ENERGY AUDIT

REPORT

Town of Needham
Department of Public Facilities
1471 Highland Avenue
Needham, Massachusetts 02492
Kate Fitzpatrick

ENERGY AUDIT REPORT

of

POLLARD MIDDLE SCHOOL

200 Harris Avenue
Needham, Massachusetts 02492

PREPARED BY:

EMG
222 Schilling Circle, Suite 275
Hunt Valley, Maryland 21031
800.733.0660
410.785.6220 (fax)
www.emgcorp.com

EMG CONTACT:

Kalyana Vadala
Program Manager
800.733.0660, ext.6236
Kvadala@emgcorp.com

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On site Date: September 19 and 20, 2011

EMG
DECISION INTELLIGENCE
25th ANNIVERSARY

TABLE OF CONTENTS

1. CERTIFICATION

EMG has completed an Energy Audit of Pollard Middle School located at 200 Harris Avenue in Needham, Massachusetts. EMG visited the site on 19th and 20th September.

The assessment was performed at the Client's request using methods and procedures consistent with ASHRAE Level II Energy Audit and using methods and procedures as outlined in EMG's Proposal.

This report is exclusively for the use and benefit of the Client identified on the first page of this report. The purpose for which this report shall be used shall be limited to the use as stated in the contract between the client and EMG.

This report is not for the use or benefit of, nor may it be relied upon by any other person or entity, for any purpose without the advance written consent of EMG.

Estimated installation costs are based on EMG's experience on similar projects and industry standard cost estimating tools including *RS Means*. In developing the installed costs, EMG also considered the area correction factors for labor rates for Needham, MA. Since actual installed costs may vary widely for particular installation based on labor & material rates at time of installation, EMG does not guarantee installed cost estimates and shall in no event be liable should actual installed costs vary from the estimated costs herein. We strongly encourage the owner to confirm these cost estimates independently. EMG does not guarantee the costs savings estimated in this report. EMG shall in no event be liable should the actual energy savings vary from the savings estimated herein.

EMG certifies that EMG has no undisclosed interest in the subject property and that EMG's employment and compensation are not contingent upon the findings or estimated costs to remedy any deficiencies due to deferred maintenance and any noted component or system replacements.

Any questions regarding this report should be directed to Kalyana Vadala at 800.733.0660, ext. 6236.

Prepared by: Kaustubh Anil Chabukswar
Energy Auditor
Project Manager

Reviewed by: _____
Kalyana Vadala
Program Manager

2. EXECUTIVE SUMMARY

The purpose of this Energy Audit is to provide Pollard Middle School with a baseline of energy usage and the relative energy efficiency of the facility and specific recommendations for Energy Conservation Measures. Information obtained from these analyses may be used to support a future application to an Energy Conservation Program, Federal & Utility grants towards energy conservation, support performance contracting, justify a municipal bond funded improvement program, or as a basis for replacement of equipment or systems.

The Pollard Middle School was originally built in 1960 followed by a renovation/expansion in 1992. The portable section of the school was installed in 1999. The existing school building contains a total of 153,355Sqft. The older section of the facility consists of a single story while the new renovated section consists of two floors. During the 1992 renovations all the HVAC system along with lighting and windows were replaced. The old steam heat was replaced with forced hot water system along with two boiler rooms containing a total of four boilers.

The study included a review of the building's construction features, historical energy and water consumption and costs, review of the building envelope, HVAC equipment, heat distribution systems, lighting, and the building's operational and maintenance practices.

EMG has uncovered a number of energy saving recommendation for the for the facility that it believes would save a considerable amount of energy annually.

High Priority ECM's:

- Install high efficiency condensing boilers
- Upgrade rooftop condensing units
- Upgrade water heater
- Upgrade lighting and install automatic controls

Major ECM's for consideration:

- Upgrade motors; install VFD for boiler room pumps
- Install demand controlled ventilation (DCV) controls for air handlers

Summary of Existing Energy Performance

Building's EPA Energy Performance Rating[1]	36
Building's Annual Energy Consumption	10,783,063 kBtu
Total Annual Energy Costs	$298,058

EMG has identified 7 Energy Conservation Measures (ECMs) for this property. The savings for each measure are calculated using standard engineering methods followed in the industry, and detailed calculations for ECM are provided in Appendix for reference. A 10% discount in energy savings was applied to account for the interactive effects amongst the ECMs. In addition to the consideration of the interactive effects, EMG has applied a 15% contingency to the implementation costs to account for potential cost overruns during the implementation of the ECMs.

The following table summarizes the recommended ECMs in terms of description, investment cost, energy consumption reduction, and cost savings.

Summary of Financial Information for Recommended Energy Conservation Measures

Item	Estimate
Total Projected Initial ECM Investment	$594,345 *(In Current Dollars)*
Estimated Annual Cost Savings Related to ECMs	$45,815 *(In Current Dollars)*
Net Effective ECM Payback	12.97 Years
Estimated Annual Energy Savings	22.39%
Estimated Annual Cost Savings	15.11%

List of Recommended Energy Conservation Measures For Pollard Middle School

ECM #	Description of ECM	Projected Initial Investment	Estimated Annual Energy Savings		Estimated Total Annual Energy Savings	Estimated Annual Water Savings	Total Estimated Annual Cost Savings	Simple Payback
			Natural Gas	Electricity				
		$	Therms	kWh	MMBtu	kgal	$	Years
No/Low Cost Recommendations								
1	Replace High Flow Faucet Aerators To Low Flow Faucet Aerators Details: Install 0.5 GPM Aerators	$623	382	0	38	48	$426	1.46
Totals for No/Low Cost Items		**$623**	**382**	**0**	**38**	**48**	**$426**	**1.46**
Capital Cost Recommendations								
1	Replace Existing Hot Water Heater With New Energy Efficient Water Heater Details: Repalce Old Gas Fired Water Heater	$11,689	973	0	97	0	$1,086	10.77
2	Replace Existing Air Conditioners with Energy Star Air Conditioners Details: Replace older Rooftop Condensing Units	$16,390	0	18,221	62	0	$3,397	4.82
3	Replace High Intensity Discharge Lamp (HID) with Induction Lighting Details: Exterior Wall Packs, Blue and Green Gymnasium	$18,086	0	31,851	109	0	$6,118	2.96

List of Recommended Energy Conservation Measures For Pollard Middle School

ECM #	Description of ECM	Projected Initial Investment	Estimated Annual Energy Savings		Estimated Total Annual Energy Savings	Estimated Annual Water Savings	Total Estimated Annual Cost Savings	Simple Payback
			Natural Gas	Electricity				
		$	Therms	kWh	MMBtu	kgal	$	Years
Capital Cost Recommendations								
4	Install Tandem Lighting System In Hallways Details: Throughout The Hallways	$18,176	0	44,962	153	0	$8,383	2.17
5	Delamp Fixtures In Individual Rooms And Install Lighting Controls Details: All Classrooms, Offices And Media Centers	$85,364	0	40,379	138	0	$7,528	11.34
6	Replace Inefficient Heating Plant Details: Replace the Existing Boiler plant with three (3) Condensing Boilers	$366,493	20,845	0	2,085	0	$23,967	15.29
Total For Capital Cost		**$516,199**	**21,818**	**135,413**	**2,644**	**0**	**$50,479**	**10.23**
	Interactive Savings Discount @ 10%		-2,220	-13,541	-268	-5	-$5,091	
	Total Contingency Expenses @15%	$77,523						
Total for Improvements		**$594,345**	**19,980**	**121,872**	**2,414**	**43**	**$45,815**	**12.97**

Detailed List of Measures Evaluated For Consideration For Pollard Middle School								
ECM #	Description of ECM	Initial Investment	Annual Energy Savings		Estimated Total Annual Energy Savings	Annual Water Savings	Total Estimated Annual Cost Savings	Payback
		$	Natural Gas	Electricity	MMBtu	kgal	$	Years
1	Replace Existing Motors With High Efficiency Motors Details: HV-1, 2 and Cluster AHU	$3,023	0	514	2	0	$101	30.03
2	Install On-Demand Ventilation on Air Handlers Details: AHU Serving Rm. 220,222,224,212,216, AHU-6, Green Gym And Cafeteria	$8,162	14	228	2	0	$62	$132
3	Install Variable Frequency Drives (VFD) Details: Install VFD's on Front Boiler Room Pumps	$42,069	0	13,221	45	0	$2,465	$17
Total for Improvements		**$53,255**	**14**	**13,964**		**0**	**$2,627**	**20.27**

3. BENCHMARKING/ENERGY PERFORMANCE SUMMARY

3.1. ENERGY STAR PORTFOLIO MANAGER FACILITY SUMMARY

EMG uses the Portfolio Manager tool developed by the Federal Environmental Protection Agency to track relative energy uses of buildings by property type. This tool allows the input of a facility's historic utility data to be compared with normalized data of a large database of its peer facilities.

Based on this analysis, the Pollard Middle School is performing below the national average level

Facility
Needham: Pollard Middle School
200 Harris Avenue
Needham, MA 02492

Facility Owner
N/A

Primary Contact for this Facility
Bill Champion
222 Schilling Circle Suite 275
Hunt Valley, MD 21031

General Information

Needham: Pollard Middle School	
Gross Floor Area Excluding Parking: (ft²)	153,355
Year Built	1960
For 12-month Evaluation Period Ending Date:	June 30, 2011

Facility Space Use Summary

School	
Space Type	K-12 School
Gross Floor Area(ft2)	153,355
Open Weekends?	No
Number of PCs	80
Number of walk-in refrigeration/freezer units[4]	2
Presence of cooking facilities[4]	Yes
Percent Cooled	40
Percent Heated	100
Months[5]	9
High School?	No
School District[6]	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 06/30/2011)	**Baseline** (Ending Date 06/30/2011)	**Rating of 75**	**Target**	**National Median**
Energy Performance Rating	36	36	75	N/A	50
Energy Intensity					
Site (kBtu/ft²)	70	70	49	N/A	62
Source (kBtu/ft2)	114	114	79	N/A	101
Energy Cost					
$/year	$ 298,059.00	$ 298,059.00	$ 206,117.24	N/A	$ 263,543.78
$/ft²/year	$ 1.94	$ 1.94	$ 1.34	N/A	$ 1.72
Greenhouse Gas Emissions					
$MtCO_2e$/year	884	884	611	N/A	782
$kgCO_2e/ft^2$/year	6	6	4	N/A	5

3.2. EPA ENERGY STAR RATING

The national energy performance rating is a type of external benchmark that helps energy managers to assess how efficiently their buildings use energy, relative to similar buildings nationwide. The rating system's 1-100 scale allows everyone to understand quickly how a building is performing. For example, a rating of 50 indicates an average energy performance, while a rating of 75 or better indicates top performance. The higher the rating, the better the building is performing. Organizations can evaluate energy performance among the buildings in their portfolio, while also comparing their performance with other similar buildings nationwide. Additionally, building owners and managers can use the performance ratings to help identify buildings that offer the best opportunity for energy improvement and recognition.

To receive the energy performance rating, facility-related data entered into the Portfolio Manager, must adhere to a series of operating and energy use conditions. If one or more of these conditions are not met, the facility will receive "N/A" (Not Available) as a rating. "NA" means that the Portfolio Manager is unable to calculate a rating for that particular period ending date, given the operating and energy use conditions provided.

A building must obtain a rating of 75 or better to be eligible to apply for the Energy Star Certification. However, a rating of 75 does not necessarily mean that a building will qualify.

3.3. SOURCE ENERGY AND SITE ENERGY

Buildings use a variety of forms of energy, including electricity, natural gas, fuel oil, and district steam. In order to provide an un-biased rating, the methodology must add together all of the energy used in a building. To combine energy in an equitable way, the ratings use source energy. Source energy is the energy that is consumed at the site, in addition to the energy used in generation and transmission.

The purpose of the conversion from site energy to source energy is to provide an equitable assessment of building-level energy efficiency. Because billed site energy use includes a combination of primary and secondary forms of energy, a comparison using site energy does not provide an equivalent thermodynamic assessment for buildings with different fuel mixes. In contrast, source energy incorporates all transmission, delivery, and production losses, which accounts for all primary fuel consumption and enables a complete assessment of energy efficiency in a building. When source energy is used to evaluate energy performance, an individual building's performance does not receive either a credit or a penalty for using any particular fuel type.

4. INTRODUCTION

The purpose of this Energy Audit is to provide Pollard Middle School with a baseline of energy usage, the relative energy efficiency of the facility, and specific recommendations for Energy Conservation Measures. Information obtained from these analyses may be used to support a future application to an Energy Conservation Program, Federal and Utility grants towards energy conservation, as well as support performance contracting, justify a municipal bond-funded improvement program, or as a basis for replacement of equipment or systems.

The energy audit consisted of an on site visual assessment to determine current conditions, itemize the energy consuming equipment (i.e. boilers, Make-Up Air Units, DHW equipment); review lighting systems both exterior and interior; and review efficiency of all such equipment. The study also included interviews and consultation with operational and maintenance personnel. The following is a summary of the tasks and reporting that make up the Energy Audit portion of the report.

The following is a summary of the tasks and reporting that make up the Energy Audit portion of the report.

ENERGY AND WATER USING EQUIPMENT

- EMG has surveyed the common areas, office areas, classrooms, maintenance facilities and mechanical rooms to document utility-related equipment, including heating systems, cooling systems, air handling systems and lighting systems.

BUILDING ENVELOPE

- EMG has reviewed the characteristics and conditions of the building envelope, checking insulation values and conditions. This review also includes an inspection of the condition of walls, windows, doors, roof areas, insulation and special use areas. Where we anticipated significant losses, we utilized infrared thermographs to analyze heat loss across the envelope.

RECOMMENDATIONS FOR ENERGY SAVINGS OPPORTUNITIES

- Based on the information gathered during the on site assessment, the utility rates, as well as recent consumption data and engineering analysis, EMG has identified opportunities to save energy and provide probable construction costs, projected energy/utility savings and provide a simple payback analysis.

ANALYSIS OF ENERGY CONSUMPTION

- Based on the information gathered during the on site assessment and a minimum of one year of utility billing history, EMG has conducted an analysis of the energy usage of all equipment, and identified which equipment is using the most energy and what equipment upgrades may be necessary. As a result, equipment upgrades or replacements are identified that may provide a reasonable return on the investment and improve maintenance reliability.

