	465	730	1050	1700	2375	2680	3300
TA-1-A	1"	1/4	430	590	700	760	1200	1750	4100	4050	4700	5500
TA-1/2x3/4-A	1/2"x3/4"	5/16	230	330	400	465	730	1050	1700	2375	2680	3300
TA-1/2-S	1/2"	5/16	120	165	200	230	320	500	825	1400	1700	1950
TA-3/4-S	3/4"	5/16	230	330	400	465	730	1050	1700	2375	2680	3300
TA-1/2-V	1/2"	5/16	120	165	200	230	320	500	825	1400	1700	1950

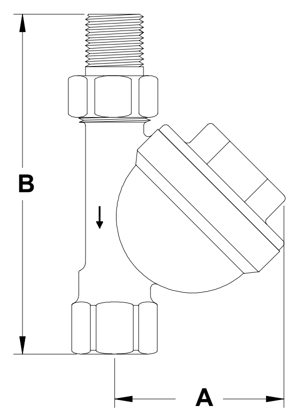
*Ratings are in accordance with standards established by The Steam Heating Equipment Manufacturers Association (SHEMA). No safety factor required.
**To convert Square Feet EDR to pounds of condensate per hour: Divide the square foot ratings by 4.
One Square Foot EDR is equivalent to net emission of 240 BTU per hour with 215°F steam in the radiator surrounded by 70°F air temperature.
***Basic ratings for trap pressures greater than 25psi are given in lbs of condensate per hour.
One pound of condensate is equivalent to approximately 1000 BTU; 1000 BTU is equivalent to approximately 4 square feet EDR.



Angle Pattern (A)



Straight Pattern (S)



Vertical Pattern (V)

Model No.	Pipe Size	A	B	C	D	E	Weight
TA-1/2-A	1/2" Angle	3.00	1.25	2.57	2.56	--	1.75 lbs
TA-3/4-A	3/4" Angle	3.38	1.37	2.87	2.56	--	1.84 lbs
TA-1-A	1" Angle	4.13	2.00	4.12	2.08	--	2.50 lbs
TA-1/2-S	1/2" Straight	3.00	2.15	3.00	2.50	1.00	1.94 lbs
TA-3/4-S	3/4" Straight	3.38	2.15	3.00	2.50	1.00	2.05 lbs
TA-1/2X3/4-A	1/2" X 3/4" Angle	3.38	1.25	2.57	2.56	--	1.75 lbs
TA-1/2-V	1/2" Vertical	2.50	4.85	--	--	--	1.65 lbs

Bulletin: TT602

POWERSMITHS

E-Saver 2016™

APPLICATION

E-Saver 2016 is an ultra-efficient low voltage dry-type transformer that exceeds the U.S. Dept. of Energy's new and more stringent efficiency legislation effective January 1, 2016[1]. E-Saver 2016 is optimized to maximize energy savings and provide an attractive payback when supplying both light loading and electronic equipment, a load profile documented to be the most widespread in most building types.

KEY PERFORMANCE CHARACTERISTICS

When tested according to the U.S. Dept. of Energy's 10 CFR Part 431, a linear load test at 35% of nameplate capacity, the E-Saver 2016 delivers an average of 41% less losses than current EPAct 2005 legislation/NEMA TP1/C802.2, and 14% less losses than NEMA Premium®, the Consortium for Energy Efficiency CEE Tier 1 and the U.S. DOE 2016 legislation[1]. Under real-world conditions savings will be even higher.

E-Saver 2016 is k-rated per UL1561 in order to be compatible with the nonlinear load profile fed by most low voltage transformers today, and has been designed and tested to maintain higher efficiency and lower losses in this environment.

EXPANDED KVA SELECTION ENABLES RIGHT-SIZING

Powersmiths enables right-sizing of electrical infrastructure by offering a much broader selection of transformer kVA sizes. The capital cost, operating cost and footprint reductions can be dramatic - on the order of 30-50%, through smaller transformers, breakers, conductors, and distribution panels.

RETROFIT CONSIDERATIONS

Powersmiths' flexible design and manufacturing process removes the many barriers associated with replacing an existing transformer, including footprint, impedance, internal terminal layout, inrush, fault and arc flash levels.

Field measurement of loading, losses and efficiency are part of Powersmiths' retrofit best practice. The end result is a refreshed electrical infrastructure with the appropriate electrical characteristics with proven and documented energy savings.

75kVA E-Saver 2016 shown with Cyberhawk TX™, hinged door and Rotatable IR Port™ options

ENVIRONMENTAL/GREEN BUILDING CONTRIBUTIONS

E-Saver 2016 contributes to green building programs and carbon footprint reduction through its substantial reduction in energy losses compared to legislation. Additional benefits include our ISO14001 certified manufacturing, biodegradable packaging, integrated metering and ability to integrate with the Powersmiths WOW™ Sustainability Management Platform.

CERTIFICATIONS & TESTING

Powersmiths certifications include ISO 9001 (Quality), ISO 14001 (Environment), ISO 17025 (Efficiency Test Lab), UL and CSA. In addition to standard industry tests, Powersmiths has a production-integrated nonlinear load test program that replicates real-world conditions to enable true losses and efficiency verification.

WARRANTY

E-Saver 2016 has an industry leading 25-year pro-rated warranty.

INTEGRATED OPTIONS

Powersmiths offers many options, such as integrated metering to provide information about capacity utilization, load profiles, power and energy use, and patented Rotatable IR Port™ and lockable hinged doors to enable safer, cost-effective and non-invasive thermal imaging of the live transformer.

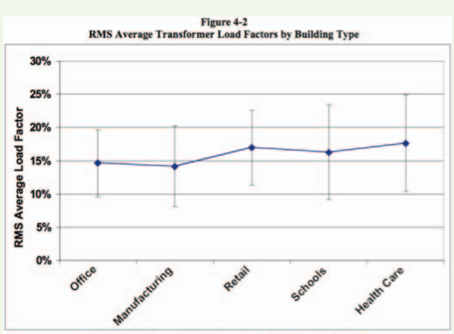


Chart from The Cadmus Group Inc. "*Metered Load Factors for Low-Voltage, Dry-Type Transformers in Commercial, Industrial, and Public Buildings*"

KEY FEATURES

- Optimized for light load and nonlinear load profiles found in most applications
- Energy savings through lower losses and reduced associated cooling provide lower lifecycle cost
- Efficiency beyond NEMA Premium®, Consortium for Energy Efficiency CEE Tier 1, U.S. DOE 2016 legislation[1] and CSL-3
- K-rated as required by UL for today's electronic equipment
- Manufactured in a certified ISO 9001, ISO 14001 and ISO 17025 facility for quality, low environmental impact, and transformer efficiency testing

[1] U.S. Department of Energy, 10 CFR Part 431: Energy Conservation Program: Energy Conservation Standards for Distribution Transformers; Final Rule, April 2013.

TECHNICAL SPECIFICATIONS

E-Saver 2016 is a copper-wound dry-type isolation transformer with a common-core, 10kV BIL, 200% rated neutral, built to NEMA ST-20, UL1561 and other applicable ANSI and IEEE standards, and is cULus Listed and CSA Efficiency Verified. Both primary and secondary terminals and voltage taps (typically six 2.5%) are readily accessible by removing the front enclosure panel. E-Saver 2016 is UL Listed for 2” clearance for ventilated openings - a significant improvement over the typical industry 6” limit. E-Saver 2016’s 220°C class insulation system is NOMEX-based with an Epoxy Co-polymer impregnant with technical performance characteristics that embed lower environmental impact, long term reliability and long life expectancy. E-Saver 2016 comes standard with 60Hz, K-7 rating, 115°C temperature rise, and carries OSHPD and IBC Seismic Certification (S_{DS}=1.5 g)*. The seismic bracing option provides a higher 2.28g.

E-Saver 2016 exceeds U.S. DOE 2016 efficiency legislation (Final Rule issued April 2013), and reduces losses over the kVA size range by an average of 41% when compared to current EPAct 2005/NEMA TP1/C802.2 legislation, and 14% less losses than NEMA Premium® and the Consortium for Energy Efficiency CEE Tier 1 level.

Designs have been carefully optimized to address primary breaker inrush characteristics and manage secondary short circuit currents and arc flash levels.

Keeping noise at a minimum is key. Every Powersmiths E-Saver 2016 comes standard 3dB quieter than NEMA ST-20 and is tested for noise prior to shipment. An even lower noise option is available for very sensitive environments.

All E-Saver™ models come standard in a NEMA 1 ventilated drip-proof indoor enclosure made of heavy gauge steel finished with epoxy powder coating for durability and low environmental impact. A wide variety of enclosures and options are available.

ORDERING INFORMATION

kVA: Rating of unit (9-1000 kVA)
PV: Primary voltage (up to 600V)
SV: Secondary voltage (up to 600/347V)

PRODUCT & MODEL INFORMATION

E-SAVER 2016 model no. format: E-SAVER-C4L-KVA-PV-SV

TECHNICAL DATA

kVA	Efficiency (%)	Impedance (%Z)	CU Model Weight (lbs)	Standard Case Size (in)	Alternate Smaller Case Size (in)
15	98.22	3.0-6.0	250-300	A (18W x 17D x 27H)	17.4W x 14.5D x 25H
20	98.31	3.0-6.0	275-325	B (26W x 18D x 30H)	23W x 15.5D x 27.5H
25	98.41	3.0-6.0	300-350	B (26W x 18D x 30H)	23W x 15.5D x 27.5H
30	98.50	3.0-6.0	350-400	B (26W x 18D x 30H)	23W x 15.5D x 27.5H
45	98.64	3.0-6.0	450-500	B (26W x 18D x 30H)	25W x 16D x 29H
50	98.67	3.0-6.0	500-550	C (32W x 22D x 40H)	26.5W x 17D x 33H
63	98.74	3.0-6.0	550-600	C (32W x 22D x 40H)	26.5W x 17D x 33H
75	98.80	3.0-6.0	675-725	C (32W x 22D x 40H)	26.5W x 17D x 33H
100	98.85	3.0-6.0	775-825	C (32W x 22D x 40H)	30.5W x 20D x 33H
112.5	98.91	3.0-6.0	875-925	C (32W x 22D x 40H)	30.5W x 20D x 33H
125	98.94	3.0-6.0	1000-1100	D (38W x 27D x 48H)	33W x 22.5D x 38H
150	98.99	3.0-6.0	1150-1250	D (38W x 27D x 48H)	33W x 22.5D x 38H
175	99.02	3.0-6.0	1250-1350	D (38W x 27D x 48H)	34.5W x 24D x 42H
200	99.05	3.0-6.0	1325-1425	D (38W x 27D x 48H)	34.5W x 24D x 42H
225	99.08	3.0-6.0	1400-1500	D+ (38W x 32D x 52H)	34.5W x 24D x 42H
250	99.10	3.0-6.0	1550-1650	D+ (38W x 32D x 52H)	37W x 26D x 43H
300	99.14	3.0-6.0	1700-1850	D+ (38W x 32D x 52H)	37W x 26D x 43H
400	99.19	3.0-6.0	2200-2350	E+ (52W x 38D x 61H)	43W x 33D x 51H
450	99.22	3.0-6.0	2500-2650	E+ (52W x 38D x 61H)	43W x 33D x 51H
500	99.24	3.0-6.0	2750-2900	E+ (52W x 38D x 61H)	43W x 33D x 51H
600	99.27	3.0-6.0	3000-3150	F (64W x 47D x 67H)	51.4W x 37.5D x 60.6H
750	99.31	3.0-6.0	3550-3700	F (64W x 47D x 67H)	51.4W x 37.5D x 60.6H
850	99.33	3.0-6.0	4100-4300	F+ (64W x 53D x 67H)	Custom
1000	99.36	3.0-6.0	4700-4900	F+ (64W x 53D x 67H)	Custom

NOTE: The above data applies to the standard configuration of each kVA. Selection of some options may change enclosure size and/or transformer weight. Consult factory for detailed product data sheet for these and other configurations. Efficiencies tested according to U.S. Dept. of Energy’s 10 CFR Part 431, a linear load test at 35% of nameplate capacity.

AVAILABLE OPTIONS

Metering: Express Logger™, SMART™ or Cyberhawk TX™ (See product cut sheets for more info)
N3R: NEMA 3R, ventilated enclosure
N2S: Indoor sprinkler proof enclosure
OSEC: Enclosure for outdoor public areas
OV: Enclosure for outdoor secure areas
SS: Painted stainless steel enclosure
NVI: Non-ventilated indoor enclosure
IRP: Rotatable IR Port™
HD: Hinged Door
F50: 50 Hz design
1S: Single electrostatic shield
2S: Dual electrostatic shields
3S: Triple electrostatic shields
SPD: (120/208 V OR 277/480V)
- **PRO80:** 80kA, 7 mode, Filter
- **PRO120:** 120kA, 7 mode, Filter
- **PRO200:** 200kA, 7 mode, Filter
- **PRO240:** 240kA, 7 mode Filter
- **PROXX:** Where XX is custom ID

LKS: Lug kit, screw-type
LKC: Lug kit, compression type
LI: Low inrush
COL: Custom color
TS: Thermal sensors at 170°C and 200°C
NLT: Nonlinear load test
SE: Sensitive environment, extra low noise
K9: K-9 rating
SB: Seismic bracing
**For Seismic certification details contact Powersmiths*
Wall-mount kit is available and sold separately

Technical specifications subject to change without notice.

POWERSMITHS

POWERSMITHS INTERNATIONAL CORP. 10 Devon Road, Brampton, Ontario L6T 5B5 Canada
Phone: (905) 791-1493 Toll-free: (800) 747-9627 Fax: (905) 791-8870 Email: info@powersmiths.com
www.powersmiths.com

807-000431-153-A02

Job Information	*Technical Data Sheet*
Job Name	Honeywell-Chatham School District
Date	12/9/2014
Submitted By	Jennifer Olivo
Software Version	02.50
Unit Tag	Chatham MS-UV (Heating & Cooling) 1000 CFM

Unit Overview

Model Number	Voltage	Cooling Coil Type	Heating Coil Type
UAVV6S10	115/60/1	DX	Hot Water

Physical

Unit		Controls
Arrangement	**Weight**	**Type**
Vertical, Floor Mounted	445 lb	Factory Installed Digital Controls

Electrical

Voltage	Minimum Voltage	Maximum Voltage	Total Unit MCA	Maximum Fuse Size
115/60/1 V/Hz/Phase	104 V	126 V	3.9 A	15 A

Fan

Performance				
Speed	**Air Volume** CFM	**External Static Pressure** inH_2O	**Motor Power** HP	**Fan Full Load Current** A
High	979	0.00	0.250	2.70

Direct Expansion Coil

Performance						
Capacity			**Air Temperature**			
			Entering		**Leaving**	
Total Btu/hr	**Sensible** Btu/hr	**Evap Refrigerant Temperature** °F	**Dry Bulb** °F	**Wet Bulb** °F	**Dry Bulb** °F	**Wet Bulb** °F
33166	24875	45.0	80.0	67.0	56.6	56.0

Hot Water Coil

Performance				
Total Capacity Btu/hr	**Air Temperature Dry Bulb**		**Fluid Temperature**	
	Entering °F	**Leaving** °F	**Entering** °F	**Leaving** °F
46059	70.0	113.4	180.0	133.9

Fluid		
Type	**Flow Rate** gpm	**Pressure Drop** ft H_2O
Water	2.00	0.85

Physical
Number of Rows
2

Warranty

Type	
Extended:	Ext. 4 yr. parts - (Entire Unit)

Notes

Accessories

Part Number	Description
105677701	Auxiliary Drain Pan for Unit End Compartment - AV
106041390	1" End Pnl, Ant Ivory, 21-7/8"D, Solid (AV AZ)
107292502	Head Press Variable Spd Kit-Condensing Units-120/
111048101	STANDARD Room Sensor with Override
105631522	LVR HORZ W/GRILLE 10 3/8HX48L CLR ANOD- W/FLGE S1

Certified Drawing	AVS-V-R-MTII-808
Daikin Applied certifies that it will furnish equipment in accordance with this drawing and specifications, and subject to its published warranty. Purchaser's approval to this drawing signifies that the equipment is acceptable under the provisions of the job specifications. Any change made hereon by any person whomsoever is subject to acceptance by Daikin	Group: **Unit Ventilator** Type: MTII **DDC Control** Date: **January 2014**

Daikin Classroom Floor Unit Ventilator Models AVS, AVV, and AVR

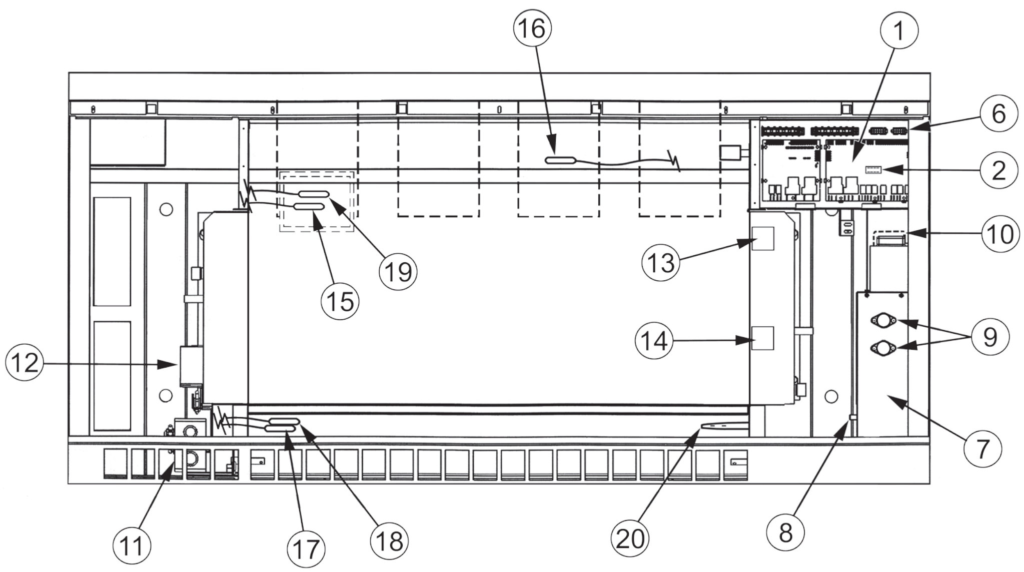
MicroTech II™ Unit Mounted DDC Control Components

1. **MicroTech II Unit Ventilator Controller (UVC):** (Located Beneath the Local User Interface Panel). Factory mounted and run tested, microprocessor-based DDC control device capable of complete Standalone unit control, Master/Slave control or incorporated into a building-wide network using an optional plug-in communication module. The UVC contains a microprocessor that is preprogrammed with the application code required to operate the unit. The UVC supports up to 6 analog inputs, 12 binary inputs, and 9 binary outputs. The UVC EXP I/O board supports up to 4 additional analog inputs and 8 additional binary outputs. Master/Slave units have the controller factory configured and installed for a local peer-to-peer network between these units (network wiring between these units needs to be field installed). Optional network communication is provided via plug-in communication modules that connect directly to the UVC.
2. **Communication Module (optional):** Plug-in network communication module that is attached to the UVC via a 12-pin header and 4 locking standoffs. Available communication modules:

- **Building Automation and Control Network (BACnet®) Master Slave/Token Passing (MS/TP) –** Allows the UVC to interoperate with systems that use the BACnet (MS/TP) protocol with a conformance level of 3. Meets the requirements of ANSI/ASHRAE 135-1995 standard for BACnet systems.
- LonWorks® compliant Space Comfort Controller (SCC) – Supports the LonWorks SCC profile number 8500_10
- Metasys N2® Open – Provides N2 Open network communication capability to the UVC.

3. **Local User Interface (LUI): (see fig. 2-1)** – The LUI provides a unit mounted interface which indicates the current unit operating state and can be used to adjust the unit ventilator operating parameters (operating mode, temperature set points, fan speed and occupancy mode). The LUI features a 2-digit display, 7 keys (1 key is hidden), and 9 individual LED indicators. See "Local User Interface (LUI)" on page 3 for further details.
4. **Tenant Override Switch: (see fig. 2-1)** – Provides a momentary contact closure that causes the unit to enter the "tenant override" operating mode for a set time period (default = 120 minutes).
5. **Time Clock: (optional on standalone units only) (see fig. 2-1)** – Factory mounted 7 day/24 hour, digital time clock with up to twenty (20) programs to sequence the unit ventilator through occupied and unoccupied modes in accordance with a user programmed time schedule.
6. **External Signal Connection Plugs:** Three (3) multi-pin plugs are factory provided and pre-wired with short wire whips that are capped (they must remain capped if not used). Provided for field wiring of :

Figure 1: Component Locations (Vertical Floor Unit Shown)

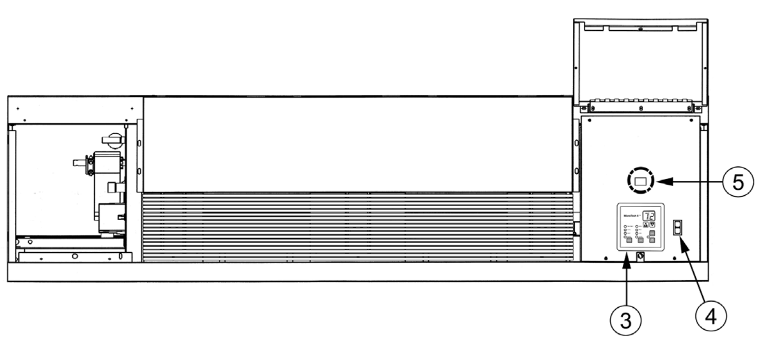


- Remote Wall Mounted Temperature Sensor (optional accessory).
- External Input Signals (by others): unoccupied, remote shutdown, ventilation lockout, dew point/humidity (night time operation), or exhaust interlock signals • External Output Options (by others): lights on/off, fault indication signal, exhaust fan on/off or auxiliary heat signal

Note: *Not all external signal options can be used simultaneously and may not be available on all software models. Refer to the "UVC Input and Output Tables" in IM 739 for available options.*

7. **Electric Connection Box:** Contains the motor speed transformer. Refer to the unit wiring diagram for specifics.
8. **Unit Main Power "On-Off" Switch:** Disconnects the main power to the unit for servicing or when the unit is to be shut down for an extended period of time.
9. Fuse(s) - Fan motor and controls have the hot line(s) protected by factory installed cartridge type fuse(s).
10. **Control Transformer:** 75 VA 24-volt NEC Class 2 transformer for 24 volt power supply. (Located behind the the motor transformer).
11. **Outdoor Air/Return Air Damper Actuator:** Direct coupled, floating point (tristate) actuator that spring returns the outdoor air damper to the closed position upon a loss of power.
12. **Face and Bypass Damper Actuator:** Direct coupled, floating point (tristate) actuator that is non-spring returned (Model AVS only).
13. **Hydronic Coil Low Air Temperature Limit (T6 freezestat):** Factory installed on all units with hydronic (water) coils.The T6 freezestat cuts out at 38oF (+/- 3oF) and automatically resets at 45oF (+/- 3oF).
14. **Low Refrigerant Temperature Sensor (S4):** The S4 sensor is provided on all units with a direct expansion (DX) cooling coil. It is located on the right hand side of the coil "u-bend".
15. **Room Temperature Sensor:** The unit mounted sensor is located in the sampling chamber (front, center section) where room air is continuously drawn through for prompt response to temperature changes in the room. A Remote Wall Mounted Temperature Sensor is also available for remote room temperature sensing. (optional accessory).
16. **Discharge Air Temperature Sensor:** The sensor is located on the second fan from the right to sense discharge air temperatures.
17. **Outdoor Air Temperature Sensor:** The sensor is located in the outdoor air section of the unit before the outdoor air damper. With network applications, the unit mounted sensor can be overridden by a remote sensor through the network.
18. **Outdoor Air Humidity Sensor (optional):** Unit mounted humidity sensor for units using Expanded outdoor enthalpy economizer or Leading Edge indoor/outdoor, true enthalpy comparison economizer. The sensor is located in the outdoor air section of the unit before the outdoor air damper. With network applications, the unit mounted sensor can be overridden by a remote sensor through the network.
19. **Room Humidity Sensor (optional):** Unit mounted humidity sensor for units capable of passive or active dehumidification or with units using Leading Edge indoor/outdoor, true enthalpy comparison economizer. The sensor is located in the sampling chamber (front, center panel) where room air is continuously drawn through for fast response to humidity changes in the room. With network applications, the unit mounted sensor can be overridden by a remote sensor through the network.
20. **CO2 Sensor (optional):** Unit mounted, single beam absorption infrared gas sensor with a sensing range of 0 – 2000 ppm and voltage output of 0 to 10 VDC (100 ohm output impedance). The Pitot Tube sensing device is located in the unit ventilator's return air stream. The optional CO2 sensor is used with the UVC's Demand Control Ventilation feature to vary the amount of outside air based on actual room occupancy. With network applications, the unit mounted sensor can be overridden by a remote sensor through the network.
21. **Control Valve(s) (not shown):** Optional accessory valve(s) may be either 2 position "End of Cycle" (AVS models) or modulating (AVV and AVR models), to control the quantity of water through the coil. Available in 2-way or 3-way configurations. Spring return actuators are required for all hot water and steam heating valves. All heating valves are Normally Open (NO) and all cooling valves Normally Closed (NC).
22. **Water In Temperature Sensor (not shown):** The (S5) water in temperature sensor is factory wired on 2-pipe CW/HW units only. The sensor must be field installed and insulated (by others) on the supply connection of the hydronic coil. It is located on the same side as the coil connections. The sensor measures the entering water temperature to determine if the temperature is acceptable for either heating or cooling based on the unit's operating state.

Figure 2: AV Top View



Economizer Control Capabilities

Basic – Compares the inside and outside air temperatures using item 16 (Room Temperature Sensor) and item 18 (Outdoor Air Temperature Sensor) to determine if outdoor air can be used for "free", economizer cooling operation.

Expanded – Compares the inside and outside air temperatures using item 16 (Room Temperature Sensor) and item 18 (Outdoor Air Temperature Sensor) and calculates the enthalpy of the outside air relative humidity using item 19 (Outdoor Air Humidity Sensor) to determine if outdoor air can be used for "free", economizer cooling operation.

Leading Edge – True enthalpy comparison economizer that compares the inside and outside air temperatures using item 16 (Room Temperature Sensor) and item 18 (Outdoor Air Temperature Sensor) and compares the enthalpy of the inside and outside air relative humidity using item 19 (Outdoor Air Humidity Sensor) and item 20 (Room Humidity Sensor) to determine if outdoor air can be used for "free", economizer cooling operation.

Economizer for Reheat

Basic – Uses items 16 (Room Temperature sensor, item 18 (Outdoor Air Temperature Sensor) and item 20 (Room Humidity Sensor) for active dehumidification (reheat) or to determine if outdoor air can be used for "free", economizer cooling operation.

Leading Edge – Uses items 16 (Room Temperature Sensor), item 18 (Outdoor Air Temperature Sensor), item 19 (Outdoor Air Humidity Sensor) and item 20 (Room Humidity Sensor) for active dehumidification (reheat) or to determine if outdoor air can be used for "free", economizer cooling operation.

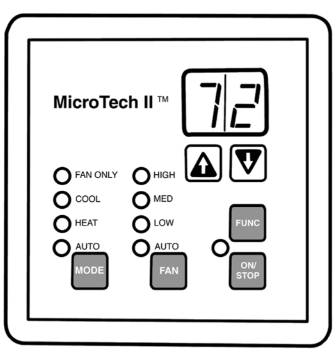
Local User Interface (LUI)

The built-in LUI touch pad (See Figure 3-1) has a 2-digit LED display that indicates the current unit operating state. The touch pad will "digitally display":

- The room set point temperature
- Current Room Temperature (With certain buttons held in place)
- Any fault code for diagnostics at the unit (With certain buttons held in place)

The LUI has a built in menu structure (Hidden Key and Password protected) with 7 keys (1 key is hidden) and 9 individual LED indicators to adjust the unit ventilator operating parameters shown below.

Figure 3: Local User Interface (LUI)



Operating Mode States (4)

- **Heat –** Heating and economizer operation only
- **Cool –** Cooling and economizer operation only
- **Fan Only –** Fan operation only
- **Auto –** Unit automatically switches between heating, cooling and economizer operation to satisfy the room load conditions. The current unit state is also displayed.

Fan States (4)

- **High** (constant speed)
- **Medium** (constant speed)
- **Low** (constant speed)
- **Auto** (part load, variable air) – Varies the fan speed automatically to meet the room load conditions whether the unit is in heating, cooling or economizer mode. The current fan speed is also displayed. During low load or normal operation (about 60% of the time) the fans will operate at low speed. When the load increases to an intermediate demand the fans automatically shift to medium speed. At near design or design load conditions, the fans will operate on high speed. A 10-minute delay between speed changes is incorporated to minimize the awareness of these changes. The outdoor air damper will index based on the fan speed to maintain the required minimum cfm (cubic feet per minute) of ventilation air.

Occupancy Modes (4)

- **Occupied –** Normal, daytime operation where the unit maintains the room set point.
- **Unoccupied –** Night set back operating mode in which the unit responds to a new room set point and cycles to maintain the condition. The fan comes on when heating or cooling is needed and runs until the load is satisfied. The outside air damper is closed during this mode. With direct expansion (DX) cooling units, when a cooling load is satisfied by the refrigerant system, the compressor is de-energized and the Unit Ventilator indoor fan continues to run for a fixed period of time to remove possible frost buildup on the evaporator coil.
- **Stand By Mode –** The unit ventilator maintains the stand by mode set point temperature with the outside air damper closed. The fan runs continuously unless it is configured to cycle in response to the room load.
- **Bypass Mode –** By depressing the Tenant Override Switch (Item 4) the unit is placed back into the Occupied Mode for a predetermined time (default of 120 minutes). This time can be set in 1-minute increments from 1 minute to 240 minutes through the Service Tool or a network.

Certified Drawing	AVV-024F
Daikin Applied certifies that it will furnish equipment in accordance with this drawing and specifications, and subject to its published warranty. Purchaser's approval to this drawing signifies that the equipment is acceptable under the provisions of the job specifications. Any change made hereon by any person whomsoever is subject to acceptance by Daikin	Group: **Unit Ventilator** Type: **Basic Unit Data** Date: **September 2014**

Daikin Classroom Floor Unit Ventilator Model AVV (F Vintage)

Standard Features

- UL/cUL listed.
- AHRI Certified chilled water performance. Unit ventilation rate certified and tested per Air Conditioning, Heating and Refrigeration Institute (AHRI) standard 840.
- Institutional quality cabinet with durable, textured, charcoal bronze paint finish on top surface. Oven baked powder paint on all other exterior panels.
- Welded chassis constructed from galvanized steel.
- Two, top hinged doors for access.
- Removable bar discharge grille.
- Three individual front access panels provided for ease of maintenance and service.
- All access panels have positive positioning threaded fasteners operated with 5/32" hex wrench.
- Insulated unit back.
- Built in pipe tunnel.
- Leveling legs.
- Rigid, double wall, insulated outdoor air damper made from welded galvanized steel, with mohair end and damper seals in turned over edges.
- Composite drain pan-hand of connection field reversible. Direction of slant can be field modified. An optional stainless steel indoor drain pan is also available.
- Room air fan shaft have oilable sleeve bearings for quietness and long life.
- Low speed room air fan constructed of injection molded polypropylene for precise, smooth, quiet performance.
- Energy efficient 1⁄4 H.P. permanent split capacitor (PSC) plug-in room air fan motor fits all size units. Located out of air stream.
- UL listed individual fusing of fan motor and controls.
- Room air motor speed controlled by multi-tap transformer, highmedium- low-off speeds.
- MicroTech™ II Controls (Optional) – State of the art "MicroTech II unit controller is a stand alone microprocessor based DDC control device that is pre-engineered, pre-programmed, pre-tested and factory installed. It provides correct sequence of operations and the advantage of one source responsibility.
- Steam coils equipped with vacuum breaker.
- Manual air vent and drain plug on water coils.
- Throwaway filter(s) factory installed in unit.

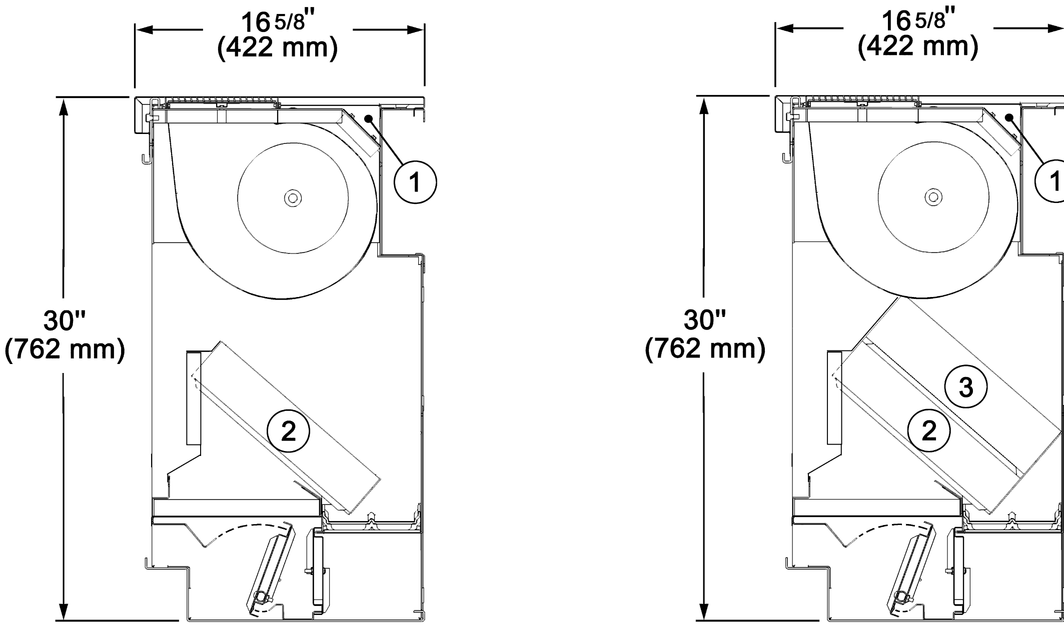
Table 1: Physical Data

			S07	S10	S13	S15
Nominal Airflow CFM (L/s):			**750 (340)**	**1000 (472)**	**1250 (590)**	**1500 (708)**
Fan Data:	**Number of Fans:**		2	3	4	4
	Size:	**Diameter - in (mm)**	8.12 (206mm)	8.12 (206mm)	8.12 (206mm)	8.12 (206mm)
		Width- in (mm)	8.25 (210mm)	8.25 (210mm)	8.25 (210mm)	8.25 (210mm)
Filter Data:	**Nominal Size:**	**in**	10 x 36-1/2 x 1	10 x 48-1/2 x 1	10 x 60-1/2 x 1	10 x 36-1/2 x 1
		(mm)	254 x 927 x 25	254 x 1232 x 25	254 x 1537 x 25	254 x 927 x 25
	Area - Ft^2 (m^2):		2.54 (.24)	3.37 (.31)	4.2 (.39)	5.08 (.47)
	Quantity:		1	1	1	2
Shipping Weight:	**16-5/8" Deep Units:**		350 (168)	425 (193)	495 (225)	570 (259)
	21-7/8" Deep Units:		370 (163)	445 (202)	525 (238)	600 (272)
Coil Water Volume Gallons (Liters):	**1 Row Coil:**		0.25 (0.95)	0.31 (1.17)	0.38 (1.44)	0.44 (1.67)
	2 Row Coil:		0.45 (1.70)	0.57 (2.16)	0.69 (2.61)	0.82 (3.10)
	3 Row Coil:		0.64 (2.42)	0.82 (3.10)	1.01 (3.82)	1.19 (4.50)
	4 Row Coil:		0.83 (3.14)	1.08 (4.09)	1.32 (5.00)	1.57 (5.94)

DAIKIN

Dimensional Data

AVV Unit Cross Sections
Valve Control

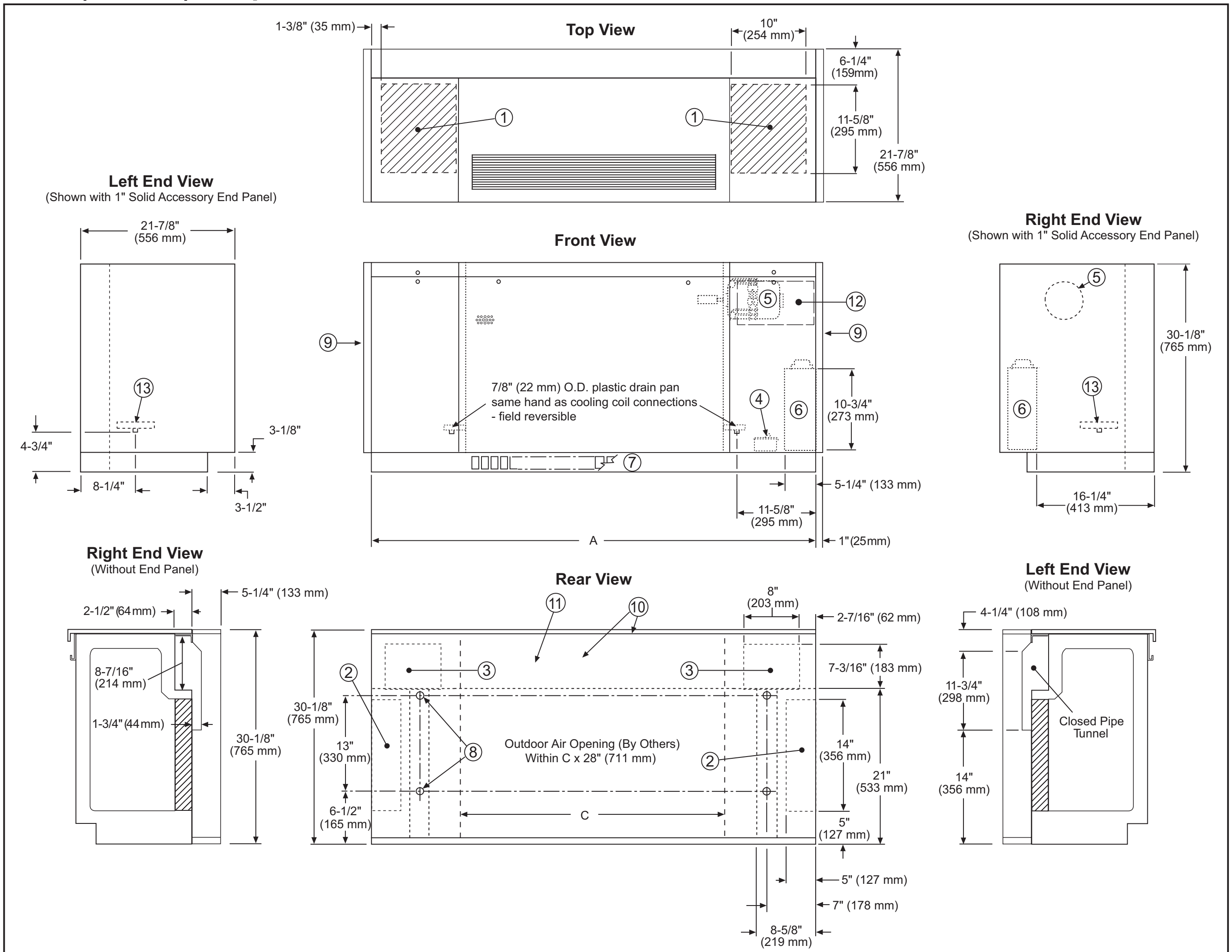


Single Coil Units	Two Coil Units	
1 Raceway for factory wiring 2 Hot Water, Steam, Chilled Water, CW/HW (2-pipe), Direct Expansion, Electric Heat	**Direct Expansion Units (DX)** 1 Raceway for factory wiring 2 Direct Expansion 3 Steam or Electric Heat 2 Hot Water 3 Direct Expansion	**Chilled Water Units** 1 Raceway for factory wiring 2 Hot Water 3 Chilled Water 2 Chilled Water 3 Electric Heat or Steam

Certified Drawing	AVV-031F
Daikin Applied certifies that it will furnish equipment in accordance with this drawing and specifications, and subject to its published warranty. Purchaser's approval to this drawing signifies that the equipment is acceptable under the provisions of the job specifications. Any change made hereon by any person whomsoever is subject to acceptance by Daikin	Group: **Unit Ventilator** Type: **Inlet Air Arrange.** Date: **October 2013**

Daikin Classroom Floor Unit Ventilator Model AVV (F Vintage) Arrangement AB – Full Adapter Back, Closed Pipe Tunnel with Solid Back

21⅞" (556mm) Deep Floor Unit – Dimensions



Uniit Size	Dimensions in inches. (mm)	
	A	C
AV S07	62 (1575)	38 (965)
AV S10	74 (1880)	50 (1270)
AV S13	86 (2184)	62 (1575)
AV S15	98 (2489)	74 (1880)

Drawing Notes (①, *, etc.)

1 Bottom entry within 10" x 11-5/8" (254 mm x 295 mm) area
2 Rear entry area 14" x 5" (356 mm x 127 mm).
3 Opening between pipe tunnel & end compartment.
4 Disconnect Switch for main power wiring.
5 Fan motor.
6 Electrical connection box.
7 Slotted kickplate for return air arrangements; partially open kickplate for draftstop arrangements.
8 (4) - 7/8" (22 mm) diameter holes in back for anchoring unit to wall.
9 Accessory panels not included with unit, order separately as an accessory.
10 Insulated top and back of unit and outside air section of adapter back.
11. Full metal plate across entire back.
12. Controls location (MicroTech II units only).
13. Drain Pan.