ENERGY AUDIT PROCESS

- Interviewing staff and review plans and past upgrades
- Performing an energy audit for each use type
- Performing a preliminary evaluation of the utility system
- Analyzing findings, utilizing ECM cost-benefit worksheets
- Making preliminary recommendations for system energy improvements and measures
- Estimating initial cost and changes in operating and maintenance costs based on implementation of energy efficiency measures
- Ranking recommended cost measures, based on the criticality of the project and the largest payback

REPORTING

The EMG Energy Audit Report includes:

- A comprehensive study identifying all applicable Energy Conservation Measures (ECMs) and priorities, based on initial cost and payback
- A narrative discussion of building systems/components considered and a discussion of energy improvement options;
- A summary of ECMs including initial costs and simple paybacks, based on current utility rates and expected annual savings.

5. FACILITY OVERVIEW AND EXISTING CONDITIONS

5.1. BUILDING OCCUPANCY

The facility is typically occupied from 6:30 AM until 11:30 PM. The chief custodian of the facility is the first person to open the facility whereas the cleaning crews are the last members to leave the facility. The Pollard Middle School has a total student population of 829 students that attend the 8th and the 9th grade classes. The total student count for the elementary school that occupies the portables is unknown.

Summary of Facility Operating Hours

	Hours Open to the Public	Hours Open to Employees
Monday-Friday	8 Hrs	14 Hrs
Saturday	0 Hrs	0 Hrs
Sunday	0 Hrs	0 Hrs

5.2. BUILDING ENVELOPE

The building envelope consists of the exterior shell, made up of the walls, windows, roof, and floor. The envelope provides building integrity and separates the exterior from the interior conditioned space.

According to the structural drawings, the foundations consist of a conventional, reinforced concrete, slab-on-grade foundation. The building has structural steel columns supporting the upper floor and roof. The upper floor has concrete-topped metal decks and is supported by steel beams. The exterior walls are finished with a brick masonry veneer and consists of CMU, vapor barrier and batt insulation in the order of R-19.

The primary roofs are classified as flat. The roof has been recently replaced in the summer of 2011. The existing roof is a mineral-surfaced cap sheet over a multi-ply bituminous built-up membrane type of roof. Based on the engineering drawing s and the documents made available it was determined that the roof has an average R-value of R-25.

The window consists of double pane-metal framed, thermally broken windows. No damage was observed on any of the windows.

Item	Construction Type
Foundation	Slab on Grade
Structure	Block with Steel Substructure and Concrete Decks
Exterior Walls	Brick veneer and metal panel system with 1.5″rightd insulation
Roof	3 Ply Built-Up flat roof along with sloped roof consisting of asphalt shingles.

The following table describes the observed or reported insulation levels at the property:

Building Element	Observed R-values
Roof // Attic	R – 25
Floors	R - 5
Exterior Walls Above Grade	R - 15

5.3. BUILDING HEATING, VENTILATION AND AIR-CONDITIONING (HVAC)

The pollard Middle School located in Needham, MA has high heating hours that cooling hours. The school is centrally heated by means of forced hot water heating system in conjunction with a series of unit ventilators, air handling units and fan coil units. The school doesn't have central cooling system, but has individual roof-mounted split system serving individual zones. The HVAC controls are partly pneumatic and partly DDC. The township staff is working on an ongoing project to convert all the existing pneumatic valves to DDC valves. It is estimated that approximately 1/3rd of the total valves are converted to DDC while the rest are still pneumatic. The HVAC systems along with the exhaust fans in the building are controlled by a central energy management system.

Heating System:

The central heating system consists of a total of four H.B Smith hot water boilers, hot water circulation pumps, AHU, FCU's and unit ventilators. The existing heating setup was installed in 1992. The middle school has two boiler rooms that are designated as front and back boiler room. The front boiler room consists of two HB Smith 2B-14Series cast iron hot water boilers. Both the boilers are rated at 4,258MBH I/P capacity and 2,930MBH Net IBR Output capacity. The boilers are designated as dual fuel boilers and used No.2 oil during the winter of 2010-11 due to issues with excessive noise from the main natural gas meter. The hot water is circulated around the building by two Magnetek built 15Hp premium efficiency pumps that are programmed to run in lead-lag configuration. Both the pumps have been installed in 1992.

The current energy management system is programmed to fire up the boilers once the outside air temperature falls below 60F. Further both the boilers are programmed to come on once the OA temperature falls below 10F. Currently the front boiler room takes up the entire building heating load and has been running without any issues.

The back boiler room consists of two HB Smith 28A-9 Series cast iron boilers along with two new Baldor Super-E type 25Hp hot water circulation pumps. The back boiler is used as 100% back up. Currently the hot water piping system is set up in such a way that when both hot water pumps run, they run against each other developing pressure beyond design capacity. This causes the valves to malfunction. EMG recommends that the pumping set up needs to be corrected to resolve this issue.

Currently none of the circulation pumps is equipped with variable frequency drives, thus they tend to operate at full load all throughout the heating season.

Cooling System:

The school building is not centrally cooled, but has approximately twenty six roof top split air-conditioning systems. Most of the units have already surpassed its ASHRAE recommended useful life of 15 years. The system consists of varying capacity ranging from 1 ton to 7.5 tons. The air-conditioning system is monitored by the energy management system in a manner that the air-conditioning do not come on until the OA temperature rises above 60F and the indoor temperature rises above 75F. This thus limits the actual hours of operation of the air conditioner thus reducing the energy consumption by the school. All the air conditioners have localized controls.

Ventilation and Exhaust Systems:

The Pollard Middle School is ventilated by a total of 57 exhaust fans that serve various restrooms, kitchen, classroom spaces and auditoriums. Currently all the exhaust fans are tied into the building management system by virtue of which their operational hours are limited to 6:00 AM to 5:00PM Monday to Friday during the normal school operations. The exhaust fans are shut off on all other days. Based on the interaction with the HVAC supervisor, the exhaust fans are routinely checked and replaced if necessary.

The auditorium in the Pollard Middle School is conditioned by two Air Handling Units. The primary AHU that supplies conditioned air to the Auditorium has a spiral duct based distribution system right above the stage. The very design of the spiral duct makes the air distribution system noisy in nature, thus making it imperfect for an auditorium environment. In addition to this primary AHU, the fresh air supply for the auditorium is also maintained by a secondary AHU that is purely controlled by the CO_2 sensor in the space. Once the CO_2 in the space rises over the prescribed limits, the second AHU starts supplying 100% outside air via a separate duct work, which is relatively quite as compared to the spiral ducts. Thus in order to maintain lower noise levels from the air distribution system the HVAC operators turn of the primary AHU and conditioned the auditorium by the secondary AHU only. This leads to 100% outside air irrespective of the occupancy level in the auditorium and increased heating load on the boiler. EMG recommends modifying the ductwork in the auditorium so that the noise levels are reduced to the accepted levels and allowing the primary AHU to take up the load of the auditorium in place of the secondary AHU.

The fresh air requirement for the rest of the Pollard school is satisfied by a series of AHU's and unit ventilators located in individual spaces. Most of the AHU's are currently bringing in 100% outside air all day long, irrespective of the space occupancy. EMG recommends installing CO_2 sensors on each of the air handling units so as to control the amount of fresh air being brought into the conditioned space.

Following are the AHU's that need to be retrofitted with CO_2 sensors:

Air Handling Unit Name	Location it Serves
Room. 220	Requires CO_2 Sensor
Room. 222	Requires CO_2 Sensor
Room. 224	Requires CO_2 Sensor
Cafeteria	Requires CO_2 Sensor
Room. 212	Requires CO_2 Sensor
Room. 216	Requires CO_2 Sensor
AHU-6 (Faculty Dining Rm.)	Requires CO_2 Sensor

Air Handling Unit Name	Location it Serves
Green Gym	Requires CO_2 Sensor

Item	Measured Values
Major Heating system type/capacity	Two each of 4258MBH and 2836MBH IBR Rated H.B Smith Boilers
Major Cooling System type/capacity	Numerous split systems
Heating hot water supply temperature	Polyshield Gas-fired Hot Water Heater. 140F supply
Chilled water supply/return temperatures	NA
Condenser water supply/return temperatures	NA
Outside Air temperature & Relative Humidity (%) at time of audit	62F and 45.2% R.H
Interior space temperatures & Relative Humidity (RH %)	Varied From Space to space, but averaged at 76F and 48% R.H
Avg. Interior space thermostat set-point	69F For Heating and 75F For Cooling

The Mechanical Equipment Schedule in Appendix contains a summary of the HVAC Equipment at the property.

5.4. BUILDING LIGHTING

The building lighting at the Pollard school mainly consists of standard 4′ long 32W T8 lamps in various configuration ranging from single bulb per fixture to four bulbs per fixture. The general lighting in the space is on the higher side of the recommended levels. EMG has observed numerous opportunities across the school where energy consumption can be reduced by modifying the current lighting pattern and reducing the light levels in the hallways and classrooms by reducing the number of lamps per fixture. Further it was also observed that none of the spaces other than the restrooms on the second floor and the portables had automatic lighting controls. This leads to the lights in the spaces being left ON for long durations without anyone being present in the space.

The lights in the gymnasium consist of 400W MH lamps that are operational from 6:30AM till 11:30PM throughout the school year. The cafeteria and first floor hallway consists of two lamp U shaped T8 lamps that are left ON from 6:30AM until 11:30PM.

The site lighting consists of 75W and 175W external wall packs. All the external lights are controlled by an electronic timer.

Space Type	Measured Light Levels (Lux)
Rm. 272	540 Lux
School Office Lobby	628 Lux
Book Keeper	1000 Lux
Green Gym	300 Lux
Hallways	600 Lux
Avg. Building Lighting Density, W/Sq.Ft	0.824 Watt/Sqft

Note: 1 foot candle = 10.764 lux

The Lighting Systems Schedules in Appendix contain a summary of the Existing Lighting Systems at the property, along with proposed Lighting Energy Conservation Measures.

5.5. BUILDING ELEVATORS AND CONVEYING SYSTEMS

The Pollard School has two hydraulic elevators, one manufactured by Dover and rated at 2500lbs and a speed of 100FPM. The second hydraulic passenger elevator is manufactured by Bakewith and is rated at 1500lbs.

5.6. BUILDING DOMESTIC HOT WATER

The domestic hot water requirement for the facility is satisfied by a single 125-gallon, 800 MBH gas-fired hot water. The hot water heater of Polyshield make was installed in 1992 and has surpassed its effective useful life period and is up for replacement. The hot water heater is set to deliver hot water at 140F, so that the kitchen receives water at 140F, the janitor's closet receives water at 130F and the restrooms receive water at 120F via the mixing valves.

The water meter is located in the front mechanical room.

The common area restrooms have commercial-grade fixtures and accessories, including water closets and lavatories. The toilets consist of flush valves. The typical flush volume was 1.6 GPF. The lavatories are equipped with aerators rated at 1.5 GPM. The lavatories are operated by manual controls. The shower heads have a rated capacity of 2.2 GPM.

DHW type	Gas-fired
Storage Tank Capacity	NA
Heating/tank set-point	140F

DHW temperature at faucet	120F
Building faucets, GPM	1.5GPM
Water closets/toilets, GPF	1.6 GPF

5.7. BUILDING NATURAL GAS AND ELECTRICITY

Natural Gas

The building is connected to the natural gas utility (Nstar). The gas main on the adjacent public street supplies the natural gas service. The gas meter and regulators are located in outside the mechanical room housing the main boilers. The gas distribution piping within the building is malleable steel (black iron). The facility is master-metered for natural gas.

Electricity

The electrical supply lines run underground pole-mounted transformer to an interior-mounted electrical meter. The main electrical service size is 2000 amps, 120-volt, three-phase, four-wire alternating current (AC). A step-down transformer is located in the main electrical room. The electrical wiring is copper, installed in metallic conduit. Circuit breaker panels are located throughout the building. The facility is master-metered for electricity.

The portables at the back of the school are equipped with its own individual electrical meter.

No. 2 Oil:

The hot water boilers in the school are dual fuel boilers, by virtue of which they can switch to No.2 Oil fuel as needed.

Emergency Generator:

A diesel-engine-driven 125kVA emergency electrical generator is located in the front mechanical room. The generator provides back-up power for elements of the fire and life safety systems. The fuel tank is an underground tank, which is located adjacent to the school.

Electrical Transformer Type (Wye, Delta)	Delta
Mounting	Pole-mounted
Location	Exterior
Main Building Electric service	2000 Amps
Primary Volts	120V
Secondary Volts	NA
Phase	3 Phase
Wire	4 Wire
Amp	2000 Amps
On site Generator (Y/N)	Yes
Generator Capacity, KVA	125 KVA
Generator Fuel Type	Diesel

Electric Meter type (Master/Sub/Direct)	Direct	Natural Gas Meter type (Master/Sub/Direct)	Direct
Meter Location	Exterior	Meter Location	Exterior
Main meter number	NA	Main meter number	NA

6. UTILITY ANALYSIS

Establishing the energy baseline begins with an analysis of the utility cost and consumption of the building. Utilizing the historical energy data and local weather information, we evaluate the existing utility consumption and assign it to the various end-users throughout the buildings. The Historical Data Analysis breaks down utilities by consumption, cost and annual profile.

This data is analyzed, using standard engineering assumptions and practices. The analysis serves the following functions:

- Allows our engineers to benchmark the energy and water consumption of the facilities against consumption of efficient buildings of similar construction, use and occupancy.
- Generates the historical and current unit costs for energy and water
- Provides an indication of how well changes in energy consumption correlate to changes in weather.
- Reveals potential opportunities for energy consumption and/or cost reduction. For example, the analysis may indicate that there is excessive, simultaneous heating and cooling, which may mean that there is an opportunity to improve the control of the heating and cooling systems.

By performing this analysis and leveraging our experience, our engineers prioritize buildings and pinpoint systems for additional investigation during the site visit, thereby maximizing the benefit of their time spent on site and minimizing time and effort by the customer's personnel.

Based upon the utility information provided about the Pollard Middle School, the following energy rates are utilized in determining existing and proposed energy costs.

Utility Rates used for Cost Analysis

Electricity (Blended Rate)	Natural Gas	No. 2 Oil
$0.19/kWh	$1.12/therm	$2.60/Gal

The data analyzed provides the following information: 1) breakdown of utilities by consumption, 2) cost and annual profile, 3) baseline consumption in terms of energy/utility at the facility, 4) the Energy Use Index, or Btu/sq ft, and cost/sq ft. For multiple water meters, the utility data is combined to illustrate annual consumption for each utility type.

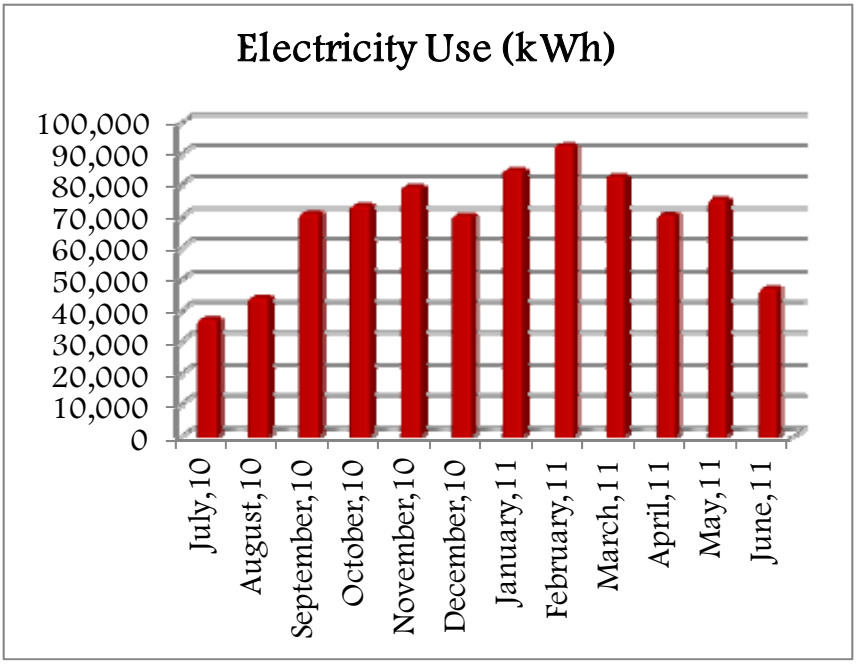
6.1. ELECTRICITY

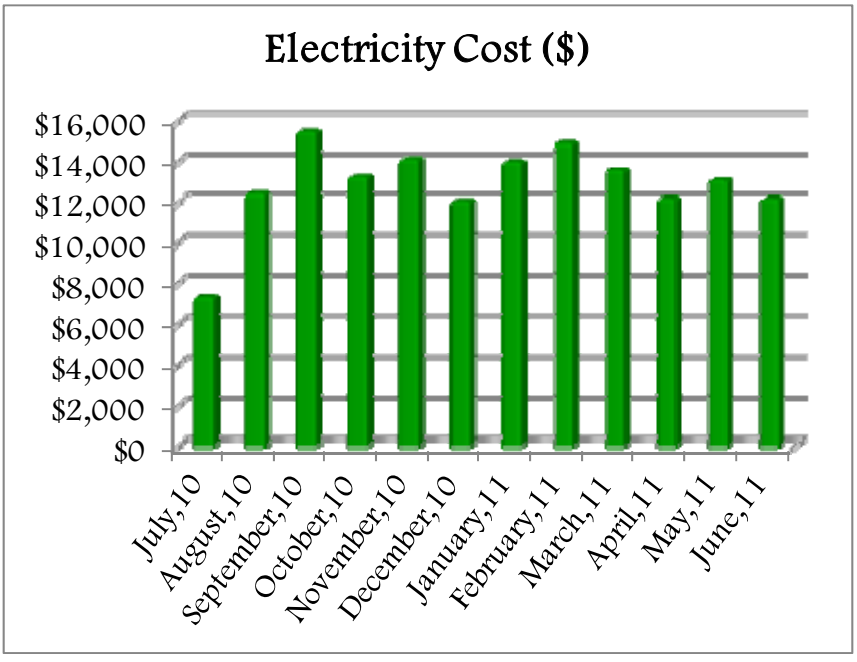
Nstar satisfies the electricity requirements of the facility. The rise in the electricity usage during the summer months is due to the use of electric driven air-conditioning equipment. The lighting is a large component of the electrical base-load due to the long operational hours of individual fixtures.

The data represented below shows a combination of Pollard School electric consumption, the portables section and the exterior lighting.

Based on the 2010-11 electric usage & costs, the average price paid during the year was $0.19 per kWh. The total annual electricity consumption for the 12-month period analyzed is 828,680kWh for a total cost of $154,500.

Billing Month	Electricity Consumption (kWh)	Unit Cost/kWh	Total Cost
July,10	37,400	$0.20	$7,361
August,10	44,000	$0.28	$12,418
September,10	71,140	$0.22	$15,459
October,10	73,540	$0.18	$13,235
November,10	79,240	$0.18	$14,112
December,10	70,440	$0.17	$12,049
January,11	85,040	$0.16	$13,976
February,11	92,580	$0.16	$14,892
March,11	82,460	$0.16	$13,578
April,11	70,620	$0.17	$12,169
May,11	75,440	$0.17	$13,090
June,11	46,780	$0.26	$12,162
Total	**828,680**	**$0.19**	**$154,500**


Electricity Use (kWh)
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
July,10
August,10
September,10
October,10
November,10
December,10
January,11
February,11
March,11
April,11
May,11
June,11

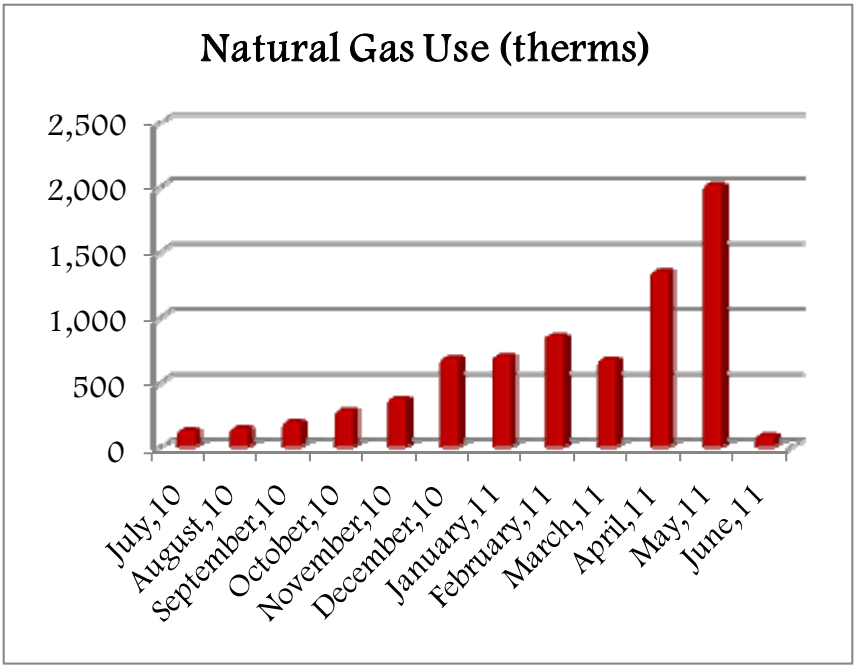

Electricity Cost ($)
$16,000
$14,000
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$0
July,10
August,10
September,10
October,10
November,10
December,10
January,11
February,11
March,11
April,11
May,11
June,11

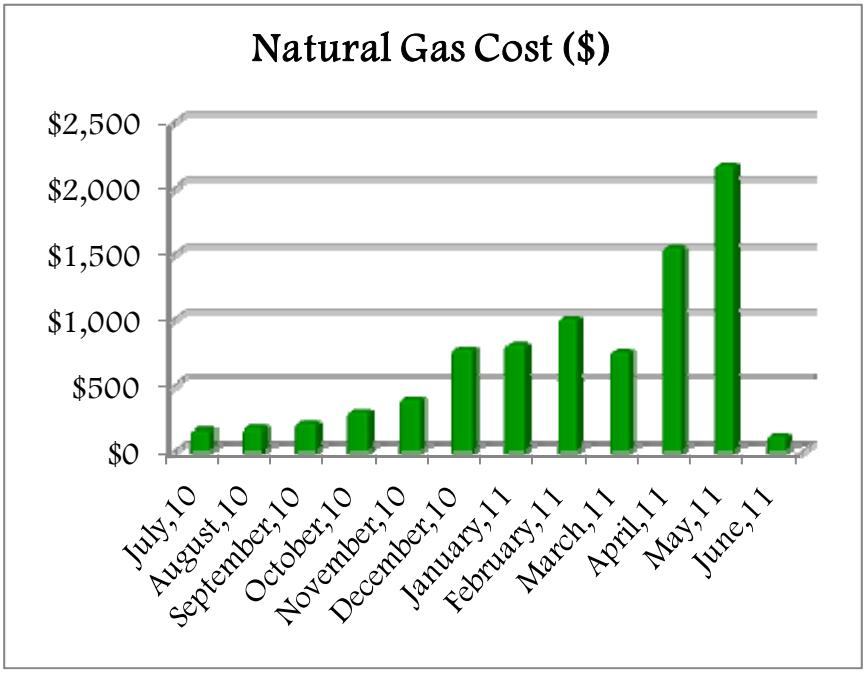
6.2. NATURAL GAS

The natural gas requirements of the facility are satisfied by Nstar. The rise in the natural gas usage during the winter months is due to the use of natural gas driven heating equipment. The base-load for the building consists of the domestic hot water heater, roof top package units on the portables and the main forced hot water boilers.

Based on the 2010-11 natural gas usage & costs, the average price paid during the year was $1.12 per therm. The total annual natural gas consumption for the 12-month period analyzed is 7539 therms for a total cost of $8,415. The natural gas consumption for the property is observed to be significantly low for the 2010-11 year as the forced hot water boilers were fired by the use of No. 2 Oil in place of natural gas due to issues with the gas meter.

Billing Month	Natural gas Consumption (Therms)	Unit Cost/therm	Total Cost
July,10	134	$1.20	$160
August,10	150	$1.18	$177
September,10	197	$1.05	$207
October,10	282	$1.05	$295
November,10	371	$1.06	$394
December,10	684	$1.14	$776
January,11	702	$1.16	$812
February,11	866	$1.16	$1,001
March,11	677	$1.11	$755
April,11	1,359	$1.14	$1,548
May,11	2,018	$1.08	$2,170
June,11	99	$1.22	$121
Total	**7,539**	**$1.12**	**$8,415**


Natural Gas Use (therms)
2,500
2,000
1,500
1,000
500
0
July,10
August,10
September,10
October,10
November,10
December,10
January,11
February,11
March,11
April,11
May,11
June,11

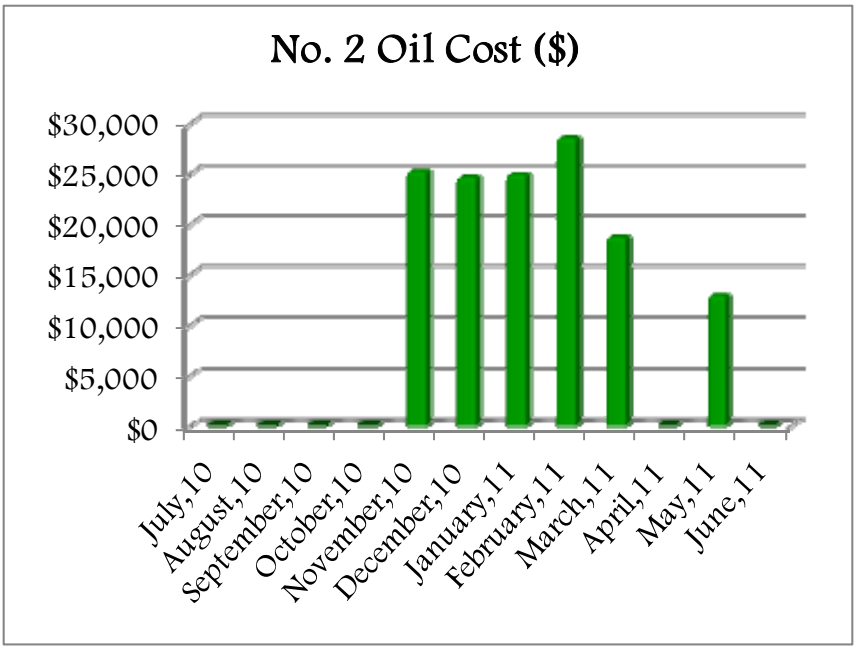

Natural Gas Cost ($)
$2,500
$2,000
$1,500
$1,000
$500
$0
July,10
August,10
September,10
October,10
November,10
December,10
January,11
February,11
March,11
April,11
May,11
June,11

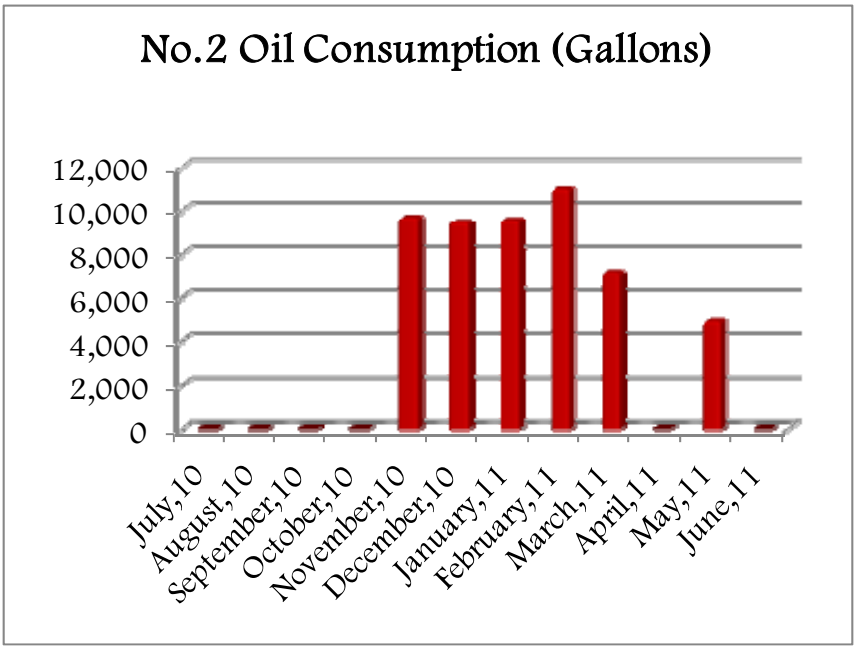
6.3. NO. 2 FUEL OIL

The No.2 Oil requirement for the Pollard Middle School is satisfied by a private contractor. Deliveries are made on as needed basis.