Certified Drawing

UV-MTII-Sensor101

Daikin Applied certifies that it will furnish equipment in accordance with this drawing and specifications, and subject to its published warranty. Purchaser's approval to this drawing signifies that the equipment is acceptable under the provisions of the job specifications. Any change made hereon by any person whomsoever is subject to acceptance by Daikin

Group: **Unit Ventilator**

Type: **MicroTech II Sensor**

Date: **December 2013**

Daikin Classroom Unit Ventilator

Standard Wall Mounted, MicroTech™ II Room Sensor Accessory with Tenant Override

The MicroTech II, wall mounted room sensor accessory has a Positive Temperature Coefficient (PTC) silicon sensing element, a red LED for unit status and a tenant override switch.

Sensor part number: 111048101

Included with the pre-assembled sensor:

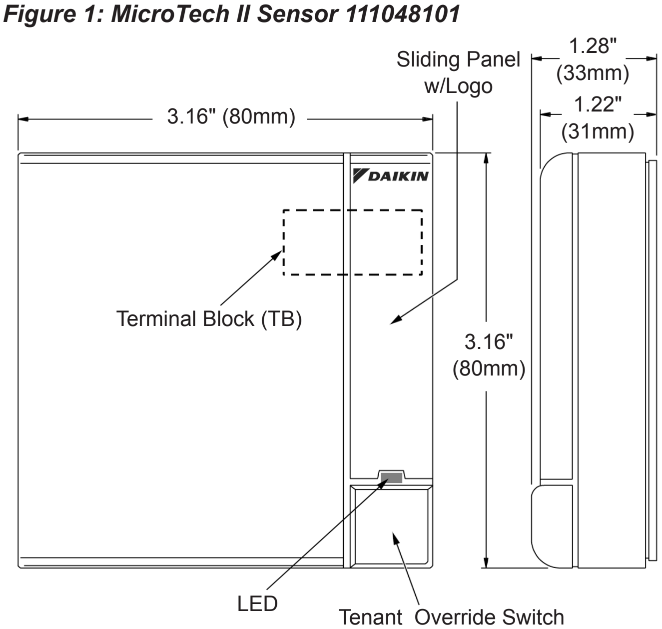
- Large (3.1" × 4.6 [80 × 117 mm]) mounting base (1) for wall box or surface mounting
- End Caps (2)
- Terminal Block (1)
- 1.5mm (1/16 in.) cover screw (1)
- Small (3.1" × 3.1" [80 × 80 mm]) mounting base (1) with attached terminal block (1) for surface mounting
- Sliding panel with printed (Daikin) logo
- Hardware for wallbox or surface mounting

Sensor Specifications

Type: 1035 ohms @ 77°F (25°C)

Accuracy: ±0.9°F (0.5°C) between 5°F and 167°F (-15°C and 75°C)

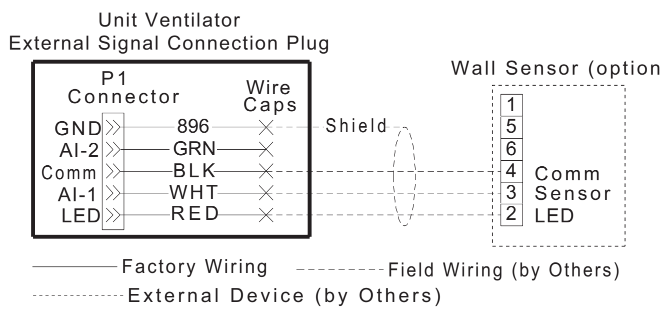
Figure 1: MicroTech II Sensor 111048101



Wiring

All field wiring connections must be run in shielded cable with the shield drain wires connected as shown in the wiring diagram.

Figure 2: Wall mounted temperature sensor wiring for standard wall sensor



Maximum Wire Length for Less than 1°F Error	
Wire Gauge	**Wire Length**
14 AWG	800 Ft
16 AWG	500 Ft
18 AWG	310 Ft
20 AWG	200 Ft
22 AWG	124 Ft

Figure 3: Wallbox mounting

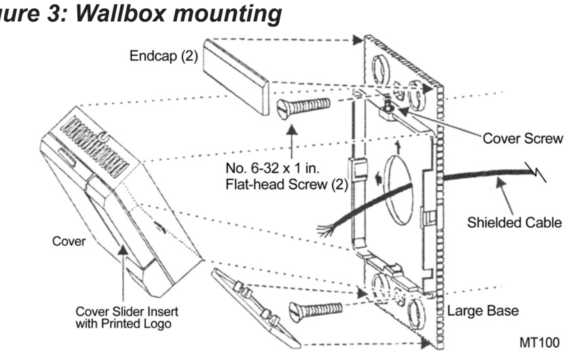
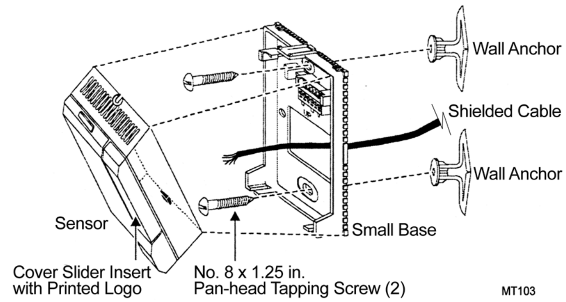


Figure 4: Surface mounting using small base



Unit Ventilators™

Job Information	*Technical Data Sheet*
Job Name	Honeywell-Chatham School District
Date	12/9/2014
Submitted By	Jennifer Olivo
Software Version	02.50
Unit Tag	Chatham MS-UV (Stage) 1000 CFM

Unit Overview

Model Number	Voltage	Heating Coil Type
UAVV6S10	115/60/1	Hot Water

Physical

Unit		Controls
Arrangement	**Weight**	**Type**
Vertical, Floor Mounted	445 lb	Factory Installed Digital Controls

Electrical

Voltage	Minimum Voltage	Maximum Voltage	Total Unit MCA	Maximum Fuse Size
115/60/1 V/Hz/Phase	104 V	126 V	3.9 A	15 A

Fan

Performance				
Speed	**Air Volume** CFM	**External Static Pressure** inH_2O	**Motor Power** HP	**Fan Full Load Current** A
High	1014	0.00	0.250	2.70

Hot Water Coil

Performance				
Total Capacity Btu/hr	**Air Temperature Dry Bulb**		**Fluid Temperature**	
	Entering °F	**Leaving** °F	**Entering** °F	**Leaving** °F
46973	70.0	112.7	180.0	133.0

Fluid		
Type	**Flow Rate** gpm	**Pressure Drop** ft H_2O
Water	2.00	0.85

Physical
Number of Rows
2

Warranty

Type	
Extended:	Ext. 4 yr. parts - (Entire Unit)

Notes

Accessories

Part Number	Description
106041390	1" End Pnl, Ant Ivory, 21-7/8"D, Solid (AV AZ)
111048101	STANDARD Room Sensor with Override
105631514	LVR HORZ W/GRILLE 10 3/8HX48L DRK BRZE- W/FLGE S1

Certified Drawing

AVS-V-R-MTII-808

Daikin Applied certifies that it will furnish equipment in accordance with this drawing and specifications, and subject to its published warranty. Purchaser's approval to this drawing signifies that the equipment is acceptable under the provisions of the job specifications. Any change made hereon by any person whomsoever is subject to acceptance by Daikin

Group: **Unit Ventilator**
Type: MTII **DDC Control**
Date: **January 2014**

Daikin Classroom Floor Unit Ventilator Models AVS, AVV, and AVR

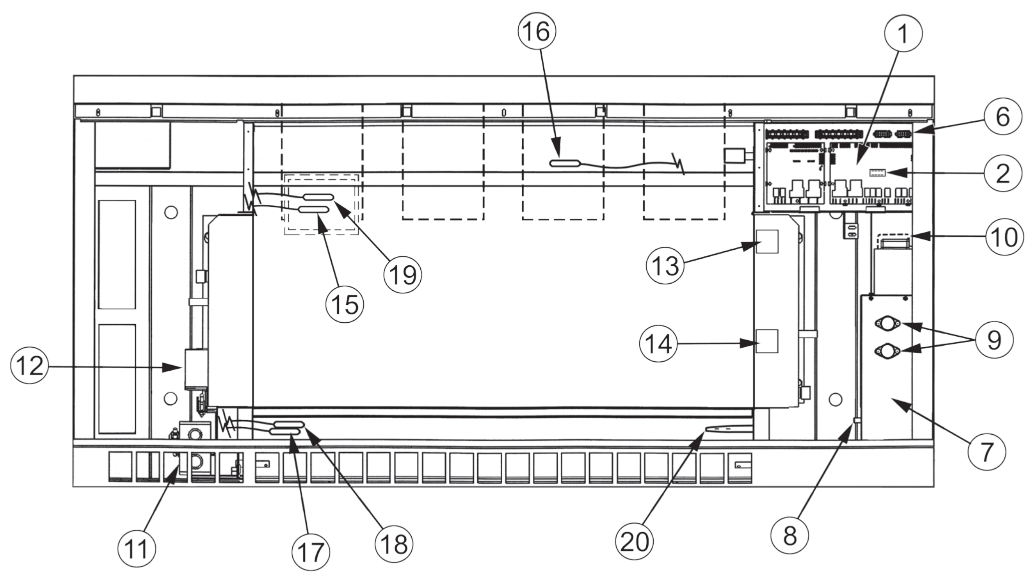
MicroTech II™ Unit Mounted DDC Control Components

1. **MicroTech II Unit Ventilator Controller (UVC):** (Located Beneath the Local User Interface Panel). Factory mounted and run tested, microprocessor-based DDC control device capable of complete Standalone unit control, Master/Slave control or incorporated into a building-wide network using an optional plug-in communication module. The UVC contains a microprocessor that is preprogrammed with the application code required to operate the unit. The UVC supports up to 6 analog inputs, 12 binary inputs, and 9 binary outputs. The UVC EXP I/O board supports up to 4 additional analog inputs and 8 additional binary outputs. Master/Slave units have the controller factory configured and installed for a local peer-to-peer network between these units (network wiring between these units needs to be field installed). Optional network communication is provided via plug-in communication modules that connect directly to the UVC.
2. **Communication Module (optional):** Plug-in network communication module that is attached to the UVC via a 12-pin header and 4 locking standoffs. Available communication modules:

- **Building Automation and Control Network (BACnet®) Master Slave/Token Passing (MS/TP) –** Allows the UVC to interoperate with systems that use the BACnet (MS/TP) protocol with a conformance level of 3. Meets the requirements of ANSI/ASHRAE 135-1995 standard for BACnet systems.
- LonWorks® compliant Space Comfort Controller (SCC) – Supports the LonWorks SCC profile number 8500_10
- Metasys N2® Open – Provides N2 Open network communication capability to the UVC.

3. **Local User Interface (LUI): (see fig. 2-1)** – The LUI provides a unit mounted interface which indicates the current unit operating state and can be used to adjust the unit ventilator operating parameters (operating mode, temperature set points, fan speed and occupancy mode). The LUI features a 2-digit display, 7 keys (1 key is hidden), and 9 individual LED indicators. See "Local User Interface (LUI)" on page 3 for further details.
4. **Tenant Override Switch: (see fig. 2-1)** – Provides a momentary contact closure that causes the unit to enter the "tenant override" operating mode for a set time period (default = 120 minutes).
5. **Time Clock: (optional on standalone units only) (see fig. 2-1)** – Factory mounted 7 day/24 hour, digital time clock with up to twenty (20) programs to sequence the unit ventilator through occupied and unoccupied modes in accordance with a user programmed time schedule.
6. **External Signal Connection Plugs:** Three (3) multi-pin plugs are factory provided and pre-wired with short wire whips that are capped (they must remain capped if not used). Provided for field wiring of :

Figure 1: Component Locations (Vertical Floor Unit Shown)

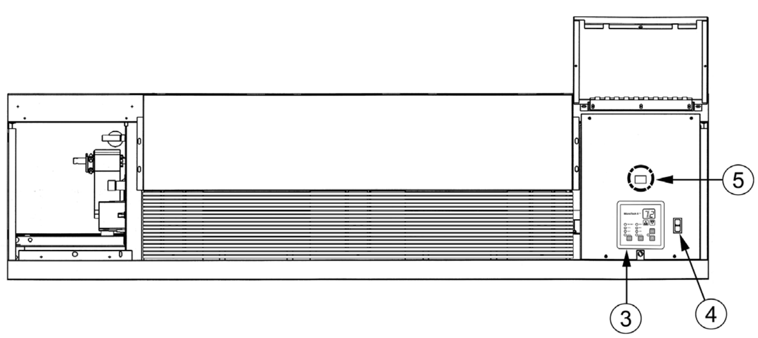


- Remote Wall Mounted Temperature Sensor (optional accessory).
- External Input Signals (by others): unoccupied, remote shutdown, ventilation lockout, dew point/humidity (night time operation), or exhaust interlock signals • External Output Options (by others): lights on/off, fault indication signal, exhaust fan on/off or auxiliary heat signal

Note: *Not all external signal options can be used simultaneously and may not be available on all software models. Refer to the "UVC Input and Output Tables" in IM 739 for available options.*

7. **Electric Connection Box:** Contains the motor speed transformer. Refer to the unit wiring diagram for specifics.
8. **Unit Main Power "On-Off" Switch:** Disconnects the main power to the unit for servicing or when the unit is to be shut down for an extended period of time.
9. Fuse(s) - Fan motor and controls have the hot line(s) protected by factory installed cartridge type fuse(s).
10. **Control Transformer:** 75 VA 24-volt NEC Class 2 transformer for 24 volt power supply. (Located behind the the motor transformer).
11. **Outdoor Air/Return Air Damper Actuator:** Direct coupled, floating point (tristate) actuator that spring returns the outdoor air damper to the closed position upon a loss of power.
12. **Face and Bypass Damper Actuator:** Direct coupled, floating point (tristate) actuator that is non-spring returned (Model AVS only).
13. **Hydronic Coil Low Air Temperature Limit (T6 freezestat):** Factory installed on all units with hydronic (water) coils.The T6 freezestat cuts out at 38oF (+/- 3oF) and automatically resets at 45oF (+/- 3oF).
14. **Low Refrigerant Temperature Sensor (S4):** The S4 sensor is provided on all units with a direct expansion (DX) cooling coil. It is located on the right hand side of the coil "u-bend".
15. **Room Temperature Sensor:** The unit mounted sensor is located in the sampling chamber (front, center section) where room air is continuously drawn through for prompt response to temperature changes in the room. A Remote Wall Mounted Temperature Sensor is also available for remote room temperature sensing. (optional accessory).
16. **Discharge Air Temperature Sensor:** The sensor is located on the second fan from the right to sense discharge air temperatures.
17. **Outdoor Air Temperature Sensor:** The sensor is located in the outdoor air section of the unit before the outdoor air damper. With network applications, the unit mounted sensor can be overridden by a remote sensor through the network.
18. **Outdoor Air Humidity Sensor (optional):** Unit mounted humidity sensor for units using Expanded outdoor enthalpy economizer or Leading Edge indoor/outdoor, true enthalpy comparison economizer. The sensor is located in the outdoor air section of the unit before the outdoor air damper. With network applications, the unit mounted sensor can be overridden by a remote sensor through the network.
19. **Room Humidity Sensor (optional):** Unit mounted humidity sensor for units capable of passive or active dehumidification or with units using Leading Edge indoor/outdoor, true enthalpy comparison economizer. The sensor is located in the sampling chamber (front, center panel) where room air is continuously drawn through for fast response to humidity changes in the room. With network applications, the unit mounted sensor can be overridden by a remote sensor through the network.
20. **CO2 Sensor (optional):** Unit mounted, single beam absorption infrared gas sensor with a sensing range of 0 – 2000 ppm and voltage output of 0 to 10 VDC (100 ohm output impedance). The Pitot Tube sensing device is located in the unit ventilator's return air stream. The optional CO2 sensor is used with the UVC's Demand Control Ventilation feature to vary the amount of outside air based on actual room occupancy. With network applications, the unit mounted sensor can be overridden by a remote sensor through the network.
21. **Control Valve(s) (not shown):** Optional accessory valve(s) may be either 2 position "End of Cycle" (AVS models) or modulating (AVV and AVR models), to control the quantity of water through the coil. Available in 2-way or 3-way configurations. Spring return actuators are required for all hot water and steam heating valves. All heating valves are Normally Open (NO) and all cooling valves Normally Closed (NC).
22. **Water In Temperature Sensor (not shown):** The (S5) water in temperature sensor is factory wired on 2-pipe CW/HW units only. The sensor must be field installed and insulated (by others) on the supply connection of the hydronic coil. It is located on the same side as the coil connections. The sensor measures the entering water temperature to determine if the temperature is acceptable for either heating or cooling based on the unit's operating state.

Figure 2: AV Top View



Economizer Control Capabilities

Basic – Compares the inside and outside air temperatures using item 16 (Room Temperature Sensor) and item 18 (Outdoor Air Temperature Sensor) to determine if outdoor air can be used for "free", economizer cooling operation.

Expanded – Compares the inside and outside air temperatures using item 16 (Room Temperature Sensor) and item 18 (Outdoor Air Temperature Sensor) and calculates the enthalpy of the outside air relative humidity using item 19 (Outdoor Air Humidity Sensor) to determine if outdoor air can be used for "free", economizer cooling operation.

Leading Edge – True enthalpy comparison economizer that compares the inside and outside air temperatures using item 16 (Room Temperature Sensor) and item 18 (Outdoor Air Temperature Sensor) and compares the enthalpy of the inside and outside air relative humidity using item 19 (Outdoor Air Humidity Sensor) and item 20 (Room Humidity Sensor) to determine if outdoor air can be used for "free", economizer cooling operation.

Economizer for Reheat

Basic – Uses items 16 (Room Temperature sensor, item 18 (Outdoor Air Temperature Sensor) and item 20 (Room Humidity Sensor) for active dehumidification (reheat) or to determine if outdoor air can be used for "free", economizer cooling operation.

Leading Edge – Uses items 16 (Room Temperature Sensor), item 18 (Outdoor Air Temperature Sensor), item 19 (Outdoor Air Humidity Sensor) and item 20 (Room Humidity Sensor) for active dehumidification (reheat) or to determine if outdoor air can be used for "free", economizer cooling operation.

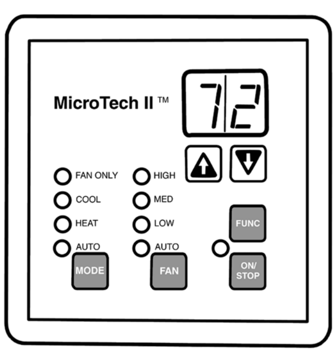
Local User Interface (LUI)

The built-in LUI touch pad (See Figure 3-1) has a 2-digit LED display that indicates the current unit operating state. The touch pad will "digitally display":

- The room set point temperature
- Current Room Temperature (With certain buttons held in place)
- Any fault code for diagnostics at the unit (With certain buttons held in place)

The LUI has a built in menu structure (Hidden Key and Password protected) with 7 keys (1 key is hidden) and 9 individual LED indicators to adjust the unit ventilator operating parameters shown below.

Figure 3: Local User Interface (LUI)



Operating Mode States (4)

- **Heat –** Heating and economizer operation only
- **Cool –** Cooling and economizer operation only
- **Fan Only –** Fan operation only
- **Auto –** Unit automatically switches between heating, cooling and economizer operation to satisfy the room load conditions. The current unit state is also displayed.

Fan States (4)

- **High** (constant speed)
- **Medium** (constant speed)
- **Low** (constant speed)
- **Auto** (part load, variable air) – Varies the fan speed automatically to meet the room load conditions whether the unit is in heating, cooling or economizer mode. The current fan speed is also displayed. During low load or normal operation (about 60% of the time) the fans will operate at low speed. When the load increases to an intermediate demand the fans automatically shift to medium speed. At near design or design load conditions, the fans will operate on high speed. A 10-minute delay between speed changes is incorporated to minimize the awareness of these changes. The outdoor air damper will index based on the fan speed to maintain the required minimum cfm (cubic feet per minute) of ventilation air.

Occupancy Modes (4)

- **Occupied –** Normal, daytime operation where the unit maintains the room set point.
- **Unoccupied –** Night set back operating mode in which the unit responds to a new room set point and cycles to maintain the condition. The fan comes on when heating or cooling is needed and runs until the load is satisfied. The outside air damper is closed during this mode. With direct expansion (DX) cooling units, when a cooling load is satisfied by the refrigerant system, the compressor is de-energized and the Unit Ventilator indoor fan continues to run for a fixed period of time to remove possible frost buildup on the evaporator coil.
- **Stand By Mode –** The unit ventilator maintains the stand by mode set point temperature with the outside air damper closed. The fan runs continuously unless it is configured to cycle in response to the room load.
- **Bypass Mode –** By depressing the Tenant Override Switch (Item 4) the unit is placed back into the Occupied Mode for a predetermined time (default of 120 minutes). This time can be set in 1-minute increments from 1 minute to 240 minutes through the Service Tool or a network.

Certified Drawing

AVV-H-061F

Daikin Applied certifies that it will furnish equipment in accordance with this drawing and specifications, and subject to its published warranty. Purchaser's approval to this drawing signifies that the equipment is acceptable under the provisions of the job specifications. Any change made hereon by any person whomsoever is subject to acceptance by Daikin

Group: **Unit Ventilator**

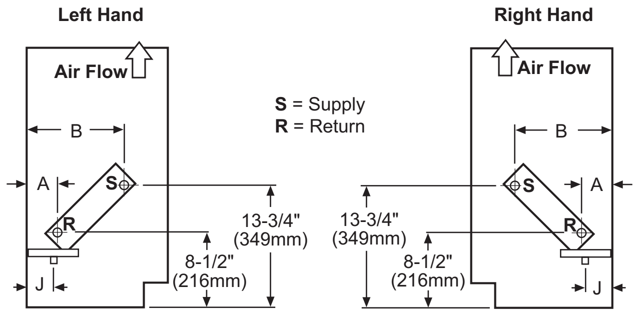
Type: **Coil Connections**

Date: **October 2013**

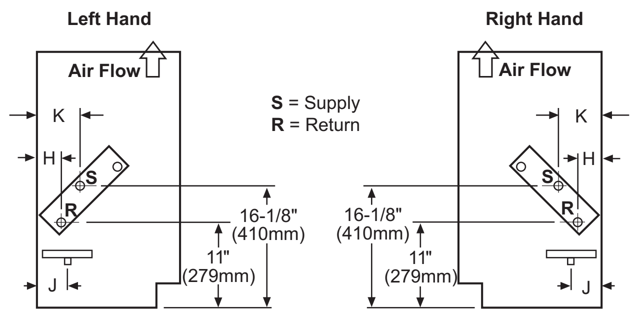
Daikin Classroom Floor Unit Ventilator Model AVV (F Vintage)

Coil Headers, Locations (Heating)

☐ Hot Water Only Unit (Coils 65, 66, 67)



☐ Steam Heating Only Unit (Coils 68, 69, 78, 79)



Note: *For opposite end drain steam coils (code 78, 79) Return (R) is 7¼" (184mm) from bottom of unit and (H) 2" (51mm) from the back of unit.*

☐ Steam Heating Only Unit (Coils 68, 69, 78, 79)

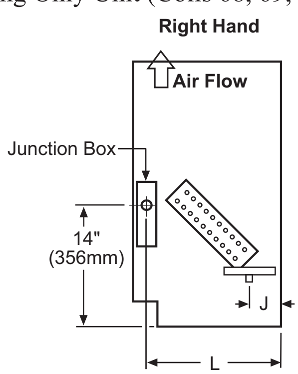


Table 1: Dimensions

Unit Depth	Coil Connection Locations - Dimensions (in inches)					
	A	B	H	J	K	L
16⅝	3¾	12¼	2⅞	3	5	14
21⅞	9	17½	8⅛	8¼	10¼	19¼

Table 2: Coil Water Capacities (Gallons/Liters)

Unit Series	S07		S10		S13		S15	
	Gal	Liter	Gal	Liter	Gal	Liter	Gal	Liter
1 Row Coil	0.24	0.91	0.29	1.10	0.35	1.32	0.41	1.55
2 Row Coil	0.41	1.55	0.52	1.97	0.63	2.38	0.74	2.80
3 Row Coil	0.58	2.20	0.74	2.80	0.92	3.48	1.07	4.05
4 Row Coil	0.76	2.88	0.96	3.63	1.2	4.54	1.4	5.30

Table 3: Heating Only - Coil Position/Combinations in Air Stream (one coil per position)

		Basic Valve Control
First Position In Airstream	Second Position In Airstream	AVV
Heating Only		
65 66 67 68 69 78 79	Z	•
12 13	Z	•

• = Available

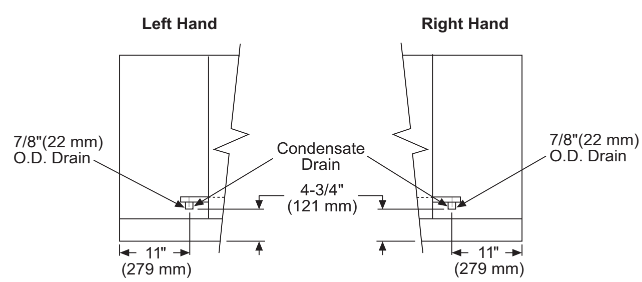
Heating Coils:
65 = 1 Row Hot Water Coil
66 = 2 Row Hot Water Coil
67 = 3 Row Hot Water Coil
68 = Low Capacity Steam Coil
69 = High Capacity Steam Coil
78 = Opposite End Drain Low Capacity Steam Coil
79 = Opposite End Drain High Capacity Steam Coil
12 = Low Electric Heat Coil
13 = High Electric Heat Coil

Cooling Coils:
Z = None

Notes:

1. *All coils have same end supply and return connections.*
2. *Steam coils have a factory installed pressure equalizing valve and a 24" (610mm) long pressure equalizing line which terminates in a ½" M.P.T. fitting.*
3. *Cooling condensate drain pan is shipped sloped down towards the cooling coil connections but is field reversible.*
4. *For limitations with coil combinations see table Table 3.*
5. *Hot water coil connections are 7/8" I.D. (female) and terminate 9" (229mm) from the end of the unit.*
6. *Steam coils are 1-1/8" female (sweat) connections and terminate 9" (229mm) from the end of the unit.*
7. *All dimensions are approximated.*

Condensate Drain Location



Front View of End Compartment (Without End Panels)

DAIKIN

Certified Drawing	AVV-024F
Daikin Applied certifies that it will furnish equipment in accordance with this drawing and specifications, and subject to its published warranty. Purchaser's approval to this drawing signifies that the equipment is acceptable under the provisions of the job specifications. Any change made hereon by any person whomsoever is subject to acceptance by Daikin	Group: **Unit Ventilator** Type: **Basic Unit Data** Date: **September 2014**

Daikin Classroom Floor Unit Ventilator Model AVV (F Vintage)

Standard Features

- UL/cUL listed.
- AHRI Certified chilled water performance. Unit ventilation rate certified and tested per Air Conditioning, Heating and Refrigeration Institute (AHRI) standard 840.
- Institutional quality cabinet with durable, textured, charcoal bronze paint finish on top surface. Oven baked powder paint on all other exterior panels.
- Welded chassis constructed from galvanized steel.
- Two, top hinged doors for access.
- Removable bar discharge grille.
- Three individual front access panels provided for ease of maintenance and service.
- All access panels have positive positioning threaded fasteners operated with 5/32" hex wrench.
- Insulated unit back.
- Built in pipe tunnel.
- Leveling legs.
- Rigid, double wall, insulated outdoor air damper made from welded galvanized steel, with mohair end and damper seals in turned over edges.
- Composite drain pan-hand of connection field reversible. Direction of slant can be field modified. An optional stainless steel indoor drain pan is also available.
- Room air fan shaft have oilable sleeve bearings for quietness and long life.
- Low speed room air fan constructed of injection molded polypropylene for precise, smooth, quiet performance.
- Energy efficient 1⁄4 H.P. permanent split capacitor (PSC) plug-in room air fan motor fits all size units. Located out of air stream.
- UL listed individual fusing of fan motor and controls.
- Room air motor speed controlled by multi-tap transformer, highmedium- low-off speeds.
- MicroTech™ II Controls (Optional) – State of the art "MicroTech II unit controller is a stand alone microprocessor based DDC control device that is pre-engineered, pre-programmed, pre-tested and factory installed. It provides correct sequence of operations and the advantage of one source responsibility.
- Steam coils equipped with vacuum breaker.
- Manual air vent and drain plug on water coils.
- Throwaway filter(s) factory installed in unit.

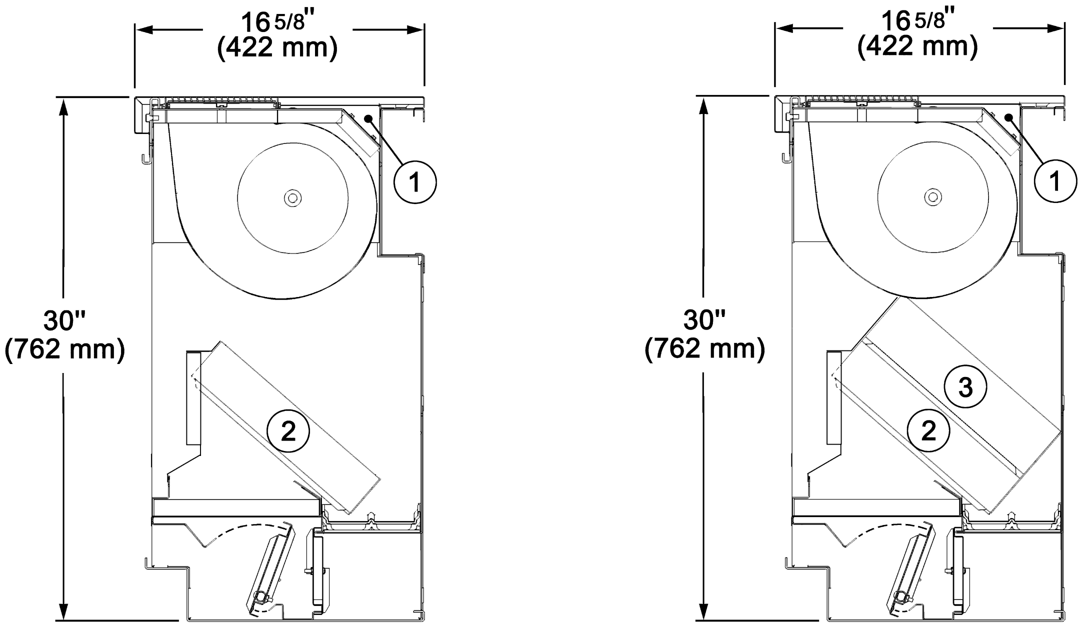
Table 1: Physical Data

			S07	S10	S13	S15
Nominal Airflow CFM (L/s):			**750 (340)**	**1000 (472)**	**1250 (590)**	**1500 (708)**
Fan Data:	**Number of Fans:**		2	3	4	4
	Size:	**Diameter - in (mm)**	8.12 (206mm)	8.12 (206mm)	8.12 (206mm)	8.12 (206mm)
		Width- in (mm)	8.25 (210mm)	8.25 (210mm)	8.25 (210mm)	8.25 (210mm)
Filter Data:	**Nominal Size:**	**in**	10 x 36-1/2 x 1	10 x 48-1/2 x 1	10 x 60-1/2 x 1	10 x 36-1/2 x 1
		(mm)	254 x 927 x 25	254 x 1232 x 25	254 x 1537 x 25	254 x 927 x 25
	Area - Ft^2 (m^2):		2.54 (.24)	3.37 (.31)	4.2 (.39)	5.08 (.47)
	Quantity:		1	1	1	2
Shipping Weight:	**16-5/8" Deep Units:**		350 (168)	425 (193)	495 (225)	570 (259)
	21-7/8" Deep Units:		370 (163)	445 (202)	525 (238)	600 (272)
Coil Water Volume Gallons (Liters):	**1 Row Coil:**		0.25 (0.95)	0.31 (1.17)	0.38 (1.44)	0.44 (1.67)
	2 Row Coil:		0.45 (1.70)	0.57 (2.16)	0.69 (2.61)	0.82 (3.10)
	3 Row Coil:		0.64 (2.42)	0.82 (3.10)	1.01 (3.82)	1.19 (4.50)
	4 Row Coil:		0.83 (3.14)	1.08 (4.09)	1.32 (5.00)	1.57 (5.94)

DAIKIN

Dimensional Data

AVV Unit Cross Sections
Valve Control

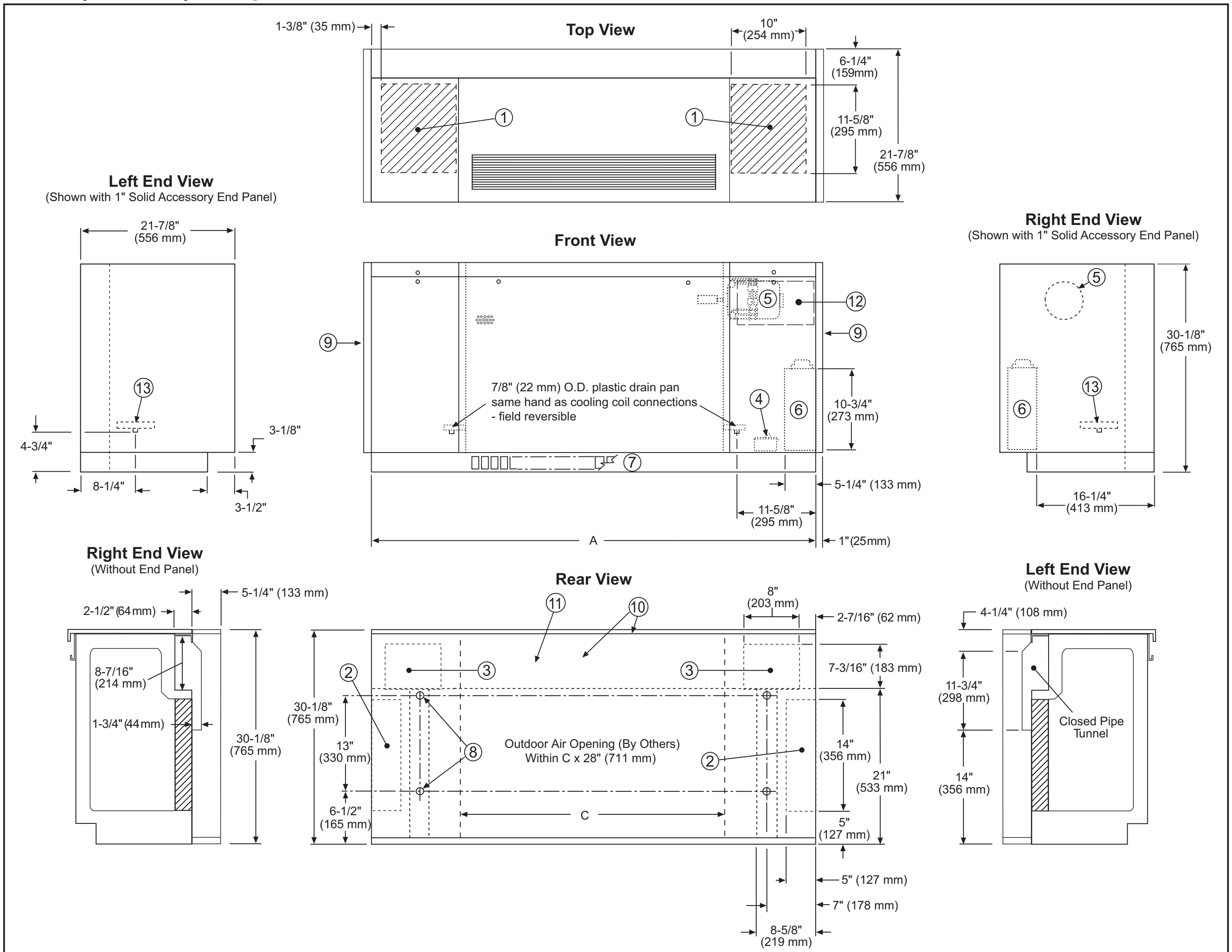


Single Coil Units	Two Coil Units	
1 Raceway for factory wiring 2 Hot Water, Steam, Chilled Water, CW/HW (2-pipe), Direct Expansion, Electric Heat	**Direct Expansion Units (DX)** 1 Raceway for factory wiring 2 Direct Expansion 3 Steam or Electric Heat 2 Hot Water 3 Direct Expansion	**Chilled Water Units** 1 Raceway for factory wiring 2 Hot Water 3 Chilled Water 2 Chilled Water 3 Electric Heat or Steam

Certified Drawing	AVV-031F
Daikin Applied certifies that it will furnish equipment in accordance with this drawing and specifications, and subject to its published warranty. Purchaser's approval to this drawing signifies that the equipment is acceptable under the provisions of the job specifications. Any change made hereon by any person whomsoever is subject to acceptance by Daikin	Group: **Unit Ventilator** Type: **Inlet Air Arrange.** Date: **October 2013**

Daikin Classroom Floor Unit Ventilator Model AVV (F Vintage) Arrangement AB – Full Adapter Back, Closed Pipe Tunnel with Solid Back

21⅞" (556mm) Deep Floor Unit – Dimensions



Uniit Size	Dimensions in inches. (mm)		Drawing Notes (1, *, etc.)
	A	C	
AV S07	62 (1575)	38 (965)	1 Bottom entry within 10" x 11-5/8" (254 mm x 295 mm) area 2 Rear entry area 14" x 5" (356 mm x 127 mm). 3 Opening between pipe tunnel & end compartment. 4 Disconnect Switch for main power wiring.
AV S10	74 (1880)	50 (1270)	5 Fan motor. 6 Electrical connection box.
AV S13	86 (2184)	62 (1575)	7 Slotted kickplate for return air arrangements; partially open kickplate for draftstop arrangements. 8 (4) - 7/8" (22 mm) diameter holes in back for anchoring unit to wall.
AV S15	98 (2489)	74 (1880)	9 Accessory panels not included with unit, order separately as an accessory. 10 Insulated top and back of unit and outside air section of adapter back. 11. Full metal plate across entire back. 12. Controls location (MicroTech II units only). 13. Drain Pan.

Daikin Applied certifies that it will furnish equipment in accordance with this drawing and specifications, and subject to its published warranty. Purchaser's approval to this drawing signifies that the equipment is acceptable under the provisions of the job specifications. Any change made hereon by any person whomsoever is subject to acceptance by Daikin

Group:	**Unit Ventilator**
Type:	**MicroTech II Sensor**
Date:	**December 2013**

Daikin Classroom Unit Ventilator

Standard Wall Mounted, MicroTech™ II Room Sensor Accessory with Tenant Override

The MicroTech II, wall mounted room sensor accessory has a Positive Temperature Coefficient (PTC) silicon sensing element, a red LED for unit status and a tenant override switch.

Sensor part number: 111048101

Included with the pre-assembled sensor:

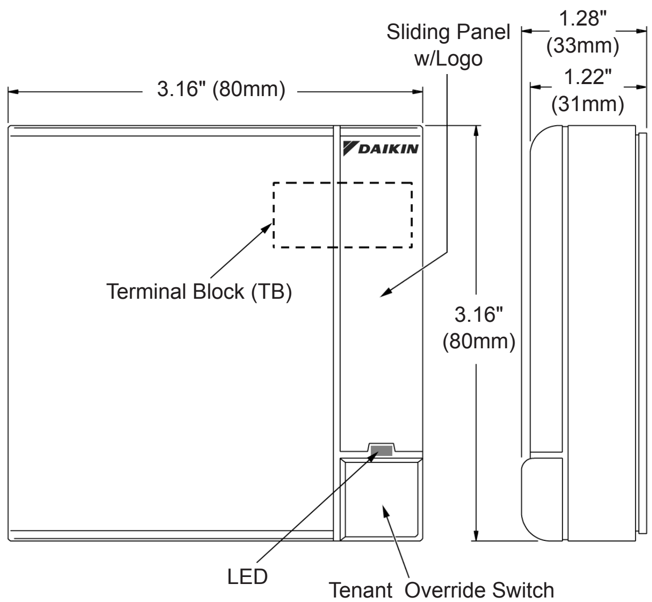
- Large (3.1" × 4.6 [80 × 117 mm]) mounting base (1) for wall box or surface mounting
- End Caps (2)
- Terminal Block (1)
- 1.5mm (1/16 in.) cover screw (1)
- Small (3.1" × 3.1" [80 × 80 mm]) mounting base (1) with attached terminal block (1) for surface mounting
- Sliding panel with printed (Daikin) logo
- Hardware for wallbox or surface mounting

Sensor Specifications

Type: 1035 ohms @ 77°F (25°C)

Accuracy: ±0.9°F (0.5°C) between 5°F and 167°F (-15°C and 75°C)

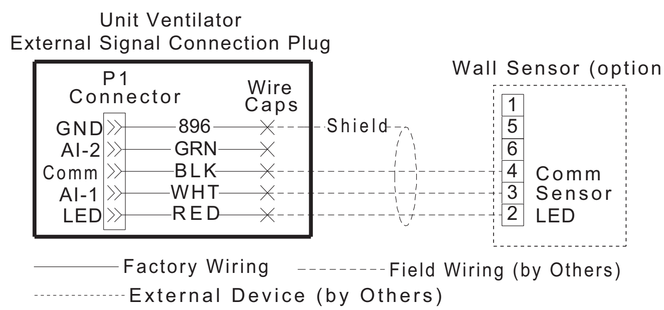
Figure 1: MicroTech II Sensor 111048101



Wiring

All field wiring connections must be run in shielded cable with the shield drain wires connected as shown in the wiring diagram.

Figure 2: Wall mounted temperature sensor wiring for standard wall sensor



Maximum Wire Length for Less than 1°F Error	
Wire Gauge	**Wire Length**
14 AWG	800 Ft
16 AWG	500 Ft
18 AWG	310 Ft
20 AWG	200 Ft
22 AWG	124 Ft

Figure 3: Wallbox mounting

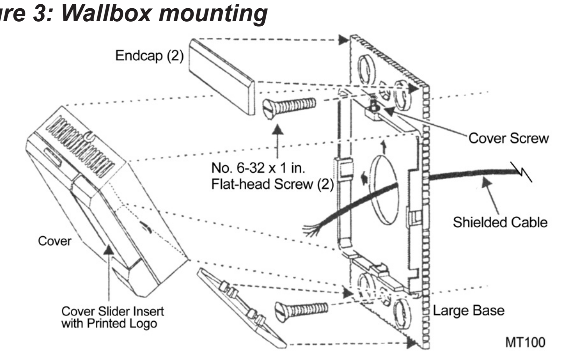
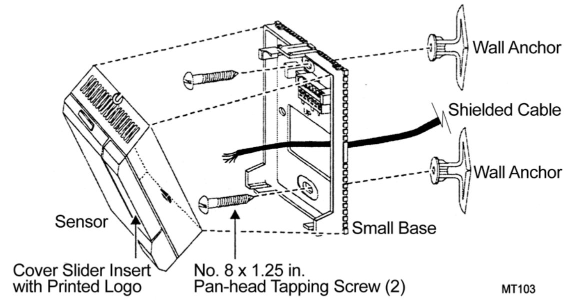


Figure 4: Surface mounting using small base



Job Information	*Technical Data Sheet*
Job Name	Honeywell-Chatham School District
Date	12/9/2014
Submitted By	Jennifer Olivo
Software Version	02.50
Unit Tag	Chatham MS-UV (Heating & Cooling)

Unit Overview

Model Number	Voltage	Cooling Coil Type	Heating Coil Type
UAVV6S15	115/60/1	DX	Hot Water

Physical

Unit		Controls
Arrangement	**Weight**	**Type**
Vertical, Floor Mounted	600 lb	Factory Installed Digital Controls

Electrical

Voltage	Minimum Voltage	Maximum Voltage	Total Unit MCA	Maximum Fuse Size
115/60/1 V/Hz/Phase	104 V	126 V	3.9 A	15 A

Fan

Performance

Speed	Air Volume CFM	External Static Pressure inH_2O	Motor Power HP	Fan Full Load Current A
High	1444	0.00	0.250	2.70

Direct Expansion Coil

Performance

Capacity			Air Temperature			
			Entering		Leaving	
Total Btu/hr	Sensible Btu/hr	Evap Refrigerant Temperature °F	Dry Bulb °F	Wet Bulb °F	Dry Bulb °F	Wet Bulb °F
53666	40250	45.0	80.0	67.0	54.3	54.3

Hot Water Coil

Performance

Total Capacity Btu/hr	Air Temperature Dry Bulb		Fluid Temperature	
	Entering °F	Leaving °F	Entering °F	Leaving °F
62878	70.0	110.1	180.0	117.1

Fluid

Type	Flow Rate gpm	Pressure Drop ft H_2O
Water	2.00	0.65

Physical

Number of Rows
2

Warranty

	Type
Extended:	Ext. 4 yr. parts - (Entire Unit)

Notes

Accessories

Part Number	Description
105677701	Auxiliary Drain Pan for Unit End Compartment - AV
106041390	1" End Pnl, Ant Ivory, 21-7/8"D, Solid (AV AZ)
107292502	Head Press Variable Spd Kit-Condensing Units-120/
105631524	LVR HZ WGRL 10 3/8HX72L CLR ANOD W/FLGE S15 H15 S
111048101	STANDARD Room Sensor with Override

Certified Drawing	AVS-V-R-MTII-808
Daikin Applied certifies that it will furnish equipment in accordance with this drawing and specifications, and subject to its published warranty. Purchaser's approval to this drawing signifies that the equipment is acceptable under the provisions of the job specifications. Any change made hereon by any person whomsoever is subject to acceptance by Daikin	Group: **Unit Ventilator**
	Type: MTII **DDC Control**
	Date: **January 2014**

Daikin Classroom Floor Unit Ventilator Models AVS, AVV, and AVR

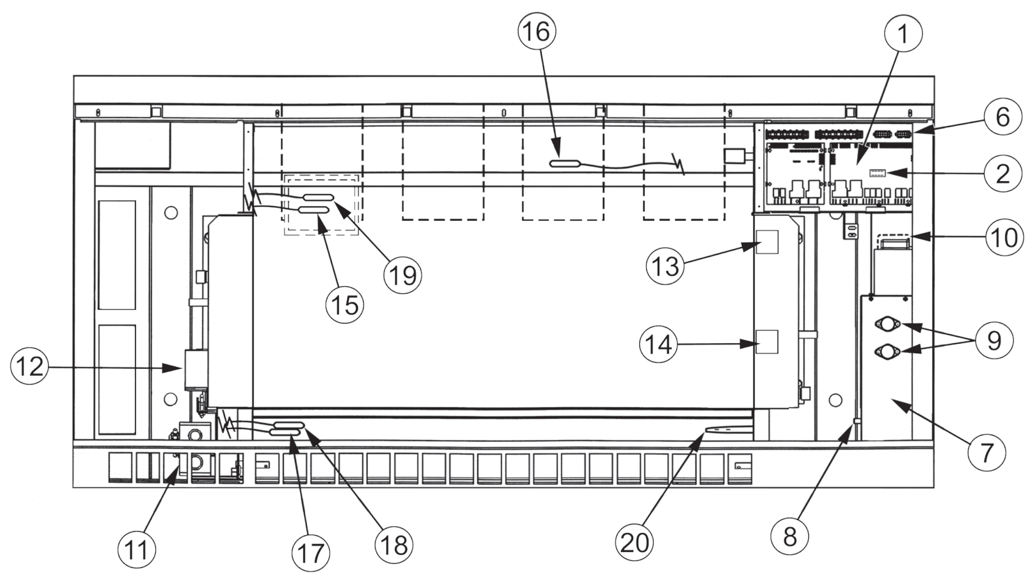
MicroTech II™ Unit Mounted DDC Control Components

1. **MicroTech II Unit Ventilator Controller (UVC):** (Located Beneath the Local User Interface Panel). Factory mounted and run tested, microprocessor-based DDC control device capable of complete Standalone unit control, Master/Slave control or incorporated into a building-wide network using an optional plug-in communication module. The UVC contains a microprocessor that is preprogrammed with the application code required to operate the unit. The UVC supports up to 6 analog inputs, 12 binary inputs, and 9 binary outputs. The UVC EXP I/O board supports up to 4 additional analog inputs and 8 additional binary outputs. Master/Slave units have the controller factory configured and installed for a local peer-to-peer network between these units (network wiring between these units needs to be field installed). Optional network communication is provided via plug-in communication modules that connect directly to the UVC.
2. **Communication Module (optional):** Plug-in network communication module that is attached to the UVC via a 12-pin header and 4 locking standoffs. Available communication modules:

- **Building Automation and Control Network (BACnet®) Master Slave/Token Passing (MS/TP) –** Allows the UVC to interoperate with systems that use the BACnet (MS/TP) protocol with a conformance level of 3. Meets the requirements of ANSI/ASHRAE 135-1995 standard for BACnet systems.
- LonWorks® compliant Space Comfort Controller (SCC) – Supports the LonWorks SCC profile number 8500_10
- Metasys N2® Open – Provides N2 Open network communication capability to the UVC.

3. **Local User Interface (LUI): (see fig. 2-1)** – The LUI provides a unit mounted interface which indicates the current unit operating state and can be used to adjust the unit ventilator operating parameters (operating mode, temperature set points, fan speed and occupancy mode). The LUI features a 2-digit display, 7 keys (1 key is hidden), and 9 individual LED indicators. See "Local User Interface (LUI)" on page 3 for further details.
4. **Tenant Override Switch: (see fig. 2-1)** – Provides a momentary contact closure that causes the unit to enter the "tenant override" operating mode for a set time period (default = 120 minutes).
5. **Time Clock: (optional on standalone units only) (see fig. 2-1)** – Factory mounted 7 day/24 hour, digital time clock with up to twenty (20) programs to sequence the unit ventilator through occupied and unoccupied modes in accordance with a user programmed time schedule.
6. **External Signal Connection Plugs:** Three (3) multi-pin plugs are factory provided and pre-wired with short wire whips that are capped (they must remain capped if not used). Provided for field wiring of :

Figure 1: Component Locations (Vertical Floor Unit Shown)



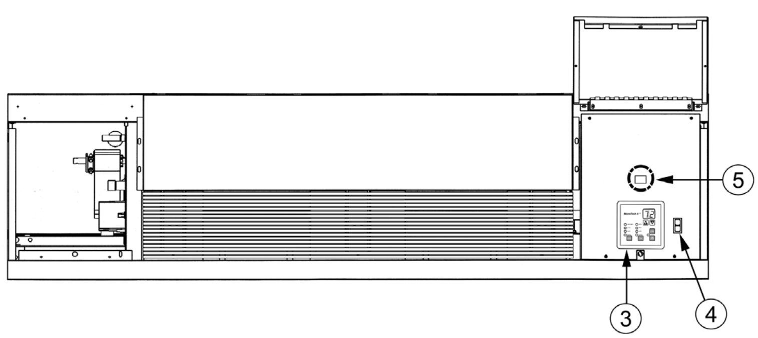
DAIKIN

- Remote Wall Mounted Temperature Sensor (optional accessory).
- External Input Signals (by others): unoccupied, remote shutdown, ventilation lockout, dew point/humidity (night time operation), or exhaust interlock signals • External Output Options (by others): lights on/off, fault indication signal, exhaust fan on/off or auxiliary heat signal

Note: *Not all external signal options can be used simultaneously and may not be available on all software models. Refer to the "UVC Input and Output Tables" in IM 739 for available options.*

7. **Electric Connection Box:** Contains the motor speed transformer. Refer to the unit wiring diagram for specifics.
8. **Unit Main Power "On-Off" Switch:** Disconnects the main power to the unit for servicing or when the unit is to be shut down for an extended period of time.
9. Fuse(s) - Fan motor and controls have the hot line(s) protected by factory installed cartridge type fuse(s).
10. **Control Transformer:** 75 VA 24-volt NEC Class 2 transformer for 24 volt power supply. (Located behind the the motor transformer).
11. **Outdoor Air/Return Air Damper Actuator:** Direct coupled, floating point (tristate) actuator that spring returns the outdoor air damper to the closed position upon a loss of power.
12. **Face and Bypass Damper Actuator:** Direct coupled, floating point (tristate) actuator that is non-spring returned (Model AVS only).
13. **Hydronic Coil Low Air Temperature Limit (T6 freezestat):** Factory installed on all units with hydronic (water) coils.The T6 freezestat cuts out at 38oF (+/- 3oF) and automatically resets at 45oF (+/- 3oF).
14. **Low Refrigerant Temperature Sensor (S4):** The S4 sensor is provided on all units with a direct expansion (DX) cooling coil. It is located on the right hand side of the coil "u-bend".
15. **Room Temperature Sensor:** The unit mounted sensor is located in the sampling chamber (front, center section) where room air is continuously drawn through for prompt response to temperature changes in the room. A Remote Wall Mounted Temperature Sensor is also available for remote room temperature sensing. (optional accessory).
16. **Discharge Air Temperature Sensor:** The sensor is located on the second fan from the right to sense discharge air temperatures.
17. **Outdoor Air Temperature Sensor:** The sensor is located in the outdoor air section of the unit before the outdoor air damper. With network applications, the unit mounted sensor can be overridden by a remote sensor through the network.
18. **Outdoor Air Humidity Sensor (optional):** Unit mounted humidity sensor for units using Expanded outdoor enthalpy economizer or Leading Edge indoor/outdoor, true enthalpy comparison economizer. The sensor is located in the outdoor air section of the unit before the outdoor air damper. With network applications, the unit mounted sensor can be overridden by a remote sensor through the network.
19. **Room Humidity Sensor (optional):** Unit mounted humidity sensor for units capable of passive or active dehumidification or with units using Leading Edge indoor/outdoor, true enthalpy comparison economizer. The sensor is located in the sampling chamber (front, center panel) where room air is continuously drawn through for fast response to humidity changes in the room. With network applications, the unit mounted sensor can be overridden by a remote sensor through the network.
20. **CO2 Sensor (optional):** Unit mounted, single beam absorption infrared gas sensor with a sensing range of 0 – 2000 ppm and voltage output of 0 to 10 VDC (100 ohm output impedance). The Pitot Tube sensing device is located in the unit ventilator's return air stream. The optional CO2 sensor is used with the UVC's Demand Control Ventilation feature to vary the amount of outside air based on actual room occupancy. With network applications, the unit mounted sensor can be overridden by a remote sensor through the network.
21. **Control Valve(s) (not shown):** Optional accessory valve(s) may be either 2 position "End of Cycle" (AVS models) or modulating (AVV and AVR models), to control the quantity of water through the coil. Available in 2-way or 3-way configurations. Spring return actuators are required for all hot water and steam heating valves. All heating valves are Normally Open (NO) and all cooling valves Normally Closed (NC).
22. **Water In Temperature Sensor (not shown):** The (S5) water in temperature sensor is factory wired on 2-pipe CW/HW units only. The sensor must be field installed and insulated (by others) on the supply connection of the hydronic coil. It is located on the same side as the coil connections. The sensor measures the entering water temperature to determine if the temperature is acceptable for either heating or cooling based on the unit's operating state.

Figure 2: AV Top View



Economizer Control Capabilities

Basic – Compares the inside and outside air temperatures using item 16 (Room Temperature Sensor) and item 18 (Outdoor Air Temperature Sensor) to determine if outdoor air can be used for "free", economizer cooling operation.

Expanded – Compares the inside and outside air temperatures using item 16 (Room Temperature Sensor) and item 18 (Outdoor Air Temperature Sensor) and calculates the enthalpy of the outside air relative humidity using item 19 (Outdoor Air Humidity Sensor) to determine if outdoor air can be used for "free", economizer cooling operation.

Leading Edge – True enthalpy comparison economizer that compares the inside and outside air temperatures using item 16 (Room Temperature Sensor) and item 18 (Outdoor Air Temperature Sensor) and compares the enthalpy of the inside and outside air relative humidity using item 19 (Outdoor Air Humidity Sensor) and item 20 (Room Humidity Sensor) to determine if outdoor air can be used for "free", economizer cooling operation.

Economizer for Reheat

Basic – Uses items 16 (Room Temperature sensor, item 18 (Outdoor Air Temperature Sensor) and item 20 (Room Humidity Sensor) for active dehumidification (reheat) or to determine if outdoor air can be used for "free", economizer cooling operation.

Leading Edge – Uses items 16 (Room Temperature Sensor), item 18 (Outdoor Air Temperature Sensor), item 19 (Outdoor Air Humidity Sensor) and item 20 (Room Humidity Sensor) for active dehumidification (reheat) or to determine if outdoor air can be used for "free", economizer cooling operation.

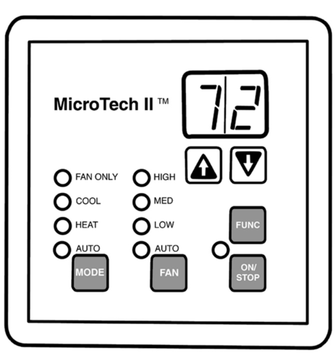
Local User Interface (LUI)

The built-in LUI touch pad (See Figure 3-1) has a 2-digit LED display that indicates the current unit operating state. The touch pad will "digitally display":

- The room set point temperature
- Current Room Temperature (With certain buttons held in place)
- Any fault code for diagnostics at the unit (With certain buttons held in place)

The LUI has a built in menu structure (Hidden Key and Password protected) with 7 keys (1 key is hidden) and 9 individual LED indicators to adjust the unit ventilator operating parameters shown below.

Figure 3: Local User Interface (LUI)



Operating Mode States (4)

- **Heat –** Heating and economizer operation only
- **Cool –** Cooling and economizer operation only
- **Fan Only –** Fan operation only
- **Auto –** Unit automatically switches between heating, cooling and economizer operation to satisfy the room load conditions. The current unit state is also displayed.

Fan States (4)

- **High** (constant speed)
- **Medium** (constant speed)
- **Low** (constant speed)
- **Auto** (part load, variable air) – Varies the fan speed automatically to meet the room load conditions whether the unit is in heating, cooling or economizer mode. The current fan speed is also displayed. During low load or normal operation (about 60% of the time) the fans will operate at low speed. When the load increases to an intermediate demand the fans automatically shift to medium speed. At near design or design load conditions, the fans will operate on high speed. A 10-minute delay between speed changes is incorporated to minimize the awareness of these changes. The outdoor air damper will index based on the fan speed to maintain the required minimum cfm (cubic feet per minute) of ventilation air.

Occupancy Modes (4)

- **Occupied –** Normal, daytime operation where the unit maintains the room set point.
- **Unoccupied –** Night set back operating mode in which the unit responds to a new room set point and cycles to maintain the condition. The fan comes on when heating or cooling is needed and runs until the load is satisfied. The outside air damper is closed during this mode. With direct expansion (DX) cooling units, when a cooling load is satisfied by the refrigerant system, the compressor is de-energized and the Unit Ventilator indoor fan continues to run for a fixed period of time to remove possible frost buildup on the evaporator coil.
- **Stand By Mode –** The unit ventilator maintains the stand by mode set point temperature with the outside air damper closed. The fan runs continuously unless it is configured to cycle in response to the room load.
- **Bypass Mode –** By depressing the Tenant Override Switch (Item 4) the unit is placed back into the Occupied Mode for a predetermined time (default of 120 minutes). This time can be set in 1-minute increments from 1 minute to 240 minutes through the Service Tool or a network.

Certified Drawing	AVV-024F
Daikin Applied certifies that it will furnish equipment in accordance with this drawing and specifications, and subject to its published warranty. Purchaser's approval to this drawing signifies that the equipment is acceptable under the provisions of the job specifications. Any change made hereon by any person whomsoever is subject to acceptance by Daikin	Group: **Unit Ventilator** Type: **Basic Unit Data** Date: **September 2014**

Daikin Classroom Floor Unit Ventilator Model AVV (F Vintage)

Standard Features

- UL/cUL listed.
- AHRI Certified chilled water performance. Unit ventilation rate certified and tested per Air Conditioning, Heating and Refrigeration Institute (AHRI) standard 840.
- Institutional quality cabinet with durable, textured, charcoal bronze paint finish on top surface. Oven baked powder paint on all other exterior panels.
- Welded chassis constructed from galvanized steel.
- Two, top hinged doors for access.
- Removable bar discharge grille.
- Three individual front access panels provided for ease of maintenance and service.
- All access panels have positive positioning threaded fasteners operated with 5/32" hex wrench.
- Insulated unit back.
- Built in pipe tunnel.
- Leveling legs.
- Rigid, double wall, insulated outdoor air damper made from welded galvanized steel, with mohair end and damper seals in turned over edges.
- Composite drain pan-hand of connection field reversible. Direction of slant can be field modified. An optional stainless steel indoor drain pan is also available.
- Room air fan shaft have oilable sleeve bearings for quietness and long life.
- Low speed room air fan constructed of injection molded polypropylene for precise, smooth, quiet performance.
- Energy efficient 1⁄4 H.P. permanent split capacitor (PSC) plug-in room air fan motor fits all size units. Located out of air stream.
- UL listed individual fusing of fan motor and controls.
- Room air motor speed controlled by multi-tap transformer, highmedium- low-off speeds.
- MicroTech™ II Controls (Optional) – State of the art "MicroTech II unit controller is a stand alone microprocessor based DDC control device that is pre-engineered, pre-programmed, pre-tested and factory installed. It provides correct sequence of operations and the advantage of one source responsibility.
- Steam coils equipped with vacuum breaker.
- Manual air vent and drain plug on water coils.
- Throwaway filter(s) factory installed in unit.

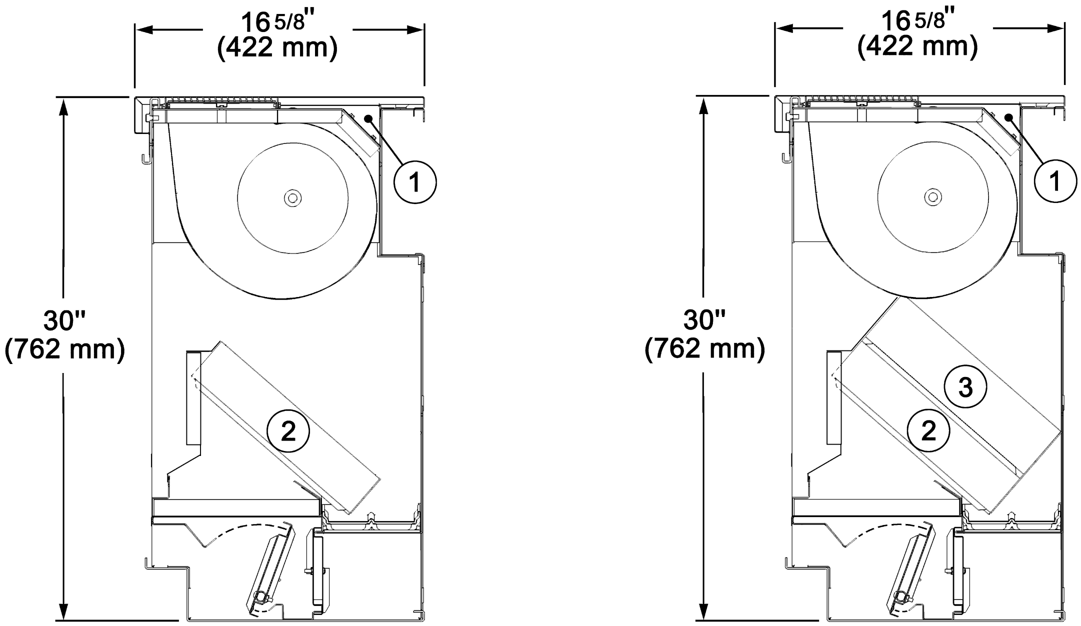
Table 1: Physical Data

			S07	S10	S13	S15
Nominal Airflow CFM (L/s):			750 (340)	1000 (472)	1250 (590)	1500 (708)
Fan Data:	Number of Fans:		2	3	4	4
	Size:	Diameter - in (mm)	8.12 (206mm)	8.12 (206mm)	8.12 (206mm)	8.12 (206mm)
		Width- in (mm)	8.25 (210mm)	8.25 (210mm)	8.25 (210mm)	8.25 (210mm)
Filter Data:	Nominal Size:	in	10 x 36-1/2 x 1	10 x 48-1/2 x 1	10 x 60-1/2 x 1	10 x 36-1/2 x 1
		(mm)	254 x 927 x 25	254 x 1232 x 25	254 x 1537 x 25	254 x 927 x 25
	Area - Ft^2 (m^2):		2.54 (.24)	3.37 (.31)	4.2 (.39)	5.08 (.47)
	Quantity:		1	1	1	2
Shipping Weight:	16-5/8" Deep Units:		350 (168)	425 (193)	495 (225)	570 (259)
	21-7/8" Deep Units:		370 (163)	445 (202)	525 (238)	600 (272)
Coil Water Volume Gallons (Liters):	1 Row Coil:		0.25 (0.95)	0.31 (1.17)	0.38 (1.44)	0.44 (1.67)
	2 Row Coil:		0.45 (1.70)	0.57 (2.16)	0.69 (2.61)	0.82 (3.10)
	3 Row Coil:		0.64 (2.42)	0.82 (3.10)	1.01 (3.82)	1.19 (4.50)
	4 Row Coil:		0.83 (3.14)	1.08 (4.09)	1.32 (5.00)	1.57 (5.94)

DAIKIN

Dimensional Data

AVV Unit Cross Sections
Valve Control



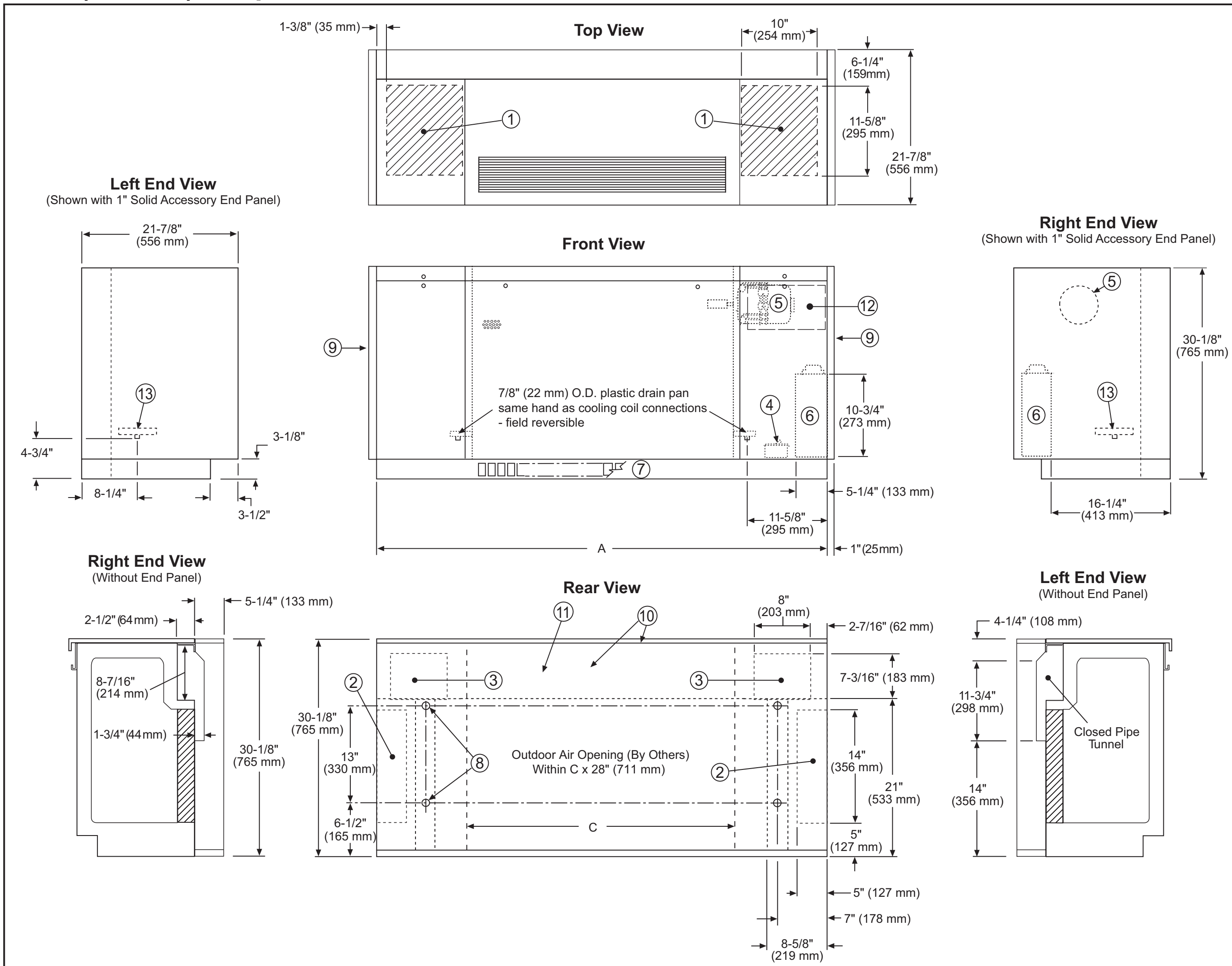
Single Coil Units	Two Coil Units	
1 Raceway for factory wiring 2 Hot Water, Steam, Chilled Water, CW/HW (2-pipe), Direct Expansion, Electric Heat	**Direct Expansion Units (DX)** 1 Raceway for factory wiring 2 Direct Expansion 3 Steam or Electric Heat 2 Hot Water 3 Direct Expansion	**Chilled Water Units** 1 Raceway for factory wiring 2 Hot Water 3 Chilled Water 2 Chilled Water 3 Electric Heat or Steam

Daikin Applied certifies that it will furnish equipment in accordance with this drawing and specifications, and subject to its published warranty. Purchaser's approval to this drawing signifies that the equipment is acceptable under the provisions of the job specifications. Any change made hereon by any person whomsoever is subject to acceptance by Daikin

Group: **Unit Ventilator**
Type: **Inlet Air Arrange.**
Date: **October 2013**

Daikin Classroom Floor Unit Ventilator Model AVV (F Vintage) Arrangement AB – Full Adapter Back, Closed Pipe Tunnel with Solid Back

21⅞" (556mm) Deep Floor Unit – Dimensions



Uniit Size	Dimensions in inches. (mm)	
	A	C
AV S07	62 (1575)	38 (965)
AV S10	74 (1880)	50 (1270)
AV S13	86 (2184)	62 (1575)
AV S15	98 (2489)	74 (1880)

Drawing Notes (1, *, etc.)

1 Bottom entry within 10" x 11-5/8" (254 mm x 295 mm) area
2 Rear entry area 14" x 5" (356 mm x 127 mm).
3 Opening between pipe tunnel & end compartment.
4 Disconnect Switch for main power wiring.
5 Fan motor.
6 Electrical connection box.
7 Slotted kickplate for return air arrangements; partially open kickplate for draftstop arrangements.
8 (4) - 7/8" (22 mm) diameter holes in back for anchoring unit to wall.
9 Accessory panels not included with unit, order separately as an accessory.
10 Insulated top and back of unit and outside air section of adapter back.
11. Full metal plate across entire back.
12. Controls location (MicroTech II units only).
13. Drain Pan.

Certified Drawing	UV-MTII-Sensor101
Daikin Applied certifies that it will furnish equipment in accordance with this drawing and specifications, and subject to its published warranty. Purchaser's approval to this drawing signifies that the equipment is acceptable under the provisions of the job specifications. Any change made hereon by any person whomsoever is subject to acceptance by Daikin	Group: **Unit Ventilator** Type: **MicroTech II Sensor** Date: **December 2013**

Daikin Classroom Unit Ventilator

Standard Wall Mounted, MicroTech™ II Room Sensor Accessory with Tenant Override

The MicroTech II, wall mounted room sensor accessory has a Positive Temperature Coefficient (PTC) silicon sensing element, a red LED for unit status and a tenant override switch.

Sensor part number: 111048101

Included with the pre-assembled sensor:

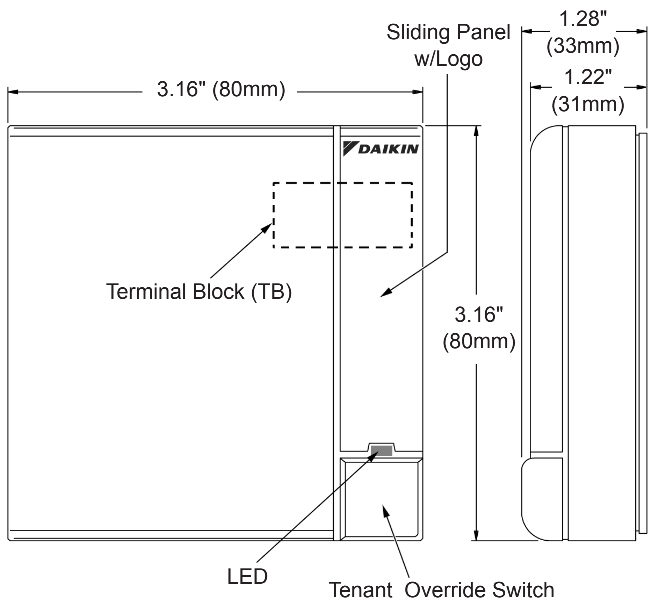
- Large (3.1" × 4.6 [80 × 117 mm]) mounting base (1) for wall box or surface mounting
- End Caps (2)
- Terminal Block (1)
- 1.5mm (1/16 in.) cover screw (1)
- Small (3.1" × 3.1" [80 × 80 mm]) mounting base (1) with attached terminal block (1) for surface mounting
- Sliding panel with printed (Daikin) logo
- Hardware for wallbox or surface mounting

Sensor Specifications

Type: 1035 ohms @ 77°F (25°C)

Accuracy: ±0.9°F (0.5°C) between 5°F and 167°F (-15°C and 75°C)

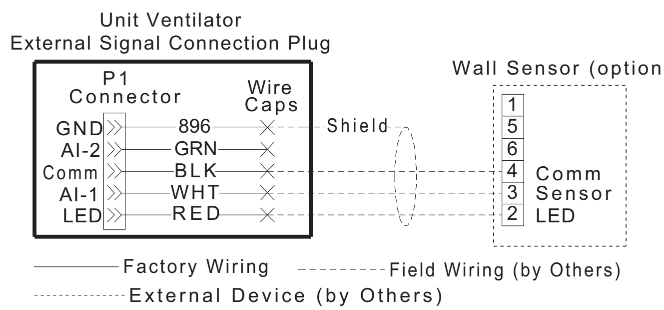
Figure 1: MicroTech II Sensor 111048101



Wiring

All field wiring connections must be run in shielded cable with the shield drain wires connected as shown in the wiring diagram.

Figure 2: Wall mounted temperature sensor wiring for standard wall sensor



Maximum Wire Length for Less than 1°F Error	
Wire Gauge	**Wire Length**
14 AWG	800 Ft
16 AWG	500 Ft
18 AWG	310 Ft
20 AWG	200 Ft
22 AWG	124 Ft

Figure 3: Wallbox mounting

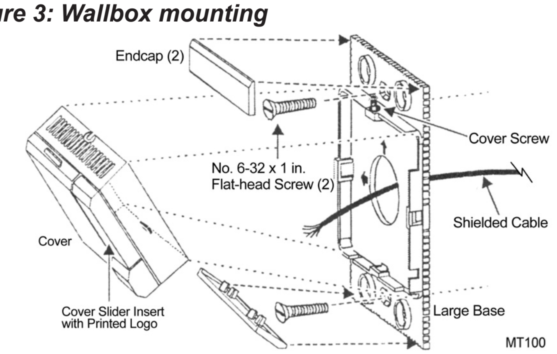
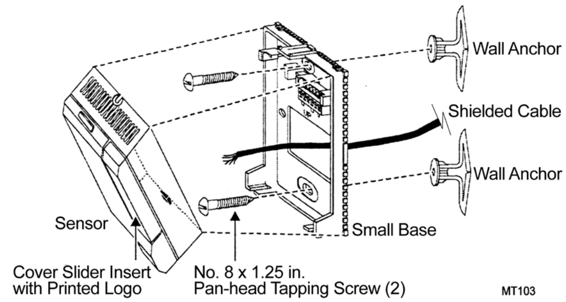


Figure 4: Surface mounting using small base



Job Information	*Technical Data Sheet*
Job Name	Honeywell-Chatham School District
Date	12/9/2014
Submitted By	Jennifer Olivo
Software Version	02.50
Unit Tag	Chatham MS-UV (Stage)

Unit Overview

Model Number	Voltage	Heating Coil Type
UAVV6S15	115/60/1	Hot Water

Physical

Unit		Controls
Arrangement	**Weight**	**Type**
Vertical, Floor Mounted	600 lb	Factory Installed Digital Controls

Electrical

Voltage	Minimum Voltage	Maximum Voltage	Total Unit MCA	Maximum Fuse Size
115/60/1 V/Hz/Phase	104 V	126 V	3.9 A	15 A

Fan

Performance				
Speed	**Air Volume** CFM	**External Static Pressure** inH_2O	**Motor Power** HP	**Fan Full Load Current** A
High	1532	0.00	0.250	2.70

Hot Water Coil

Performance				
Total Capacity Btu/hr	**Air Temperature Dry Bulb**		**Fluid Temperature**	
	Entering °F	**Leaving** °F	**Entering** °F	**Leaving** °F
65005	70.0	109.1	180.0	115.0

Fluid		
Type	**Flow Rate** gpm	**Pressure Drop** ft H_2O
Water	2.00	0.65

Physical
Number of Rows
2

Warranty

Type	
Extended:	Ext. 4 yr. parts - (Entire Unit)

Notes

Accessories

Part Number	Description
106041390	1" End Pnl, Ant Ivory, 21-7/8"D, Solid (AV AZ)
105631524	LVR HZ WGRL 10 3/8HX72L CLR ANOD W/FLGE S15 H15 S
111048101	STANDARD Room Sensor with Override

Certified Drawing	AVS-V-R-MTII-808
Daikin Applied certifies that it will furnish equipment in accordance with this drawing and specifications, and subject to its published warranty. Purchaser's approval to this drawing signifies that the equipment is acceptable under the provisions of the job specifications. Any change made hereon by any person whomsoever is subject to acceptance by Daikin	Group: **Unit Ventilator** Type: MTII **DDC Control** Date: **January 2014**

Daikin Classroom Floor Unit Ventilator Models AVS, AVV, and AVR

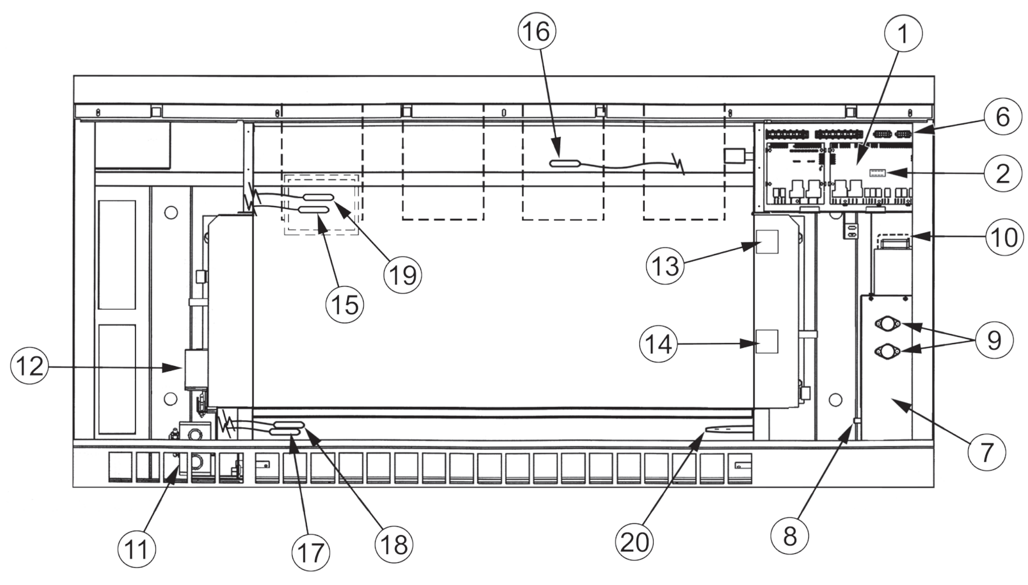
MicroTech II™ Unit Mounted DDC Control Components

1. **MicroTech II Unit Ventilator Controller (UVC):** (Located Beneath the Local User Interface Panel). Factory mounted and run tested, microprocessor-based DDC control device capable of complete Standalone unit control, Master/Slave control or incorporated into a building-wide network using an optional plug-in communication module. The UVC contains a microprocessor that is preprogrammed with the application code required to operate the unit. The UVC supports up to 6 analog inputs, 12 binary inputs, and 9 binary outputs. The UVC EXP I/O board supports up to 4 additional analog inputs and 8 additional binary outputs. Master/Slave units have the controller factory configured and installed for a local peer-to-peer network between these units (network wiring between these units needs to be field installed). Optional network communication is provided via plug-in communication modules that connect directly to the UVC.
2. **Communication Module (optional):** Plug-in network communication module that is attached to the UVC via a 12-pin header and 4 locking standoffs. Available communication modules:

- **Building Automation and Control Network (BACnet®) Master Slave/Token Passing (MS/TP) –** Allows the UVC to interoperate with systems that use the BACnet (MS/TP) protocol with a conformance level of 3. Meets the requirements of ANSI/ASHRAE 135-1995 standard for BACnet systems.
- LonWorks® compliant Space Comfort Controller (SCC) – Supports the LonWorks SCC profile number 8500_10
- Metasys N2® Open – Provides N2 Open network communication capability to the UVC.