Based on the 2009 delivery records and receipts, the average price paid during the year was $2.60 per-gallon. The total annual fuel oil deliveries for the 12-month period analyzed was 51,998 gallons for a total cost of $135,142.

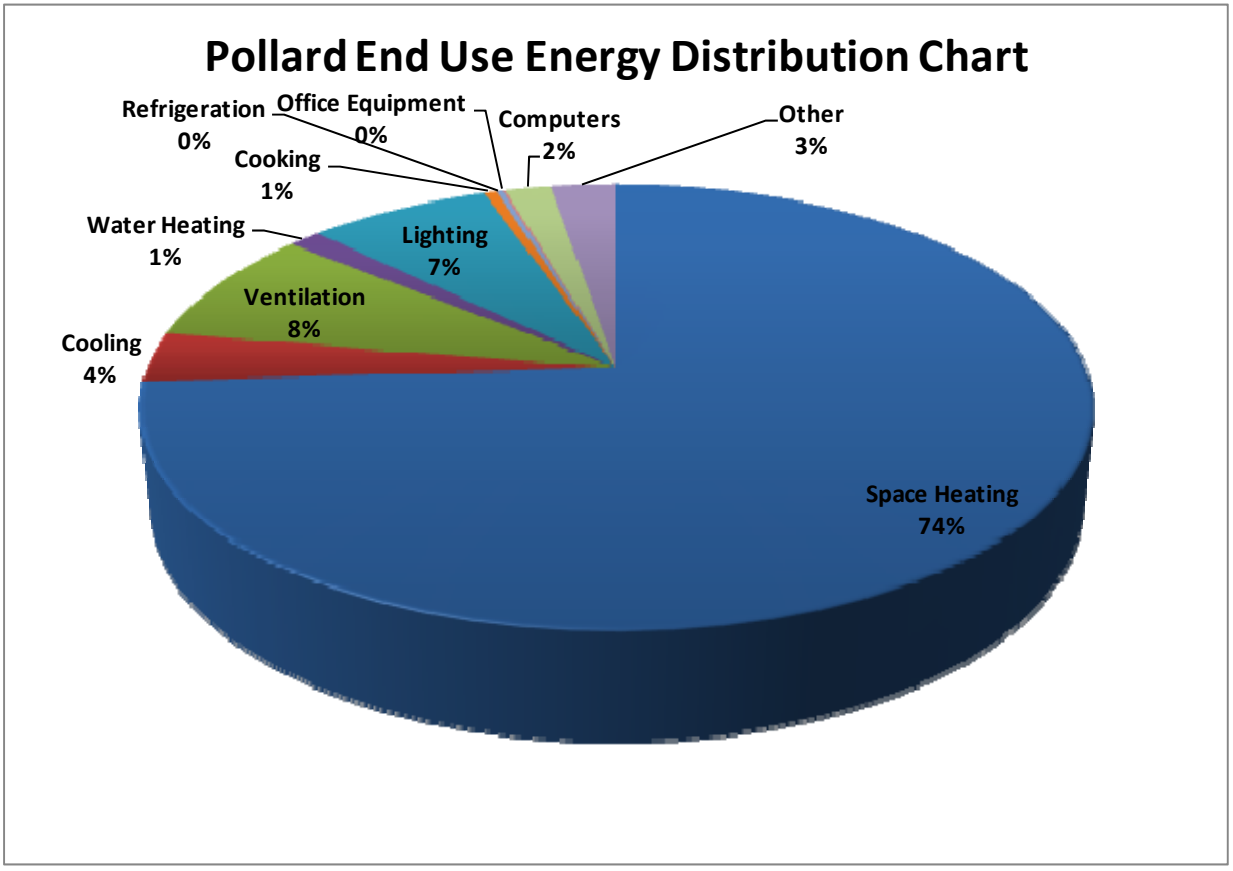
Delivery Month	Fuel Oil Consumption (Gallons)	Unit Cost/gal	Total Cost
July,10	0	0	$0
August,10	0	0	$0
September,10	0	0	$0
October,10	0	0	$0
November,10	9,704	$2.60	$25,221
December,10	9,489	$2.60	$24,661
January,11	9,592	$2.60	$24,929
February,11	11,001	$2.60	$28,590
March,11	7,213	$2.60	$18,746
April,11	0	0	$0
May,11	5,000	$2.60	$12,995
June,11	0	0	$0
Total	**51,998**	**$2.60**	**$135,142**


No. 2 Oil Cost ($)
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$0
July,10
August,10
September,10
October,10
November,10
December,10
January,11
February,11
March,11
April,11
May,11
June,11


No.2 Oil Consumption (Gallons)
12,000
10,000
8,000
6,000
4,000
2,000
0
July,10
August,10
September,10
October,10
November,10
December,10
January,11
February,11
March,11
April,11
May,11
June,11

7. END USE ENERGY DISTRIBUTION

Components of Annual Energy Use																	
	Electricity (1 kWh = 3.412 kBtu)				Natural Gas				Total Cost		No.-2 Oil				Total Energy	
	%	kWh	kBtu	Cost	%	therms	kBtu	Cost	Total- $	% Total	%	Gallons	kBtu	Cost	MBtu	% Total
Space Heating	***6.0%***	49,721	169,647	$9,270.02	***81.0%***	*6,107*	610,415	6,814	$16,084	***9.9%***	***100.0%***	*51,998*	7,201,706	$135,142	7981.8	***74.0%***
Cooling	***13.6%***	112,700	384,534	$21,012.04			0	0	$21,012	***12.9%***	***0.0%***	*0*	0	$0	384.5	***3.6%***
Ventilation	***32.0%***	265,178	904,786	$49,440.10			0	0	$49,440	***30.3%***	***0.0%***	*0*	0	$0	904.8	***8.4%***
Water Heating	***0.0%***	8	28	$1.55	***19.0%***	*1,432*	143,184	1,598	$1,600	***1.0%***	***0.0%***	*0*	0	$0	143.2	***1.3%***
Lighting	***28.0%***	232,030	791,688	$43,260.08			0	0	$43,260	***26.5%***	***0.0%***	*0*	0	$0	791.7	***7.3%***
Cooking	***2.0%***	16,574	56,549	$3,090.01	***0.0%***	*0*	0	0	$3,090	***1.9%***	***0.0%***	*0*	0	$0	56.5	***0.5%***
Refrigeration	***1.0%***	8,287	28,275	$1,545.00			0	0	$1,545	***0.9%***	***0.0%***	*0*	0	$0	28.3	***0.3%***
Office Equipment	***0.4%***	3,480	11,875	$648.90			0	0	$649	***0.4%***	***0.0%***	*0*	0	$0	11.9	***0.1%***
Computers	***7.0%***	58,008	197,922	$10,815.02			0	0	$10,815	***6.6%***	***0.0%***	*0*	0	$0	197.9	***1.8%***
Other	***10.0%***	82,868	282,746	$15,450.03			0	0	$15,450	***9.5%***	***0.0%***	*0*	0	$0	282.7	***2.6%***
Total	100.0%	**828,854**	2,828,050	$154,532.7	*100.0%*	***7,539***	753,598	8,412	**$162,945**	100.0%	*100.0%*	***51,998***	7,201,706	135,142	**10783.4**	100.0%


Pollard End Use Energy Distribution Chart
Refrigeration 0%
Office Equipment 0%
Computers 2%
Other 3%
Cooking 1%
Water Heating 1%
Lighting 7%
Ventilation 8%
Cooling 4%
Space Heating 74%

8. ENERGY CONSERVATION MEASURES (ECM)

EMG has identified a total of 7 Energy Conservation Measures (ECMs) for this property. All the ECMs are broken into two major categories:

1. **No/Low Cost Recommendations**: No/Low cost is defined as any project with initial investment of less than $1,000.
2. **Capital Cost Recommendations**: Capital cost defined as any project with initial investment greater than $1,000.

EMG screens ECMs using two financial methodologies. ECMs which are considered financially viable must meet both criteria.

1. Simple Payback Period –The number of years required for the cumulative value of energy or water cost savings less future non-fuel or non-water costs to equal the investment costs of the building energy or water system, without consideration of discount rates. ECMs with a payback period greater than the Expected Useful Life (EUL) of the project are not typically recommended, as the cost of the project will not be recovered during the lifespan of the equipment. These ECMs are recommended for implementation during future system replacement. At that time, replacement may be evaluated based on the premium cost of installing energy efficient equipment.

$$Simple\ Payback = \frac{Initial\ Cost}{Annual\ Savings}$$

2. Savings-to-Investment Ratio (SIR) – The savings-to-investment ratio is the ratio of the present value savings to the present value costs of an energy or water conservation measure. The numerator of the ratio is the present value over the estimated useful life (EUL) of net savings in energy or water and non-fuel or non-water operation and maintenance costs attributable to the proposed energy or water conservation measure. The denominator of the ratio is the present value of the net increase in investment and replacement costs less salvage value attributable to the proposed energy or water conservation measure. It is recommended that energy efficiency recommendations should be based on a calculated SIR, with larger SIRs receiving a higher priority. A project is typically only recommended if SIR is greater than or equal to 1.0, unless other factors outweigh the financial benefit.

$$SIR = \frac{Present\ Value\ (Annual\ Savings, i\%, EUL)}{Initial\ Cost}$$

Key Metrics to Benchmark the Subject Property's Energy Usage Profile

- Building Site Energy Use Intensity - The sum of the total site energy use in thousand of Btu per unit of gross building area. Site energy accounts for all energy consumed at the building location only not the energy consumed during generation and transmission of the energy to the site.
- Building Source Energy Use Intensity – The sum of the total source energy use in thousand of Btu per unit of gross building area. Source energy is the energy consumed during generation and transmission in supplying the energy to your site.
- Building Cost Intensity - This metric is the sum of all energy use costs in dollars per unit of gross building area.

- Greenhouse Gas Emissions - Although there are numerous gases that are classified as contributors to the total for Greenhouse Emissions, the scope of this energy audit focuses on carbon dioxide (CO_2). Carbon dioxide enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement).

Site Energy Use Intensity (EUI)	Rating	
Current Site Energy Use Intensity (EUI)	70	kBtu/ft2
Post ECM Site Energy Use Intensity (EUI)	55	kBtu/ft2
Building Cost Intensity (BCI)	Rating	
Current Building Cost Intensity	$1.94	/ft2
Post ECM Building Cost Intensity	$1.65	/ft2

Summary of the Greenhouse Gas Reductions from Recommended Energy Conservation Measures

The following table provides a summary of the projected Greenhouse Gas Emissions reductions as a result of the recommended Energy Conservation Measures:

Greenhouse Gas Emissions Reduction	Rating	
Estimated kWh Reduction	121,872	kWh
Estimated Annual Thermal Energy Reduction	19,980	Therms
Total CO_2 Emissions Reduced	146	$MtCO_2/yr$
Total Cars Off The Road (Equivalent)*	27	
Total Acres of Pine Trees Planted (Equivalent)*	33	

*Equivalent reductions per DOE emissions calculation algorithms.

The following table describes each recommended ECM in terms of initial investment, electricity and natural gas savings, water savings, annual energy cost and maintenance savings, payback and SIR

List of Recommended Energy Conservation Measures For Pollard Middle School

ECM #	Description of ECM	Projected Initial Investment	Estimated Annual Energy Savings		Estimated Total Annual Energy Savings	Estimated Annual Water Savings	Total Estimated Annual Cost Savings	Simple Payback	S.I.R.	Life Cycle Savings	Expected Useful Life (EUL)
			Natural Gas	Electricity							
		$	Therms	kWh	MMBtu	kgal	$	Years		$	Years
No/Low Cost Recommendations											
1	Replace High Flow Faucet Aerators To Low Flow Faucet Aerators Details: Install 0.5 GPM Aerators	$623	382	0	38	48	$426	1.46	5.84	$3,013	10.00
Totals for No/Low Cost Items		**$623**	**382**	**0**	**38**	**48**	**$426**	**1.46**			
Capital Cost Recommendations											
1	Replace Existing Hot Water Heater With New Energy Efficient Water Heater Details: Repalce Old Gas Fired Water Heater	$11,689	973	0	97	0	$1,086	10.77	1.11	$1,270	15.00
2	Replace Existing Air Conditioners with Energy Star Air Conditioners Details: Replace older Rooftop Condensing Units	$16,390	0	18,221	62	0	$3,397	4.82	2.47	$24,166	15.00
3	Replace High Intensity Discharge Lamp (HID) with Induction Lighting Details: Exterior Wall Packs, Blue and Green Gymnasium	$18,086	0	31,851	109	0	$6,118	2.96	3.92	$52,805	15.00
4	Install Tandem Lighting System In Hallways Details: Throughout The Hallways	$18,176	0	44,962	153	0	$8,383	2.17	3.93	$53,331	10.00
5	Delamp Fixtures In Individual Rooms And Install Lighting Controls Details: All Classrooms, Offices And Media Centers	$85,364	0	40,379	138	0	$7,528	11.34	0.75	-$21,146	10.00
6	Replace Inefficient Heating Plant Details: Replace the Existing Boiler plant with three (3) Condensing Boilers	$366,493	20,845	0	2,085	0	$23,967	15.29	0.75	-$21,146	10.00
Total For Capital Cost		**$516,199**	**21,818**	**135,413**	**2,644**	**0**	**$50,479**	**10.23**			
	Interactive Savings Discount @ 10%		-2,220	-13,541	-268	-5	-$5,091				
	Total Contingency Expenses @15%	$77,523									
Total for Improvements		**$594,345**	**19,980**	**121,872**	**2,414**	**43**	**$45,815**	**12.97**			

If all of the above mentioned ECM's are implemented, POLLARD MIDDLE SCHOOL could potentially save approximately $45,815 per year with an investment of $594,345, yielding a net effective payback of 12.97years.

8.1. ECM CALCULATION ASSUMPTIONS

EMG has made the following assumptions in calculation of the Energy Conservation Measures.

- Building operating hours, as detailed in section 5.1 are assumed to be 40 hours per week.
- The facility occupancy is assumed to be 829 students.
- Annual Heating Equipment Operating Hours are derived from actual consumption and equipment input rates to be 5,641 hours/year
- Annual Cooling Equipment Operating Hours are derived from actual consumption and equipment input rates to be 729 hours/year

8.2. NO/LOW COST ECM DESCRIPTIONS

EMG has identified 1 No/Low Cost Energy Conservation Measures (ECMs) for this property. This includes all measures which can be implemented below the cost threshold of $1000. The following paragraphs describe each of these ECMs along with the initial installed costs, annual energy savings, and payback periods.

8.2.1. Install Low Flow Aerators

By reducing the flow of water coming from the restroom faucets, aerators can generate energy savings at low cost and with easy installation. The savings generated would be in the form of reduced water and sewer costs and at the same time aerators would save energy by reducing the demand for hot water. The average faucet has a flow rate of about 1.5-2.0 GPM. Adding a screw-in faucet aerator reduces the flow to 0.5 to 1.0 GPM in the bathroom and 2.2 GPM in the kitchen. In addition to saving energy and water, the "foamier" water that comes from faucet aerators wets objects better than water from a faucet with no aerator, which tends to bounce off the object rather than thoroughly wetting it.

EMG recommends replacing all the aerators with new low flow 0.5 GPM aerators. Since the major consumption of the hot water is via faucet aerators, EMG believes a significant energy savings in terms of energy consumed by hot water heater can be achieved by executing this ECM.

8.3. CAPITAL COST ECM DESCRIPTIONS

EMG has identified 6 Capital Cost Energy Conservation Measures (ECMs) for this property. This list includes recommended measures which have an estimated implementation cost of greater than $1000. The following paragraphs describe each of these ECMs, in addition to their initial installed costs, annual energy savings, and payback periods.

8.3.1. Repalce Domestic Hot Water Heater With New High Efficiency Hot Water Heater

The domestic hot water requirement for the Pollard School is satisfied by a single 125-gallon 800MBH input gas-fired hot water heater. The existing hot water heater was installed in 1992 and has already outlived its useful life. Based on the manufacturer specification, a new water heater is rated at 83% efficiency. Thus based on the age and use of the hot water heater it is assumed that the existing thermal efficiency of the hot water heater has dropped to about 75%.

The hot water heater design has evolved over the time and new high efficiency condensing hot water heaters are currently available in the market that have a manufacturer rated efficiency in excess of 95%. This would provide an increase of 20% over the existing domestic hot water efficiency.

The proposed replacement is estimated to save up to 973 therms per year.

8.3.2. Replace old Air Conditioners With New Energy Star Certified Airconditioners

Advances in compressor and condenser technology have allowed for the development of more efficient air-conditioning systems. As a result cooling can be provided at the same rate, with a lower energy input. Energy efficiency ratio (EER) is the ratio of cooling output to power input. Seasonal energy efficiency ratio (SEER) is an adjusted figure based on the length of the cooling season. A higher EER or SEER indicates a more efficient unit which can provide the same cooling capacity while consuming less energy. The minimum standard for air conditioner performance in most areas is currently 13 SEER as required by the 2006 International Energy Conservation Code. Units rated at 16 SEER (14 EER) or better qualify for Energy Star certification.

Pollard school has number of roof top split systems that were installed in 1993-95. All of these units have outlives their expected useful life and it is recommended that these units be replaced with new high efficiency air conditioners. The table below provides the details of the air conditioners that need to be replaced.

Table-1					
Manufacturer	**Year**	**Location**	**Model No.**	**Tonnage**	**Serves**
TRANE	1993	Rooftop	TTRO12C100	1 Ton	Secretary's Office
TRANE	1993	Rooftop	TTRO12C100	1 Ton	Admins Office
TRANE	1993	Rooftop	TTR012C1	1 Ton	A/C Nurse
TRANE	1995	Rooftop	TTR024C100A1	2 Ton	Rm 258
Table-2					
Manufacturer	**Year**	**Location**	**Model No.**	**Tonnage**	**Serves**
TRANE	1995	Rooftop	TTR036C100	3 Ton	Rm 278
TRANE XE 1000	1995	Rooftop	TTR024C100A1	2 Ton	Rm 200
TRANE	1995	Rooftop	TTA048C300	4 Ton	Rm 210
TRANE	1995	Rooftop	TTA048C300	2 Ton	Rm 220
TRANE	1995	Rooftop	TTA048C300	2 Ton	Rm.224

Table-2					
Manufacturer	**Year**	**Location**	**Model No.**	**Tonnage**	**Serves**
TRANE	1995	Rooftop	TTA060C300	5 Ton	Rm 219,221
American Standard	1995	Rooftop	TTA120B300	10 Ton	Cluster Rm

The Table-1 shows all the condensing units that need to be replaced immediately while the second table shows all the units that are on the verge of replacement. The proposed ECM would give savings from replacing all the units in both the tables.

It is strongly recommended that all the future condenser replacements be of the same make so as to minimize the maintenance cost and reduce the inconvenience.

The above ECM is estimated to save approximately 18,221kWh annually.

8.3.3. Replace Metal Halides With Induction In The Gymnasium And External Wall Packs

An induction light is similar to a fluorescent light in that mercury in a gas fill inside the bulb is excited; emitting UV radiation that in turn is converted into visible white light by the phosphor coating on the bulb. Like fluorescent, the phosphor coating determines the color qualities of the light. Fluorescent lamps use electrodes to strike the arc and initiate the flow of current through the lamp, which excites the gas fill. Each time voltage is supplied by the ballast and the arc is struck, the electrodes degrade a little, eventually causing the lamp to fail. Induction lamps do not use electrodes. Instead of ballast, the system uses a high-frequency generator with a power coupler.

The generator produces a radio frequency magnetic field to excite gas fill. With no electrodes, the lamp lasts longer. Induction lamps, in fact, last up to 100,000 hours, with the lamp producing 70% of its light output at 60,000 hours. In other words, their rated life is 5-13 times longer than metal halide (7,500 to 20,000 hours at 10 hours/start).

Induction lamps are ideally suited for high-ceiling applications where the lamps are difficult, costly or hazardous to access. They are also ideally suited for such applications where the advantages of fluorescent lighting are sought but a light source is needed that can start and operate efficiently in extremely cold temperatures. As a result, induction lighting is a suitable for a wide range of applications, including not only warehouses, industrial buildings, cafeterias, gymnasiums, etc., but also signage, tunnels, bridges, roadways, outdoor area and security fixtures, parking garages, public spaces, and freezer and cold storage lighting.

The increased costs occurs in the induction systems themselves – which could be 5 to 6 times more than metal halide systems, and also in new fixtures, which can inflate payback periods and reduce return on investment. But you also generally get a 30% reduction in capital and operating costs immediately from the reduced number of fixtures made possible by the higher light output. You also get 15% more efficiency just because the induction system (lamp and electronic ballast) is more efficient. Apply that over ten years plus reduced replacement and maintenance costs compared to metal halide and other HID lamps and suddenly it makes a lot of sense to go into induction lighting systems.

- Long Service Life: up to 100,000hrs (5 times the lamp life of Metal Halides)
- Energy Saving: save up to 40% compared to metal halides, 13 times more efficient than incandescent light bulbs, and up to twice as efficient as compact fluorescent lights
- Instant On/Off: no waiting time between re-strike
- High Efficiency: lighting efficiency >80lm/w
- High Lumens Maintenance: >70% after 60,000 hrs

- Wide Selection of Color Temperature:2720K- 6500K
- High Power Factor Ballast: $\lambda > 0.95$
- Flicker-free : high frequency (250KHz) creates a better and more comfortable light for users and prevents eye injury when viewed directly
- Optional Dimmable Ballast for Integrated Control: linearly dimmable to 30%

Currently both the Blue and Green gymnasiums are lit by a total of twenty, 400W metal halide fixtures that operate from 6:30AM until 11:30PM all throughout the school year. EMG recommends replacing these metal halides with 250W induction lamps along with four occupancy sensors in each of the gymnasium that would control the fixtures. This would ensure that the lights in the gymnasium remain off during un-occupied hours.

The exterior wall packs for the school consists of 75W MH and 175W MH. EMG recommends replacing them with 40W and 120W induction lamps respectively. It is recommended to replace the whole fixture rather than retrofitting in order to get the warrantee on the lamps.

The proposed ECM is expected to reduce the annual electric consumption by approximately 31,851kWh.

8.3.4. Delamp And Install Tandem Lighting In Halways

The hallways in the Pollard Middle School are lit by a combination of different lighting fixture type that includes; one, two, three, four and U shaped lamp fixtures. Based on the conversation with the custodian it was learned that the hallway lights in the school are left ON from 6:30 AM until 11:30 PM all throughout the year. The duration generally reflects the time at which the custodian opens the school doors until the cleaners leave the building. Further the light levels in the hallways were observed to be much higher than the prescribed levels.

Thus EMG recommends delamping all the thirty two four lamp fixtures in the hallways to two lamp fixtures along with reflectors and disconnecting alternate single lamp fixtures in the hallways.

In addition to delamping EMG also recommends installing occupancy sensors in the hallways so as to implement Tandem lighting across the building. Tandem lighting would consists of series of ceiling-mounted occupancy controls that would turn off alternate light fixtures post detecting un-occupancy for a pre-programmed duration of time.

EMG estimates that the project would involve installing approximately 36 ceiling-mounted occupancy sensors across all the hallways.

The proposed ECM is estimated to save approximately 44,963kWh annually.

8.3.5. Delamp Four Lamp Fixtures To Two Lamp Fixtures And Install Occupancy Sensors in All Rooms

The lighting in office and common areas often tends to warm and bright. Whereas when the LUX readings taken at these locations, are compared to the IESNA lighting standard, it is often observed that the lighting levels are over the prescribed levels. In such circumstances EMG advises to go for de-lamping of individual light fixtures, such that the LUX levels post de-lamping would be in a close range to that of the prescribed limit. The result of de-lamping is reduction in the brightness in the specific areas, but would always be slightly above the recommended IESNA levels. The light readings are taken by hand held light meter, at an approximately table top height from the floor. The advantage of de-lamping is reduction in the demand load as well as the annual lighting energy consumption. EMG recommends taking de-lamping trials at different locations before implementing it across the entire space.

Currently most of the classrooms and offices have four lamp T8 fixtures with single ballast. The average light levels taken in these spaces showed that the Lux readings where often on the higher side of the recommended range that extends from 300 LUX to 60 LUX. EMG recommends that all the four lamp light fixtures be retrofitted with reflectors and be de-lamped from four lamp per fixture to two lamp per fixture.

In addition to delamping the four lamp fixtures to two lamp fixtures, EMG also recommends installing occupancy sensors in each of the classroom and office space so as to ensure that the lights are turned off once the sensor detects no occupancy for more than a prescribed duration of time.

Based on the detailed site survey it is determined that approximately 395 four lamp fixtures need to be delamped to two lamp fixtures along with installation of 105 ceiling-mounted occupancy sensors.

In addition to the classrooms the central cafeteria is also lit by a set of fifty, three lamp U shaped lamps that are left ON all throughout the school day. Lights were observed to be ON irrespective of the occupancy in the space. Thus EMG recommends installing ceiling-mounted occupancy sensors in the cafeteria that would turn off the lights in individual spaces once it detects that the space is unoccupied for a pre-programmed duration of time.
It should be noted that when installing occupancy sensor all the electronic instant start ballast be replaced with rapid start ballasts. It is assumed that all the existing light fixtures are equipped with electronic instant start ballast and hence this ECM takes into consideration the cost for replacing all the ballasts with new rapid start ballasts.

EMG considers upgrading the lighting in the school building as a major capital expenditure from which the school will continue to profit for many years to come. Thus, even though the ECM fails the SIR test, EMS still recommends delamping all lamp fixtures and installing occupancy sensors in individual spaces.

8.3.6. Install Condesning natural gas fired hot water boilers

EMG recommends replacing the current cast iron sectional hot water boilers with about 68.8% manufacturer rated efficiency with 94% efficient natural gas fired condensing hot water boilers. For improved part load performance, we recommend total of three (3) condensing boilers to replace the two cast iron boilers. The condensing boilers will be equipped with outside air reset controls. The savings and avoided maintenance cost justifies such replacement.

8.4. ECMs Evaluated For Consideration

EMG has identified 3 Energy Conservation Measures (ECMs) which were evaluated for this property but not recommended based on financial criteria. EMG screens ECMs using two financial methodologies. ECMs which are considered financially viable must meet both criteria.

The following paragraphs describe each of these ECMs along with the initial installed cost, annual energy savings and payback period for each ECM.

8.4.1. Replace Inefficient Fan Motors in The Air Handling Units With High Efficiency Units

High-efficiency motors will perform the same function as standard motors, but will improve efficiency by reducing losses in the conversion of electrical to mechanical energy. For example, magnetic losses are reduced by using thinner, higher quality steel lamination in the stator and rotor core. The air gap between rotor and stator is minimized by manufacturing to higher tolerances. More copper is used in the stator windings to reduce resistive losses. On motors with fans, smaller and more efficient fans are used.

The best applications are generally those in which the motor operates at least eight hours or more per day (NCEL 1983a). In some cases, the savings in electrical energy consumption justifies immediate replacement.

However, high-efficiency motors are not cost-effective when their premium cost cannot be recovered during the normal life of the motor because of limited hours of operation.