3. **Local User Interface (LUI): (see fig. 2-1)** – The LUI provides a unit mounted interface which indicates the current unit operating state and can be used to adjust the unit ventilator operating parameters (operating mode, temperature set points, fan speed and occupancy mode). The LUI features a 2-digit display, 7 keys (1 key is hidden), and 9 individual LED indicators. See "Local User Interface (LUI)" on page 3 for further details.
4. **Tenant Override Switch: (see fig. 2-1)** – Provides a momentary contact closure that causes the unit to enter the "tenant override" operating mode for a set time period (default = 120 minutes).
5. **Time Clock: (optional on standalone units only) (see fig. 2-1)** – Factory mounted 7 day/24 hour, digital time clock with up to twenty (20) programs to sequence the unit ventilator through occupied and unoccupied modes in accordance with a user programmed time schedule.
6. **External Signal Connection Plugs:** Three (3) multi-pin plugs are factory provided and pre-wired with short wire whips that are capped (they must remain capped if not used). Provided for field wiring of :

Figure 1: Component Locations (Vertical Floor Unit Shown)

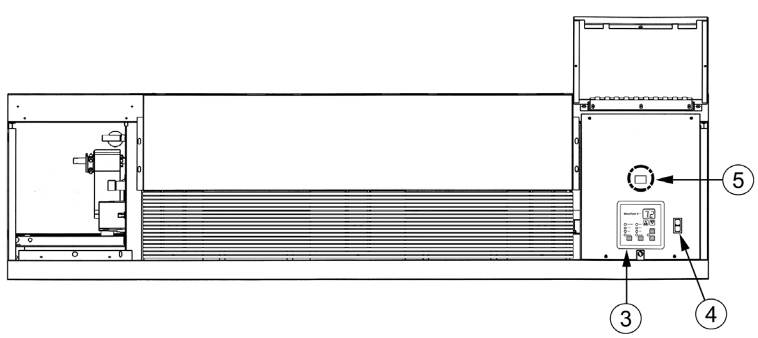


- Remote Wall Mounted Temperature Sensor (optional accessory).
- External Input Signals (by others): unoccupied, remote shutdown, ventilation lockout, dew point/humidity (night time operation), or exhaust interlock signals • External Output Options (by others): lights on/off, fault indication signal, exhaust fan on/off or auxiliary heat signal

Note: *Not all external signal options can be used simultaneously and may not be available on all software models. Refer to the "UVC Input and Output Tables" in IM 739 for available options.*

7. **Electric Connection Box:** Contains the motor speed transformer. Refer to the unit wiring diagram for specifics.
8. **Unit Main Power "On-Off" Switch:** Disconnects the main power to the unit for servicing or when the unit is to be shut down for an extended period of time.
9. Fuse(s) - Fan motor and controls have the hot line(s) protected by factory installed cartridge type fuse(s).
10. **Control Transformer:** 75 VA 24-volt NEC Class 2 transformer for 24 volt power supply. (Located behind the the motor transformer).
11. **Outdoor Air/Return Air Damper Actuator:** Direct coupled, floating point (tristate) actuator that spring returns the outdoor air damper to the closed position upon a loss of power.
12. **Face and Bypass Damper Actuator:** Direct coupled, floating point (tristate) actuator that is non-spring returned (Model AVS only).
13. **Hydronic Coil Low Air Temperature Limit (T6 freezestat):** Factory installed on all units with hydronic (water) coils.The T6 freezestat cuts out at 38oF (+/- 3oF) and automatically resets at 45oF (+/- 3oF).
14. **Low Refrigerant Temperature Sensor (S4):** The S4 sensor is provided on all units with a direct expansion (DX) cooling coil. It is located on the right hand side of the coil "u-bend".
15. **Room Temperature Sensor:** The unit mounted sensor is located in the sampling chamber (front, center section) where room air is continuously drawn through for prompt response to temperature changes in the room. A Remote Wall Mounted Temperature Sensor is also available for remote room temperature sensing. (optional accessory).
16. **Discharge Air Temperature Sensor:** The sensor is located on the second fan from the right to sense discharge air temperatures.
17. **Outdoor Air Temperature Sensor:** The sensor is located in the outdoor air section of the unit before the outdoor air damper. With network applications, the unit mounted sensor can be overridden by a remote sensor through the network.
18. **Outdoor Air Humidity Sensor (optional):** Unit mounted humidity sensor for units using Expanded outdoor enthalpy economizer or Leading Edge indoor/outdoor, true enthalpy comparison economizer. The sensor is located in the outdoor air section of the unit before the outdoor air damper. With network applications, the unit mounted sensor can be overridden by a remote sensor through the network.
19. **Room Humidity Sensor (optional):** Unit mounted humidity sensor for units capable of passive or active dehumidification or with units using Leading Edge indoor/outdoor, true enthalpy comparison economizer. The sensor is located in the sampling chamber (front, center panel) where room air is continuously drawn through for fast response to humidity changes in the room. With network applications, the unit mounted sensor can be overridden by a remote sensor through the network.
20. **CO2 Sensor (optional):** Unit mounted, single beam absorption infrared gas sensor with a sensing range of 0 – 2000 ppm and voltage output of 0 to 10 VDC (100 ohm output impedance). The Pitot Tube sensing device is located in the unit ventilator's return air stream. The optional CO2 sensor is used with the UVC's Demand Control Ventilation feature to vary the amount of outside air based on actual room occupancy. With network applications, the unit mounted sensor can be overridden by a remote sensor through the network.
21. **Control Valve(s) (not shown):** Optional accessory valve(s) may be either 2 position "End of Cycle" (AVS models) or modulating (AVV and AVR models), to control the quantity of water through the coil. Available in 2-way or 3-way configurations. Spring return actuators are required for all hot water and steam heating valves. All heating valves are Normally Open (NO) and all cooling valves Normally Closed (NC).
22. **Water In Temperature Sensor (not shown):** The (S5) water in temperature sensor is factory wired on 2-pipe CW/HW units only. The sensor must be field installed and insulated (by others) on the supply connection of the hydronic coil. It is located on the same side as the coil connections. The sensor measures the entering water temperature to determine if the temperature is acceptable for either heating or cooling based on the unit's operating state.

Figure 2: AV Top View



Economizer Control Capabilities

Basic – Compares the inside and outside air temperatures using item 16 (Room Temperature Sensor) and item 18 (Outdoor Air Temperature Sensor) to determine if outdoor air can be used for "free", economizer cooling operation.

Expanded – Compares the inside and outside air temperatures using item 16 (Room Temperature Sensor) and item 18 (Outdoor Air Temperature Sensor) and calculates the enthalpy of the outside air relative humidity using item 19 (Outdoor Air Humidity Sensor) to determine if outdoor air can be used for "free", economizer cooling operation.

Leading Edge – True enthalpy comparison economizer that compares the inside and outside air temperatures using item 16 (Room Temperature Sensor) and item 18 (Outdoor Air Temperature Sensor) and compares the enthalpy of the inside and outside air relative humidity using item 19 (Outdoor Air Humidity Sensor) and item 20 (Room Humidity Sensor) to determine if outdoor air can be used for "free", economizer cooling operation.

Economizer for Reheat

Basic – Uses items 16 (Room Temperature sensor, item 18 (Outdoor Air Temperature Sensor) and item 20 (Room Humidity Sensor) for active dehumidification (reheat) or to determine if outdoor air can be used for "free", economizer cooling operation.

Leading Edge – Uses items 16 (Room Temperature Sensor), item 18 (Outdoor Air Temperature Sensor), item 19 (Outdoor Air Humidity Sensor) and item 20 (Room Humidity Sensor) for active dehumidification (reheat) or to determine if outdoor air can be used for "free", economizer cooling operation.

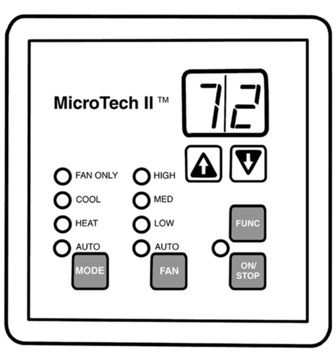
Local User Interface (LUI)

The built-in LUI touch pad (See Figure 3-1) has a 2-digit LED display that indicates the current unit operating state. The touch pad will "digitally display":

- The room set point temperature
- Current Room Temperature (With certain buttons held in place)
- Any fault code for diagnostics at the unit (With certain buttons held in place)

The LUI has a built in menu structure (Hidden Key and Password protected) with 7 keys (1 key is hidden) and 9 individual LED indicators to adjust the unit ventilator operating parameters shown below.

Figure 3: Local User Interface (LUI)



Operating Mode States (4)

- **Heat –** Heating and economizer operation only
- **Cool –** Cooling and economizer operation only
- **Fan Only –** Fan operation only
- **Auto –** Unit automatically switches between heating, cooling and economizer operation to satisfy the room load conditions. The current unit state is also displayed.

Fan States (4)

- **High** (constant speed)
- **Medium** (constant speed)
- **Low** (constant speed)
- **Auto** (part load, variable air) – Varies the fan speed automatically to meet the room load conditions whether the unit is in heating, cooling or economizer mode. The current fan speed is also displayed. During low load or normal operation (about 60% of the time) the fans will operate at low speed. When the load increases to an intermediate demand the fans automatically shift to medium speed. At near design or design load conditions, the fans will operate on high speed. A 10-minute delay between speed changes is incorporated to minimize the awareness of these changes. The outdoor air damper will index based on the fan speed to maintain the required minimum cfm (cubic feet per minute) of ventilation air.

Occupancy Modes (4)

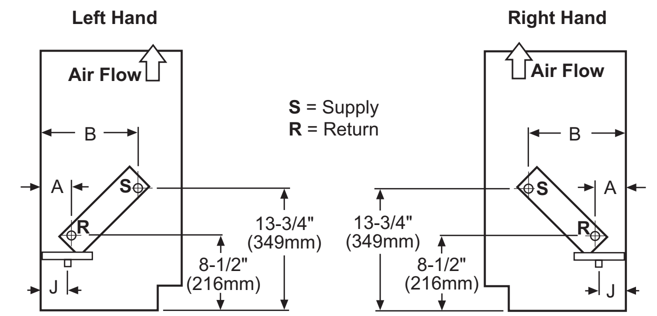
- **Occupied –** Normal, daytime operation where the unit maintains the room set point.
- **Unoccupied –** Night set back operating mode in which the unit responds to a new room set point and cycles to maintain the condition. The fan comes on when heating or cooling is needed and runs until the load is satisfied. The outside air damper is closed during this mode. With direct expansion (DX) cooling units, when a cooling load is satisfied by the refrigerant system, the compressor is de-energized and the Unit Ventilator indoor fan continues to run for a fixed period of time to remove possible frost buildup on the evaporator coil.
- **Stand By Mode –** The unit ventilator maintains the stand by mode set point temperature with the outside air damper closed. The fan runs continuously unless it is configured to cycle in response to the room load.
- **Bypass Mode –** By depressing the Tenant Override Switch (Item 4) the unit is placed back into the Occupied Mode for a predetermined time (default of 120 minutes). This time can be set in 1-minute increments from 1 minute to 240 minutes through the Service Tool or a network.

Certified Drawing	AVV-H-061F
Daikin Applied certifies that it will furnish equipment in accordance with this drawing and specifications, and subject to its published warranty. Purchaser's approval to this drawing signifies that the equipment is acceptable under the provisions of the job specifications. Any change made hereon by any person whomsoever is subject to acceptance by Daikin	Group: **Unit Ventilator** Type: **Coil Connections** Date: **October 2013**

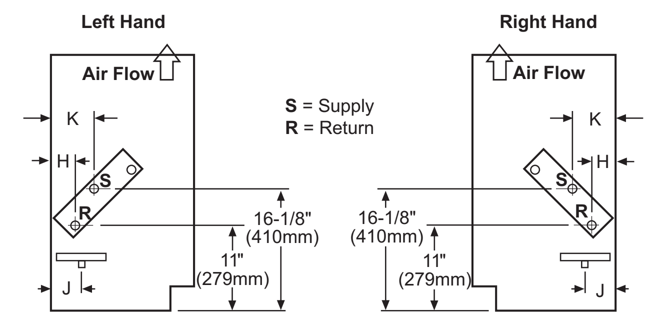
Daikin Classroom Floor Unit Ventilator Model AVV (F Vintage)

Coil Headers, Locations (Heating)

☐ Hot Water Only Unit (Coils 65, 66, 67)



☐ Steam Heating Only Unit (Coils 68, 69, 78, 79)



Note: *For opposite end drain steam coils (code 78, 79) Return (R) is 7¼" (184mm) from bottom of unit and (H) 2" (51mm) from the back of unit.*

☐ Steam Heating Only Unit (Coils 68, 69, 78, 79)

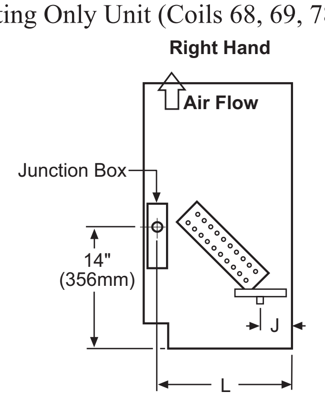


Table 1: Dimensions

Unit Depth	Coil Connection Locations - Dimensions (in inches)					
	A	B	H	J	K	L
16⅝	3¾	12¼	2⅞	3	5	14
21⅞	9	17½	8⅛	8¼	10¼	19¼

Table 2: Coil Water Capacities (Gallons/Liters)

Unit Series	S07		S10		S13		S15	
	Gal	Liter	Gal	Liter	Gal	Liter	Gal	Liter
1 Row Coil	0.24	0.91	0.29	1.10	0.35	1.32	0.41	1.55
2 Row Coil	0.41	1.55	0.52	1.97	0.63	2.38	0.74	2.80
3 Row Coil	0.58	2.20	0.74	2.80	0.92	3.48	1.07	4.05
4 Row Coil	0.76	2.88	0.96	3.63	1.2	4.54	1.4	5.30

Table 3: Heating Only - Coil Position/Combinations in Air Stream (one coil per position)

First Position In Airstream	Second Position In Airstream	Basic Valve Control AVV
Heating Only		
65 66 67 68 69 78 79	Z	•
12 13	Z	•

• = Available

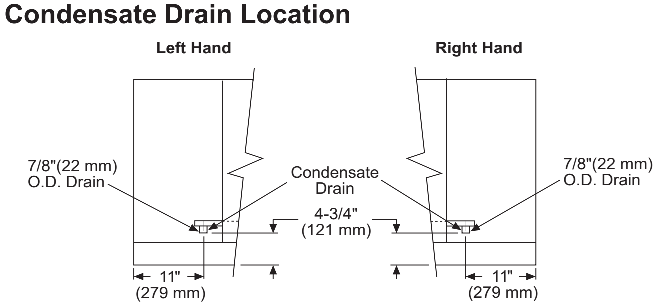
Heating Coils:
65 = 1 Row Hot Water Coil
66 = 2 Row Hot Water Coil
67 = 3 Row Hot Water Coil
68 = Low Capacity Steam Coil
69 = High Capacity Steam Coil
78 = Opposite End Drain Low Capacity Steam Coil
79 = Opposite End Drain High Capacity Steam Coil
12 = Low Electric Heat Coil
13 = High Electric Heat Coil

Cooling Coils:
Z = None

Notes:

1. *All coils have same end supply and return connections.*
2. *Steam coils have a factory installed pressure equalizing valve and a 24" (610mm) long pressure equalizing line which terminates in a ½" M.P.T. fitting.*
3. *Cooling condensate drain pan is shipped sloped down towards the cooling coil connections but is field reversible.*
4. *For limitations with coil combinations see table Table 3.*
5. *Hot water coil connections are 7/8" I.D. (female) and terminate 9" (229mm) from the end of the unit.*
6. *Steam coils are 1-1/8" female (sweat) connections and terminate 9" (229mm) from the end of the unit.*
7. *All dimensions are approximated.*

Condensate Drain Location



Front View of End Compartment (Without End Panels)

DAIKIN

Daikin Classroom Floor Unit Ventilator Model AVV (F Vintage)

Standard Features

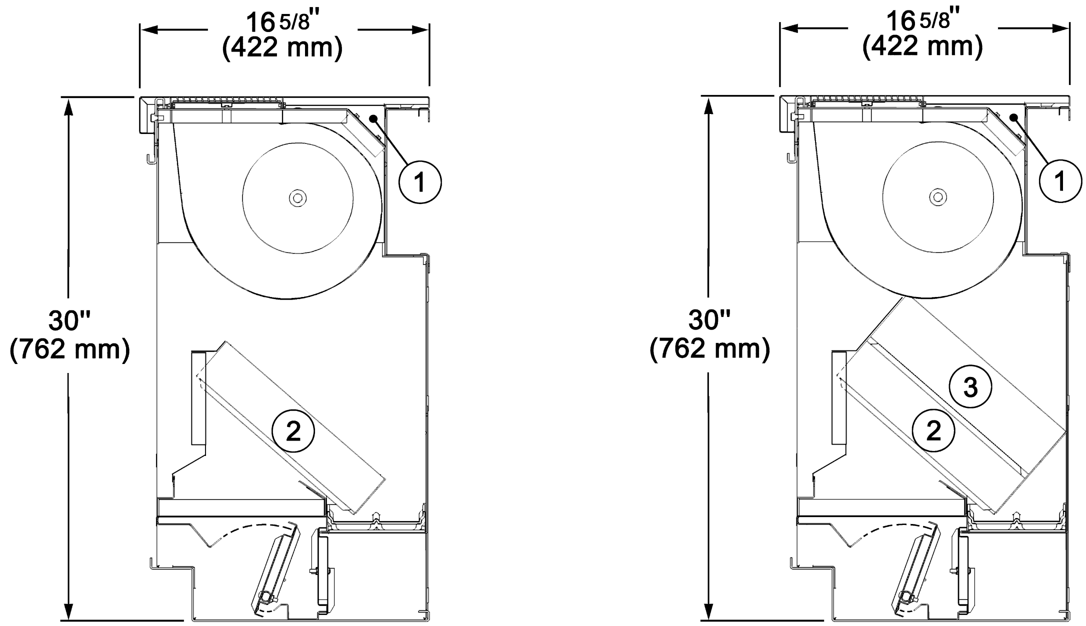
- UL/cUL listed.
- AHRI Certified chilled water performance. Unit ventilation rate certified and tested per Air Conditioning, Heating and Refrigeration Institute (AHRI) standard 840.
- Institutional quality cabinet with durable, textured, charcoal bronze paint finish on top surface. Oven baked powder paint on all other exterior panels.
- Welded chassis constructed from galvanized steel.
- Two, top hinged doors for access.
- Removable bar discharge grille.
- Three individual front access panels provided for ease of maintenance and service.
- All access panels have positive positioning threaded fasteners operated with 5/32" hex wrench.
- Insulated unit back.
- Built in pipe tunnel.
- Leveling legs.
- Rigid, double wall, insulated outdoor air damper made from welded galvanized steel, with mohair end and damper seals in turned over edges.
- Composite drain pan-hand of connection field reversible. Direction of slant can be field modified. An optional stainless steel indoor drain pan is also available.
- Room air fan shaft have oilable sleeve bearings for quietness and long life.
- Low speed room air fan constructed of injection molded polypropylene for precise, smooth, quiet performance.
- Energy efficient 1⁄4 H.P. permanent split capacitor (PSC) plug-in room air fan motor fits all size units. Located out of air stream.
- UL listed individual fusing of fan motor and controls.
- Room air motor speed controlled by multi-tap transformer, highmedium- low-off speeds.
- MicroTech™ II Controls (Optional) – State of the art "MicroTech II unit controller is a stand alone microprocessor based DDC control device that is pre-engineered, pre-programmed, pre-tested and factory installed. It provides correct sequence of operations and the advantage of one source responsibility.
- Steam coils equipped with vacuum breaker.
- Manual air vent and drain plug on water coils.
- Throwaway filter(s) factory installed in unit.

Table 1: Physical Data

			S07	S10	S13	S15
Nominal Airflow CFM (L/s):			**750 (340)**	**1000 (472)**	**1250 (590)**	**1500 (708)**
Fan Data:	**Number of Fans:**		2	3	4	4
	Size:	**Diameter - in (mm)**	8.12 (206mm)	8.12 (206mm)	8.12 (206mm)	8.12 (206mm)
		Width- in (mm)	8.25 (210mm)	8.25 (210mm)	8.25 (210mm)	8.25 (210mm)
Filter Data:	**Nominal Size:**	**in**	10 x 36-1/2 x 1	10 x 48-1/2 x 1	10 x 60-1/2 x 1	10 x 36-1/2 x 1
		(mm)	254 x 927 x 25	254 x 1232 x 25	254 x 1537 x 25	254 x 927 x 25
	Area - Ft^2 (m^2):		2.54 (.24)	3.37 (.31)	4.2 (.39)	5.08 (.47)
	Quantity:		1	1	1	2
Shipping Weight:	**16-5/8" Deep Units:**		350 (168)	425 (193)	495 (225)	570 (259)
	21-7/8" Deep Units:		370 (163)	445 (202)	525 (238)	600 (272)
Coil Water Volume Gallons (Liters):	**1 Row Coil:**		0.25 (0.95)	0.31 (1.17)	0.38 (1.44)	0.44 (1.67)
	2 Row Coil:		0.45 (1.70)	0.57 (2.16)	0.69 (2.61)	0.82 (3.10)
	3 Row Coil:		0.64 (2.42)	0.82 (3.10)	1.01 (3.82)	1.19 (4.50)
	4 Row Coil:		0.83 (3.14)	1.08 (4.09)	1.32 (5.00)	1.57 (5.94)

Dimensional Data

AVV Unit Cross Sections
Valve Control

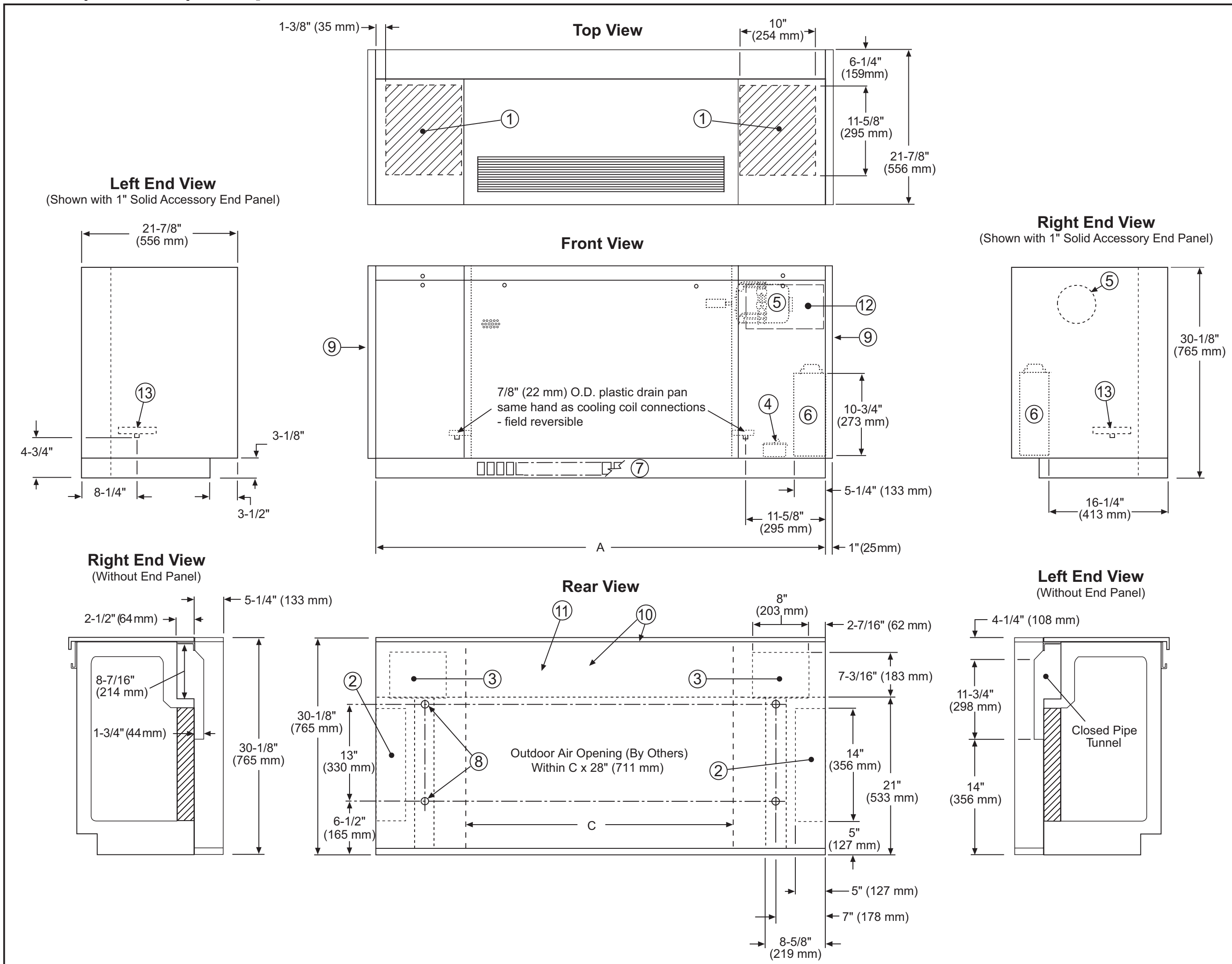


Single Coil Units	Two Coil Units	
1 Raceway for factory wiring 2 Hot Water, Steam, Chilled Water, CW/HW (2-pipe), Direct Expansion, Electric Heat	**Direct Expansion Units (DX)** 1 Raceway for factory wiring 2 Direct Expansion 3 Steam or Electric Heat 2 Hot Water 3 Direct Expansion	**Chilled Water Units** 1 Raceway for factory wiring 2 Hot Water 3 Chilled Water 2 Chilled Water 3 Electric Heat or Steam

Certified Drawing	AVV-031F
Daikin Applied certifies that it will furnish equipment in accordance with this drawing and specifications, and subject to its published warranty. Purchaser's approval to this drawing signifies that the equipment is acceptable under the provisions of the job specifications. Any change made hereon by any person whomsoever is subject to acceptance by Daikin	Group: **Unit Ventilator** Type: **Inlet Air Arrange.** Date: **October 2013**

Daikin Classroom Floor Unit Ventilator Model AVV (F Vintage) Arrangement AB – Full Adapter Back, Closed Pipe Tunnel with Solid Back

21⅞" (556mm) Deep Floor Unit – Dimensions



Uniit Size	Dimensions in inches. (mm)	
	A	C
AV S07	62 (1575)	38 (965)
AV S10	74 (1880)	50 (1270)
AV S13	86 (2184)	62 (1575)
AV S15	98 (2489)	74 (1880)

Drawing Notes (①, *, etc.)

1 Bottom entry within 10" x 11-5/8" (254 mm x 295 mm) area
2 Rear entry area 14" x 5" (356 mm x 127 mm).
3 Opening between pipe tunnel & end compartment.
4 Disconnect Switch for main power wiring.
5 Fan motor.
6 Electrical connection box.
7 Slotted kickplate for return air arrangements; partially open kickplate for draftstop arrangements.
8 (4) - 7/8" (22 mm) diameter holes in back for anchoring unit to wall.
9 Accessory panels not included with unit, order separately as an accessory.
10 Insulated top and back of unit and outside air section of adapter back.
11. Full metal plate across entire back.
12. Controls location (MicroTech II units only).
13. Drain Pan.

Certified Drawing	UV-MTII-Sensor101
Daikin Applied certifies that it will furnish equipment in accordance with this drawing and specifications, and subject to its published warranty. Purchaser's approval to this drawing signifies that the equipment is acceptable under the provisions of the job specifications. Any change made hereon by any person whomsoever is subject to acceptance by Daikin	Group: **Unit Ventilator** Type: **MicroTech II Sensor** Date: **December 2013**

Daikin Classroom Unit Ventilator

Standard Wall Mounted, MicroTech™ II Room Sensor Accessory with Tenant Override

The MicroTech II, wall mounted room sensor accessory has a Positive Temperature Coefficient (PTC) silicon sensing element, a red LED for unit status and a tenant override switch.

Sensor part number: 111048101

Included with the pre-assembled sensor:

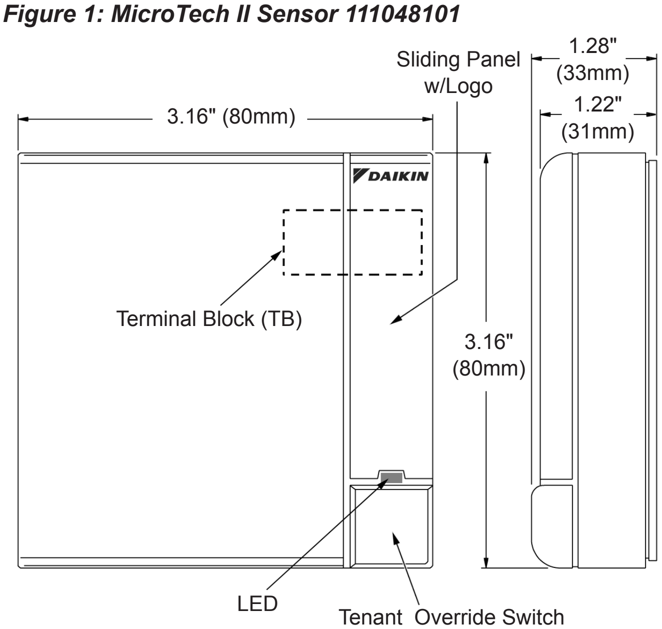
- Large (3.1" × 4.6 [80 × 117 mm]) mounting base (1) for wall box or surface mounting
- End Caps (2)
- Terminal Block (1)
- 1.5mm (1/16 in.) cover screw (1)
- Small (3.1" × 3.1" [80 × 80 mm]) mounting base (1) with attached terminal block (1) for surface mounting
- Sliding panel with printed (Daikin) logo
- Hardware for wallbox or surface mounting

Sensor Specifications

Type: 1035 ohms @ 77°F (25°C)

Accuracy: ±0.9°F (0.5°C) between 5°F and 167°F (-15°C and 75°C)

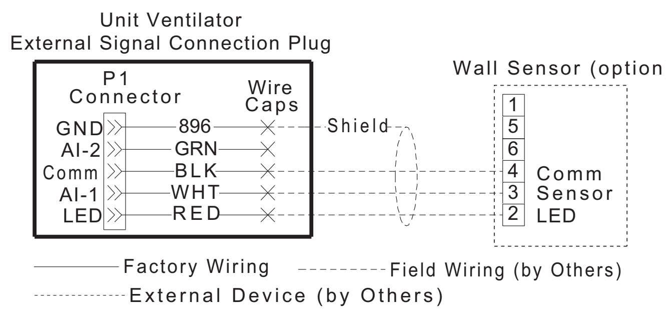
Figure 1: MicroTech II Sensor 111048101



Wiring

All field wiring connections must be run in shielded cable with the shield drain wires connected as shown in the wiring diagram.

Figure 2: Wall mounted temperature sensor wiring for standard wall sensor



Maximum Wire Length for Less than 1°F Error	
Wire Gauge	**Wire Length**
14 AWG	800 Ft
16 AWG	500 Ft
18 AWG	310 Ft
20 AWG	200 Ft
22 AWG	124 Ft

Figure 3: Wallbox mounting

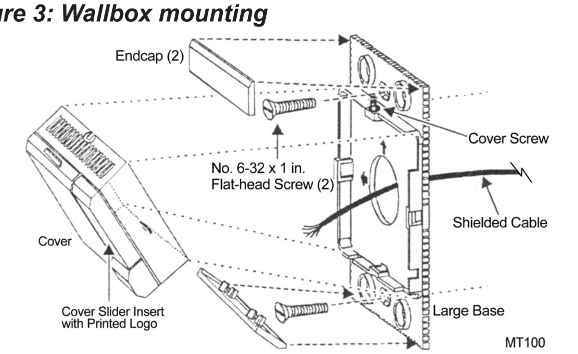
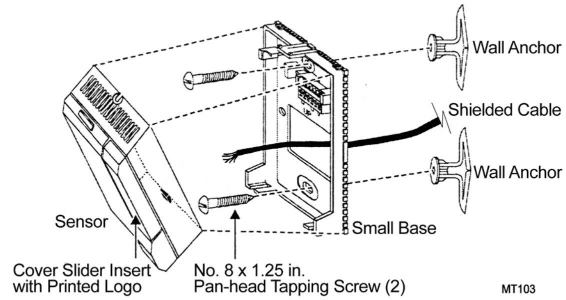


Figure 4: Surface mounting using small base



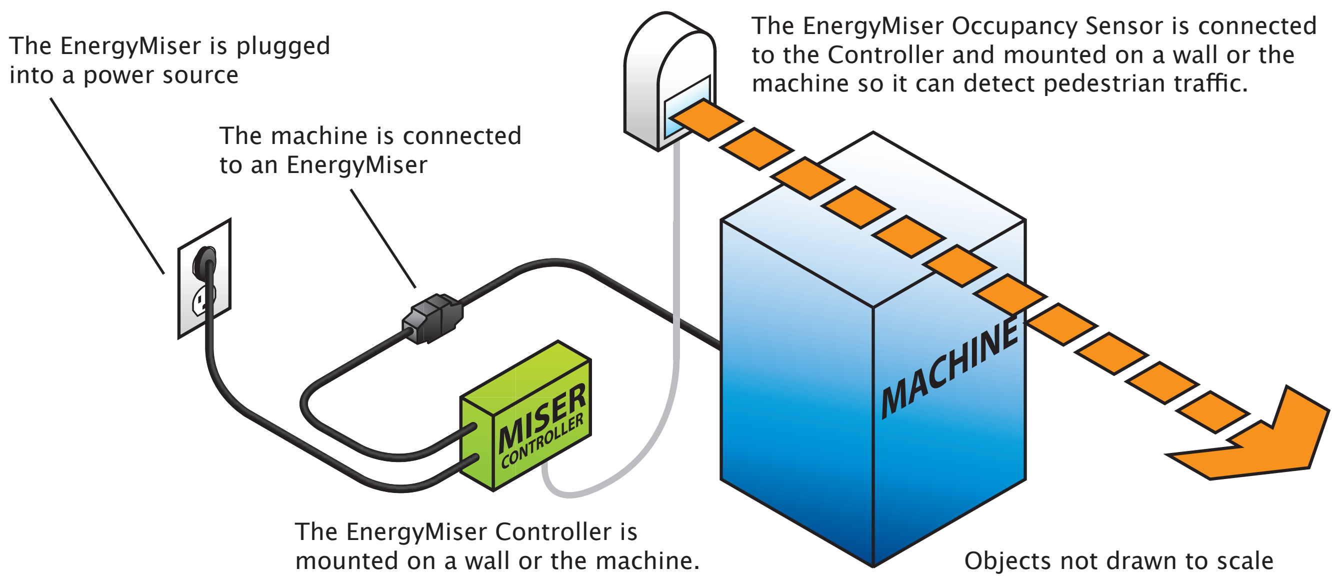
EnergyMisers

EnergyMiser® Products are easy to install devices designed to lower the energy consumption of vending machines, commercial coolers, and other "always on" machines and appliances. No other technology can compete with its price and ease of installation for the immediate energy savings that can be achieved.

- Win and retain accounts by offering energy-efficient technology
- Save clients up to $150 per machine, per year
- Typical return on investment in 12 months
- Easy retrofit field installation
- Reduction in machine energy use an average of 35-45%
- Reduced machine maintenance and longer machine lifespans
- Environmental benefits such as reducing pollution and natural resource use

How EnergyMisers Work

External EnergyMisers use a controller and a machine mounted sensor to monitor room occupancy and temperature. If 15 minutes pass without any pedestrian traffic, the EnergyMiser will power down the machine. The machine is powered back up when people return and at regular intervals to to keep the product cold. External controllers are best suited for low traffic areas.



Internal EnergyMisers use sales based intelligence to power down the cooling system while leaving lighting and controller electronics on. While the cooling system is powered down, the internal EnergyMiser monitors the room's temperature and automatically re-powers the cooling system at regular intervals to keep the product cold. Internal controllers are best suited for high traffic areas.

Who Uses EnergyMisers

Several large retailers such as Wal-Mart and Kroger have installed EnergyMiser Products at their locations. Educational facilities along with the US Government have purchased EnergyMisers through GSA. Also, many utilities offer rebates on the purchase of EnergyMiser products and several have provided customers with EnergyMiser Products at no cost through Turnkey Programs.

USA Technologies 100 Deerfield Lane, Suite 140, Malvern, PA 19355 • 800.633.0340 • www.usatech.com

EnergyMiser Products

VendingMiser® - for cold drink vending machines

VM150 - Indoor Wall Mount Controller with Occupancy Sensor
VM151 - Indoor Wall Mount Controller with 10' Repeater Cable
VM160 - Outdoor Wall Mount Controller with Occupancy Sensor and Weather-proof Enclosure
VM161 - Outdoor Wall Mount Controller with 10' Repeater Cable and Weather-proof Enclosure
VM170 - Indoor Controller with EZ Mount Z-Bracket and Occupancy Sensor
VM171 - Indoor Controller with EZ Mount L-Bracket and 10' Repeater Cable
VM180 - Outdoor Controller with EZ Mount Z-Bracket, Occupancy Sensor, and Weatherproof Enclosure
VM181 - Outdoor Controller with EZ Mount L-Bracket, 10' Repeater Cable and Weatherproof Enclosure
VM2iQ - Internal VendingMiser

CoolerMiser™ - for commercial glass-front coolers

CM150 - Indoor Wall Mount Controller with Occupancy Sensor
CM151 - Indoor Wall Mount Controller with 10' Repeater Cable
CM170 - Indoor Controller with EZ Mount Z-Bracket and Occupancy Sensor
CM171 - Indoor Controller with EZ Mount L-Bracket and 10' Repeater Cable
CM2iQ - Internal CoolerMiser

SnackMiser® - for snack vending machines

SM150 - Indoor Wall Mount Controller with Occupancy Sensor
SM151 - Indoor Wall Mount Controller with 10' Repeater Cable
SM170 - Indoor Controller with EZ Mount Z-Bracket and Occupancy Sensor
SM171 - Indoor Controller with EZ Mount L-Bracket and 10' Repeater Cable

PlugMiser™ - for most major electrical equipment

PM150 - Indoor Wall Mount Controller with Occupancy Sensor
PM151 - Indoor Wall Mount Controller with 10' Repeater Cable
PM190 - Indoor Controller with Leg Mount and Occupancy Sensor

VendingMiser VM150

CoolerMiser CM150

SnackMiser SM150

PlugMiser PM150

Visit www.energymisers.com for more information.

USA TECHNOLOGIES

USA Technologies 100 Deerfield Lane, Suite 140, Malvern, PA 19355 • 800.633.0340 • www.usatech.com

THE FUTURE OF WINDOWS

STANDARD FEATURES

- AAMA Certified AP-AW100 (60" X 144" AAMA/NWWDA 101/I.S.2-97 Configuration C)
- 15 psf water test
- Superior thermal strut
- COLORS and/or finishes can differ from **interior** to **exterior** of window
- Aesthetically pleasing flush vent design protects weatherstripping, reduces dust accumulation and insures long lasting perfofmance
- Vents are precision miter-cut, reinforced with aluminum gusset blocks and mechanically crimped
- Wet glazed with silicone and snap-in glazing beads
- Tubular meeting rails and vents

OPTIONS

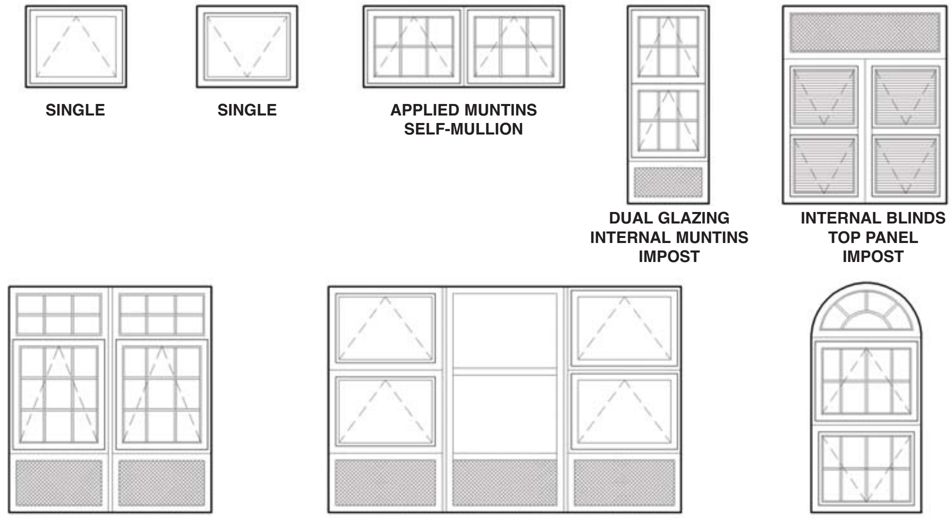
- Dual glazing with removable access panels (can be combined with polycarbonate glazing for vandal resistant applications)
- Triple glazing with up to 1 1/4” insulating glass at exterior and removable access panels at interior
- 5/8" or 1" deep internal blinds
- 1/2" deep extruded profiled muntins (exterior applied or between dual glazing, can be combined with 5/8" deep internal blinds)
- True muntins • Insect screens • Custodial locks (key operated)
- Pole operated white bronze spring catch locks (project-in only)
- Key operated limit stops • Manual or motorized remote operators
- Mates with all 3 1/2” double hung, casement and fixed series
- Impact resistant (level of performance based on glazing and window components)
- Scissor arm (roto) operators (project out only)

Architectural Window
Manufacturing Corporation

359 Veterans Blvd., Rutherford, NJ 07070
201-939-2200 • Fax: 201-939-2201
awsales@architecturalwindow.com
www.architecturalwindow.com

SERIES 3000i FLUSH VENT PROJECT-IN/OUT

DESIGN OPTIONS



SINGLE

SINGLE

APPLIED MUNTINS
SELF-MULLION

DUAL GLAZING
INTERNAL MUNTINS
IMPOST

INTERNAL BLINDS
TOP PANEL
IMPOST

IMPOST
3-PIECE MULLION
FIXED TOP TRANSOM
BOTTOM PANEL
INTERNAL MUNTINS

MATCHING FIXED LITES
TRUE MUNTINS

ARCHED TRANSOM
INTERNAL MUNTINS

PERFORMANCE CLASS/GRADE: AP-AW100

MAXIMUM TEST SIZE: 60" X 144"

GLAZING THICKNESS: 1/8" to 2 5/8"

MUNTINS: True, exterior applied or between glass

DUAL GLAZING: (SPLIT SASH) 2 1/4" air space between (2) pieces of 1/4" glass. Interior access panel is removable for easy cleaning or repair

INTERNAL BLINDS: Between the lites of glass in dual glazing application. Manual and pole operated controls are available.

FINISHES: Clear or color anodized, electrostatically applied baked enamel or high performance paint.

TWO-TONE: Windows can be fabricated where COLOR and/or finish are different from outside to inside of window.

MULLING: Three piece or self mullions between operable and/or matching 3 1/2" deep fixed windows.

SCREENS: Insect screens with fiberglass mesh in extruded aluminum frames. Aluminum or stainless steel mesh is optional.

IMPACT PERFORMANCE: Windows can be fabricated to comply with AAMA or ASTM impact requirements.

PERFORMANCE

SERIES	3000i
AAMA RATING AAMA/NWWDA 101/I.S. 2-97*	AP-AW100
AIR INFILTRATION** (cfm/ft^2) at 6.24 psf	.10
WATER TEST PRESSURE (psf)	15
UNIFORM LOAD DEFLECTION (psf)	100
UNIFORM LOAD STRUCTURAL (psf)	150

Note: Thermal performance results will vary based on different glazing options. Consult Architectural Window for thermal information.

* Any windows tested on or prior to 12/31/05, will be held to AAMA/NWWDA 101/I.S. 2-97 requirements. Windows tested after 12/31/05, will be held to AAMA/WDMA/CSA 101/I.S.2/A440-05 requirements.