EMG recommends replacing motors in the following Air Handling Units:

AHU's	Motor (HP)	Existing (%)	Proposed (%)
HV-1 (220 Days/yr)	5 Hp	86.5%	90.2%
HV-2 (180 Days/Yr)	5 Hp	86.5%	90.2%
Cluster-1 (180 Days/Yr)	5 Hp	89.5%	92.4%

8.4.2. Install On-Demand Sensors in Air Handling Units

Some buildings are ventilated at a rate in excess of the recommended values. To reduce the energy consumed by the ventilation system, the ventilation rates should be lowered, unless typically high levels of pollutants are being generated. (If human carcinogens or other harmful contaminants are suspected to be present in the occupied space, other relevant standards or guidelines, such as OSHA or NIH, must supersede the listed values.) For spaces with transient or variable occupancy, the quantity of outdoor air should be adjusted by use of dampers, multi-speed ventilation fans, or by duty cycling the system. When contaminants independent of the occupants are generated in the space, the supply of outdoor air should lead occupancy so that acceptable conditions are attained before occupants return. On the other hand, if contaminants are generated solely by the occupants, the supply of outdoor air may lag occupancy. Such control over the ventilation rate can be achieved by installing on demand ventilation system on air-handling units that senses the amount of carbon dioxide in the return air and modulates the external air flow based on it. In case the CO_2 levels are low, which means the occupancy level in the facility is below normal, hence there doesn't exist, a need to bring in fresh air. This indirectly reduces the load on the air handling unit as it decreases the amount of energy required to condition the outside air.

Conversely on detecting a high level of pollutants and carbon dioxide residue in the return air, the sensor shall modulate to increase the intake of outside air, for compensating the impure air.

EMG recommends installing CO2 sensors on each of the air handling units that have in built economizers so as to control the quantity of outside air being brought into the space. The following table provides the list of air handling units that require to be retrofitted with CO2 sensors.

Air Handling Unit Name
Room. 220
Room. 222
Room. 224
Cafeteria
Room. 212
Room. 216
AHU-6 (Faculty Dining Rm.)
Green Gym

8.4.3. Install Variable Frequency Drives on main Hot Water Circulation Pumps

The Pollard middle school is currently heated by four central forced hot water boilers located in two separate boiler rooms. The hot water from the boilers is circulated around the building by two 15 Hp and two 25Hp circulation pumps.

EMG recommends installing VFD on primary hot water circulation pumps for improved part load operation.

9. IMPLEMENTION OF AN OPERATIONS AND MAINTENANCE PLAN

The quality of the maintenance and the operation of the facility's energy systems have a direct effect on its overall energy efficiency. Energy-efficiency needs to be a consideration when implementing facility modifications, equipment replacements, and general corrective actions. The following is a list of activities that should be performed as part of the routine maintenance program for the property. These actions, which have been divided into specific and general recommendations, will insure that the energy conservation measures identified in this report will remain effective. The following general recommendations should be continued or implemented.

Main Recommendations:

- Address the issue with increase in pressure due to water flowing in opposite direction when both the boilers rooms are operational. This might involve re-piping of a certain section in the pipe work along with relocation of the ball-valve. The resolution of this issue would result in appropriate run time distribution between the four boilers.
- Replace all pneumatic control valves with new digital control valves
- Replace all non functional CO2 sensors and test they regularly
- Replace all three way valves with new two way valves
- Replace the spiral ductwork with new inflatable/VAV type ductwork in the auditorium
- Replace the broken/noisy exhaust duct work in the auditorium

Building Envelope

1. Caulking and weather stripping functional and effective at all times
2. Walls observed weekly and holes patched in the building envelope as required
3. Windows inspected monthly for damaged panes and failed thermal seals
4. Automatic door closing mechanisms repaired and adjusted as needed

Heating and Cooling

1. The burners cleaned and fuel/air ratios optimized during routine maintenance checks
2. Temperature settings reduced in unoccupied areas and set points seasonally adjusted.
3. Existing pneumatic control valves and dampers checked for functionality monthly and repaired, when needed
4. Equipment inspected for worn or damaged parts as part of a monthly maintenance check
5. Ductwork visually inspected and checked for leaks or damaged insulation as part of a monthly maintenance check
6. Hot air registers and return air ductwork clean and unobstructed
7. Air dampers operating correctly
8. Test and balance completed annually to ensure heating uniform throughout the spaces
9. Evaporator coils and condenser coils regularly checked and cleaned
10. Air filters inspected monthly and replaced prior to excessive visual buildup (May increase filter costs, but will reduce fan energy costs)

Domestic Hot Water

1. Domestic hot water heater temperature set to the minimum temperature required
2. Hot water piping checked routinely for damaged insulated and leaks
3. Tank-type water heaters flushed monthly

Lighting

1. Only energy-efficient replacement lamps used and in-stock for replacement (28W –T8 lamps)
2. Lighting fixture reflective surfaces and translucent covers clean
3. Walls clean and bright to maximize lighting effectiveness
4. Timers and/or photocells operating correctly on exterior lighting

Existing Equipment and Replacements

1. Refrigerator and freezer doors closed and sealed correctly
2. Kitchen exhaust fans only used when needed or timers installed to limit operation
3. Office/ computer equipment either in the "sleep" or "off" mode when not used
4. All other recommended equipment specific preventive maintenance actions conducted
5. Usage demands on the building/ equipment not changed significantly since the original building commissioning or the most recent retro-commissioning

10. APPENDICES

APPENDIX A: Photographic Record
APPENDIX B: Thermal Photographic Record
APPENDIX C: Site Plan
APPENDIX D: Records of Communication
APPENDIX E: Glossary of Terms
APPENDIX F: Mechanical Equipment Inventory
APPENDIX G: Lighting Systems Schedules
APPENDIX H: ECM Calculations
APPENDIX I: Supporting Documents

APPENDIX A:
PHOTOGRAPHIC RECORD

DUE DILIGENCE FOR THE LIFE CYCLE OF REAL ESTATE

EMG PHOTOGRAPHIC RECORD

Project No.: 98515.11R-006.268 **Project Name: Pollard Middle School**

Photo #1:	Front view of the school

Photo #2:	Front view

Photo #3:	External view

Photo #4:	External view

Photo #5:	External view of the Blue and Green Gym

Photo #6:	External view

EMG PHOTOGRAPHIC RECORD

Project No.: 98515.11R-006.268 **Project Name: Pollard Middle School**

Photo #7:	External view

Photo #8:	External view

Photo #9:	Bridge connecting the two sections

Photo #10:	Portables

Photo #11:	Portables

Photo #12:	Open field

EMG PHOTOGRAPHIC RECORD

Project No.: 98515.11R-006.268 **Project Name: Pollard Middle School**

Photo #13:	Main electric meter

Photo #14:	Main gas meter

Photo #15:	Main domestic water meter

Photo #16:	Natural gas-fired hot water boilers in the front boiler room

Photo #17:	Main hot water circulation pumps

Photo #18:	No.2 oil pumps for the boiler

EMG PHOTOGRAPHIC RECORD

Project No.: 98515.11R-006.268 **Project Name: Pollard Middle School**

Photo #19:	Mechanical Room 1 (has 3x AHU)

Photo #20:	Hot water boilers in Boiler Room 2

Photo #21:	Hot water circulation pumps in Boiler Room 2

Photo #22:	Packages RTU's serving the portables

Photo #23:	Roof top split systems servings individual spaces

Photo #24:	New flat roof and skylights

EMG PHOTOGRAPHIC RECORD

Project No.: 98515.11R-006.268 **Project Name: Pollard Middle School**

Photo #25:	Kitchen HVAC system

Photo #26:	Typical unit ventilators

Photo #27:	Typical urinals - 1.6 GPF

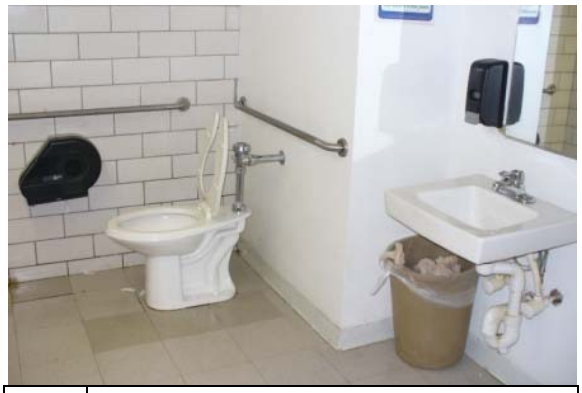


Photo #28:	Typical water closet and faucets

Photo #29:	All electric kitchen

Photo #30:	Typical hallways

DUE DILIGENCE FOR THE LIFE CYCLE OF REAL ESTATE

EMG PHOTOGRAPHIC RECORD

Project No.: 98515.11R-006.268 **Project Name: Pollard Middle School**

Photo #31:	Typical hallways

Photo #32:	Blue Gym

Photo #33:	Classroom

Photo #34:	Classroom

Photo #35:	Library

Photo #36:	Auditorium

EMG PHOTOGRAPHIC RECORD

Project No.: 98515.11R-006.268 **Project Name: Pollard Middle School**

Photo #37:	External wall pack with 40W CFL

Photo #38:	Typical portable exterior lighting

Photo #39:	Typical auditorium lighting

Photo #40:	Outside lights timer

APPENDIX B:
THERMAL PHOTOGRAPHIC RECORD

EMG DUE DILIGENCE FOR THE LIFE CYCLE OF REAL ESTATE

EMG PHOTOGRAPHIC RECORD

Project No.: 98515.11R-006.268 **Project Name: Pollard Middle School**

Photo #1:	Front elevation - IR

Photo #2:	Side elevation - IR

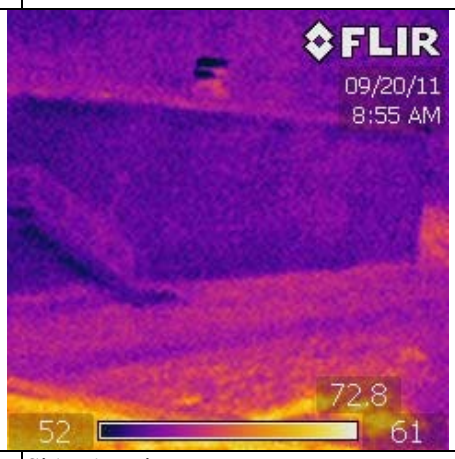


Photo #3:	Side elevation - IR

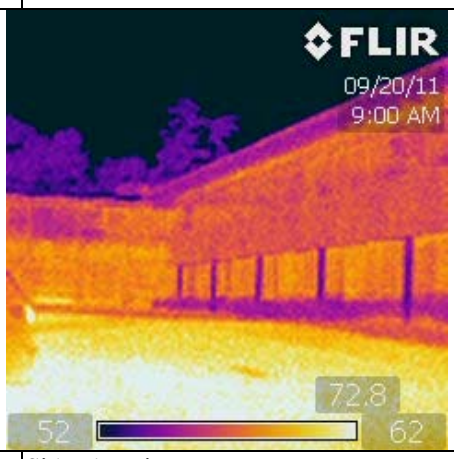


Photo #4:	Side elevation - IR

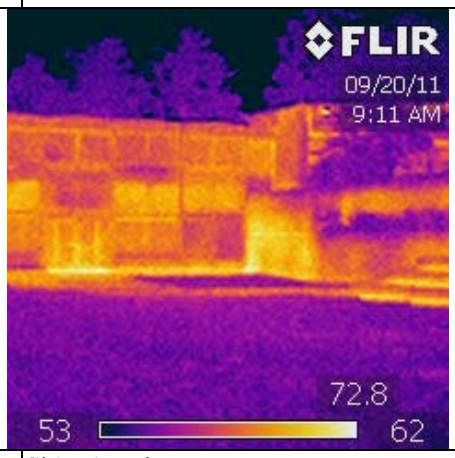


Photo #5:	Side elevation - IR

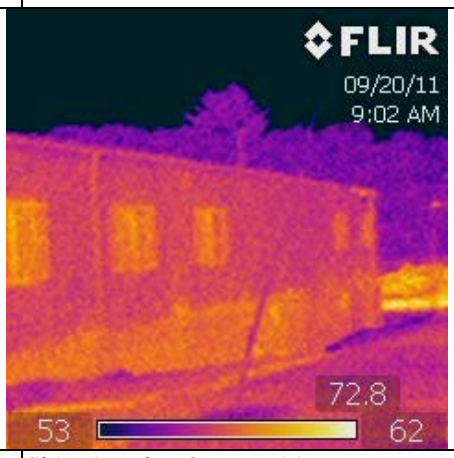


Photo #6:	Side elevation for portables - IR

APPENDIX C:
SITE PLAN

Site Plan

EMG	**Source:** **WWW.bing.com**	**Project Number:** **98515.11R-006.268**
N	**The north arrow indicator is an approximation of 0° North.**	**Project Name:** **Pollard Middle School**
		On-Site Date: **September 19th 2011**

APPENDIX D:
RECORDS OF COMMUNICATION

RECORD OF COMMUNICATION

Date:	**19th and 20th of September**	**Time:**	**7:00 AM**
Project Number:	**98515.11R-006.268**	**Recorded by:**	**Kaustubh Anil Chabukswar**
Project Name:	**Pollard Middle School**		

Communication with: Jack Hastings
of: Needham, Township
Phone: NA

Communication via:

- X Telephone Conversation
- X Discussions During Site Assessment
- X Office Visitation/Meeting at:
- Other:

RE:

Summary of Communication:

APPENDIX E:
GLOSSARY OF TERMS

Glossary of Terms and Acronyms

ECM – Energy Conservation Measures are projects recommended to reduce energy consumption. These can be No/Low cost items implemented as part of routine maintenance or Capital Cost items to be implemented as a capital improvement project.

Initial Investment – The estimated cost of implementing an ECM project. Estimates typically are based on R.S. Means Construction cost data and Industry Standards.

Annual Energy Savings – The reduction in energy consumption attributable to the implementation of a particular ECM. These savings values do not include the interactive effects of other ECMs.

Cost Savings – The expected reduction in utility or energy costs achieved through the corresponding reduction in energy consumption by implementation of an ECM.

Simple Payback Period –The number of years required for the cumulative value of energy or water cost savings less future non-fuel or non-water costs to equal the investment costs of the building energy or water system, without consideration of discount rates.

EUL – Expected Useful Life is the estimated lifespan of a typical piece of equipment based on industry accepted standards.

RUL – Remaining Useful Life is the EUL minus the effective age of the equipment and reflects the estimated number of operating years remaining for the item.