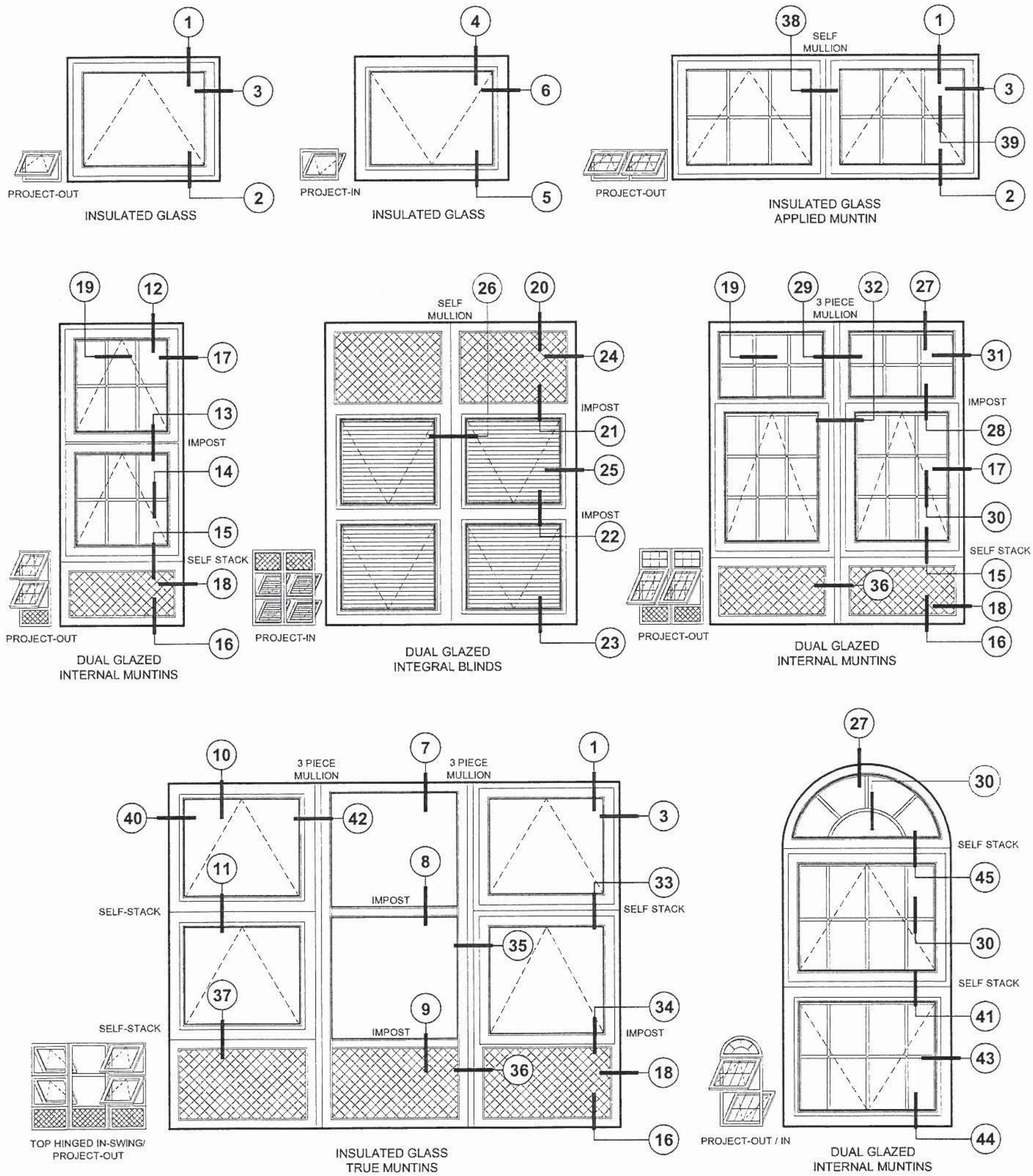
** Air infiltration results represent the maximum allowable by AAMA for the applicable performance class. Actual results are often lower than those shown. Consult Architectural Window for actual performance.

Architectural Window
Manufacturing Corporation

359 Veterans Blvd., Rutherford, NJ 07070
201-939-2200 • Fax: 201-939-2201
awsales@architecturalwindow.com
www.architecturalwindow.com

ARCHITECTURAL WINDOW
MANUFACTURING CORPORATION

Window Elevations Series 3000i 3 1/2" Projected (In/Out)

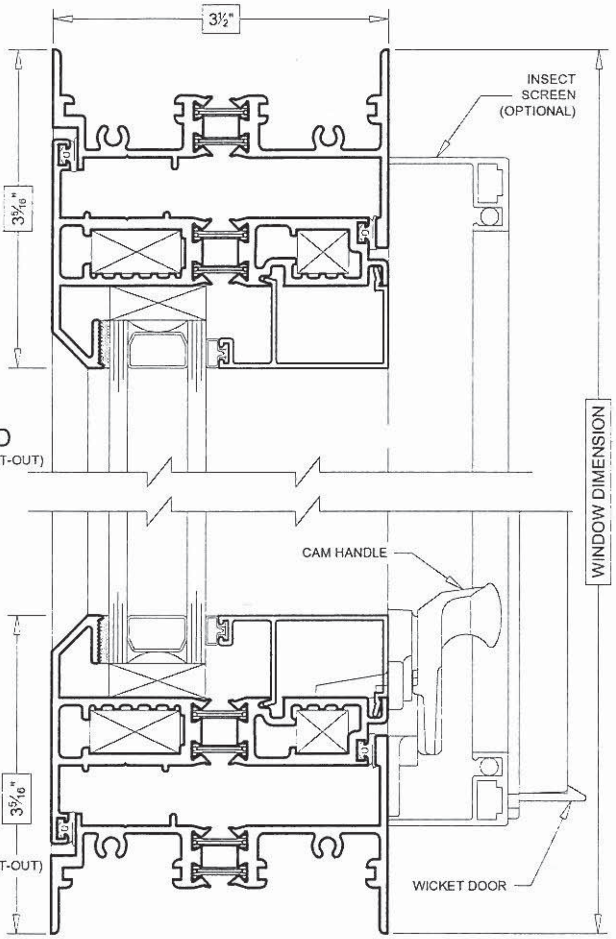


NOT TO SCALE

Details shown reflect the most commonly used configurations.
Contact AWM for additional details and/or assistance.

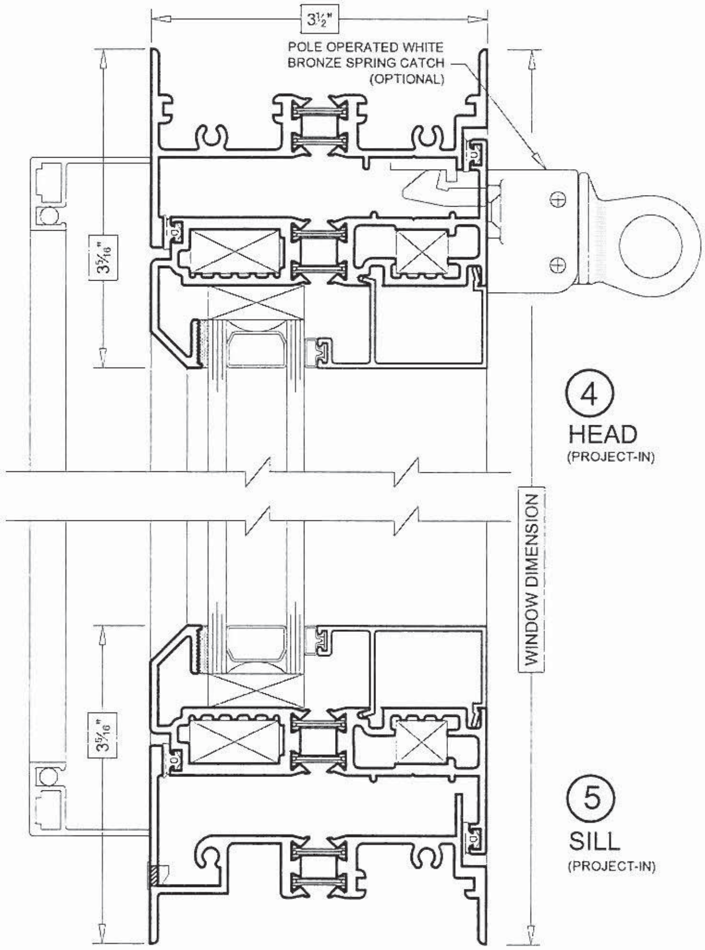
359 Veterans Blvd., Rutherford, New Jersey 07070
Tel: (201) 939-2200 Fax: (201) 939-2201

Window Details
Series 3000i
3 1/2" Projected (In/Out)



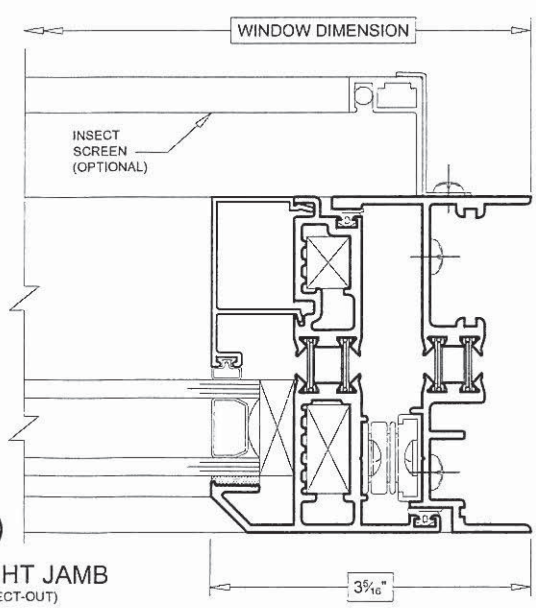
1 HEAD (PROJECT-OUT)

2 SILL (PROJECT-OUT)

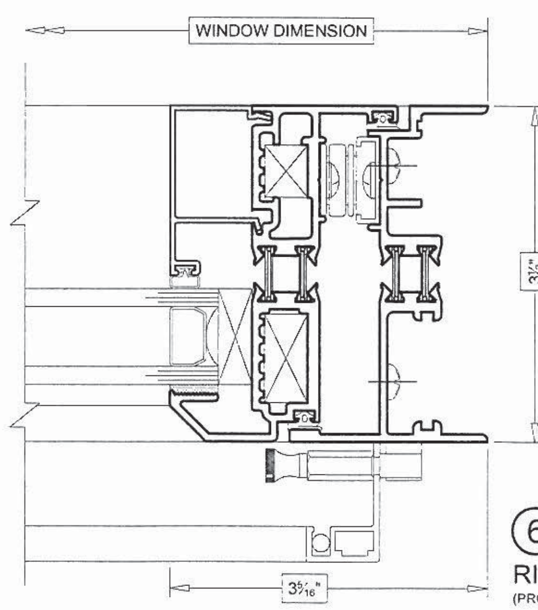


4 HEAD (PROJECT-IN)

5 SILL (PROJECT-IN)



3 RIGHT JAMB (PROJECT-OUT)



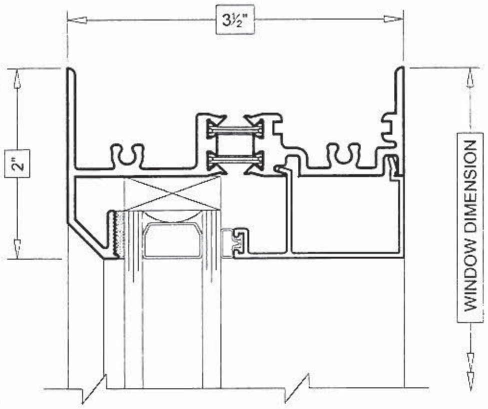
6 RIGHT JAMB (PROJECT-IN)

HALF SCALE DETAILS

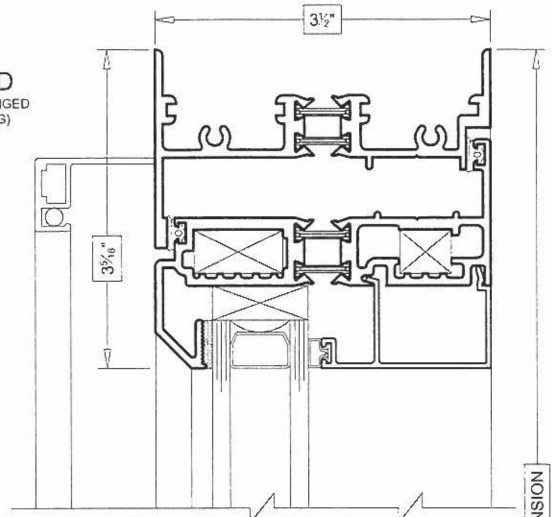
Details shown reflect the most commonly used configurations. Contact AWM for additional details and/or assistance.

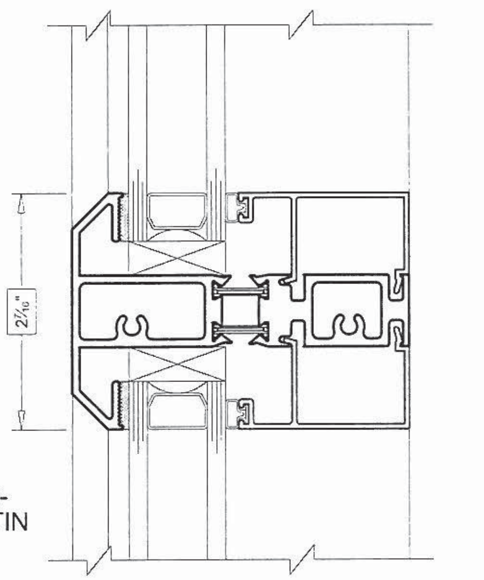
359 Veterans Blvd., Rutherford, New Jersey 07070
Tel: (201) 939-2200 Fax: (201) 939-2201

(7)
HEAD
(FIXED)

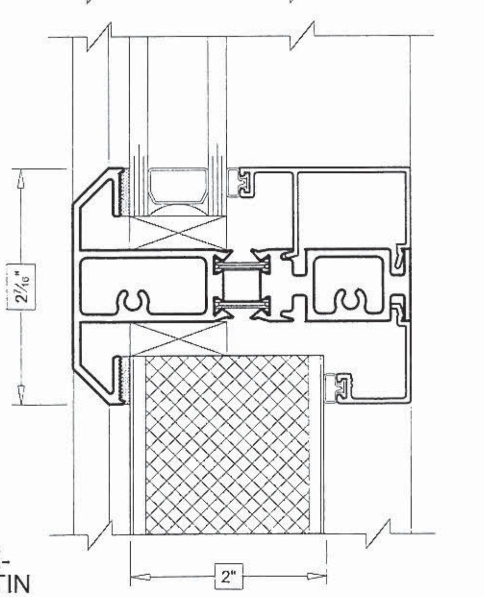


(10)
HEAD
(TOP-HINGED IN-SWING)

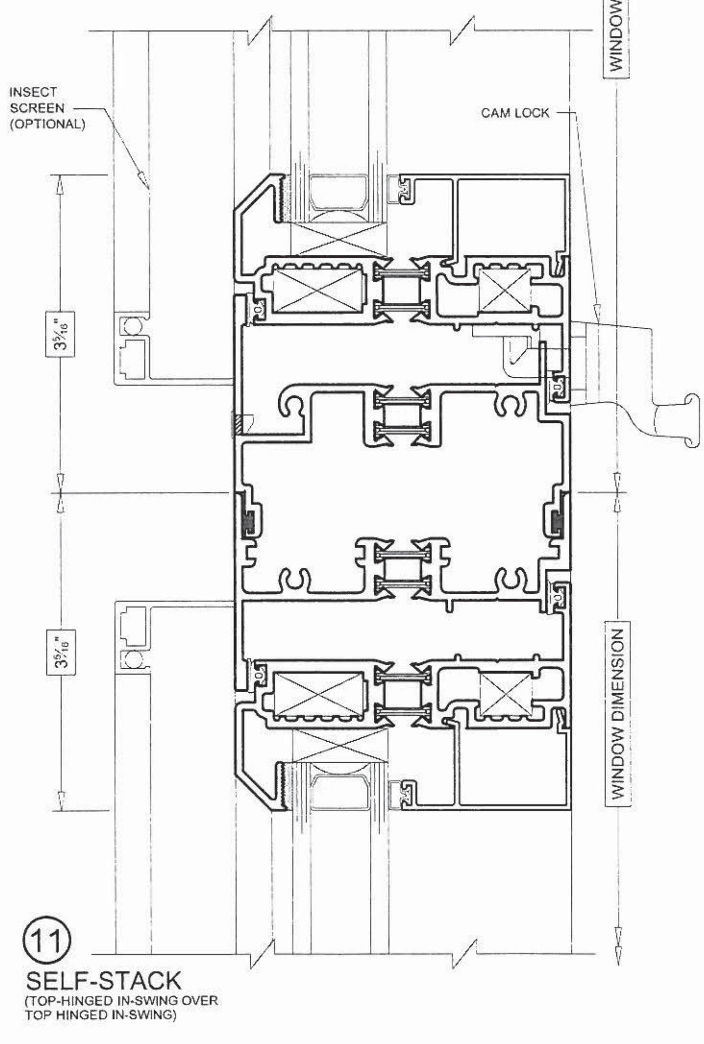




(8)
TRUE-MUNTIN



(9)
TRUE-MUNTIN
(FIXED OVER FIXED PANEL)

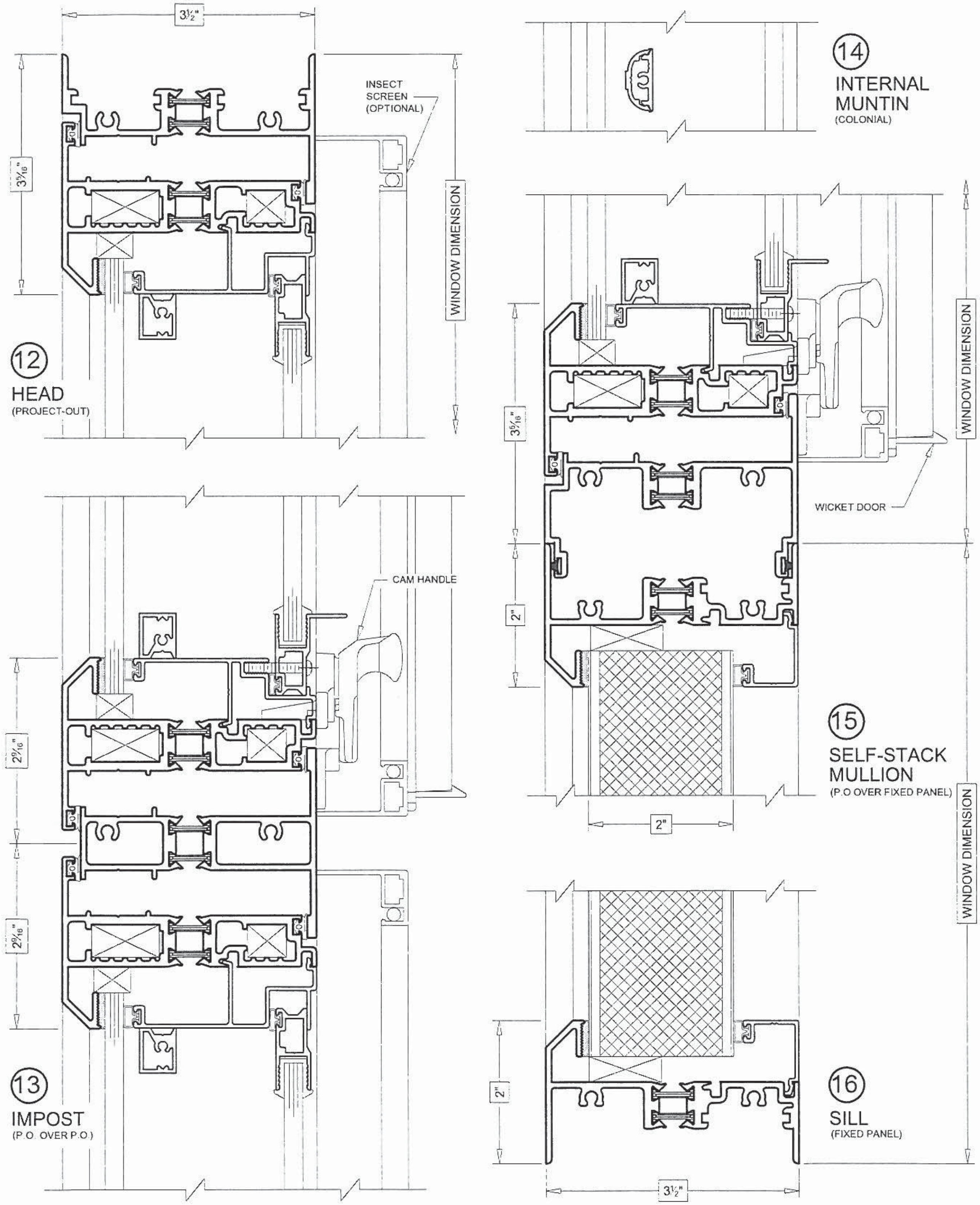


(11)
SELF-STACK
(TOP-HINGED IN-SWING OVER TOP HINGED IN-SWING)

Details shown reflect the most commonly used configurations.
Contact AWM for additional details and/or assistance.

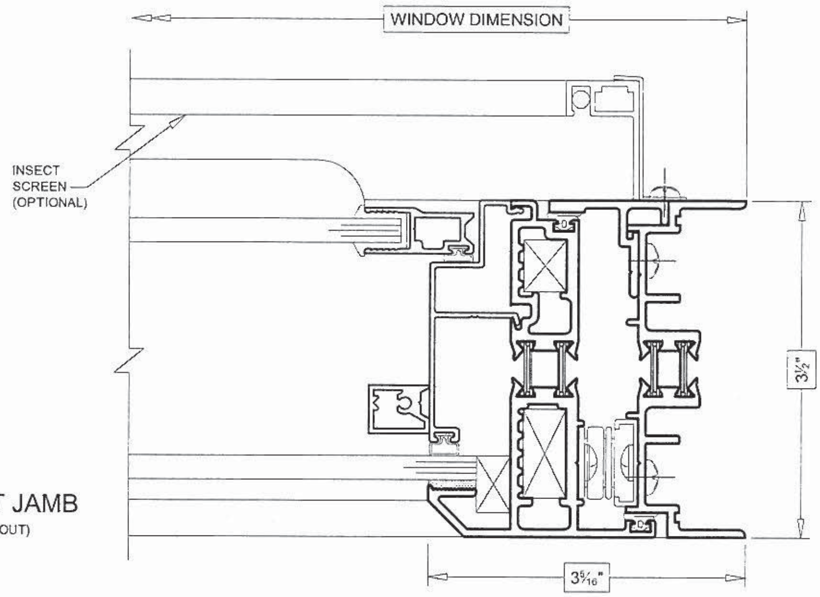
359 Veterans Blvd., Rutherford, New Jersey 07070 Tel: (201) 939-2200 Fax: (201) 939-2201

Window Details
Series 3000i
3 1/2" Projected (In/Out)

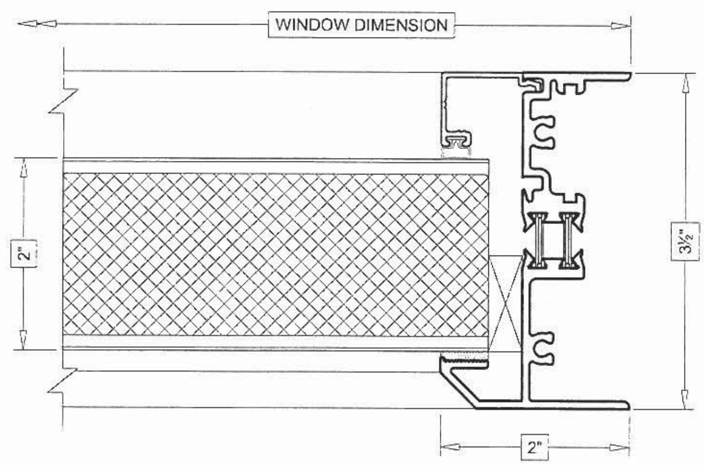


359 Veterans Blvd., Rutherford, New Jersey 07070 Tel: (201) 939-2200 Fax: (201) 939-2201

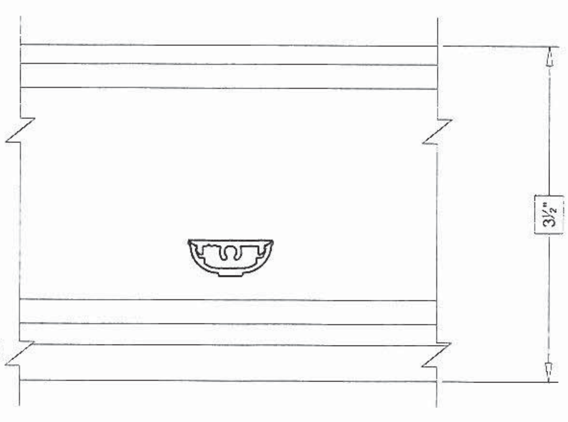
Window Details
Series 3000i
3 1/2" Projected
(In/Out)



(17)
RIGHT JAMB
(PROJECT-OUT)



(18)
RIGHT JAMB
(FIXED PANEL)



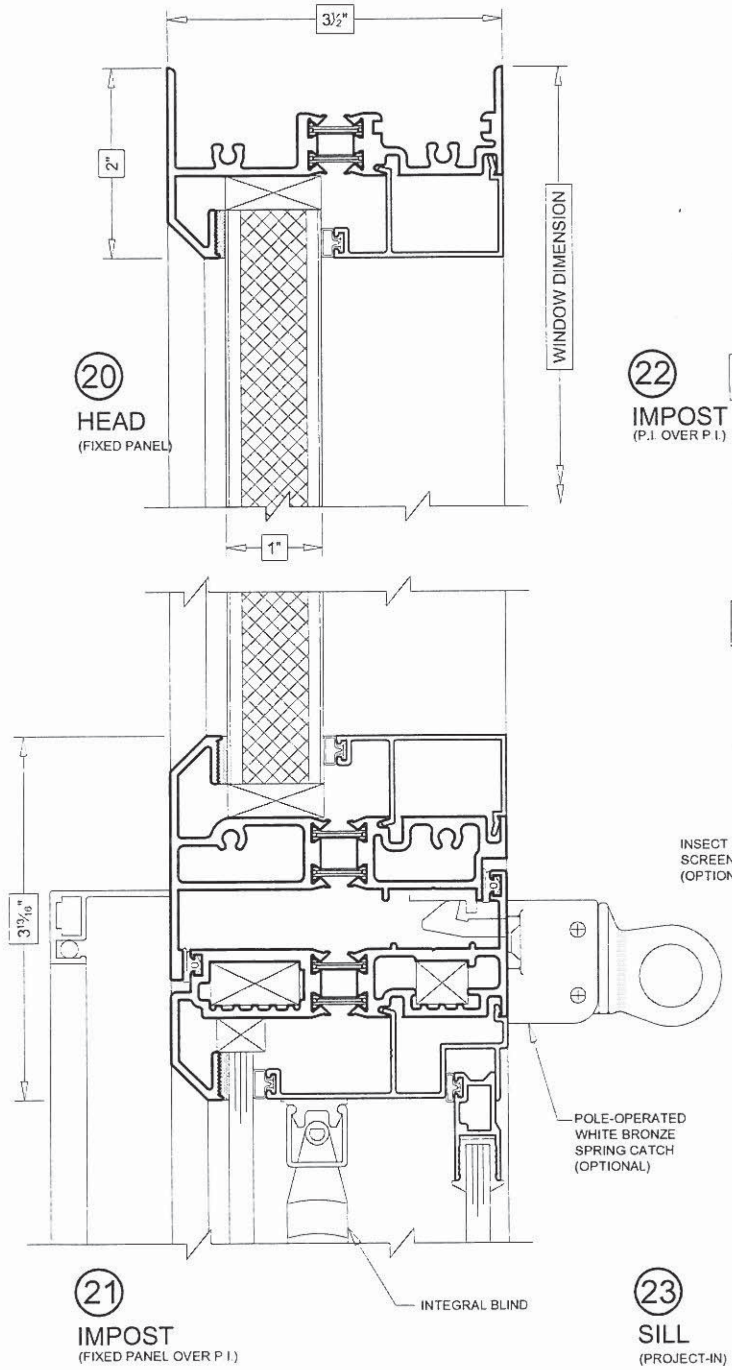
(19)
INTERNAL MUNTIN
(COLONIAL)

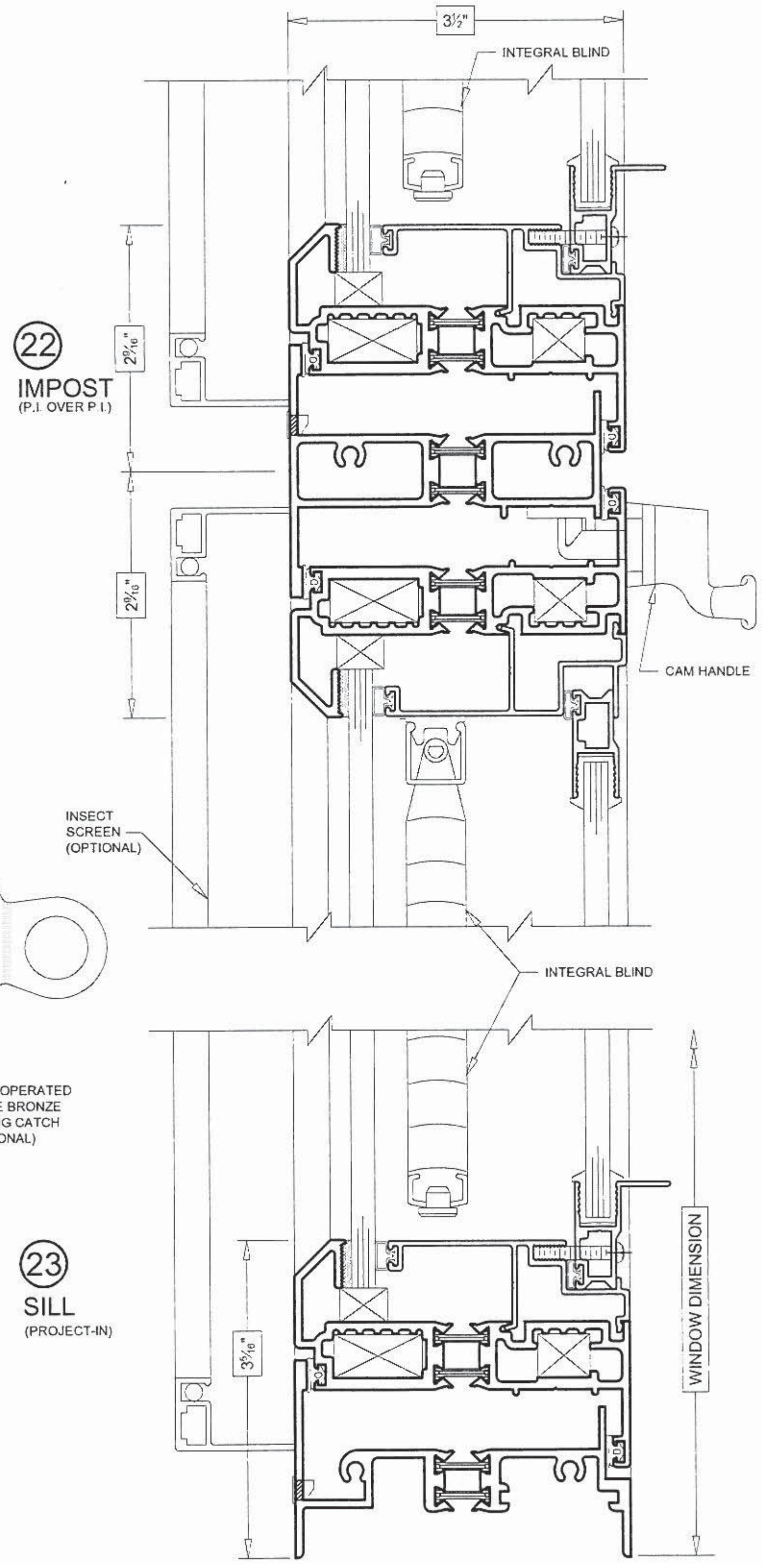
HALF SCALE DETAILS

Details shown reflect the most commonly used configurations.
Contact AWM for additional details and/or assistance.

359 Veterans Blvd., Rutherford, New Jersey 07070
Tel: (201) 939-2200 Fax: (201) 939-2201

Window Details
Series 3000i
3 1/2" Projected (In/Out)



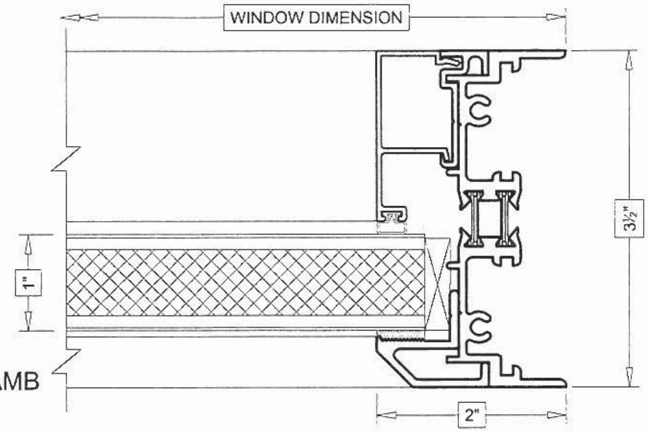


HALF SCALE DETAILS

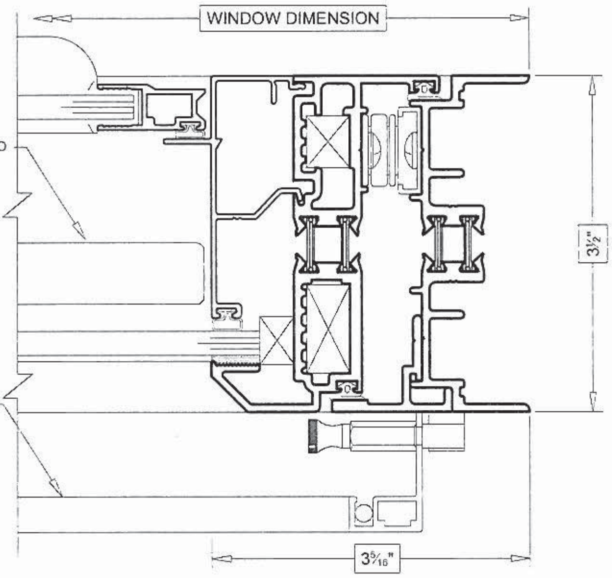
Details shown reflect the most commonly used configurations.
Contact AWM for additional details and/or assistance.

359 Veterans Blvd., Rutherford, New Jersey 07070
Tel: (201) 939-2200 Fax: (201) 939-2201

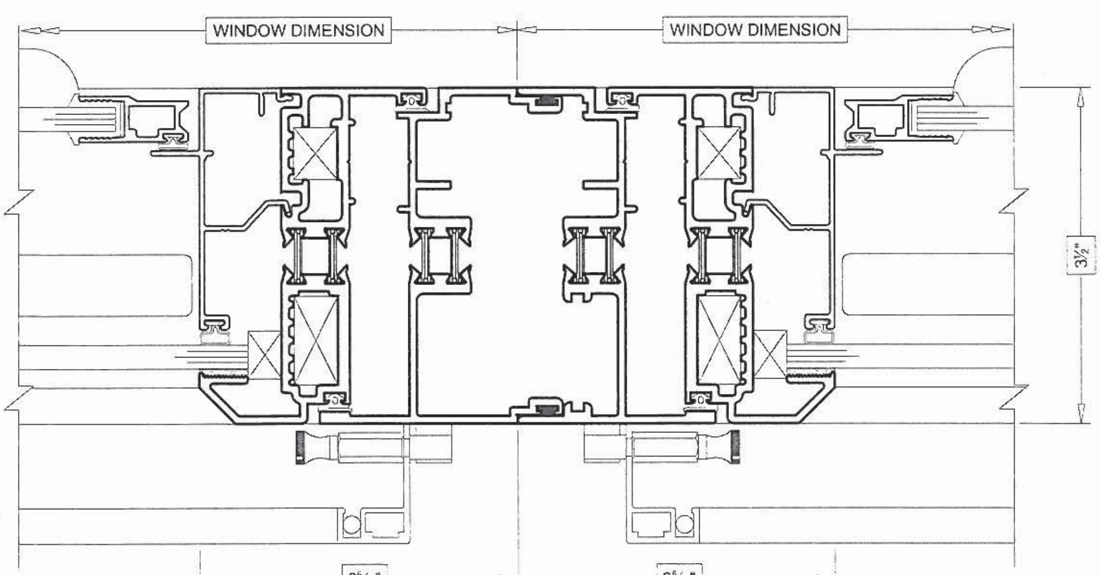
Window Details
Series 3000i
3 1/2" Projected
(In/Out)



(24)
RIGHT JAMB
(FIXED PANEL)



(25)
RIGHT JAMB
(PROJECT-IN)



(26)
SELF-MULLION
(P.I. TO P.I.)

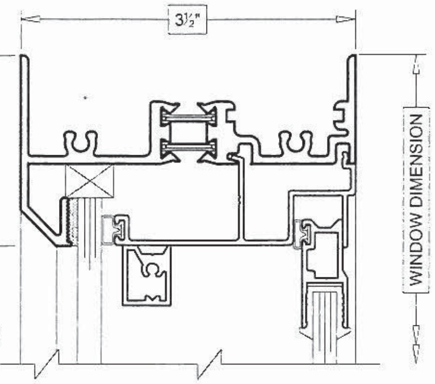
HALF SCALE DETAILS

Details shown reflect the most commonly used configurations.
Contact AWM for additional details and/or assistance.

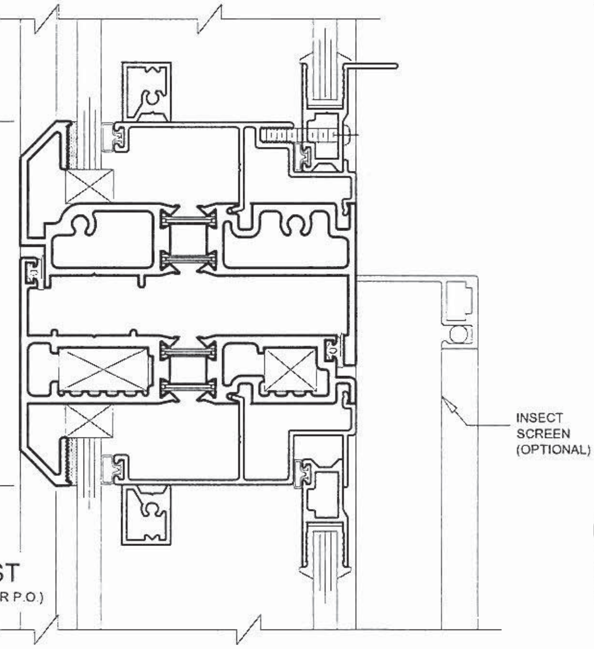
359 Veterans Blvd., Rutherford, New Jersey 07070
Tel: (201) 939-2200 Fax: (201) 939-2201

ARCHITECTURAL
WINDOW
MANUFACTURING CORPORATION

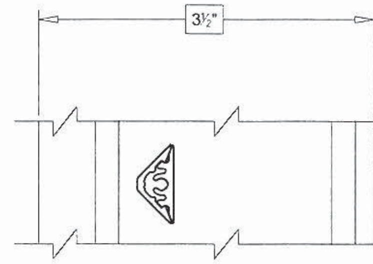
Window Details
Series 3000i
3 1/2" Projected
(In/Out)



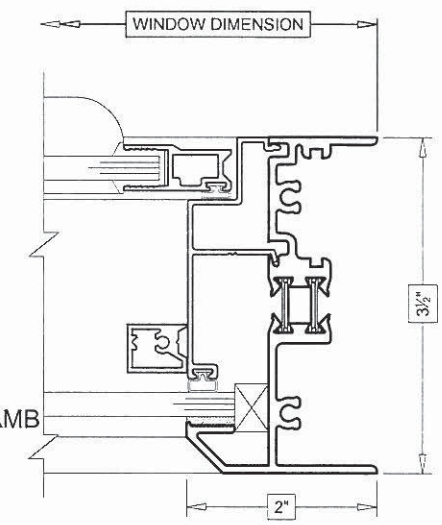
(27)
HEAD
(FIXED)



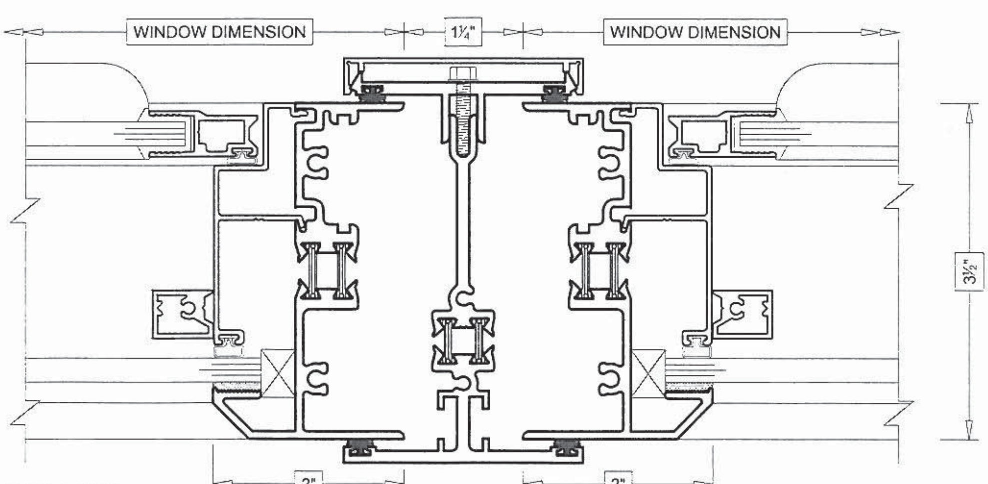
(28)
IMPOST
(FIXED OVER P.O.)