SIR - The savings-to-investment ratio is the ratio of the present value savings to the present value costs of an energy or water conservation measure. The numerator of the ratio is the present value of net savings in energy or water and non-fuel or non-water operation and maintenance costs attributable to the proposed energy or water conservation measure. The denominator of the ratio is the present value of the net increase in investment and replacement costs less salvage value attributable to the proposed energy or water conservation measure. It is recommended that energy-efficiency recommendations be based on a calculated SIR, with larger SIRs receiving a higher priority. A project typically is recommended only if the SIR is greater than or equal to 1.0, unless other factors outweigh the financial benefit.

Life Cycle Cost - The sum of the present values of (a) **I**nvestment costs, less salvage values at the end of the study period; (b) Non-fuel operation and maintenance costs: (c) Replacement costs less salvage costs of replaced building systems; and (d) Energy and/or water costs.

Life Cycle Savings – The sum of the estimated annual cost savings over the EUL of the recommended ECM, expressed in present value dollars.

Building Site Energy Use Intensity - The sum of the total site energy use in thousand of Btu per unit of gross building area. Site energy accounts for all energy consumed at the building location only not the energy consumed during generation and transmission of the energy to the site.

Building Source Energy Use Intensity – The sum of the total source energy use in thousand of Btu per unit of gross building area. Source energy is the energy consumed during generation and transmission in supplying the energy to your site.

Building Cost Intensity - This metric is the sum of all energy use costs in dollars per unit of gross building area.

Greenhouse Gas Emissions - Although there are numerous gases that are classified as contributors to the total for Greenhouse Emissions, the scope of this energy audit focuses on carbon dioxide (CO_2). Carbon dioxide enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement).

APPENDIX F:
MECHANICAL EQUIPMENT INVENTORY

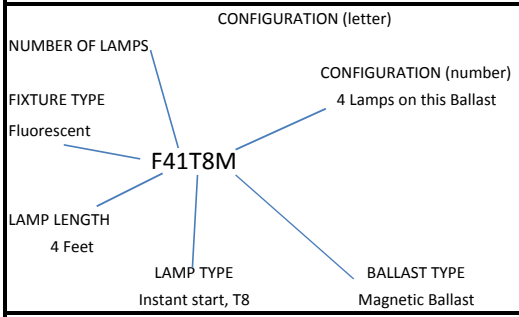
Mechanical Equipment Inventory- Pollard Middle School							
Equipment	Manufacturer	Year Installed	Location	Model/Type	Capacity	Serves	Remarks
Boilers (2x)	Smith	1992	Front Boiler Rm.	2B-14	4,258MBH	Whole School	Old But Works Well
HWP (2x)	Magnetek	1992	Front Boiler Rm.	Catg. R416	15Hp	Whole School	Old But Works Well
Domestic Hot Wate Heater	Polyshield	1992	Front Boiler Rm.	1000P125A-TP	800MBH	Whole School	Works Well
Main Generator	Kohler	1992	Front Boiler Rm.	100R07231	125kVA,100kW	Emergency Fixtures	Old But Works Well
Pneumatic Air Comprressor	Curtis	1992	Front Boiler Rm.	3kW31G	2x(1.5Hp Motors)	Whole School	Old But Works Well
AHU-6	TRANE	1992	Mech Rm-1	k95k79443	1 HP fan motor	Faculty Dining	Pneumatic Controls
HV-2	TRANE	1992	Mech Rm-1	E223	5Hp Fan	Kitchn	86.5% Effi Motors
HV-2	TRANE	1992	Mech Rm-1	E223	5Hp Fan	Locker Rm	86.5% Effi Motors
Boilers (2x)	Smith	1992	Back Boiler Rm.	28A-9	1941MBH	Whole School	Not Used Much
HWP (2x)	Baldor	1992	Back Boiler Rm.	EM2531T-8	25Hp	Whole School	Never Used
Elevator-1	Beckwith	NA	New Construction	NA	1500Lbs	School	Old But Works Well
Elevator-2	Dover	1992	New Construction	EP-60-20	2500 Lbs	School	Works Well
AHU	TRANE	1992	Art Room	k95k79554	2Hp Motors	Art Room	Works Well
AHU	TRANE	1992	Rm 222	k95k79554	2Hp Motors	Wood Work	Works Well
AHU	TRANE	1992	Rm224	k95k79554	2Hp Motors	Art Room	Works Well
AHU	TRANE	1992	Auditorium	NA	NA	Auditorium	Meant to supply Outside Air
AHU	TRANE	1992	Auditorium	NA	NA	Auditorium	Meant to circulate air with heating coils
AHU	Magic Aire	1994	Rm 221	60-BVM/BUX-A	NA	Rm 221&219	Works Well
AHU	TRANE	1995	Cluster-1	K95K80211	NA	Cluster Rm	Works Well
AHU	TRANE	1992	Cafeteria	MCCA014	7.5HP	Cafeteria	Works Well

Mechanical Equipment Inventory- Pollard Middle School							
Equipment	Manufacturer	Year Installed	Location	Model/ Type	Capacity	Serves	Remarks
Condensing Unit	TRANE XE 1000	1995	Rooftop	TTR024C100A1	2 Ton	Rm 200	Old But Works Well
Condensing Unit (3X)	Sanyo	NA	Rooftop	C2432	2 Ton	Rm. 203,205,207	Works Well
Condensing Unit	Daikin	2008	Rooftop	RXYQ96PTJU	8 Ton	Rm 209	New
Condensing Unit	American Standard	2011	Rooftop	2A7B3036	3 Ton	Rm.211	New
Condensing Unit	TRANE	1995	Rooftop	TTA048C300	4Tons	Rm 210	Old But Works Well
Condensing Unit	TRANE	2000	Rooftop	TCD090C30	5 Ton	Rm-214	New
Condensing Unit	Trane	NA	Rooftop	TTA048C300	2 Ton	Faculty Dining	Works Well
Condensing Unit	TRANE	1995	Rooftop	TTA048C300	2 Ton	Rm 220	Works Well
Condensing Unit	TRANE	NA	Rooftop	TTA048C300	2 Ton	Rm.222	Works Well
Condensing Unit	TRANE	1995	Rooftop	TTA048C300		Rm.224	Works Well
Condensing Unit (4X)	Goodman	2010	Rooftop	GSC13030		Media-1,2,3&4	Works Well
Condensing Unit	TRANE	1995	Rooftop	TTA060C300	5Ton	Rm 219,221	Works Well
Condensing Unit	American Standard	1995	Rooftop	TTA120B300	10Tons	Cluster Rm	Works Well
Condensing Unit	American Standard	2011	Rooftop	2A7B3018A	1.5Ton	Principals office	Works Well
Condensing Unit	TRANE	1993	Rooftop	TTRO12C100	1 Ton	Secretary's Office	Works Well
Condensing Unit	TRANE	1993	Rooftop	TTRO12C100	1 Ton	Admins Office	Works Well
Condensing Unit	TRANE	1993	Rooftop	TTR012C1	1 Ton	A/C Nurse	Works Well
Condensing Unit	TRANE	NA	Rooftop	TTA036C100	3 Ton	Rm 281	Works Well
Condensing Unit	TRANE	1995	Rooftop	TTR024C100A1	2 Ton	Rm 258	Works Well
Condensing Unit	Mitsubishi	NA	Rooftop	MU_A17NA	1 Ton	Network Closet	Works Well
Condensing Unit	TRANE	1995	Rooftop	TTR036C100	3 Ton	Rm 278	Works Well

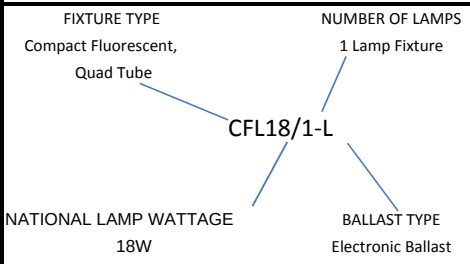
APPENDIX G:
LIGHTING SYSTEMS SCHEDULES

Fixture Code Legend and Notes

Sample Linear Fluorescent Fixture Code



Sample of Other Fixture Code:



Code Explanations

Fixture Type

CF	Compact Fluorescent
CFD	Compact Fluorescent, double-D shape
CFS	Compact Fluorescent, Spiral
CFT	Compact Fluorescent, Twin tube (including "Biaxial" fixtures)
CFQ	Compact Fluorescent, Quad tube
ECF	Exit sign, Compact Fluorescent
EI	Exit sign, Incandescent
ELED	Exit sign, LED
F	Fluorescent, linear
FC	Fluorescent, Circline
FU	Fluorescent, U-tube
H	Halogen
HLV	Halogen, Low Voltage
HPS	High Pressure Sodium
I	Incandescent
LED	Light Emitting Diode (LED) traffic signal
MH	Metal Halide
MHPS	Metal Halide, Pulse Start
MV	Mercury Vapor
QL	Induction

Lamp Type

for fluorescent fixtures

A	"F25T12" - 25 watt, 4ft, T12 lamp
IL or T8	T8, Instant start
SIL	T8, Instant start, Super 30 watt
SSIL or T8N	T8, rapid start, Super 28 watt
L	T8, rapid start
T5	T5, standard
T5HO	T5, standard, High output lamp
T12	T12, Energy efficient
EH	T12, Energy efficient, High output lamp
EI	T12, Energy efficient, Instant start
EV	T12, Energy efficient, Very high output
T12M	T12, Standard magnetic
SIL	T12, Standard, Instant start
HO	T12, Standard, High output lamp
SV	T12, Standard, Very high output lamp
T	T10, Standard

Ballast Type

for fluorescent fixtures

E	Electronic
M	Standard magnetic

Configuration (letter)

T	Tandem wired fixture
DL	Delamped fixture, i.e. some lamps permanently removed but ballasts remain

Configuration (number)

for delamped fixtures

Number signifies the total number of ballasts in the fixture: e.g. An "F42EEID2" is an "F44EE" with two lamps removed so that there is one extaneous ballast

for tandem wired ballasts

Number signifies the total number of lamps being run by the ballast: e.g. An "F42LLIT4" would indicate that a four-lamp ballast is wired to run two-lamp fixtures.

with no preceding letter

Number indicates the number of ballasts in an ambiguous multiple ballast fixture: e.g. An "F43ILU2" indicates a three-lamp fixture with two ballasts (as is often the case if there is A/B switching).

Notes:

1) The column labeled Watts/Fixtures in the data table includes ballast loads.

2) The fixture wattage values represent an average value, rounded to the nearest whole watt.

Existing Facilities Program Lighting Form:

Performance Based

Project Name:	98515.11R-006.268
Facility Name:	Pollard Middle School
Date: ########	Project Manager: Kaustubh Anil Chabukswar

Existing Control Legend	
LS	Light Switch
PS	Photosensor
T	Timer
MS	Motion Sensor
EC	Emergency Control

INSTRUCTIONS Coding Legend			
CF	Compact Fluorescent	I	Incandescent
F	Fluorescent, linear	LED	Light Emitting Diode
H	Halogen	MH	Metal Halide
HPS	High Pressure Sodium	MV	Mercury Vapor
I	Incandescent	QL	Induction