(30)
INTERNAL
MUNTIN
(TRAPEZOIDAL)



(31)
RIGHT JAMB
(FIXED)



(29)
3-PIECE MULLION
(FIXED TO FIXED)

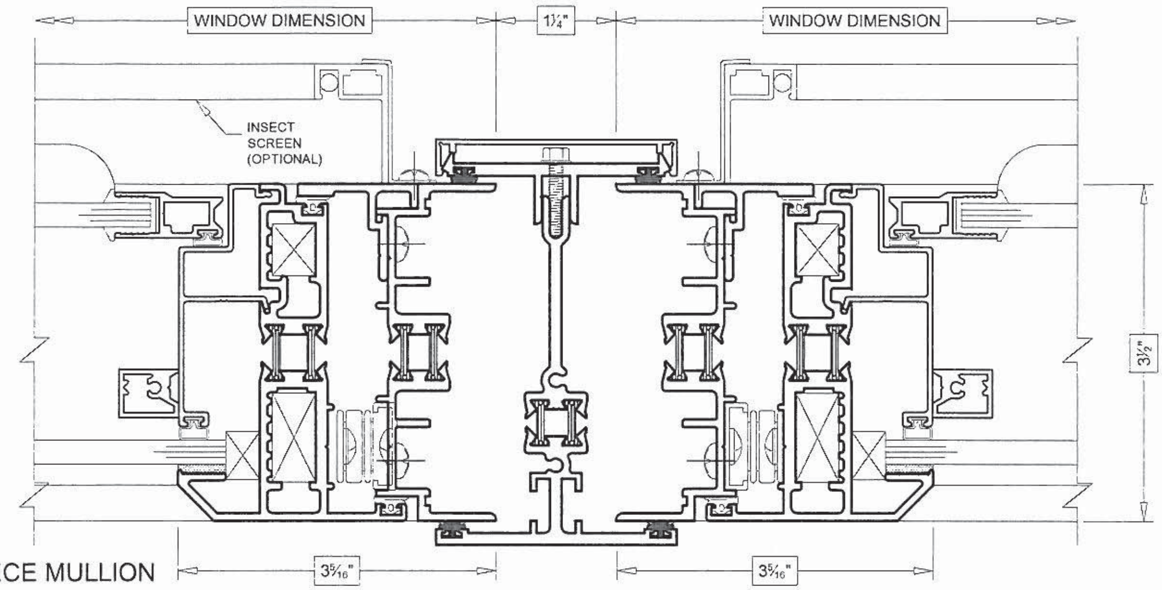
HALF SCALE DETAILS

Details shown reflect the most commonly used configurations.
Contact AWM for additional details and/or assistance.

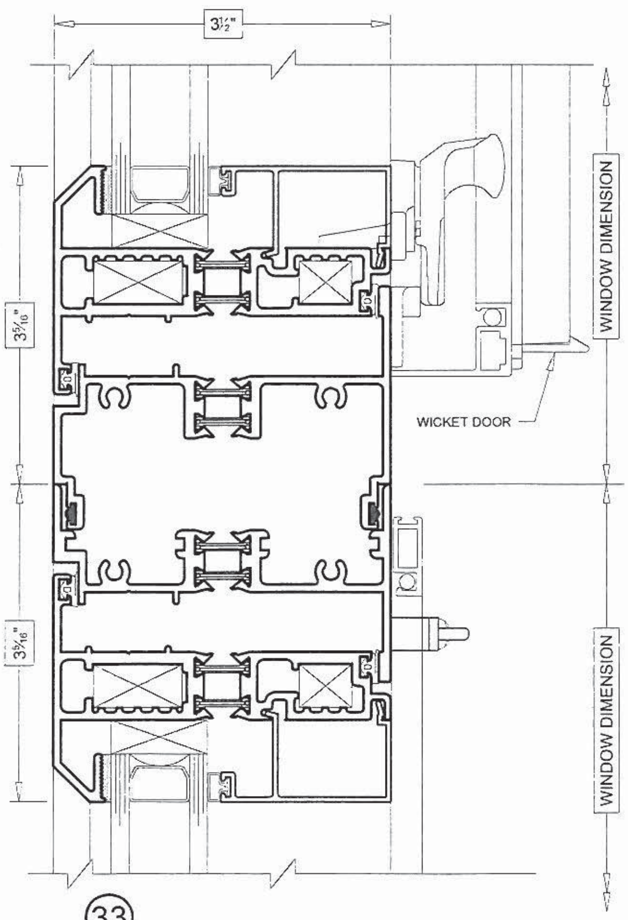
359 Veterans Blvd., Rutherford, New Jersey 07070

Tel: (201) 939-2200 Fax: (201) 939-2201

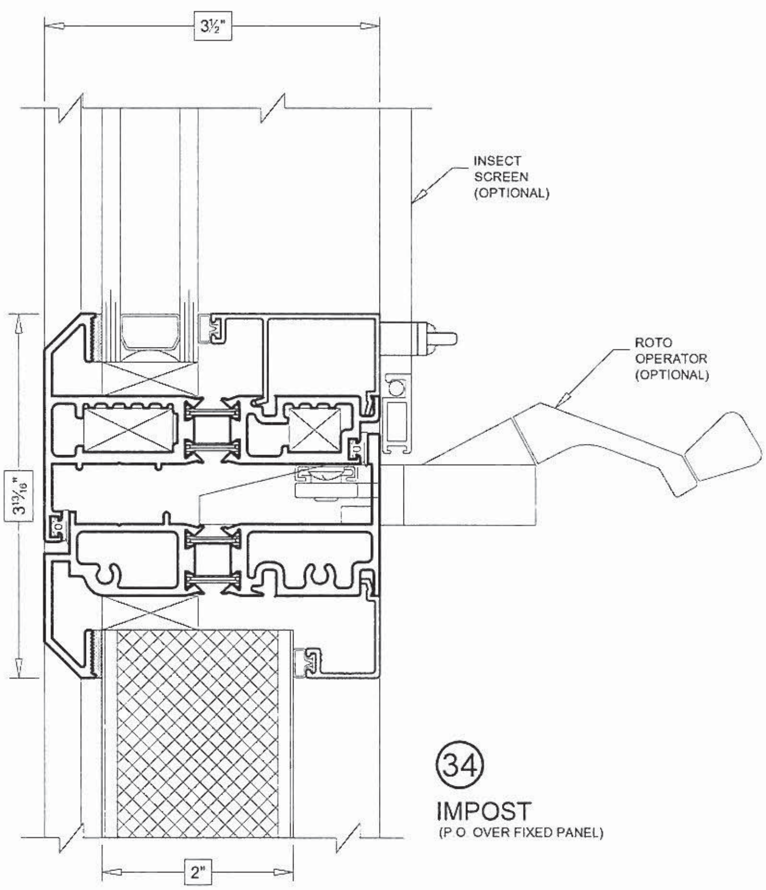
Window Details
Series 3000i
3 1/2" Projected (In/Out)



(32) 3-PIECE MULLION
(P.O. TO P.O.)



(33) SELF-STACK
(P.O. OVER P.O.)



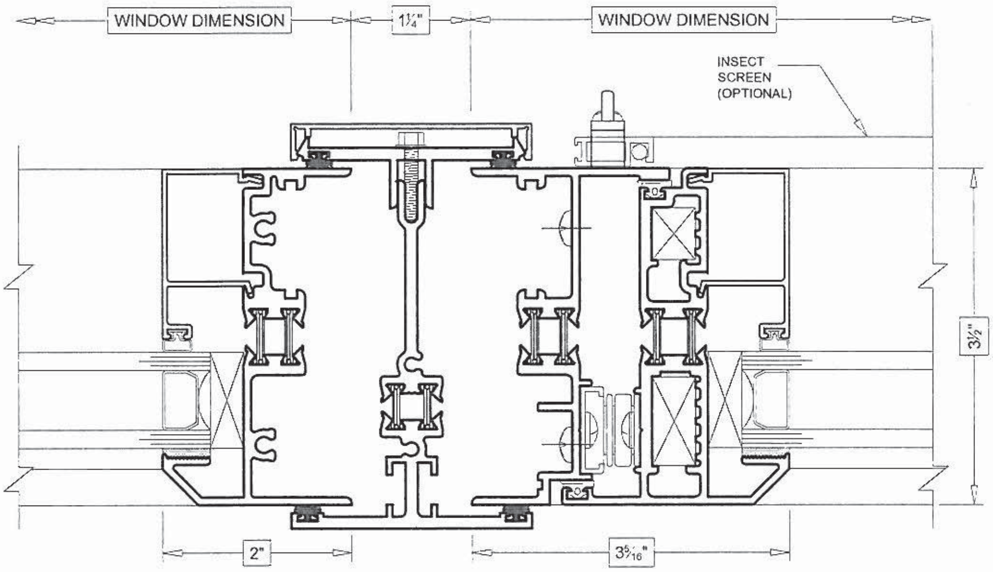
(34) IMPOST
(P.O. OVER FIXED PANEL)

HALF SCALE DETAILS

Details shown reflect the most commonly used configurations.
Contact AWM for additional details and/or assistance.

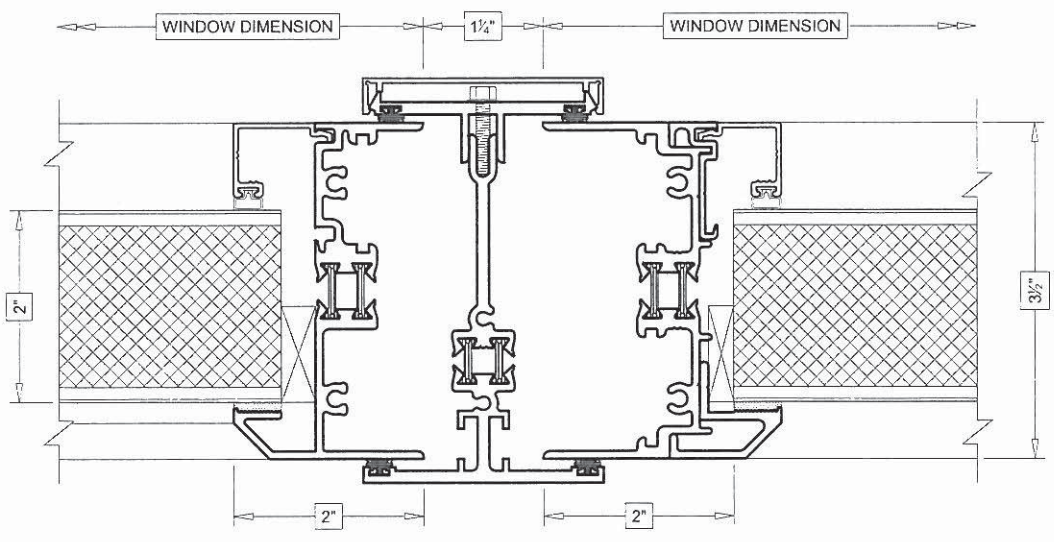
359 Veterans Blvd., Rutherford, New Jersey 07070

Tel: (201) 939-2200 Fax: (201) 939-2201



35

3-PIECE MULLION
(FIXED TO P.O.)

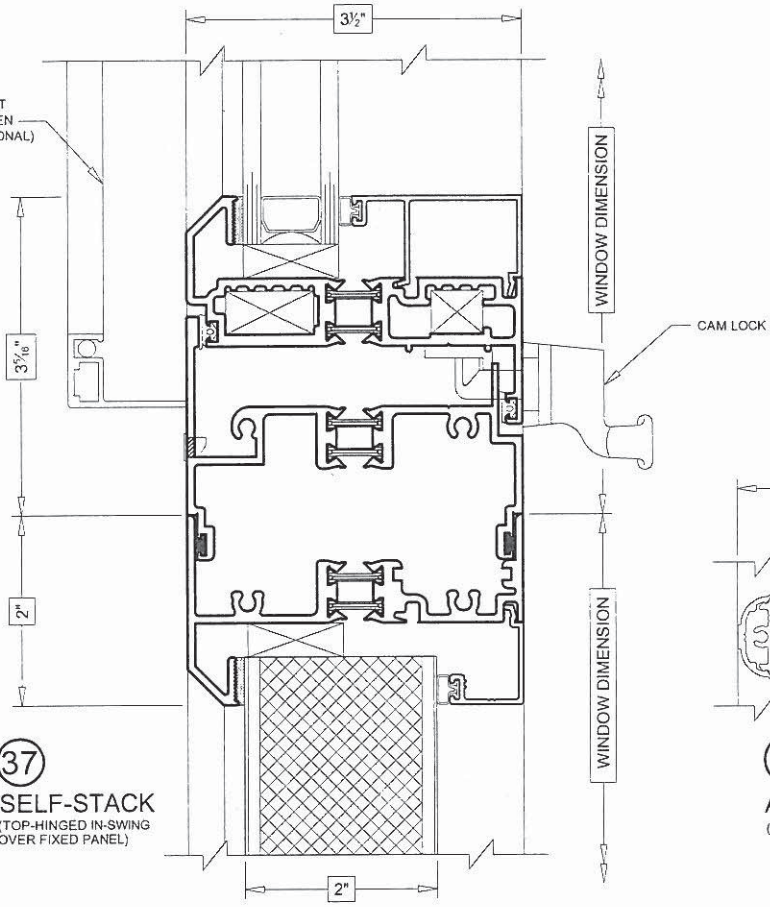


36

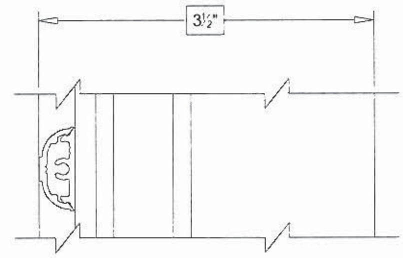
3-PIECE MULLION
(FIXED PANEL TO FIXED PANEL)

359 Veterans Blvd., Rutherford, New Jersey 07070
Tel: (201) 939-2200 Fax: (201) 939-2201

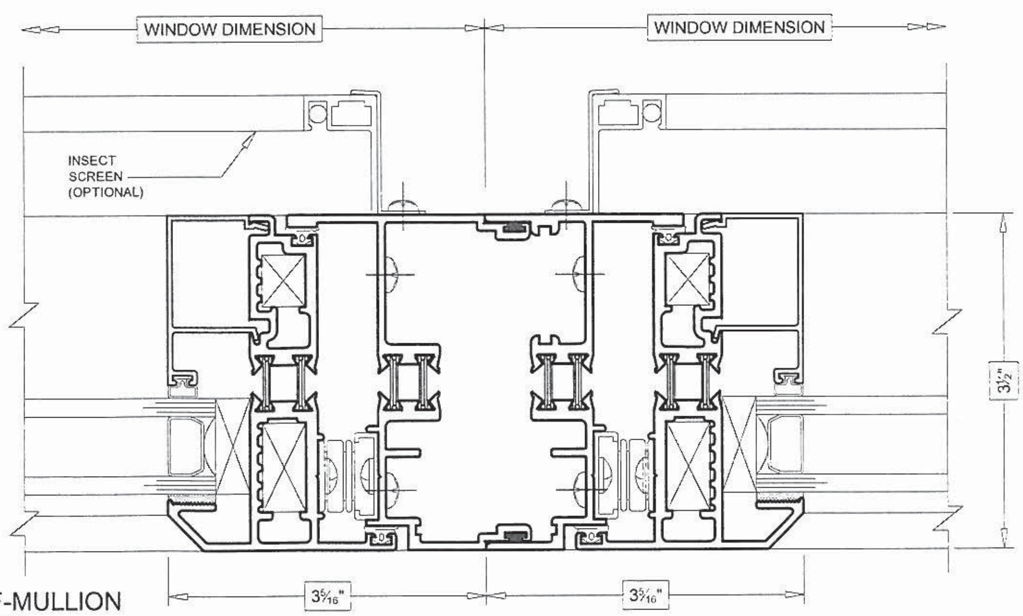
Window Details
Series 3000i
3 1/2" Projected (In/Out)



(37) SELF-STACK
(TOP-HINGED IN-SWING OVER FIXED PANEL)



(39) APPLIED MUNTIN
(COLONIAL)



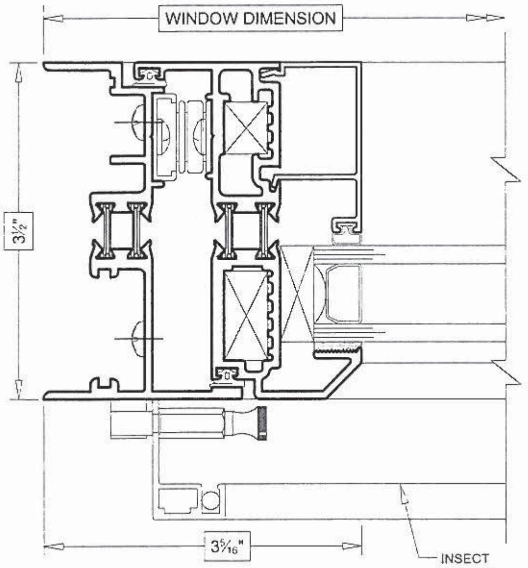
(38) SELF-MULLION
(P.O. TO P.O.)

HALF SCALE DETAILS

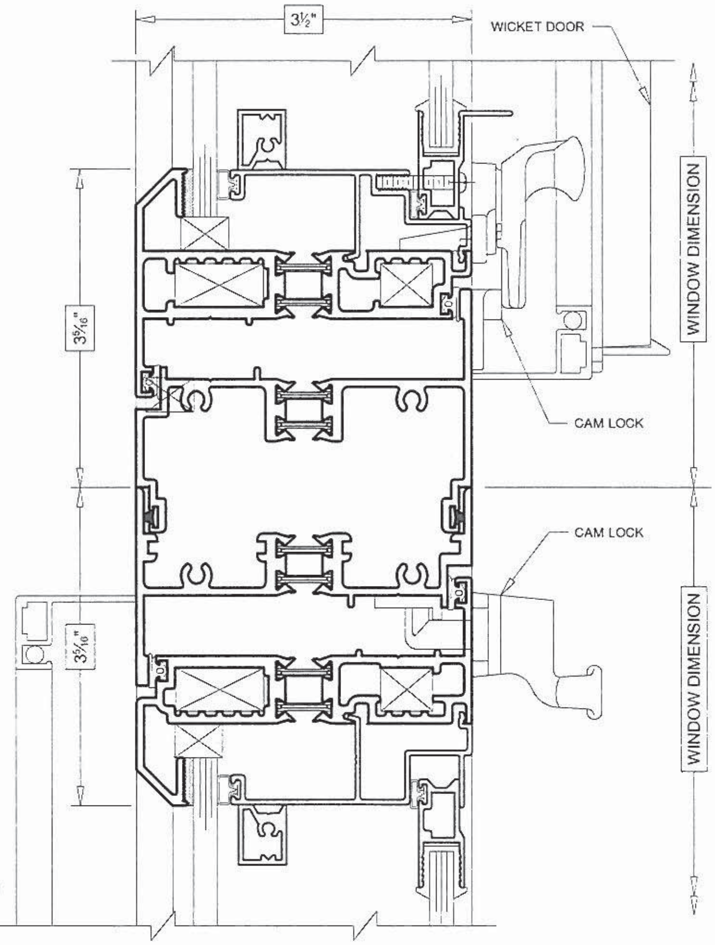
Details shown reflect the most commonly used configurations.
Contact AWM for additional details and/or assistance.

359 Veterans Blvd., Rutherford, New Jersey 07070
Tel: (201) 939-2200 Fax: (201) 939-2201

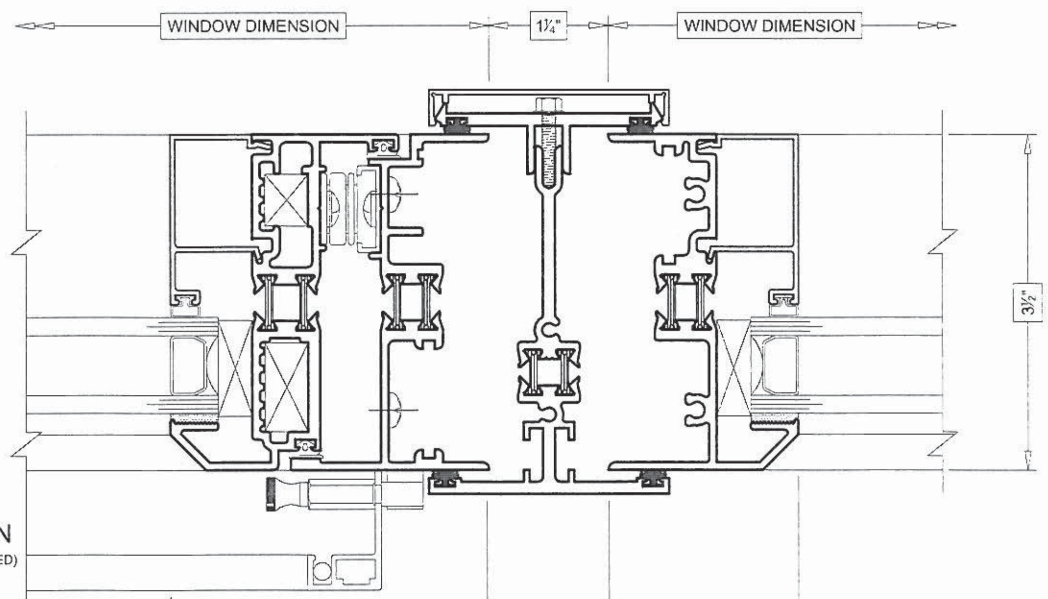
Window Details
Series 3000i
3 1/2" Projected
(In/Out)



(40) LEFT JAMB
(TOP HINGED IN-SWING)



(41) SELF-STACK
(PROJECT-OUT OVER PROJECT-IN)



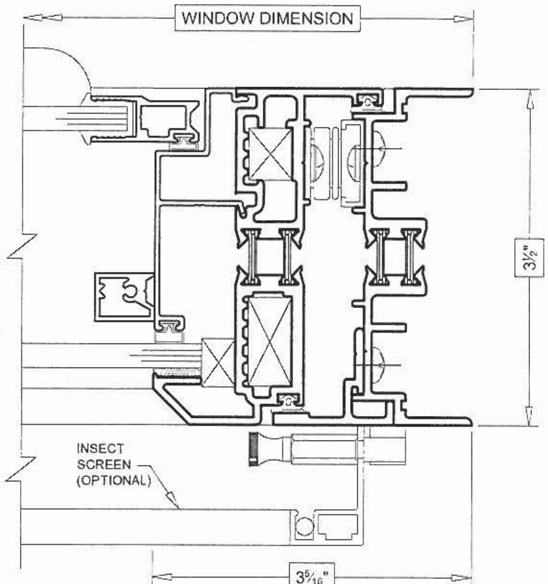
(42) 3-PIECE MULLION
(TOP HINGED IN-SWING TO FIXED)

HALF SCALE DETAILS

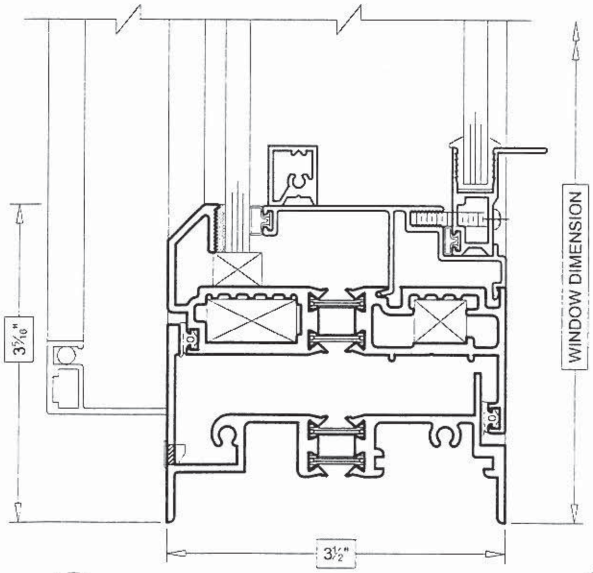
Details shown reflect the most commonly used configurations.
Contact AWM for additional details and/or assistance.

359 Veterans Blvd., Rutherford, New Jersey 07070
Tel: (201) 939-2200 Fax: (201) 939-2201

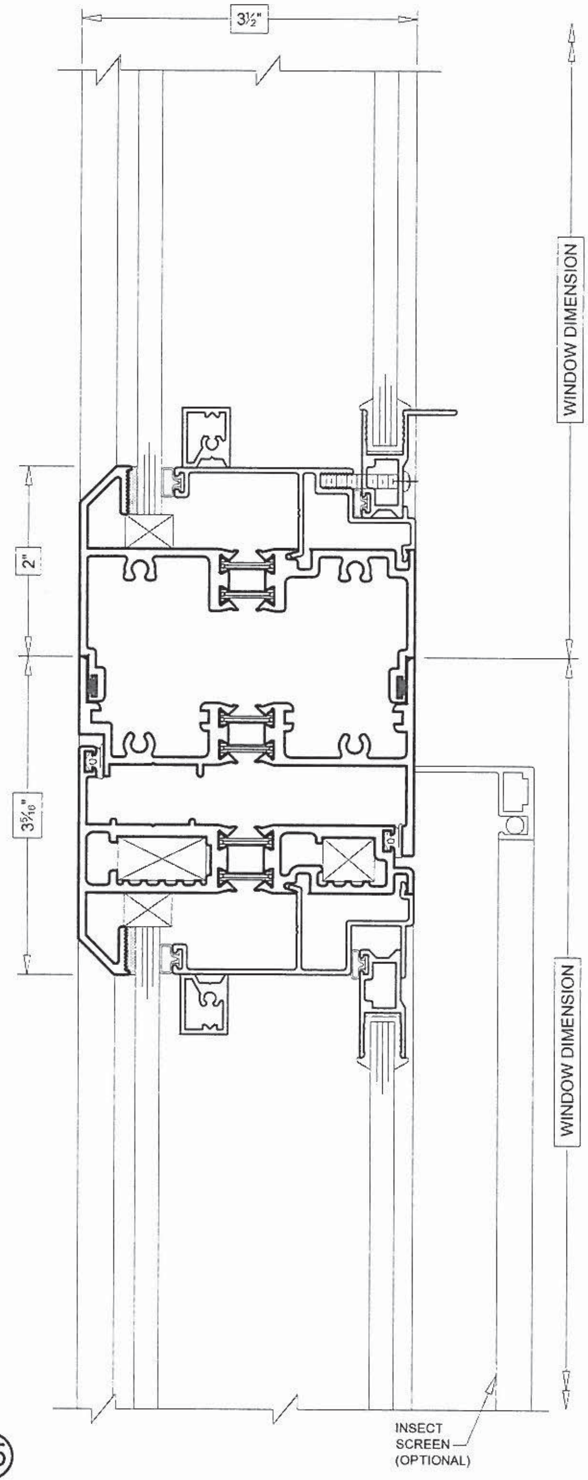
Window Details
Series 3000i
3 1/2" Projected (In/Out)



43
RIGHT JAMB
(PROJECT-IN)



44
SILL
(PROJECT-IN)



45
SELF-STACK
(FIXED OVER P.O.)

HALF SCALE DETAILS

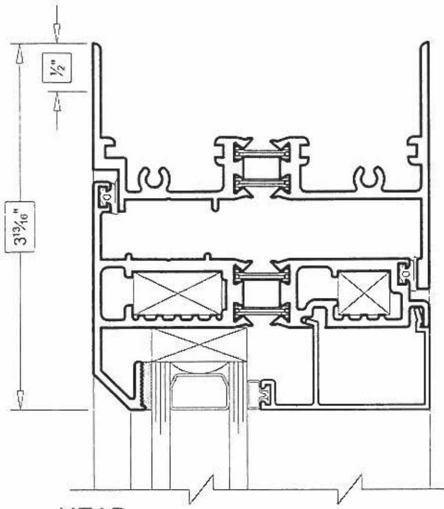
Details shown reflect the most commonly used configurations.
Contact AWM for additional details and/or assistance.

359 Veterans Blvd., Rutherford, New Jersey 07070
Tel: (201) 939-2200 Fax: (201) 939-2201

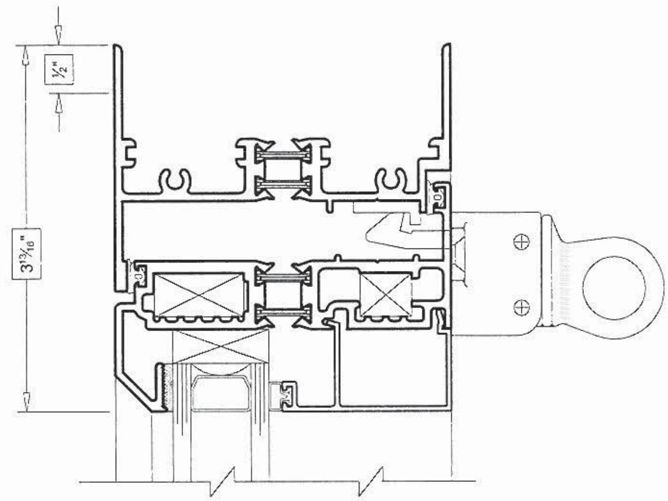
ARCHITECTURAL
WINDOW
MANUFACTURING CORPORATION

Window Details
Series 3000i
3 1/2" Projected
(In/Out)

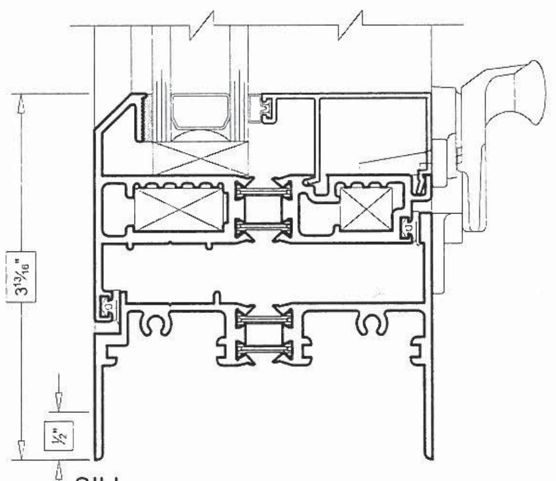
Optional 1/2" Extended Frames
for use with Panning, Sub-Frames,
Mullions, and Other Accessories.



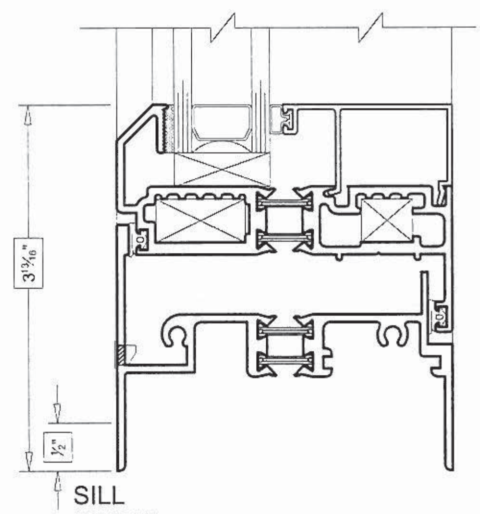
HEAD
(PROJECT-OUT)



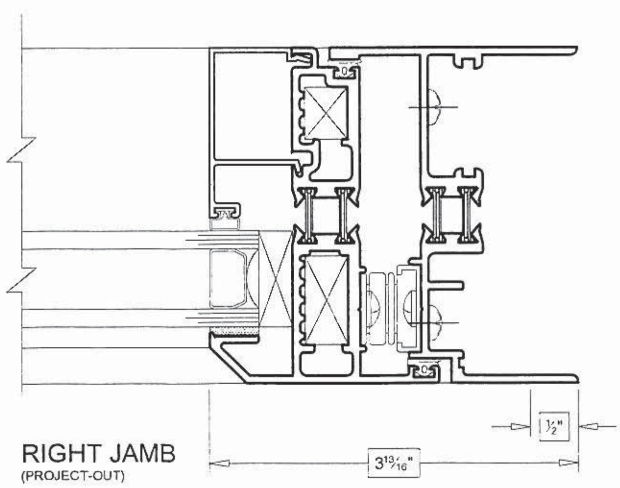
HEAD
(PROJECT-IN)



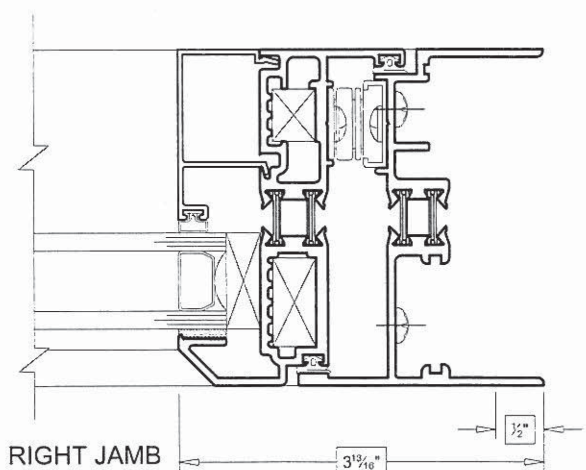
SILL
(PROJECT-OUT)



SILL
(PROJECT-IN)



RIGHT JAMB
(PROJECT-OUT)



RIGHT JAMB
(PROJECT-IN)

HALF SCALE DETAILS

Details shown reflect the most commonly used configurations.
Contact AWM for additional details and/or assistance.

359 Veterans Blvd., Rutherford, New Jersey 07070
Tel: (201) 939-2200 Fax: (201) 939-2201

APPENDIX 4 SAFETY MANAGEMENT PLAN

This Page Intentionally Left Blank

HSE Safety Management Plan

Prepared by:	Tim Laverick
Signature:	
Date:	01/19/15
HSE Manager:	Steve Serian
Signature:	
Date:	
Customer:	School District of the Chathams
Signature:	
Date:	

NOTE: A SIGNED AND ACCEPTED COPY IS TO BE KEPT ON SITE AND ON CONTRACT FILE.

INTRODUCTION

The Health, Safety & Environmental (HSE) Site Management Plan is an integral part of all work and site specific procedures for all Honeywell operations. Honeywell is committed to developing safety systems which ensure the highest standard of health and safety for all employees. We aim to continually improve the systems of work and strive for best practice in the area of health, safety and environment. Honeywell aims to control risk through the implementation of an effective HSE Site Management Plan and Program.

The objective of this document is to establish a plan for implementing the company safe operations management program. The plan is intended to minimize losses, meet regulatory compliance requirements and to implement site health, safety and environmental regulations established by the Customer.

Honeywell demonstrates its commitment to health and safety by making all levels of management accountable for all health and safety issues. We attribute the success of effective safety systems to the ability to communicate the agreed standards of performance between employees and management. Honeywell's commitment to health, safety and the environment can be viewed at **Attachment 1: Honeywell HSE Commitment Statements.**

1. Plan Deployment

The HSE Plan is one component of Honeywell's Safe Operations Management (SOM) program. The HSE Plan, and its relevant components and references specific to this project, should be reviewed with the Customer, Honeywell representatives and subcontractors/contractors to ensure effective deployment of the SOM program. This includes:

(1) On-site meeting between Customer and Honeywell representative(s) and subcontractors.
(2) Customer and Honeywell representative(s) and subcontractors are briefed and understand the Safety Management Plan:
  a) Site information,
  b) Hazard and risk assessments,
  c) HSE training,
  d) Activity schedules,
  e) Measures of HSE performance.
(3) Plan is to be reviewed on a quarterly basis to ensure Management of Change.
(4) Plan shall be maintained to ensure that relevant information is available to employees, contractors, customers, clients and the public concerning the effects of the Company's activities and materials on the safety and health of people and impact on the environment.
(5) Communication and management systems shall be developed, implemented and maintained throughout each site to facilitate continuous improvement in performance.

(6) Active consultation and communication with employees and contractors in the improvement of health, safety and environmental work.

Honeywell Management Systems are the property of Honeywell and must be maintained in accordance with Honeywell Information Security guidelines. Clients wishing to view any components of the Honeywell Operating System (external to Safe Operations Management) can request to do so by contacting the Honeywell Project Manager, who will assess the request and where deemed appropriate, arrange for viewing of the relevant Honeywell information.

2. Revision Sheet

When changes are made to this document, the revision sheet must be revised and all controlled copies of the document updated and distributed per the Distribution List.

Revision	Date	Description
Initial Draft	01/19/15	Initial document

3. Distribution List

One hard copy will be maintained for the assigned contract on site. Electronic copy can be distributed, upon request.

Copy	Name	Organization & Title	Email Address
1	Bob Platt	Honeywell Project Manager	Robert.Platt@Honeywell.com
2	Steve Serian	Honeywell HSE Leader	Steven.Serian@Honeywell.com
3	Jim Freeman	Honeywell PM Leader	James.Freeman@Honeywell.com
4	John Cataldo	Customer Project Manager	jcataldo@chatham-nj.org
5		Customer HSE Leader	

4. Contents

SECTION 1 – SITE INFORMATION & HSE ADMINISTRATION

5. Contract – Scope of Work Description

Project name:	School District of the Chathams
Customer name and address:	58 Meyersville Road, Chatham, NJ 07928
Scope of work (summary):	Lighting, Mechanical, Controls, Building Envelope, Transformers
Start Date:	
Completion Date:	

6. Key Project Contacts (List all Honeywell Employees & Contractors)

Honeywell Project Manager	Bob Platt	203-215-7340, Robert.Platt@honeywell.com
Honeywell Project Administrator	Tim Laverick	908-635-3853, timothy.laverick@honeywell.com
Honeywell Branch Project Manager		
Honeywell Regional HSE Leader	Steve Serian	603-930-0222, steven.serian@honeywell.com
Customer Project Manager	John Cataldo	973-457-2504, jcataldo@chatham-nj.org
Customer HSE Leader		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		

7. Customer HSE Reporting

Honeywell will report HSE performance to the Customer, if required, as defined in the scope of work and/or contract. Reporting topics may include:

- Customer requested HSE metrics at customer request,
- Incidents/injuries, Safety Observation System events,
- Summary of HSE Project Manager site reviews/audits, Contractor audit results

8. Cardinal Rules – Unacceptable Behaviors & Attitudes

The Cardinal Rules shall be displayed at all Honeywell locations, including field offices and also at designated Honeywell offices within the Customer site. All employees are to adhere to the Cardinal Rules which can be viewed at **Attachment 2: Honeywell Cardinal Rules**.

9. Responsibilities, Authority & Resources

Management & Resources

The Honeywell Project Manager is responsible for the implementation of the Honeywell Health, Safety and Environment Plan requirements and shall maintain and monitor programs aimed at continuous improvement of HSE performance. Appropriate health, safety and environmental support and resources shall be available to assist project and service managers to discharge their responsibilities.

Honeywell Project Manager Responsibilities

Each PM is accountable for implementation of Honeywell's HSE Policy. Specific responsibilities are:

- Supports and promotes jobsite safety through leadership and example.
- Becomes involved in task safety analysis in order to identify any hazards and manage the associated risks prior to work being done.
- Ensures the completion of job hazard analysis prior to the beginning of any work including review and approval.
- Insist upon employee's and subcontractor's compliance with established safety rules, correcting any unsafe acts or conditions, and implementing corrective or disciplinary actions as necessary for the effective functioning of the safety program.
- Ensure all team members are trained in safe work procedures.
- Ensure regular hazard inspections are carried out within areas under their control.
- Verify that employees and subcontractors implement the designated site safe work procedures/systems.
- Ensure approved Honeywell employee protective equipment is issued and proper instruction given as to its use, maintenance and storage.
- Be involved in formal as well as informal safety audits and monitor contractor and site safety performance on a regular basis.
- Ensure that all accidents and injuries are reported and investigated.
- Identify cause of non-compliance and investigate/document actions to correct safe work method deficiencies or rectify inappropriate workplace behaviors, including consultation, counselling, training and/or disciplinary action.
- Preparation and regular review of work procedures.

All Honeywell Employee Responsibilities

Employees have a duty to cooperate in the achievement of a safe and accident free workplace, through:

- Cooperating in fulfilment of the obligations placed on Honeywell International.
- Identify all tasked and prepare risk assessments.
- Working with care for their own safety and that of others who may be affected by their actions
- Reporting unsafe conditions and behaviours.
- Wear and maintain any issued personal protective equipment (PPE) when necessary.
- Assisting in the investigation of any accidents with the objective to prevent recurrence.
- Maintain a safe working environment for all Honeywell/Contractor employees that may be utilized for this project.
- Report all safety issues or events directly to the Honeywell Project Manager.

Subcontractors shall be responsible for complying with all Subcontractor Responsibilities

Subcontractors shall be responsible for complying with all statutory obligations and shall exercise all possible care for the health and safety of their personnel and other persons at the workplace who may be affected by their activities. Subcontractors shall at all times comply with Honeywell's HSE policy and procedures. As a condition of employment all employees are expected to work in a safe and responsible manner. The employee is ultimately responsible for his or her own safety. All contractors shall provide the employee with all the necessary training and PPE, but the employee must make the proper choices when performing an assigned task. Any issues not covered by this Safety Plan should be communicated to the relevant Honeywell representative. The Contractor's personnel will have responsibilities, which include but may not be limited to the following:

- Establishing safety responsibilities for their site personnel including their subcontractors.
- Insisting and ensuring correct and safe practices are used at all times.
- Providing adequate resources, personnel, equipment, time and funds to ensure the objectives of the safety plan are met.
- Completing the required work authorization forms and safety permits for each activity.

- Following safety rules and verbal instructions. Ask superintendent questions when any uncertainty exists.
- Ensuring their site personnel are suitably trained to effectively carry out their HSE responsibilities.
- Using tools in a safe and appropriate manner in accordance with their design; inspecting them for damage prior to each use.
- Ensuring safety auditing and performance reporting requirements specified by Honeywell are met.
- Reporting any unsafe acts or conditions, correcting them whenever possible.
- Reporting all injuries, incidents and near misses immediately, no matter how minor.

Project Employee/Contractor List

The Honeywell Project Manager will maintain the **Attachment 3 Site Project Contractor/Employee List**. All Contractors and Honeywell Employees working on site, listed or not, have a duty to cooperate in the achievement of a safe and accident free workplace.

10. Site Facilities

Honeywell Designated Areas

All designated Honeywell areas, if any, at the customer site must be maintained by Honeywell staff to ensure these facilities are kept in a clean and hygienic condition for the duration of the contract. At a minimum, these areas are to be inspected weekly to identify any workplace hazards or risks and to ensure minimum standards are maintained. If there is a Honeywell office you are required to post the Honeywell Commitment Statement and Cardinal Safety Rules. Depending on local or federal requirements ensure regulatory postings are current.

Security

Honeywell employees must meet all customer security requirements. This may include visitor badges, access training, appropriate regulatory and/or customer documentation, background checks, registry upon arrival and departure, etc. Badges are to be worn above the waist and in a visible position at all times while on site.

11. Honeywell Staff Training

Training needs shall be identified and training delivered to ensure that the project and service managers have the appropriate health, safety and environmental management skills. Honeywell employees shall be instructed in safe systems of work to ensure they work with proper regard for the safety, health, and protection of themselves, others and the environment. The Honeywell Project Manager is responsible for identifying the specific training requirements of their team members and ensuring the required training is undertaken. This training may be either Honeywell internal training, or training specific to the project location provided by the customer, provided the minimum content requirements are met. The minimum required training for the project scope of work is listed in Section 3 of this safety management plan.

12. Contractor Work Authorization & Permits

Contractor Sign-in & Work Authorization

Contractors must complete the Contractor Safety Declaration and Work Authorization Form with required risk assessments and permits prior to commencing work. Low risk work can be undertaken by contractors without direct authorization given that the relevant Honeywell Project Manager is aware of the:

1) Scope of work.
2) Time the work is to be undertaken.
3) Workers performing the work.

Attachment 4: Contractor Safety Declaration & Work Authorization Form
Attachment 5: Safety Permit Applications

13. Accident / Incident Events

Reporting of Accident / Incident Events

Honeywell Employees & Contractors must adhere to the following reporting requirements,

(1) Globally contact the Honeywell Project Manager
(2) Honeywell employees only - Call the HSE Hotline at 1-866-466-1765
(3) Honeywell Project Manager will contact the customer safety manager if required.
(4) The Honeywell HSE Manager must be contacted should any of these events occur.
    a. All injuries and incident events
    b. Release of dangerous goods or hazardous substances to the environment
(5) Certain incidents must also be reported to the relevant local workplace safety or environmental

protection authorities in accordance with local legislation.

Incident Investigation of Accident / Incident Events

Honeywell Representative must follow the following criteria after an accident or incident occurs.

(1) Conduct an incident investigation in accordance with Honeywell injury and incident investigation requirements in consultation with the regional HSE manager and affected employee(s).
(2) Ensure implementation and close out of short and/or long-term corrective actions to prevent re-occurrence.
(3) Present to Honeywell Project Management Leader and HSE Manager all planned corrective actions.

Attachment 6: Incident Investigation Report

14. Safety Observation System Events

Safety Observations must be submitted to the Honeywell Project Manager by any Honeywell employee using the **Attachment 7 Safety Observation Form**. Safety Observation is an unplanned event or condition that could have reasonably resulted in personal injury or illness, equipment or property damage, an environmental excursion, or when a safety control measure is challenged or ignored.

15. Site Evacuation Procedures

The Honeywell site specific **Emergency Response Plan, Attachment 17** shall be prepared, if a customer equivalent response plan is not available. The Honeywell Project Manager shall review and incorporate the emergency response plan into the Safety Management Plan. Either the Honeywell or Customer site specific emergency response plan shall be followed and this plan shall be communicated to all Honeywell employees, contractors, and visitors prior to working at the project site. For any Honeywell-occupied spaces such as a job trailer, leased office space or warehouse used during the course of a project, Honeywell shall complete a Honeywell site specific Emergency Risk Assessment by checking the appropriate boxes, then complete a site specific Emergency Response Plan as explained in the Emergency Response Procedure.

SECTION 2 – SITE RISK ASSESSMENT TOOLS

16. Hazard Reporting

It is the responsibility of all employees to immediately report any unsafe act or condition to the Honeywell Project Manager. Honeywell actively encourages all employees and contractors to report hazards. The strength of our Health, Safety Management Plan relies on the ability of Honeywell employees and contractors to report hazards.
At each site, all hazards that are identified by employees or contractors shall be communicated immediately to the Honeywell Project Manager. In the event that the hazard is considered significant, it must be reported immediately to the appropriate Customer representative.

17. Site Assessment Tools

Identify Site Hazards

Hazards associated with contracted scope of work shall be identified and documented in the **Attachment 8 hazard assessment site inventory**. The Hazard Assessment Site Inventory should include all identified hazards for the scope of work on this contract. The Hazard Assessment is used to prepare task and generic risk assessments or contractor authorizations.

Risk Assessment & Contractor Work Authorization Forms

Each hazard must be assessed according to the risk calculator listed on the **Attachment 9 Risk Assessment Form** to ensure the hazards are categorized as low, medium or high risks. Risk exposure to hazards in the work environment is determined by consequence and severity resulting in a low, medium or high risk level. **[**Click **HERE** for sample Risk Assessments / Safe Work Procedures.**]**

Risk assessments and contractor work authorization forms include a list of control measures which need to be developed and made readily available for the duration of the work. Hazards shall be controlled to ensure that consequent risks are eliminated or reduced as far as is reasonably practicable. Control measures shall be reviewed and monitored for their effectiveness. Continuous consultation should occur with all employees and contractors on site to ensure that hazards are identified and controls implemented.

Control measures will be selected in accordance with both established Field Risk Assessment Forms and the “Hierarchy of Control Measures” aimed at eliminating the hazard or hazardous activity. The most desirable control measure must be selected using the control hierarchy, in this order, elimination, substitution, engineering control, administrative control and personal protective equipment.

Tasks assessed as a high risk will require notifying the Honeywell Project Manager prior to commencement of work. The Honeywell Project Manager will evaluate the task for personal safety issues. All relevant activity check sheets and permits shall be completed in advance, and applicable guidelines, procedures, and/or work instructions will be reviewed and followed prior to and during the performance of the tasks.

Both contract and site specific data should be reviewed for inclusion in the orientation process to ensure key hazards/risks and any expectations in relation to the hazard elimination/risk management are communicated to the relevant employees and contractors.

The Honeywell Project Manager shall ensure that risk assessment and contractor authorization forms are implemented where required and ensure a quality standard of service is provided. Honeywell has developed a list of safety procedures for site work that facilitate compliance to legislative requirements. After the contractor completes the work authorization form the contractor may use previously completed Honeywell and/or the customer field risk assessment forms, provided that the contractor understands the procedure and takes ownership of the field risk assessment forms. All field risk assessment forms need to be reviewed by each employee prior to commencement of work.

Field Risk Assessment Forms identified are assessed for any potential risks of personal injury or injury to others, and property damage or environmental damage. Risk Assessments are separated into generic and task specific functions. The following are only examples and do not include all tasks that may apply at the customer or Honeywell location,

- Generic Field Risk Assessment Forms include common steps that are prepared once and can be used at multiple locations,
  - Climbing a ladder, working from a scaffold, scissor lifts, aerial lifts, man lift, etc.
  - Safe driving to/from customer locations
  - Personnel safety at customer locations, including walking on site
  - Roof Work
  - Mobilization of personnel, equipment or heavy components
  - Working on operating equipment
- Task Specific Field Risk Assessment Forms are prepared for a unique task at the customer site,
  - Equipment specific Lock Out / Tag Out, of electrical, mechanical, hydraulic, pneumatic, gravity, gas tie-ins, refrigerant servicing, etc.
  - Working from heights involving fall protection
  - Demolition of Electrical Cabling, equipment, etc.
  - Working in areas (e.g., installation, demolition) with live power or active control / fiber-optic cable, including junction boxes, where there is a substantial possibility of interrupting a live circuit.

18. Site Specific Field Risk Assessment Form Inventory

The Project Manager is responsible for keeping an inventory of the completed risk assessments and contractor work authorizations for the scope of work of this contract using the table provided in the hazard assessment site survey Attachment 8. This includes specific Field Risk Assessment Forms identified as a result of the completed Risk Assessments and Contractor Work Authorization Forms. All contract personnel are required to be familiar with the procedures and when they are to be used. These procedures must be followed at all times when the identified major risk activity is performed. Full records are to be kept for every major risk activity performed.

SECTION 3 – Site Requirements, HSE Training, Licenses and Competency

19. Customer Site Orientation

General Requirements

All Honeywell employees and contractors working on the customers sites will complete the customer site orientation, if required by the customer. Honeywell contractor orientations shall be managed by the Honeywell Project Manager to ensure that all orientations, including site safety management plan requirements are received and accepted by contractors and Honeywell staff, documented as being completed, and maintained in this plan for all contract personnel as required by Honeywell.

Orientation Schedule

The following orientations must be completed:

Orientation	Orientation Frequency	Key Contact(s)
Contractor Orientation	Prior to commencement of work. Complete **Site Orientation Form Attachment 10** with contractors & their employees Prior to commencement of work. Complete **Attachment 12 Field Safety Checklist** which document potential hazards. Review Contractor Work Authorization Forms with required safety permits.	Tim Laverick
Honeywell Employee Orientation	1. Prior to commencement of work and annually. Complete required monthly training modules per **Attachment 11 Training Register**. 2. Document employee having completed Risk Assessment Forms with required safety permits.	Tim Laverick

20. HSE Training, Licenses & Certificate of Competency

Honeywell Staff, Contractors and Sub-contractors

Both Honeywell Staff and contractors are required to complete the Attachment 11 Training Register as proof of completion of the required training. Honeywell employees are required to complete **Attachment 15 Vehicle, Tool, & PPE Inspection Checklist**. Additional training requirements may be required by local regulations. If applicable, this must be verified as completed before commencing work at the site. Training must be completed prior to performing site specific task or activities. All contractors and Honeywell employees are required to be currently licensed in accordance with state and local requirements to perform the work and activities associated with the contract scope of work.

SECTION 4 – Site HSE Activity Schedule

21. Honeywell Project Manager HSE Activity Schedule

1) Conduct Safety Inspections:
    a) Attachment 12 Field Safety Checklist – Project Manager to complete prior to starting work onsite and annually.
    b) **Attachment 13 Behavioural Observation Checklist** – Project Manager to complete periodically to assess Honeywell field employees during scheduled construction.
    c) **Attachment 14 Contractor Safety Checklist** – Project Manager to complete periodically to assess Contractor safety compliance.
2) Attend Customer safety meetings and audits, as scheduled.
3) Report Safety Observations to the HSE Manager and Customer.
4) Document and approve all Risk Assessments, Contractor Work Authorizations and required safety permits.

SECTION 5 – Site HSE Performance

22. HSE Metrics

The following HSE metrics will be documented and maintained during project construction,

- Attendance at weekly contractor safety meetings.
- Number of safety audits performed and completed.
- Number (and %) of safety audit items in conformance with requirements.
- Number and types of injuries, illnesses, and safety observation events noted during the project.

Honeywell

SECTION 6 – Contract Forms and Tools

23. Contract Forms and Tools

Contracts Forms, Tools and Procedures

The following list includes all pertinent safety forms for the use of initiating and maintaining safe work practices as described in this Safety Management Plan. These forms are also included in the following pages of this section.

Attachment No.	Document Name	Time to Complete:	Frequency	Responsible to Complete
–	Safety Management Plan (SMP)	Start of contract	Once for each phase/contract	Honeywell PM
1	HSE Commitment Statements	Start of contract	Once with SMP	Honeywell PM (Post on-site)
2	HSE Cardinal Rules	Start of contract	Once with SMP	Honeywell PM (Post on-site)
3	Site Employee/Contractor list	Booking Date – Before Installation	Update as needed throughout project duration	Honeywell PM
4	Contractor Work Authorization Form	Booking Date – Before Installation	Update as needed throughout project duration	All Subcontractors
5	Safety Permit Applications	Before performing task that requires it.	As required throughout installation	Contractor / Honeywell Field Employees
6	Incident Investigation Report Form	Within 24 hours of incident.	As required throughout project duration	Honeywell PM
7	Safety Observation Form	Throughout Project Duration	Monthly	All Honeywell Employees
8	Hazard Assessment Site Inventory	Booking Date – Before Installation	Update as needed throughout project duration	Honeywell PM
9	Risk Assessment Form	Booking Date – Before Installation	Update as needed throughout project duration	Honeywell Field Employees
10	Site Orientation Form	Booking Date – Before Installation	Once with SMP	Honeywell PM
11	Training Register	Booking Date – Before Installation	Once with SMP	Honeywell PM
12	Field Safety Checklist	Booking Date – Before Installation	Done once for each trade, Update as needed throughout project duration	Honeywell PM
13	Behavioral Observation Checklist	Throughout installation	Monthly while Honeywell field employees are working	Honeywell PM
14	Contractor Safety Checklist	Throughout installation	Monthly while subcontractors are working	Honeywell PM
15	Vehicle, Tool, & PPE Inspection Checklist	Throughout project duration	Quarterly	Honeywell PM/Employees
16	Site Specific Emergency Plan	Booking Date – Before Install	Once with SMP	Honeywell PM

Sustainable Opportunity Policy
Honeywell's Commitment to Health, Safety and the Environment

By integrating health, safety and environmental considerations into all aspects of our business, we protect our employees, our communities and the environment, achieve sustainable growth and accelerated productivity, drive compliance with all applicable regulations and develop technologies that expand the sustainable capacity of our world. Our health, safety and environmental management systems reflect our values and help us meet our business objectives.

- We protect the safety and health of our employees, and minimize the environmental footprint of our operations through efforts to prevent illness, injury and pollution.
- We actively promote and develop opportunities for expanding sustainable capacity by increasing fuel efficiency, improving security and safety, and reducing emissions of harmful pollutants.
- We are committed to compliance with all of our health, safety, environmental and legal requirements everywhere we operate.
- Our commitment to health, safety and the environment is an integral aspect of our design of products, processes and services, and of the lifecycle management of our products.
- Our management systems apply a global standard that provides protection of both human health and the environment during normal and emergency situations.
- We identify, control and endeavor to reduce emissions, waste and inefficient use of resources and energy.
- We are open with stakeholders and work within our communities to advance laws, regulation and practices that safeguard the public.
- We abide by the company's own strict standards in cases where local laws are less stringent.
- Our senior leadership and individual employees are accountable for their role in meeting our commitments.
- We measure and periodically review our progress and strive for continuous improvement.

These are our commitments to health, safety, and the environment, and to creating Sustainable Opportunity everywhere we operate.

Dave Cote
Chairman and CEO

John Rajchert
President HBS
July 6, 2014

SMP Attachment 2: Honeywell Cardinal Rules

No Employee/Contractor may:

1. Engage in horseplay or conduct that endangers or injures employees, risks damage or actually does damage to company and/or customer property or the environment.
2. Bring into any company and/or customer site: firearms, explosives, or weapons of any type.
3. Bypass or operate equipment without guards, safety devices, or control equipment without following company and/or customer established procedures and protocols.
4. Disassemble, enter or perform servicing, changeover or maintenance on equipment without properly de-energizing and safeguarding all power sources according to the applicable lock-out/tag-out policy.
5. Violate a life safety permit procedure (confined space, hot work, line breaking and fall protection).
6. Knowingly place her/himself or another person in physical danger, conceal a safety hazard or unlawful chemical release to the environment, or fail to promptly obtain attention for a personal injury or chemical spill.
7. Possess or be under the influence of illegal drugs (not prescribed by a Physician of for their own use) or alcohol while on a customer site, company-owned and/or company-operated facility.

The actions listed above have been found to have such great potential for serious injury or damage that any employee that engages in such actions may be subject to discipline, up to and including termination from the company or removal from the project site, regardless of previous performance. This policy is intended to protect the employee and his/her co-workers.

All employees are expected to understand and adhere to these Cardinal Rules and to request assistance in questionable situations. Further, all employees are encouraged to question the safety and environmental performance of all operations and become involved in improving them.

Project Manager Signature:

SMP Attachment 3: Site Employee Contractor List

Badge #	Employer	Name	Phone Number	Supervisor

SMP Attachment 4: Contractor Safety Declaration & Work Authorization Form

Contractor Safety Declaration

As a duly authorized and designated representative and agent of ________________________________ , hereafter called "Contractor/Subcontractor", I hereby certify and agree for myself and for and on behalf of Contractor /Subcontractor:

I have visited the project site ____ and visually inspected the general and local conditions which could affect the Contractor /Subcontractor Work. Any failure of the Contractor /Subcontractor to reasonably ascertain from a visual inspection of the site, the general and local conditions which could affect the Contractor /Subcontractor Work, will not relieve the Contractor/Subcontractor from its responsibility to properly complete the Contractor /Subcontractor Work without additional expense to Honeywell. In addition, I have read and agree to comply with all the Terms and Conditions as specified in the written contract.

1. I have already instructed or will immediately instruct all such agents and employees with respect to such conditions and/or hazards and the proper safety precautions to be observed in regard there to;

2. I certify that all necessary, adequate and operative protective clothing and equipment have been or will be immediately issued to all such agents and employees, together with full instructions and training for their use at Contractor's cost;

3. I certify that all Honeywell Safety and Work Specific procedures as specified in the Honeywell Contractors Safety Guide, including those addressing employee personal protective equipment (PPE), Life Critical Tasks and tool and equipment requirements will be put into effect; and that all such agents and employees will be properly supervised to insure compliance in the use of PPE, procedures and equipment and in the strict observance of safety rules and regulations;

4. I certify that all such agents and employees have completed the identified and required training and that proof of such training has been submitted to Honeywell representative. If such identified training has not been completed I agree to complete such training as identified and required to a standard equivalent or exceeding Honeywell standards.

5. I certify that I will participate in the Honeywell program to observe and monitor all such agents and employees for compliance to specified Safety Procedures and work practices as defined or required by any and all governmental regulations and laws.

6. At a minimum, I certify that Contractor /Subcontractor employees have been trained and/or briefed for the following applicable programs (identified with x), in accordance with local laws/regulations,

- ☐ General safety rules and regulations
- ☐ Specific safety requirements
- ☐ Confined space entry
- ☐ Eye and face protection
- ☐ Hearing protection
- ☐ Burning, welding and cutting
- ☐ Utility line hazards/precautions
- ☐ Chemical line hazards/precautions
- ☐ Workplace chemical hazards
- ☐ other (specify)

- ☐ General protective clothing and equipment requirements
- ☐ Lockout and tagout
- ☐ Line breaking
- ☐ Excavation
- ☐ Respiratory protection
- x_ Honeywell Contractor HSE Guide
- ______________________
- ______________________
- ______________________

Date: _____________ ____
Signature of Contractor's/Subcontractor's Representative

Date: _____________ ____
Signature of Honeywell Representative

Honeywell Use Only: **HID #:**

PRELIMINARY SAFETY DETAILS		*Honeywell Use Only: Work Authorisation Form Expiry : (Max 12 months) HSE Signed:*			
Site		Contractor		Phone	
Name (PM responsible for the work)		Job / PO / SR Number			
Names of other workers		Honeywell Project Manager			
Scope of Work		Project Duration			
Location of Work					

1. Will you be using sub-contractors?	Yes □	No □	*You must inform the Honeywell Works Supervisor of all sub-contractors you intend to use.*	
2. Are all workers inducted to site & aware of first aid & emergency procedures?		Yes □	No □→	*If **No**, Do Not Proceed. Contact The Honeywell Project Manager*
3. Are workers familiar with the work area and specific hazards in the work area(s)?		Yes □	No □→	
4. Are tools, plant and equipment in good order (plant maintained, electrical equip. tagged, etc)?	No Plant/Tools□	Yes □	No □→	
5. Are workers aware of the safety requirements for the job & licensed where required?		Yes □	No □→	

If the Scope of Works changes Honeywell must be contacted prior to undertaking the new works

HAZARD ID, RISK ASSESSMENT & CONTROLS -----------------------------

Identify the Hazards ✓ **applicable**	**Assess the Risk** ✓ **applicable**	When assessing risks use these risk levels:	Minor Potential for minor injury / first aid treatment Moderate Potential for lost time injury / medical treatment Major Potential for death or serious injury
		Detail Risk Control Measures to Be Used	**Responsible Person**
□ Exposure to live electrical circuit	**Major*** □	List controls to eliminate or minimize risks.	List who is responsible for ensuring the controls are in place and are
□ Fall > 1.8m	**Moderate*** □	Refer to relevant procedure or JSA.	
□ Line Breaking	**Minor** □		
□ Confined Space Entry	** Detail Risk Controls & Responsibilities. Direct Authorisation required from the Honeywell Work Supervisor prior to commencing works.*		
□ Asbestos			
□ Traffic / Mobile Plant			
□ Chemicals / Fumes / Dusts			
□ Noise / Vibration			
□ Public exposure to hazards			
□ Spill to Environment			
OTHER			

MANDATORY SAFETY PERMITS & SYSTEM ISOLATIONS Safety Permits must be obtained and approved before commencing the following works. If not listed below use "other" section. (✓ applicable):					**Other (not listed)**	List any Risk Control Safety permits not listed below here.	
□ Hot Works	□ Live Electrical	□ Confined Space Access	□ Line Breaking	□ Roof/Ceiling Access	□ Equipment Isolation	□ Fire / EVAC Impairment	□ Penetration in fire rating material
6. Will the work cause interruption/isolation of site utilities (water, gas, electricity)?					No □	Yes □→	*If **Yes**, contact the Honeywell Works Supervisor*
7. Will you need to isolate systems or services (medical gas, UPS, security, comms, etc)?					No □	Yes □→	
If Yes to Q7 or Q8, what is the extent and impact of the isolation(s) / interruption?							

CONTRACTOR DECLARATION

I confirm that all necessary Health, Safety and Environment protection measures and precautions as detailed in this form will be taken to ensure the health and safety of workers and others who may be affected by the work. I also confirm the workers undertaking this work are competent, and where required, licensed to carry out the tasks.

Contractor Signature		**Date**	

SMP Attachment 5: Safety Permit Applications (Contractor & Honeywell Employee)

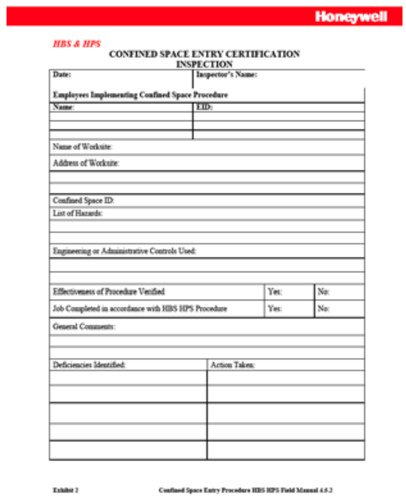
The permits listed below are required when called for by a risk assessment or contractor work authorization and must be documented and kept with the SMP. Permits not included or shown below may still be applicable, as determined by the Honeywell PM. Contractors may also use their own permits if approved and accepted by Honeywell PM.

Line Breaking, roof/ceiling access, Equipment Isolation, Fire/EVAC Impairment, Penetration in Fire Rated Material, Others

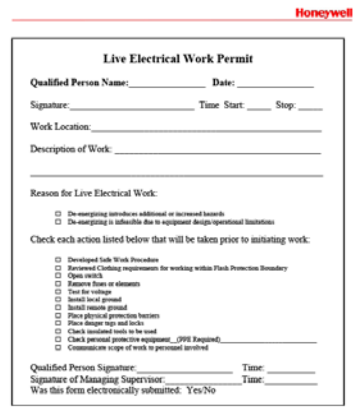
(Click on images below for PDF file attachment)

Hot Work Permit

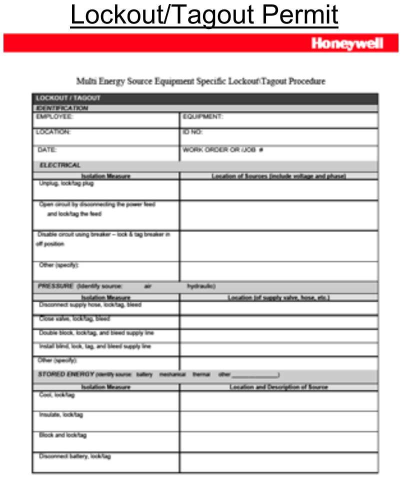
Confined Space Permit & Cert.



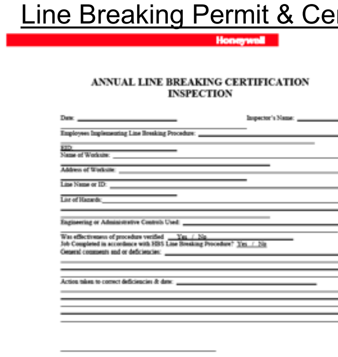
Live Electrical Permit



Lockout/Tagout Permit



Line Breaking Permit & Cert.



SMP Attachment 6: Incident Investigation Report – Filed per Occurrence

Part 1: BASIC INFORMATION (Complete and return to HBS HSE Hotline within 24 hours)

Name of person reporting (if not the Supervisor)	Date of report	
Name and address of location	Region/Business Site Code (LID)	Supervisor's name Supervisor's telephone number

Claimant / Accident Information

Full Name of injured party Employee ID #	Address of injured party Home phone: Work phone:		Is the injured party ☐ Male ☐ Female
	Employee's typical work schedule:		
Date of Hire Job title Employment status	Days worked ☐ Mon ☐ Tue ☐ Wed ☐ Thu ☐ Fri ☐ Sat ☐ Sun	Time begins/ends to work	Contractor? ☐ Yes ☐ No If YES, please complete: Name and address of Temporary Agency/ Contractor: Contact: Phone number:

Date of accident Time of Accident ☐AM☐ PM	Employer notified on what date	Name of place where incident occurred Address where incident occurred	Was there lost time? ☐ Yes ☐ No If yes, Last day worked

Briefly describe the incident

Were authorities contacted? (police, fire, ambulance) ☐ Yes ☐ No If YES, who	Was a report number given? ☐ Yes ☐ No If YES, list number

Were any safeguards provided? ☐ Yes ☐ No
Were they in use at the time of the incident? ☐ Yes ☐ No

NATURE OF INCIDENT:

TYPE OF INCIDENT:

PART OF BODY:

Medical Care Information

Name and address of treating physician	Name and address of treating hospital/clinic
Phone number of treating physician	Phone number of treating hospital/clinic
Date employee first visited the doctor	What treatment was given (please check)

Describe diagnosis / medical treatment the doctor provided (List prescribed medications if any)

Physical restrictions noted by the medical provider during the initial visit?

Witness Information

Name and address of a witness to the incident	Phone number where witness can be reached

Comments from witness Nº 1

Name and address of a witness to the incident	Phone number where witness can be reached

Comments from witness Nº 2

Anything related to the incident you would like to add

Part 2: INCIDENT INVESTIGATION (Complete & return to the HBS Regional HSE Leader within 5 days)	
Root Cause Analysis	
Why did the incident happen? (Direct Cause)	
Why did this occur? (Contributing Cause)	
Why did that occur? (Contributing Cause)	
ADDITIONAL COMMENTS:	
PRIMARY ROOT CAUSE:	
SECONDARY/CONTRIBUTING ROOT CAUSE(S)	
Please explain or if additional information is meaningful, please describe:	

List corrective and preventative actions:

Corrective Action	Responsible Person	Target Date	Completion Date

SMP Attachment 7: Safety Observation Form

SAFE OBSERVATION SYSTEM (SOS) REPORT FORM

A SOS is an unplanned event or condition that could have reasonably resulted in personal injury or illness, equipment or property damage, or an environmental excursion. Some examples include: Unsafe Conditions, Unsafe behavior, Events where injury could have occurred but did not, Events where property damage resulted or could have resulted, Events where a control measure was challenged or ignored.

1	SOS Title:					
2	Reporting Employee Name:		Employee EID:			
3	Name of Person responsible for closure:		Employee EID:			
4	Supervisor name:		Supervisor EID:			
5	Name of Contract	Contract Number	6	Address:		
7	Describe the SOS (what happened) / (Do *not use individual names if you have seen an unsafe practice)*:					
8	Honeywell HBS	9	Country: America	10	Region:	11 State:
12	Date SOS Observed:	DD/MM/YYYY				
13	Or select only one recommended time period for closing corrective action:	☐ One week ☐ Two weeks ☐ One month ☐ Three months ☐ Six months ☐ Twelve months				
14	Describe the corrective action:					
15	Date SOS to be closed (meet AOP goal):	DD/MM/YYYY				
16	Consequence of occurrence (select only one):	☐ Catastrophic (fatality) ☐ Major (hospitalisation) ☐ Serious (medical treatment/recordable) ☐ Minor (first aid) ☐ Negligible	17	Likelihood of Recurrence (select only one):	☐ Almost certain (>2 times/year) ☐ Highly likely (once per year ☐ Likely (once every three years) ☐ Unlikely (once every five years) ☐ Remote (once every ten years)	
18	Type of Hazard: (select only one):	☐ Contact in / between / under ☐ Contact with electricity ☐ Contact with sharp object ☐ Exposure to chemical (gas, dust, fume) ☐ Exposure to extreme temp. (hot/cold) ☐ Exposure to noise ☐ Exposure to low oxygen		☐ Fall from elevation ☐ Lifting / Repetitive Motion / Ergonomic exposure ☐ Liquid Splash / Contact struck against ☐ Slip / Trip / Fall (same level) ☐ Struck by ☐ Vehicle ☐ Another kind of hazard		
19	Type of SOS (select only one):	☐ Unsafe Behavior	☐ Unsafe Condition	☐ Incident with property damage	☐ Incident without property damage	
20	Location of Safety Observation (select only one):	☐ Manufacturing plant / Mill ☐ Honeywell Office ☐ Customer Office ☐ Hospital ☐ School ☐ Mechanical Room		☐ Laboratory ☐ Residence ☐ Warehouse ☐ Roof ☐ Computer Room / Control Room ☐ Vehicle ☐ Other		
21	Honeywell Risk Calculator (select only one):	☐ Major	☐ Moderate	☐ Minor		
22	Status:	☐ Open	☐ Closed			
23	Manager / Lead Signature:			Date:	DD/MM/YYYY	
	REMEMBER SAFETY IS EVERYONE'S RESPONSIBILITY					

SMP Attachment 8: Hazard Assessment Site Inventory

The following table lists each of the completed contractor work authorization forms and risk assessments for the scope of work of this contract.

HID#	Description of Hazard, Location, Safety Permits Required	Original Date	Check which is applicable below		Review Date
			Contractor Authorization Form	Risk Assessment Form	
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					

SMP Attachment 9: Field Risk Assessment Form

FIELD RISK ASSESSMENT FORM CRITERIA / CALCULATOR

Hierarchy of Controls

ELIMINATE THE HAZARD	SUBSTITUTE THE HAZARD	ENGINEERING CONTROLS	ADMINISTRA-TIVE CONTROLS	PERSONAL PROTECTIVE EQUIPMENT
Cut panel wood off site	Replace ladder with scissor lift	Physical barrier / exhaust ventilation	Written procedures / Work instructions / etc.	Hearing Protection, Hard Hats, Gloves, etc

HONEYWELL RISK ASSESSMENT CALCULATOR

SEVERITY / CONSEQUENCE

PROBABILITY / LIKELIHOOD	1. Negligible	2. Minor	3. Serious	4. Major	5. Catastrophic
5. Almost Certain	Medium	High	High	High	High
4. Highly Likely	Medium	Medium	Medium	High	High
3. Likely	Low	Low	Medium	Medium	High
2. Unlikely	Low	Low	Low	Medium	High
1. Remote	Low	Low	Low	Medium	Medium

Severity / Consequence Criteria	Probability / Likelihood Criteria
Catastrophic ❑ Injury: Fatality of employees, contractors or the public. (Tier 1) ❑ Environment/Assets: Irreversible contamination of environment; Significant damage to building/equipment integrity. ❑ Public Relations: Significant public interest, national and/or international media involvement or significant impact on business reputation. ❑ Law and Permits: Federal regulatory intervention and/or regulatory fines greater then $5M to the company/unit; Government withdrawal of permits to operate the entire Honeywell unit or project.	**Almost Certain** 5. Occurred or likely to occur many times.
Major ❑ Injury: Extensive injury or Hospitalization of employees, contractors or the public. (Tier 2) ❑ Environment/Assets: Reversible contamination of environment; Moderate damage to building/equipment integrity. ❑ Public Relations: Moderate public interest, regional media involvement or moderate impact on business reputation. ❑ Law and Permits: Regional/District/State regulatory intervention and or regulatory fines greater then $1M to the company/unit; Government suspension of permits to operate a project.	**Highly Likely** 4. Occurred or likely to occur several times.
Serious ❑ Injury: Medical treatment of employees, contractors or the public. (Tier 2) ❑ Environment/Assets: Reversible small contamination of environment; Minor damage to building/equipment integrity. ❑ Public Relations: Some public interest, local media involvement or some impact on business reputation. ❑ Law and Permits: Local regulatory intervention and/or fines less then $1M to the company/unit; Customer suspension of some permits to a daily operation or written warning to Honeywell or project management.	**Likely** 3. Occurred or likely to occur once.
Minor ❑ Injury: First-aid treatment or Safety Observation of an employee, contractor or a member of the public. (Tier 3) ❑ Environment/Assets: No contamination of environment, no breach of law and no damage to building/equipment integrity. ❑ Public Relations: Little public interest, local media involvement or little impact on business reputation. ❑ Law and Permits: No suspension of permits to operate, continue daily operations, verbal warning to Honeywell or project management.	**Unlikely** 2. Might occur or likely to occur.
Negligible ❑ Injury: No injury. ❑ Environment/Assets: No impact. ❑ Public Relations: No public interest, local media involvement or no impact on business reputation. ❑ Law and Permits: No impact.	**Remote** 1. Rarely occurs.

RISK ASSESSMENT GUIDELINES

In most instances, moderate and major risks to health and safety can be adequately managed using site specific safe systems of work. For example, if a safety harness is specified as the control measure for working at height the risk assessment form should specify the pre-use inspections, selection of proper anchorage points, training of wearers, rescue of a suspended worker, etc.

For work with plant and substances consideration must be given to any safety recommendations of the manufacturer (e.g. the MSDS).

The actual workers performing the task should participate in all steps of the risk assessment process. It is crucial that the workers involved in the activity have input in the development and review of the safety measures.

Remember.

1. The risk assessment provides a written record of the process to be used to carry out a task safely. To demonstrate mutual understanding, it should be signed off by the parties who have responsibility for the tasks.
2. Management processes must be in place to ensure workers are competent and have the skills to complete the job and that there is a required level of supervision to ensure the tasks are completed as documented.
3. The risk assessment should be completed by all employees involved in the activity, not just the principal contractor or supervisor.

Describe the Site and the Scope of Work (Job Task)

The risk assessment should contain a brief description of the scope of work, location, supervisor, contractors, date & revision date where relevant.
Details of the specific area where the work is to be performed should also be included with the site details (e.g., building 1, phase 1 etc)

Document the Hazards that Make up the Scope of Work (Job Task)

In consultation with the persons performing the work, write down the hazards required to perform the scope of work/job task in the order to be carried out.
Details of the equipment and tools to be used should also be included. (e.g., fixing cabling to metal frame in roof space using an explosive powered ramset gun).

Identify Harm from Exposure to the Hazard

For each hazard, identify the harm/injury that may be caused from exposure to the hazard (s) to those engaged in the task or to others in the vicinity. For example, the main hazards from drilling concrete include exposure to hazardous silica dust, flying debris, high torque of tools and noise. The respective consequences would typically include respiratory damage, hearing damage, eye damage, sprains or cuts.
Pay particular attention to the use of plant and power tools to ensure that all safety hazards are identified.
For mobile plant check the general plant risk assessment record/Work instructions, as this will provide specific information on potential hazards associated with the plant.

Document all the Existing Risk Control Measures Associated with the Hazard to Eliminate / Reduce Risk

List all the control measures required to eliminate or minimise the risk of injury from the identified hazard (Refer to relevant Honeywell HSE Procedures). Control measures include training, instructions, information and supervision. For each hazard assess the foreseeable level of risk using the Honeywell risk assessment calculator.

Also include cross reference in the control measure column to any other risk assessments undertaken as part of the task, by referring to relevant hazard assessed (i.e. manual handling of ladders).

Risk Control Measures

Risk control measures should be selected in consultation with the relevant workers, making reference to the Honeywell HSE procedures where applicable. It may be necessary to seek advice from persons with safety training, working experience & the relevant Safety Advisor to identify the most appropriate control measure.
When selecting control measures consider:

- All persons that may be affected by the hazard, not just those involved in performing the task.
- The actual work practices on site.
- How often and for how long people are exposed to the hazard.
- The experience of workers doing the task.
- Safe work methods available and their effectiveness.
- The degree of safety training & instruction required (e.g. Safety inductions, safe work procedures, PPE use, use of MSDS's or the amount of supervision required).

Document Risk Level

Using the Risk Calculator, perform a risk assessment: evaluate the potential severity and probability (1, 2, 3, 4 or 5) of an incident for each hazard associated with the task.

Use the Risk Matrix to establish the risk ranking for each Task and Hazard; based on the Severity and Probability of an event, determine Low, Medium or High risk
Low Risk (green): Adhere to current hazard controls
Medium Risk (yellow): Control plan requires cell supervisor approval. Task should only proceed once the controls are in place
High Risk (red): Control plan must be reviewed and approved by the supervisor and site HSE. Work should not proceed until all the controls are in place and verified.
High risk tasks must also be added to site Risk Assessment tool. Activities should take place to lower risk classification.

List in priority order any additional control measures required to eliminate or reduce the hazard to the lowest exposure level possible relevant to the Hierarchy of Control.

Hierarchy of Risk Control Measures

Select control measures from the highest level practicable in levels 1 to 5 below, e.g., first try to eliminate the hazard, as this gives the best result. The measures at the lower levels are less effective and require training of workers plus frequent review of the hazards and systems of work. In some situations a combination of control measures may need to be used.

1 - Eliminate the hazard
Discontinue the activity or stop using the plant, tool or substance where practicable.
2 - Substitute the hazard
Use something safer or change the system of work
3 - Engineering controls
Use guards, fencing, safety screens, etc to separate workers from the hazard, use dust extractors on tools or exhaust ventilation to reduce dust
4 - Administrative controls.
e.g. specific worker instructions or procedures.
5 - Personal protective equipment (PPE).
Only when level 1 - 4 control measures have been considered and applied to the highest extent practicable, any remaining risk may be reduced by using PPE such as safety harness, eye protection, hearing protection, etc.

Any specific training, permits and information needed to carry out the task safely should also be noted (e.g. work at height training).

Identify Who Is Responsible

Document the names of the person's responsible for implementing the control plan (additional controls/information) to lower the risk level.

Monitor and Review the Risk Assessment

Make sure the work is supervised to ensure that the work is carried out as documented in the risk assessment.
Review the risk assessment if conditions, location, etc of the work change or after an appropriate length of time. Consider also:

- Whether the control measures are suitable for the task.
- The degree of support it has amongst the employees concerned.
- The effectiveness of control measures.

Designated Major Risk Tasks

Major risk work includes, but is not limited to:

- Unprotected work at heights >1.8 meters / 6 feet, particularly on roofs.
- Working on ladders above 1.8 meters / 6 feet.
- Entering confined spaces.
- Live electrical works.
- Working with mobile plant and machinery.
- Working near power lines.
- Working with elevating work platforms and cranes.
- Trenching and excavation.
- Work on or near gas mains or electricity supplies.
- Working with/near asbestos or lead or their removal.
- Demolition.
- Using certain hazardous substances including carcinogens.

Assessing and Reviewing Subcontractor Risk Assessments

The team leader/project manager or their delegated representative should ensure that the adequacy of subcontractor risk assessments and any associated safety documents and instructions are assessed prior to commencing work. In assessing subcontractor risk assessments consider the following:

- Compliance with Honeywell's policies and procedures.
- Has the recommended process been followed to develop the risk assessment?
- Are foreseeable significant hazards and risks to health and safety identified in relation to the nature of the works, including plant, tools and equipment used?
- Are risk control measures adequate and in line with the hierarchy of controls?
- Are all legislative requirements satisfied?
- Has the subcontractors inducted their workers into their own risk assessment?
- Is there adequate provision for supervision to ensure control?

[CLICK HERE FOR LINK TO PRE-POPULATED RISK ASSESSMENTS/SAFE WORK PROCEDURES]

FIELD RISK ASSESSMENT FORM

ASSESSMENT NO:

SITE LOCATION:	SCOPE OF WORK (JOB TASK):	PERMIT TO WORK REQUIRED? Yes ☐ No ☐

PERSON POTENTIALLY EXPOSED: / DURATION OF EXPOSURE: / FREQUENCY OF JOB:

PERSON POTENTIALLY EXPOSED		DURATION OF EXPOSURE		FREQUENCY OF JOB
☐ ALL STAFF	☐ CONTRACTORS	☐ UNDER 5 MINUTES	☐ 6-15 MINUTES	☐ CONTINUOUS/ ONGOING
☐ STAFF MEMBER PERFORMING JOB ONLY	☐ VISITORS	☐ 16-30 MINUTES	☐ 31-45 MINUTES	☐ NO OF TIMES PER WEEK
☐ MEMBERS OF THE PUBLIC	☐ OTHER (SPECIFY)	☐ 46 MINS -1 HOUR	☐ 1 HOUR OR MORE	☐ NO OF TIMES PER MONTH

HONEYWELL RISK ASSESSMENT CALCULATOR

Severity / Consequence

Probability/ Likelihood	1. Negligible	2. Minor	3. Serious	4. Major
5. Almost Certain	Medium	High	High	High
4. Highly Likely	Medium	Medium	Medium	High
3. Likely	Low	Low	Medium	Medium
2. Unlikely	Low	Low	Low	Medium
1. Remote	Low	Low	Low	Medium

JOB HAZARD EXPOSURE OR DETAILED HAZARD AND HARM *List each of the hazards associated with the scope of work in the sequence they are encountered including possible harm and effects.*	RISK LOW / MEDIUM /HIGH *Using the Honeywell Hazard & Risk Matrix list the risk level against each hazard*	RISK CONTROL MEASURES / SPECIAL PERMIT REQUIREMENTS *List the control measures required to eliminate or minimise the risk of injury from the identified hazard (Refer to relevant Honeywell HSE Procedures)*	RISK LOW / MEDIUM /HIGH *Using the Honeywell Hazard & Risk Matrix list the risk level against each hazard*	ASSIGN RESPONSIBILITY *Write the name of the person responsible (supervisor or above): implement the control measures identified.*

I have read and understood the content of this RISK ASSESSMENT and agree to follow the requirements as outlined or alternatively contact the responsible Honeywell supervisor to revise the agreement

This risk assessment is written and approved at an administrative level. This approval does not imply that the risk assessment is a comprehensive and accurate document. Any subsequent use of the risk assessment makes it implicit upon the user to verify the accurate sequence of events, potential hazards, risks and controls.	RISK ASSESSMENT AUTHOR (PRINT NAME)	AUTHOR'S SIGNATURE	ASSESSMENT DATE
	MANAGERS NAME (PRINT NAME)	MANAGER'S SIGNATURE	ASSESSMENT REVIEW DATE

EMPLOYEE SIGNATURES

EMPLOYEE NAME (PRINT NAME)	EMPLOYEE SIGNATURE	DATE	EMPLOYEE NAME (PRINT NAME)	EMPLOYEE SIGNATURE	DATE

SMP Attachment 10: Orientation Form (Completed at Project Construction Kick-off)

Employee/Contractor:…………………………………… Contract: ……………………………………… Date……………………………...

Honeywell Representative:…………………………………………………………………………….

Please tick ✓	Yes	No	Comments
• Honeywell/Customer HSE Policy	☐	☐	
• Discuss (or provide copies) of relevant Honeywell and/or Customer HSE procedures	☐	☐	
• Discuss/provide copy of Contractor HSE guidelines	☐	☐	
• First Aid arrangements	☐	☐	
• Location of hazardous materials listed in Hazardous Materials Register	☐	☐	
• Emergency Procedures	☐	☐	
• Evacuation Procedures	☐	☐	
• HSE Risk Assessment Worksheet	☐	☐	
• Reviewed Health and Safety Plan	☐	☐	
• Site Entry/Access requirements	☐	☐	
• Specific Training for special Area/Tasks (list below)	☐	☐	
• Works Authorization Form requirements	☐	☐	
	☐	☐	
	☐	☐	

I have completed the Orientation & Training as required for this Contract and agree to follow the guidelines and procedures as outlined in these courses.

Name	Signature	Name	Signature

SMP Attachment 10: (Completed by ALL Contractor/HW Employees prior to construction start)

I have read and understand the Risk Assessments, completed Site Orientation & Safety training as required for this Contract at (enter project name) and agree to follow all guidelines to work safely

Print Name	Signature	Company	Date

SMP Attachment 10: (Completed by ALL Contractor/HW Employees prior to construction start)

I have read and understand the Risk Assessments, completed Site Orientation & Safety training as required for this Contract at (enter project name) and agree to follow all guidelines to work safely

Print Name	Signature	Company	Date

SMP Attachment 11: Training Register

The following table lists the Site Specific training requirements that must be completed prior to working on the project site. These training procedures were identified as a result of the completed hazard and risk assessments observed at the contract site. All employees and contractors must be familiar with the required training for this project and agree to follow these procedures for the entire duration of the project.

Training Register				
#	Training Requirement	Contract Required (yes or no)	Who is to Complete	Comments
1	Customer orientation	Yes	Honeywell Employees	
2	Honeywell Safety Awareness / Orientation	Yes	Honeywell Employees	
3	Asbestos Awareness	Yes	Honeywell Employees	
4	Bloodborne Pathogen Awareness			
5	Canine Awareness			
6	Cold Weather Safety			
7	Compressed Gas Awareness			
8	Confined Space Awareness	Yes	Honeywell Employees	
9	Confined Space Entry – advanced training required	Yes	Honeywell Employees	
10	Cranes & Slings	Yes	Honeywell Employees	
11	Driver Safety	Yes	Honeywell Employees	
12	Electrical Arc Flash Awareness	Yes	Honeywell Employees	
13	Electrical Safety General Awareness	Yes	Honeywell Employees	
14	Emergency Preparedness Plan (Customer)			
15	Environmental Hazard	Yes	Honeywell Employees	
16	Eye & Face Protection	Yes	Honeywell Employees	
17	Fall Protection	Yes	Honeywell Employees	
18	Fire Extinguisher Usage	Yes	Honeywell Employees	
19	Hand & Power Tool	Yes	Honeywell Employees	
20	Hazard Communication	Yes	Honeywell Employees	
21	Hearing Protection	Yes	Honeywell Employees	
22	Hot Work Permit	Yes	Honeywell Employees	
23	Ladder Safety	Yes	Honeywell Employees	
24	Laser Safety			
25	Lead Safety	Yes	Honeywell Employees	
26	Line Breaking	Yes	Honeywell Employees	
27	Lock Out/Tag Out	Yes	Honeywell Employees	
28	Machine Safeguarding			
29	Management of Change	Yes	Honeywell Employees	
30	Manual Material Handling / Back Safety	Yes	Honeywell Employees	
31	Office Ergonomics	Yes	Honeywell Employees	
32	Personal Protective Equipment	Yes	Honeywell Employees	
33	Powered Industrial Trucks	Yes	Honeywell Employees	
34	Process Safety Management			
35	Refrigerant Management	Yes	Honeywell Employees	
36	Respiratory Protection	Yes	Honeywell Employees	
37	Safety Observation System (SOS)	Yes	Honeywell Employees	
38	Safe Operations Management (SOM)Training	Yes	Honeywell Employees	
Below list other customer specific training requirements, if applicable.				
1				
2				

SMP Attachment 12: Field Safety Checklist

Form completed by ________________ Date __________

Honeywell requires a Field HSE Check List be maintained onsite for all current or new projects. It is to be performed prior to starting work during the initial site visit. Hazards identified are to be communicated to all personnel working at the site and referenced during future visits.

Original Date: ________________ Revision Date: ________________
Contractor(s): ________________
Customer Name: ________________ Customer Contact: ________________ Address: ________________
Telephone No: ________________ Customer HSE Rep: ________________ Phone: ________________

1. Scope of work summary:

2. Personal protective equipment required on site?

	NO		YES (Honeywell)		YES (Contractor)	
Fall Protection?	☐		☐		☐	
Hard Hat?	☐		☐		☐	
Safety Glasses?	☐		☐		☐	
Hearing Protection?	☐		☐		☐	
Safety Shoes?	☐		☐		☐	
Protective Clothing? (specify)	☐		☐		☐	
Respiratory protection? Explain:	☐		☐		☐	

3. Safety hazards encountered at customer's facility (Check and explain plans for addressing the hazard).

Check for Yes	Safety Hazard	Name of Contractor / Personnel Performing Work	Plans to Address: Risk Assessment or Contractor Work Authorization
☐	Construction environment		
☐	High or low temperature materials or equipment		
☐	Welding		
☐	Laser equipment		
☐	Confined space or isolated work area		
☐	Overhead operations		
☐	Work at heights requiring a ladder, lift platform or basket; who provides the equipment and has appropriate training been completed?		
☐	Are there areas where the following conditions are present: Oxygen deficient atmosphere, toxic gases, vapors, fumes, mists, dusts, lead, mercury?		
☐	Known or suspected carcinogens including asbestos		
☐	Potential exposure to biohazards		
☐	Explosive or highly combustible materials		
☐	Excessive noise levels (signage identifies area)		
☐	High voltage (480 volts or greater) in the work area		
☐	Radiation sources		
☐	Ergonomics: excessive bending/stooping, cramped space		
☐	Slippery surfaces		
☐	Open pits, vats, trenches		
☐	Material handling requiring hoists, cranes, rigging, forklifts?		
☐	Raw or partially treated sewage		
☐	High pressure equipment		
☐	Unguarded machinery		
☐	Hot work permits required		
☐	Lockout/tagout permits required		
☐	Emergency evacuation		
☐	Special parking or security requirements		
☐	Customer hazard communication requirements		
☐	Process safety management requirements		
☐	Applicable MSDS's available; if no, who obtains them		
☐	Other hazards		

4. Specific safety considerations necessary to abide with customer's safety procedures. ________________________________

5. Have all employees been briefed on the customer's site emergency response and evacuation plans & how will employees be accounted for in the event of an emergency? ________________________________

6. Does the customer have a drug/alcohol policy for contractors and does it include drug testing?________________________

7. Have the employees assigned to this project received appropriate safety training to prepare them for safety issues identified? __________

Complete, Sign and review on first visit or after work order changes. Revise annually. Review, sign & date:

Honeywell Manager	Employee\Contractor	Customer Representative (Optional)

SMP Attachment 13: Behavioral Observation Checklist (HW Employee Monitoring)

Utilize the Behavior Observation Checklist to identify both safe and at risk conditions in the work environment. After observation provide feedback to the employee for both safe and at risk observations. All at risk observations must have comments to identify corrective action or explanation. Only respond to questions that apply to the task

1. Observer

Report Observer Name

Observer EID

2. Observed

Observed Name

Observed EID

3.Task performed by Employee:____

(4)	Select SBU: HBS or HPS	(5)	Select Pole (Americas or EMEA or AP):	(6)	Region within Pole:	(7)	State/District /Branch within Region:

(8) Location of Behavior Observation (select only one):	☐ Manufacturing plant / Mill ☐ Honeywell Office ☐ Customer Office ☐ Hospital ☐ School ☐ Mechanical Room	☐ Laboratory ☐ Residence ☐ Warehouse ☐ Roof ☐ Computer Room / Control Room ☐ Vehicle ☐ Other
(9) Date BOC Observed:	DD/MM/YYYY	

SAFE PATH OF TRAVEL			
Uses designated walkways to access work area	SAFE	AT RISK	N/A
Has clear view of path to travel	SAFE	AT RISK	N/A
PERSONAL PROTECTIVE EQUIPMENT (PPE)			
Head Protection	SAFE	AT RISK	N/A
Eye/Face Protection	SAFE	AT RISK	N/A
Hand Protection	SAFE	AT RISK	N/A
Foot Protection	SAFE	AT RISK	N/A
Respiratory Protection	SAFE	AT RISK	N/A
Electrical Protection	SAFE	AT RISK	N/A
Personal gas detector	SAFE	AT RISK	N/A
SAFE MOTOR VEHICLE OPERATION			
Does not use any mobile device while driving	SAFE	AT RISK	N/A
Secures equipment for safe transport	SAFE	AT RISK	N/A
Vehicle properly maintained	SAFE	AT RISK	N/A
Parking brake engaged when parked	SAFE	AT RISK	N/A
BODY POSITIONING DURING TASK			
Uses knees to lift not back	SAFE	AT RISK	N/A
Use knee pads when kneeling	SAFE	AT RISK	N/A
Watches hand placement / Keeps eyes on task	SAFE	AT RISK	N/A
Avoids pinch points or “line of fire” hazards	SAFE	AT RISK	N/A
Note: Line of fire: Struck by/against, caught in /between/under			
LADDERS			
Properly stores ladder on vehicle	SAFE	AT RISK	N/A
Ladders inspected prior to use	SAFE	AT RISK	N/A
Right ladder (step/extension) for the job	SAFE	AT RISK	N/A
Three points of contact at all times	SAFE	AT RISK	N/A
Does not use ladders in wet conditions	SAFE	AT RISK	N/A
Uses tool belt/back pack to carry tools	SAFE	AT RISK	N/A
PRE-JOB PLANNING			

Identifies all hazards in the work environment	SAFE	AT RISK	N/A
Conducts risk assessment using the risk calculator for	SAFE	AT RISK	N/A
Low / Medium or High Risks	SAFE	AT RISK	N/A
Obtains Work Permit where required	SAFE	AT RISK	N/A
Implements controls prior to starting work	SAFE	AT RISK	N/A
Communicates job activities with customer or team	SAFE	AT RISK	N/A
TOOLS			
Tools properly maintained	SAFE	AT RISK	N/A
Lock out, tag out properly applied	SAFE	AT RISK	N/A
Verifies zero energy after lock out	SAFE	AT RISK	N/A
Proper use of tools/ Uses right tool for the job	SAFE	AT RISK	N/A
Inspects tools before use	SAFE	AT RISK	N/A
INCLEMENT WEATHER			
Drinking plenty of fluids	SAFE	AT RISK	N/A
Taking rest breaks	SAFE	AT RISK	N/A
Uses ice cleats for icy conditions	SAFE	AT RISK	N/A
WORK ENVIRONMENT			
Keeps work area clean / free of trip hazards	SAFE	AT RISK	N/A
Checks work area for bees, wasps, snakes, etc	SAFE	AT RISK	N/A
HAZARD/INCIDENT REPORTING			
Reports Safety Observations	SAFE	AT RISK	N/A
Knows how to report injuries	SAFE	AT RISK	N/A
OTHER CRITICAL BEHAVIORS OBSERVED			
______________________	SAFE	AT RISK	N/A
______________________	SAFE	AT RISK	N/A

Describe At Risk Behavior:

Describe Safe Behavior:

Corrective action entered into SOS: Yes: **No:** **SOS Number:**

Manager / Lead Signature **Date** DD/MM/YYYY

SMP Attachment 14: Contractor Performance Safety Checklist (Contractor Audits)

Contractor Performance Safety Checklist				
Site location:		**Location of work**		
Auditor:		**Date and time**	**Date**	**Time**
Details of work being undertaken				
Contract Number or Name				
Name of contractor				

Observed health and safety standards				**Comments**
(i)	Have all contractor and sub contractor staff attended a site safety orientation course and received required HSE training?	Yes	No	
(ii)	Have all contractor and sub contractor staff aware of the sites emergency procedures?	Yes	No	
(iii)	Have all contractor and sub contractor staff been aware of what to do in the event of an accident and/or safety observation? (speak to contractor staff)	Yes	No	
(iv)	Has the contractor made adequate first aid provision?	Yes	No	
(v)	Have safety observations been submitted to Honeywell on a periodic basis?	Yes	No	
(vi)	Are the contractor and sub contractor risk assessments, safe work procedures, method statements, HSE procedures, and permits to work being followed?	Yes	No	
(vii)	Has required PPE, e.g. hard hats, safety boots, etc. been provided according to the risk assessment and is it being worn?	Yes	No	
(viii)	Has the contractor implemented life critical control measures for fall protection, electrical safety, arc flash, and permit confined spaces?	Yes	No	
(ix)	Where applicable are the contractor works securely fenced off or otherwise protected from the public, staff, etc?	Yes	No	
(x)	Is the contractor maintaining a safe work area and implementing good housekeeping standards, including safe egress to roads, aisles, stairs, etc.?	Yes	No	
(xi)	Is the contractor holding regular tool box talks with employees?	Yes	No	
(xii)	Other observations			

Auditor: *I hereby declare that I have completed health and safety monitoring on the contractor named above*

Name (capitals)		Signature			
Job Title		Time		Date	
Contractors representatives name		Signature		Date	
Site managers name		Signature		Date	

SMP Attachment 15: Vehicle, Tool, & PPE Inspection Checklist (Honeywell Employees)

EMPLOYEE NAME:	VEHICLE #:
SUPERVISOR NAME:	VEHICLE MILEAGE:
LOCATION ID# VEHICLE ASSIGNED:	INSPECTION DATE (MM/DD/YY):

	Insp	Test	Items	OK	DEV	N/A	Deviations: Enter a brief description of deviation, action taken, and date corrected
VEHICLE SAFETY ITEMS	x		**Housekeeping -** vehicle, tools, and equipment are neat and orderly, items in driver compartment are adequately secured				
	x		**Ladder racks** - in good condition, hardware intact, operates easily, ladders secure				
	x		**Exterior/Body damage** - exterior clean and in good condition (note all damage including scratches, dents, etc.)				
	x	x	**Lights** visible and operational - headlights (low & high beam), tail lights, brake lights, emergency flashers, other lights				
	x	x	**Windshield washer system/wipers/fluid** - operating properly, good condition, appropriate fluid level				
	x	x	**Seatbelt** - available and in good condition				
	x		**Glass & mirrors** - clean, no cracks or pits in areas that obstruct driver's view, mirrors securely mounted, properly positioned				
	x	x	**Tire Condition and Pressure** - appropriate tire wear and pressure (including spare)				
	x	x	**Fluid levels -** verify that oil is full, no fluid leaks				
	x	x	**Tire Condition and Pressure** - adequate tread depth and appropriate tire wear, proper pressure (including spare)				
	x	x	**Brakes** - operating properly (per driver's verbal report), verify that emergency brake operates properly				
	x	x	**Doors & locks** - door catches and handles work properly, locks work properly and can be secured				
	x		**Fire extinguisher** - mounted within vehicle, gauge needle in "green" zone or otherwise indicates "full"				
	x		**First aid kit** - vehicle kit available and adequately stocked				
	x		**Chocks and cones -** available, as needed				
	x		**Vehicle registration, insurance card, driver's license, Honeywell driver's guide, fuel card** -present, current, available for appropriate vehicle				
LADDERS & FALL	x		**Ladders** - Rungs, rails, hardware, rope in good condition. Appropriate ladder size and type available (non-conductive ladder available when electricity could be encountered)				
	x		**Fall protection equipment** - harness, lanyard, anchoring equipment inspected and in good condition. Complete system from same manufacturer. Harness and lanyard stored properly (without twisting, bending, away from chemicals and direct sunlight). Replaced according to manufacturer guidance.				
PPE	x		**Eye protection** - readily available, clean, in good condition				
	x	x	**Hard hat** – in good condition, no cracks or dents. Cradle system intact and in good condition. Clean surface.				
	x		**Hand and foot protection** - available and in good condition				
	x		**Hearing protection** – appropriately selected, clean, in good condition, stored properly				

	x	x	**Respiratory protection** - appropriately selected, in good condition, stored properly				
TOOLS & EQUIPMENT	x		**Power tools** - in good condition; cords, plugs, prongs present and good condition; grounded or double insulated; no broken pads; guards in place; removed from service/replaced promptly if poor condition detected				
	x		**Pneumatic tools** - hose/whip secured to tool by positive means (to prevent tool from being accidentally disconnected); safety clips or retainers used on impact/percussion tools				
	x		**Hand tools** - Good condition, no mushroomed heads, no broken or cracked parts; removed from service/replaced promptly if poor condition				
	x		**Fuel-powered tools/equipment** - good condition; stored so as to prevent spilling of fuel during transport; when in use in enclosed spaces, measures are taken to prevent build-up of gases and fumes; stopped for refueling, service, and maintenance				
ELECTRICAL	x		**Extension cords** - cord and plugs in good condition (no cracks, cuts, or tape), prongs intact, cord is grounded or double-insulated (and/or GFI available)				
	x		**Lockout/Tagout** - appropriate devices available (locks, tags, hasps, etc.), appropriate variety available for job conditions				
	x	x	**Amp Meter** - clean, no damage, proper storage, good working order, test battery				
COMPRESSED	x		**Torches, hoses, regulators** - fittings in good condition, no leaks, auto shut-off tested, hoses & connections designed for pressure and service to which subjected; equipped with backflow prevention or flash arrestor				
	x		**Gas cylinders** - turned off, stored upright with caps in place, secured (to prevent tipping), properly labeled, used with appropriate PPE, regulators and torches removed and/or disconnected from cylinders when not used				
	x		**Personal Protective Equipment for Hot Work** (i.e. face shield, body protection, etc.) - protective equipment available and in good condition				
MISCELLANEOUS	x		**Outdoor/inclement weather supplies & equipment** - appropriate supplies available for hazards encountered (i.e. drinking water/fluids, snow/ice management equipment {sand, shovels, etc.], insect spray [di-electric spray required if working near electricity], sunscreen, etc.)				
	x		**Chemicals** - only "approved" chemicals used, all containers properly labeled, containers stored properly (secured). Material Safety Data Sheets (MSDS) on file at HON office. If refrigerant is distributed, logs are available and up-to-date.				
	x		**Hand lines and ropes** - no cuts, abrasions, decay, burns, signs of wear				
	x		**Portable blowers** - in good condition, proper ratings on blower, proper set-up and use (test)				
	x	x	**Air monitoring equipment (for confined space entry)** - appropriate for job conditions and hazards potentially encountered, in good condition and functioning properly, test/calibrate equipment according to requirements, appropriate calibration gases and test kit available				
	x	x	**Electrical insulating gloves (for electrical hot work) -** if used and available, ensure appropriate class/type for use, verify current inspection/test date stamp rubber protective layer (w/in past 9 mos.), stored in bag with fingers upright, stored away from direct sunlight in dedicated bag				
	x		**Electrical mats/barriers** - Mats and barriers in good condition, no tears, rips or holes. Appropriate for hazards encountered.				
	x		**Gasoline** - stored in approved flammable liquid container with self-closing lid, flame/flash arrestor. Stored to prevent tipping. Maximum capacity stored less than 5 gallons.				
	x		**Heaters** – equipped with proper shut-off (tip over protection), use only approved heaters in good condition.				
	x		**Permits** - verify adequate supply of required permits (Hot Work, Live Electrical, Permit-Required Confined Space Entry, etc.)				

SMP Attachment 17: Emergency Response Plan

HBS & HPS Facilities Emergency Response Plan

Honeywell Business Unit:	
Street Address:	
City, State, Zip:	
Date of ERP Review:	

Emergency Response Preparedness (ERP) Checklist: ***(Click on PDF)***

SMP Attachment 17: Emergency Response Plan

TABLE OF CONTENTS

1. EMERGENCY PREPAREDNESS PLAN SCOPE:

Honeywell International Inc. (Honeywell) will provide a safe and healthy work environment. Consistent with policy, the following emergency action plan is developed for this site and will guide the actions taken by employees, management, and emergency coordinators. Emergency events addressed by this plan include building evacuation, fires, severe weather, medical emergencies, Bomb Threats or other facility-related emergencies that could endanger employees and/or visitors to this Honeywell location.

2. HSE HOTLINE REPORTING GUIDANCE:

Report all Injuries and Illnesses and Emergency Events addressed within this reporting procedure to the **Honeywell Hotline at (866-466-1765).** Early Post Injury Reporting with Immediate First Aid measures can reduce Injury Severity & Eliminate the need for Future Medical Care (Recordable Injuries).

3. DRILLS/TEST OF EMERGENCY PREPAREDNESS PLAN:

Familiarity with responsibilities and procedures must be thorough so that response to the plan is automatic. Each location is responsible for accomplishing at least one emergency situation drill every twelve (12) months. After accomplishing the emergency situations drill it must be documented on the Emergency Preparedness Drill Critique.

4. FACILITY IDENTIFICATION, DESCRIPTION, GENERAL INFORMATION:

Office Name/LID	
Address	
Description of Bldg, Usage	
Location Description, Cross Streets, Directions	
Facility Utilities, Nearby Buildings	

5. EMERGENCY COORDINATOR INFORMATION

THE EMERGENCY COORDINATOR HAS PRIMARY RESPONSIBILITY FOR ASSURING THE IMPLEMENTATION OF THIS EMERGENCY PREPAREDNESS PLAN AND REQUIREMENTS STATED HEREIN. WHEN EMERGENCIES OCCUR, THE EMERGENCY COORDINATOR MAINTAINS PRIMARY RESPONSIBILITY FOR APPROPRIATE NOTIFICATIONS TO EMPLOYEES, HONEYWELL MANAGEMENT, MUNICIPAL EMERGENCY SERVICES (I.E. FIRE AND/OR POLICE DEPARTMENTS), AND OTHER AGENCIES OR SERVICES THAT MAY ASSIST IN MANAGEMENT OF THE EMERGENCY.

The alternate Emergency Coordinator serves in place of the Emergency Coordinator when the primary coordinator is unavailable. (It is recommended that these positions be filled with employees who are typically in the building for the majority of the workday.)

A. THE PRIMARY EMERGENCY COORDINATOR FOR THIS FACILITY IS:

Name	
Title	
Office Phone	
Pager or Cell	
Alternate Phone	

B. THE ALTERNATE EMERGENCY COORDINATOR FOR THIS FACILITY IS:

Name	
Title	
Office Phone	
Pager or Cell	
Alternate Phone	

6. HONEYWELL CRISIS COMMUNICATION:

Major crisis situations often generate interest from the news media and require effective internal communications to address employee concerns. As soon as possible following a major crisis event, contact the Communications Leader to discuss the situation so appropriate internal and external communications plans and tools can be developed. Examples of such times where crisis reporting should be accomplished include the following:

a. Catastrophic facility damage caused by fires, storms, explosions, or earthquakes, tsunamis, accidents that may result in severe injury and threats or acts of violence or terrorism

b. Other unexpected events that have the potential to cause harm to Honeywell's employees, reputation, competitive positioning, or financial viability.

I. INTERNAL RESOURCE NUMBERS: It is always appropriate to contact the local site leader if they are not on-site at the time of the incident. Additionally, based on the nature of the event/injury it may also be necessary to contact other Honeywell personnel listed below:

	Name	Office Phone	Cell Phone
Local Site Leader(s)			
HSE Leader	Steve Serian	603-930-0222	603-930-0222
Facilities Manager			
HR Leader			
ACS Security Director	Jeff Soholt	763-954-6123	952-303-1648

❖ **Additional Links**
- o **Corporate Communication Policy**
- o **Corporate Communication Contacts**

II. EXTERNAL RESOURCES / EMERGENCY PHONE NUMBERS:

	Name	Phone
Police Department		911
Fire & Ambulence		911
Building Landlord/Manager		
Other		

7. EMERGENCY EVACUATION SYSTEM:

A fire alarm will be used to alert employees within the building of fire or severe weather emergency or other need to evacuate the building or to seek shelter in place. In buildings that are not equipped with audible emergency alarms, employees will be alerted to other emergencies through direct verbal communication from the Emergency Coordinator(s) and/or designated alternate.

The Emergency Coordinator or designated alternate will make physical contact with employees who have sight or hearing disabilities to ensure that they are aware of the emergency.

a. BUILDING EVACUATION:

Evacuation of employees to a rally point outside of the building or to a refuge area within the building will be enacted whenever there is a threat to their safety or health because of an emergency condition. The refuge area shall be a safe area within the building away from windows where employees can gather, for example, in severe weather. The Emergency Coordinator is authorized to enact the evacuation of a particular room, floor, or the building.

- ✓ The designated rally point is:
  Specify:
  If the designated rally point is involved in the emergency, the alternate rally point will be:
  Specify:
- ✓ The designated (indoor) refuge area is:
  Specify:
- ✓ The Emergency Coordinator and Team will be responsible for accounting for all employees, visitors and contractors. If personnel are unaccounted for after conducting the headcount at the rally point, the Emergency Coordinator will be the designated person responsible for communicating with emergency services.
- ✓ Re-entry to the building will be coordinated through emergency services and the Emergency Coordinator. In the event of an incident preventing re-entry, the Emergency Coordinator will work with senior management, Facilities, and Health, Safety, Environmental (HSE) departments to assure the safety of the building and personnel.
- ✓ Injured personnel will receive medical care through the municipality's emergency response system.
- ✓ In the event an unplanned evacuation results from an actual site emergency, the Emergency Coordinator shall ensure appropriate notifications are made to site leadership.
- ✓ A diagram or description of the evacuation routes, exit doors, rally points and refuge areas are posted:
  Specify:
  The designated exit doors for this facility are (list exit doors).
- ✓ Know the locations of your building evacuation route, outdoor rally point, and indoor refuge area before an emergency occurs by reviewing the posted/attached instructions and/or evacuation map.

8. MEDICAL EMERGENCY:

Remember to report all injuries no matter how minor to your manager and HSE leader immediately and the **Honeywell Hotline at (866-466-1765).** *Never enter into a medical emergency area unless you are sure there are no hazards present. Scan the area visually, overhead as well, to ensure that there are no physical dangers present. We do not want to delay the initial medical emergency response nor do we want to provide additional responses to would-be rescuers. Never move or attempt to render any assistance that could impact greater injury to the already injured victim.*

The following steps to be taken in the event of an on-site medical emergency:

a. *Immediately contact First Aid personnel and dial 9-911 for assistance, such as loss of consciousness, uncontrolled bleeding, potential heart attack or stroke and give exact location and nature of the emergency.*

b. *Remember, when First Aid arrives, they are in charge. Persons in the immediate area should be limited to only those identified by the First Aid Attendant. The First Aid Person will provide direction and course of action.*

c. *If further medical assistance is required, the First Aid Attendant or designate will contact dial 911 and request an ambulance be dispatched*

9. FIRE EMERGENCY (Evacuate and call 9-911):

To protect yourself, it is important to understand the basic characteristics of fire. Fire spreads quickly so there is no time to gather valuables or make a phone call. In just two minutes, a fire can become life-threatening. In five minutes, a residence can be engulfed in flames. Heat and smoke from fire can be more dangerous than the flames. Inhaling the super-hot air can sear your lungs. Fire produces poisonous gases that make you disoriented and drowsy. Asphyxiation is the leading cause of fire deaths, exceeding burns by a three-to-one ratio.

a. Protective Measures for Fires:
- ✓ Insure smoke alarms are installed, tested and cleaned in accordance with applicable instructions.
- ✓ Ensure Fire Suppression Systems are maintained and tested in accordance with applicable instructions.
- ✓ Ensure Fire extinguishers are in place and serviceable.
- ✓ Accomplish Annual Emergency Fire Drills to prepare employees.

b. Escaping the Fire:
- ✓ Review escape routes with personnel and practice escaping from each room.
- ✓ Ensure security doors and other antitheft mechanisms that could block outside window entry are easily opened from the inside.
- ✓ Remain low to the floor (where the air is safer in a fire) when escaping from a fire.
- ✓ Clean out storage areas. Never allow trash, old newspapers, boxes or magazines to accumulate.

c. Flammable Items:
- ✓ Never use gasoline, benzene, naphtha, or similar flammable liquids indoors.
- ✓ Store flammable liquids in approved containers in well-ventilated storage areas.

d. Fire sources and smoking:
- ✓ Never smoke near flammable liquids
- ✓ Smoke only in designated smoking areas as described below:

Specify:

Provide deep sturdy ashtrays or outdoor approved cigarette/cigar disposal cans.

e. Heating Sources
- ✓ Be careful when using portable heating sources.
- ✓ Ensure space heaters are at least three feet (1 meter) away from combustible materials.
- ✓ Ensure Portable heating devices have a tilt shutoff as well as a timer shutoff.
- ✓ Always unplug Portable Heating Devices when not in use.

f. Electrical Wiring:
- ✓ Ensure electrical wiring is not exposed.
- ✓ Never Daisy Chain extension cords.
- ✓ Inspect extension cords for frayed or exposed wires or loose plugs.
- ✓ Make sure outlets have cover plates and no exposed wiring.
- ✓ Make sure wiring does not run under rugs, over nails, or across high-traffic areas.
- ✓ Do not overload extension cords or outlets. If you need to plug in two or three appliances, get a UL-approved unit with built-in circuit breakers to prevent sparks and short circuits.

g. During a Fire If your clothes catch on fire:
- ✓ Stop, drop, and roll until the fire is extinguished.

10. TERROIST / BOMB / BIOLOGICAL / CHEMICAL / RADIOLOGICALTHREAT EMERGENCY:

a. Remain calm, listen carefully and record the following details:
- ✓ *Time the call was received,*
- ✓ *Details of the threat (Where is the bomb or When it is expected to explode),*
- ✓ *Details of the caller (voice tone – angry, joking, sarcastic, quiet, business-like),*
- ✓ *Background noise (car noise, street noise, television, radio),*
- ✓ *Time the call ended*

c. Notify Local Police Department, Honeywell Management and Security immediately.

Bomb, Chemical and/or Biological Threat Guideline

Detailed DESCRIPTION OF CALLER'S VOICE

Male ______ Female______

Young _____ Middle Aged _____ Older______

_________ Calm _________ Nasal
_________ Angry _________ Stutter
_________ Excited _________ Lisp
_________ Slow _________ Raspy
_________ Rapid _________ Deep
_________ Soft _________ Cleared Throat
_________ Loud _________ Deep Breathing
_________ Laughter _________ Cracked Voice
_________ Crying __________Accent
_________ Normal __________Familiar
_________ Slurred __________Disguised

BACKGROUND SOUNDS

_________ Street _________ Factory
_________ Animal _________ Clear
_________ Voices __________PA System
_________ House __________Traffic
_________ Other

THREAT LANGUAGE

_________*Well spoken* __________ *Incoherent*
_________Foul/ Irrational ________ Read Message?

Ask the below EXACT WORDS upon BOMB THREAT

1. *Where is the device right now?*
2. *What does it look like?*
3. *What kind of a device is it?*
4. *Why are you doing this?*
5. *What is your name?*
6. Are you part of an organization?
7. *Why are you warning us?*
8. What will cause it to activate?

*Person receiving call*____________________________________ *Time Caller hung up*____________

*Phone number at which call was received*____________________ *Date*___________________

11. HAZARDOUS CHEMICALS:

If applicable, identify and list below all hazardous chemical quantities stored on site. Otherwise state "Not Applicable" to this location.

- ✓ **Inside and/or outside locations:**
- ✓ **Quantities of hazardous materials:**
- ✓ **Physical and/or chemical hazards, i.e., asphyxiation hazards**
- ✓ **Hazardous material properties, i.e. flammability, toxicity. Reference location of Safety Data Sheets**

12. INTERNAL HAZARD / CONTROL MEASURES:

Include in this section any process operations that may fail during an emergency event.

Possible Failures	Emergency Control Measure Description

The following are examples of process operations that are addressed in the procedure, but do not need to be part of this section if not applicable to your location: *(Truck/railcar deliveries, transfer of materials, utilities, pollution control devices, control rooms, pipelines, control valves, ventilation systems, boilers, pressure vessels, security access controls, fire protection systems, identify existing engineering control measures to avoid release of hazardous materials).* However, if applicable, prepare emergency control measures for each potential failed process that may apply to your location.

13. EMERGENCY DRILL REQUIREMENTS

a. *Annual Emergency Evacuation Drills*

- ✓ *Drills must be accomplished annually and include different types of Emergency Scenarios as outlined in this Emergency Preparedness Plan*
- ✓ *Upon completion of the Emergency Evacuation Drill use the Critique Form to Document Drill.*
- ✓ *In accordance with Corporate Policy,* once the Emergency Evacuation Drill is complete, forward the Critique Form to regional HSE Manager for entry into the Corporate Event Tracking System.

b. *Annual AED Emergency Drill*

- ✓ *If a location has more than 200 employees an AED is required.* Before making the determination to purchase an AED, contact your Regional Safety Manager.
- ✓ Locations with AEDs must conduct AED drills at least annually on all shifts where AED trained personnel are present. These drills must be documented and must measure the actual response time.
- ✓ When AED drill response times are greater than or equal to 5 minutes, the organization must create a corrective action plan to reduce the response time to less than 5 minutes. *This action plan must be documented in the Corporate Event Tracking System by the HSE Manager*. Corrective actions must include a mechanism for ensuring the response time of 5 minutes or less is met.

14. NATURAL DISASTERS:

a. TORNADO EMERGENCY:

I. Tornado Terms:

- ✓ **Tornado Watch:** Means Tornadoes are possible. Remain alert for approaching storms. Watch the sky and stay tuned to NOAA Weather Radio, commercial radio, or television for information.
- ✓ **Tornado Warning:** A tornado has been sighted or indicated by weather radar. Take shelter immediately.

II. Protective Measures before and during a Tornado:

- ✓ Listen to NOAA Weather Radio or to commercial radio or television newscasts for the latest information & remain alert.
- ✓ Look for approaching danger signs such as a dark greenish sky or dark low-lying cloud with rotation or evidence of large hail.
- ✓ Listen for a loud roar, similar to a freight train.
- ✓ If you see approaching storms or any of the danger signs, be prepared to take shelter immediately or if you're under a tornado WARNING, seek shelter immediately!
- ✓ If inside an enclosed structure such as a small building, school, nursing home, hospital, factory, shopping center or high-rise building, go to a pre-designated shelter area such as a safe room, basement, storm cellar, or the lowest building level. If there is no basement, go to the center of an interior room on the lowest level (closet, interior hallway) away from corners, windows, doors, and outside walls. Put as many walls as possible between you and the outside. Get under a sturdy table and use your arms to protect your head and neck. Do not open windows.
- ✓ If outside with no shelter lie flat in a nearby ditch or depression and cover your head with your hands.
- ✓ Watch out for flying debris. Flying debris from tornadoes causes most fatalities and injuries.

b. HURRICANE/CYCLONE EMERGENCY:

I. Hurricanes Terms:

- ✓ **Hurricane/Cyclone and Tropical Storm Watch**: Hurricane/tropical storm conditions are possible in the specified area, usually within 36 hours. Tune in to NOAA Weather Radio, commercial radio, or television for information.
- ✓ **Hurricane/Cyclone and Tropical Storm Warning**: Hurricane/tropical storm conditions are expected in the specified area, usually within 24 hours.

II. Hurricane/Cyclone Protective Measures before and during a Hurricane:

- ✓ Make plans to secure property by closing all windows, doors and roof vents if possible.
- ✓ Determine a safe room / location for shelter.
- ✓ Listen to the radio or TV for information.
- ✓ Turn off utilities if instructed to do so.
- ✓ Evacuate building if directed by local authorities and be sure to follow their instructions.

c. EARTHQUAKE EMERGENCY:

I. Protective Measures before and during an Earthquake:

- ✓ *Keep your cool, avoid panic and confusion and ride out the motion.*
- ✓ *Take cover under a sturdy desk, table, or bench or against an inside wall, and hold on. If there isn't a table or desk near you, cover your face and head with your arms and crouch in an inside corner of the building.*
- ✓ *Stay away from glass, windows, outside doors and walls, and anything that could fall, such as lighting fixtures or furniture.*
- ✓ *Use a doorway for shelter only if it is in close proximity to you and if you know it is a strongly supported, load bearing doorway.*
- ✓ *Remain inside until shaking stops and it is safe to go outside. Most injuries during earthquakes occur when people are hit by falling objects when entering into or exiting from buildings.*
- ✓ *Be aware that the electricity may go out or the sprinkler systems or fire alarms may turn on.*
- ✓ *Do not use elevators during an Earthquake.*

II. Post Earthquake Protective Measures: *Being prepared for aftershocks are extremely important. Even though secondary shockwaves are usually less violent, they can be strong enough to cause additional damage to already weekend structures.*

- ✓ *Check for injuries amongst those around you. Notify First Aid of injured persons as soon as safe to do so. Do not move the seriously injured unless they are in immediate danger. Try and keep the injured warm.*
- ✓ *Contact local emergency resource centers such as the hospital or fire department as required for injuries or fire concerns or call 9-911.*
- ✓ *Stay away from damaged areas unless your assistance has been specifically requested by police, fire, or relief organizations*
- ✓ *Listen for sounds or smell of leaking gas and exit building if the smell of gas apparent.*
- ✓ *Be aware of possible tsunamis if you live in coastal areas. These are also known as seismic sea waves (mistakenly called "tidal waves"). When local authorities issue a tsunami warning, assume that a series of dangerous waves is on the way. Stay away from the beach.*
- ✓ *Always open cabinets cautiously as objects may have shifted causing falling hazards.*
- ✓ *Never leave the worksite area unless you have advised your Site Manager. You may be jeopardizing your safety (bridge or road damage, et cetera) as well as create traffic congestion for emergency vehicles.*
- ✓ *If evacuation is ordered, leave by the nearest emergency exit and report directly to your designated assembly/rally point.*

d. VOLCANO EMERGENCY:

I. Protective Measures before and during a Volcanic Eruption:

- ✓ Monitor local radio stations and News Broadcasts

- ✓ Ensure the building / office ventilation system is turned off. This will keep ash particulates from entering building.
- ✓ Cover sensitive equipment with plastic sheets to keep ash particulates from entering parts.
- ✓ Evacuate immediately from the volcano area to avoid flying debris, hot gases, lateral blast and lava flow.
- ✓ Wear long-sleeved shirts and long pants.
- ✓ Use goggles and war eyeglasses instead of contact lenses.
- ✓ Use a dust mask or hold a damp cloth over your face to help with breathing.
- ✓ Stay away from areas downwind from the volcano to avoid volcanic ash.
- ✓ Stay indoors until the ash has settled unless there is a danger of the roof collapsing.
- ✓ Close doors, windows and turn off all ventilation systems.

e. TSUNAMI EMERGENCY:

I. Understanding Tsunamis Terms:

- ✓ Advisory: An earthquake has occurred in the Pacific basin, which might generate a tsunami.
- ✓ Watch: A tsunami was or may have been generated, but is at least two hours travel time to the area in Watch status.
- ✓ Warning: A tsunami was, or may have been generated, which could cause damage; therefore, people in the warned area are strongly advised to evacuate.

II. Tsunami Protective measures before and during a tsunami event:

- ✓ Turn on your radio to learn if there is a tsunami warning if an earthquake occurs and you are in a coastal area.
- ✓ Move inland to higher ground immediately and stay there.
- ✓ **Visual Indication of Imminent Tsunami** - Strong Earthquake lasting 20 seconds or more where it is difficult to stand or walk or the water level at the beach begins receding / being pulled back into the ocean.

15. Insert PDF of Building Evacuation Map and Location of Fire Extinguishers on Following Page

Insert PDF map on here or on next page