	PRE-INSTALLATION											POST-INSTALLATION								
Line Item	**ECM**	**Type of ECM Code** (Refer to ECM Code Worksheet)	**Additional ECM Code (if applicable)**	**Floor**	**Area Description**	**Light Reading** (Record if ECM)	**Usage**	**Baseline Annual Hours**	**Existing Control**	**Pre Fixt. No.**	**Pre Fixt Code**	**Post Fixt No.**	**Post Fixt Code** (Refer to Wattable Table Worksheet)	**Post Watts/ Fixt**	**Post kW / Space**	**Proposed Weekly Hours**	**Proposed Annual Weeks**	**Proposed Annual Hours**	**Proposed Control**	**kW Saved**	**Annual kWh Saved**
Integer line number	(Type 'ECM" if applied)	ECM CODE Worksheet Link	For two ECMs in one line item	Floor fixture is on	Description of location that matches site map	Lux (link to light standards)	hrs/ week	Existing annual hours for the usage group	Pre-installation control device	# of existing fixtures	TypWattage Table Link	# of existing fixtures	TypWattage Table	Watts/Fixt from Wattage Table	(Post Watts/Fixt) * (Post Fixt No.)	Hrs / Wk	Wks/Yr	Proposed annual hours for the usage group	Post-installation control device	Pre kW/Space - Post kW/Space	(PreFixt #*PreWatts/Fixt * Baseline Hrs) - (PostFixt#*PostWatts/Fixt * Proposed Hours)
Ex.		*RB*		*10*	*Men's Room*		*5*	*3,000*	*Light Switch*	*3*	*F44T12*	*3*	*F42T8*	*59*	*0.18*			*2,000*	*Motion Sensor*	*0.26*	*765*
2	ECM	RB - Replace Bulb	#N/A	1	Lecture Hall	430	20	720	LS	13	I60	13	CFL25	33	0.429	20.00	36.00	720	MS	0.35	253
3	ECM	MS - Install Motion Sensors	DL - Delamping	1	Rm. 100	907	40	1,440	LS	9	F44T8	9	F42T8	59	0.531	32.00	36	1,152	MS	0.48	840
4	ECM	MS - Install Motion Sensors	DL - Delamping	1	Rm. 101	787	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
5	ECM	MS - Install Motion Sensors	DL - Delamping	1	Rm. 102	705	40	1,440	LS	2	F44T8	2	F42T8	59	0.118	32.00	36	1,152	MS	0.11	187
6	ECM	MS - Install Motion Sensors	DL - Delamping	1	Rm. 103	560	40	1,440	LS	9	F44T8	9	F42T8	59	0.531	32.00	36	1,152	MS	0.48	840
7	ECM	MS - Install Motion Sensors	DL - Delamping	1	Rm. 104	1,200	40	1,440	LS	9	F44T8	9	F42T8	59	0.531	32.00	36	1,152	MS	0.48	840
8	ECM	MS - Install Motion Sensors	DL - Delamping	1	Rm. 105	440	40	1,440	LS	9	F44T8	9	F42T8	59	0.531	32.00	36	1,152	MS	0.48	840
9	ECM	MS - Install Motion Sensors	DL - Delamping	1	Rm. 106	710	40	1,440	LS	2	F44T8	2	F42T8	59	0.118	32.00	36	1,152	MS	0.11	187
10	ECM	MS - Install Motion Sensors	DL - Delamping	1	Rm. 107	528	40	1,440	LS	9	F44T8	9	F42T8	59	0.531	32.00	36	1,152	MS	0.48	840
11	ECM	MS - Install Motion Sensors	DL - Delamping	1	Rm. 108	900	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
12	ECM	MS - Install Motion Sensors	DL - Delamping	1	Rm. 109	650	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
13	ECM	MS - Install Motion Sensors	DL - Delamping	1	Rm. 110	711	40	1,440	LS	2	F44T8	2	F42T8	59	0.118	32.00	36	1,152	MS	0.11	187
14	ECM	MS - Install Motion Sensors	DL - Delamping	1	Rm132	213	40	1,440	LS	4	FU3T8	4	FU3T8	89	0.356	32.00	36.00	1,152	MS	0.00	103
16	ECM	MS - Install Motion Sensors	DL - Delamping	1	Boys Room	365	40	1,680	LS	1	F44T8	1	F42T8	59	0.059	32.00	36	1,152	MS	0.05	120
17	ECM	MS - Install Motion Sensors	DL - Delamping	1	Mens Room	344	40	1,680	LS	1	F44T8	1	F42T8	59	0.059	32.00	36	1,152	MS	0.05	120
18	ECM	MS - Install Motion Sensors	#N/A	1	Girls Restroom (Near Gym)	450	40	1,680	LS	1	F42T8	1	F42T8	59	0.059	32.00	42.00	1,344	MS	0.00	20
19	ECM	MS - Install Motion Sensors	#N/A	1	Girls Locker Room	500	20	840	LS	12	FU3T8	12	FU3T8	89	1.068	16.00	42.00	672	MS	0.00	179
20	ECM	MS - Install Motion Sensors	#N/A	1	Girls Locker Room	500	20	840	LS	2	F42T8	2	F42T8	59	0.118	16.00	42.00	672	MS	0.00	20
21	ECM	MS - Install Motion Sensors	#N/A	1	Boys Restroom (Near Gym)	205	40	1,680	LS	1	F42T8	1	F42T8	59	0.059	32.00	42.00	1,344	MS	0.00	20
22	ECM	MS - Install Motion Sensors	#N/A	1	Boys Locker Room	500	20	840	LS	12	FU3T8	12	FU3T8	89	1.068	16.00	42.00	672	MS	0.00	179
23	ECM	MS - Install Motion Sensors	#N/A	1	Boys Locker Room	500	20	840	LS	2	F42T8	2	F42T8	59	0.118	16.00	42.00	672	MS	0.00	20
24	ECM	MS - Install Motion Sensors	RB - Replace Bulb	1	Green Gymnasium	277	85	3,570	LS	10	MH400	10	QL250	258	2.58	25.00	42.00	1,050	MS	2.00	13,642
25	ECM	MS - Install Motion Sensors	RB - Replace Bulb	1	Blue Gym	300	85	3,570	LS	10	MH400	10	QL250	258	2.58	25.00	42.00	1,050	MS	2.00	13,642
27	ECM	MS - Install Motion Sensors	#N/A	1	Teacher's Break Room	570	45	1,620	LS	12	F43T8	12	F43T8	89	1.068	33.75	36.00	1,215	MS	0.00	433
28	ECM	MS - Install Motion Sensors	#N/A	1	Teacher's Break Room	570	45	1,620	LS	1	FU3T8	1	FU3T8	89	0.089	29.25	36.00	1,053	MS	0.00	50
29	ECM	#N/A	DL - Delamping	1	Kitchen	580	40	1,440	LS	12	F44T8	12	F42T8	59	0.708	40.00	36.00	1,440	LS	0.64	916
31	ECM	MS - Install Motion Sensors	#N/A	2	Rm. 286	470	40	1,440	LS	9	F43T8	9	F43T8	89	0.801	32.00	36.00	1,152	MS	0.00	231
32	ECM	MS - Install Motion Sensors	#N/A	2	Rm. 287	550	40	1,440	LS	9	F43T8	9	F43T8	89	0.801	32.00	36.00	1,152	MS	0.00	231

												PRE-INSTALLATION							POST-INSTALLATION		
Line Item	**ECM**	**Type of ECM Code** (Refer to ECM Code Worksheet)	**Additional ECM Code (if applicable)**	**Floor**	**Area Description**	**Light Reading** (Record if ECM)	**Usage**	**Baseline Annual Hours**	**Existing Control**	**Pre Fixt. No.**	**Pre Fixt Code**	**Post Fixt No.**	**Post Fixt Code** (Refer to Wattable Table Worksheet)	**Post Watts/ Fixt**	**Post kW / Space**	**Proposed Weekly Hours**	**Proposed Annual Weeks**	**Proposed Annual Hours**	**Proposed Control**	**kW Saved**	**Annual kWh Saved**
Integer line number	(Type 'ECM" if applied)	ECM CODE Worksheet Link	For two ECMs in one line item	Floor fixture is on	Description of location that matches site map	Lux (link to light standards)	hrs/ week	Existing annual hours for the usage group	Pre-installation control device	# of existing fixtures	TypWattage Table Link	# of existing fixtures	TypWattage Table	Watts/Fixt from Wattage Table	(Post Watts/Fixt) * (Post Fixt No.)	Hrs / Wk	Wks/Yr	Proposed annual hours for the usage group	Post-installation control device	Pre kW/Space - Post kW/Space	(PreFixt #*PreWatts/Fixt * Baseline Hrs) - (PostFixt#*PostWatts/Fixt * Proposed Hours)
33	ECM	MS - Install Motion Sensors	#N/A	2	Rm. 288	505	40	1,440	LS	9	F43T8	9	F43T8	89	0.801	32.00	36.00	1,152	MS	0.00	231
34	ECM	MS - Install Motion Sensors	#N/A	2	Rm. 289	550	40	1,440	LS	9	F43T8	9	F43T8	89	0.801	32.00	36.00	1,152	MS	0.00	231
35	ECM	MS - Install Motion Sensors	#N/A	2	Rm. 290	835	40	1,440	LS	3	F43T8	3	F43T8	89	0.267	32.00	36.00	1,152	MS	0.00	77
36	ECM	MS - Install Motion Sensors	#N/A	2	Rm. 291	550	40	1,440	LS	9	F43T8	9	F43T8	89	0.801	32.00	36.00	1,152	MS	0.00	231
37	ECM	MS - Install Motion Sensors	#N/A	2	Rm. 293	535	40	1,440	LS	6	F43T8	6	F43T8	89	0.534	32.00	36.00	1,152	MS	0.00	154
38	ECM	MS - Install Motion Sensors	#N/A	2	Rm. 200	680	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
39	ECM	MS - Install Motion Sensors	#N/A	2	Rm. 201	480	40	1,440	LS	4	F44T8	4	F42T8	59	0.236	32.00	36	1,152	MS	0.21	373
40	ECM	MS - Install Motion Sensors	#N/A	2	Rm. 202	1,040	40	1,440	LS	9	F44T8	9	F42T8	59	0.531	32.00	36	1,152	MS	0.48	840
41	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 203	600	40	1,440	LS	9	F44T8	9	F42T8	59	0.531	32.00	36	1,152	MS	0.48	840
42	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 204	1,060	40	1,440	LS	9	F44T8	9	F42T8	59	0.531	32.00	36	1,152	MS	0.48	840
43	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 205	505	40	1,440	LS	9	F44T8	9	F42T8	59	0.531	32.00	36	1,152	MS	0.48	840
44	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 206	1,000	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
45	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 207	900	40	1,440	LS	9	F44T8	9	F42T8	59	0.531	32.00	36	1,152	MS	0.48	840
46	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 208	1,000	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
47	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 209 (Media Rm.)	600	40	1,440	LS	8	F44T8	8	F42T8	59	0.472	32.00	36	1,152	MS	0.42	746
53	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm.214	NA	20	720	LS	32	F42T8	32	F42T8	59	1.888	16.00	36.00	576	MS	0.00	272
54	ECM	MS - Install Motion Sensors	DL - Delamping	2	Music Office	NA	20	720	LS	1	F44T8	1	F42T8	59	0.059	16.00	36	576	MS	0.05	47
55	ECM	MS - Install Motion Sensors	DL - Delamping	2	Band Office	NA	20	720	LS	6	F44T8	6	F42T8	59	0.354	16.00	36	576	MS	0.32	280
56	ECM	MS - Install Motion Sensors	DL - Delamping	2	Closet	NA	15	540	LS	1	F44T8	1	F42T8	59	0.059	12.00	36	432	MS	0.05	35
57	ECM	MS - Install Motion Sensors	#N/A	2	Mens & Women Restroom	NA	45	1,890	LS	2	F42T8	2	F42T8	59	0.118	36.00	42.00	1,512	MS	0.00	45
58	ECM	MS - Install Motion Sensors	#N/A	2	Wood Shop	NA	40	1,440	LS	12	F42T8	12	F42T8	59	0.708	32.00	36.00	1,152	MS	0.00	204
59	ECM	MS - Install Motion Sensors	#N/A	2	Art Room	NA	40	1,440	LS	28	F42T8	28	F42T8	59	1.652	32.00	36.00	1,152	MS	0.00	476
60	ECM	MS - Install Motion Sensors	#N/A	2	Rm. 224	NA	40	1,440	LS	28	F42T8	28	F42T8	59	1.652	32.00	36.00	1,152	MS	0.00	476
61	ECM	MS - Install Motion Sensors	#N/A	2	Media Center	510	40	1,440	LS	90	F42T8	90	F42T8	59	5.31	32.00	36.00	1,152	MS	0.00	1,529
62	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 219	520	40	1,440	LS	4	F44T8	4	F42T8	59	0.236	32.00	36	1,152	MS	0.21	373
63	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 217	570	40	1,680	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	721
64	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm.221	440	40	1,440	LS	4	F44T8	4	F42T8	59	0.236	32.00	36	1,152	MS	0.21	373
65	ECM	MS - Install Motion Sensors	DL - Delamping	2	RM 223	440	40	1,440	LS	5	F44T8	5	F42T8	59	0.295	32.00	36	1,152	MS	0.27	467
66	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm 219	NA	40	1,680	LS	1	F44T8	1	F42T8	59	0.059	32.00	36	1,152	MS	0.05	120
67	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm.225	635	40	1,440	LS	5	F44T8	5	F42T8	59	0.295	32.00	36	1,152	MS	0.27	467
68	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 226	350	40	1,440	LS	4	F44T8	4	F42T8	59	0.236	32.00	36	1,152	MS	0.21	373
69	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 227	555	40	1,440	LS	4	F44T8	4	F42T8	59	0.236	32.00	36	1,152	MS	0.21	373
70	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 228	450	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
71	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm.229	350	40	1,440	LS	2	F44T8	2	F42T8	59	0.118	32.00	36	1,152	MS	0.11	187

		PRE-INSTALLATION										POST-INSTALLATION									
Line Item	**ECM**	**Type of ECM Code** (Refer to ECM Code Worksheet)	**Additional ECM Code (if applicable)**	**Floor**	**Area Description**	**Light Reading** (Record if ECM)	**Usage**	**Baseline Annual Hours**	**Existing Control**	**Pre Fixt. No.**	**Pre Fixt Code**	**Post Fixt No.**	**Post Fixt Code** (Refer to Wattable Table Worksheet)	**Post Watts/ Fixt**	**Post kW / Space**	**Proposed Weekly Hours**	**Proposed Annual Weeks**	**Proposed Annual Hours**	**Proposed Control**	**kW Saved**	**Annual kWh Saved**
Integer line number	(Type 'ECM" if applied)	ECM CODE Worksheet Link	For two ECMs in one line item	Floor fixture is on	Description of location that matches site map	Lux (link to light standards)	hrs/ week	Existing annual hours for the usage group	Pre-installation control device	# of existing fixtures	TypWattage Table Link	# of existing fixtures	TypWattage Table	Watts/Fixt from Wattage Table	(Post Watts/Fixt) * (Post Fixt No.)	Hrs / Wk	Wks/Yr	Proposed annual hours for the usage group	Post-installation control device	Pre kW/Space - Post kW/Space	(PreFixt #*PreWatts/Fixt * Baseline Hrs) - (PostFixt#*PostWatts/Fixt * Proposed Hours)
72	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm.230	455	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
73	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 233	1,124	40	1,440	LS	2	F44T8	2	F42T8	59	0.118	32.00	36	1,152	MS	0.11	187
74	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 235	1,124	40	1,440	LS	2	F44T8	2	F42T8	59	0.118	32.00	36	1,152	MS	0.11	187
75	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 237	420	40	1,440	LS	1	F44T8	1	F42T8	59	0.059	32.00	36	1,152	MS	0.05	93
76	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 274	400	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
77	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 272	400	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
78	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 270	540	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
79	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm.276	540	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
80	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 268	540	40	1,440	LS	4	F44T8	4	F42T8	59	0.236	32.00	36	1,152	MS	0.21	373
81	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 284	411	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
82	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm.285	650	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
83	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 282	555	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
84	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 280	425	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
85	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 278	463	40	1,440	LS	4	F44T8	4	F42T8	59	0.236	32.00	36	1,152	MS	0.21	373
86	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 281	496	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
87	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 283	551	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
88	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 260	563	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
89	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 266	574	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
90	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 262	320	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
91	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 264	455	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
92	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 254	451	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
93	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 252	465	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
94	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 253	233	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
95	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm.251	356	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
96	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 250	5,451	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
97	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 248	453	40	1,440	LS	5	F44T8	5	F42T8	59	0.295	32.00	36	1,152	MS	0.27	467
98	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 243	373	40	1,440	LS	1	F44T8	1	F42T8	59	0.059	32.00	36	1,152	MS	0.05	93
99	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 241	459	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560
100	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 239	653	40	1,440	LS	4	F44T8	4	F42T8	59	0.236	32.00	36	1,152	MS	0.21	373
101	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 240	463	40	1,440	LS	4	F44T8	4	F42T8	59	0.236	32.00	36	1,152	MS	0.21	373
102	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 246	453	40	1,440	LS	4	F44T8	4	F42T8	59	0.236	32.00	36	1,152	MS	0.21	373
103	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 242	436	40	1,440	LS	8	F44T8	8	F42T8	59	0.472	32.00	36	1,152	MS	0.42	746
104	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 244	563	40	1,440	LS	8	F44T8	8	F42T8	59	0.472	32.00	36	1,152	MS	0.42	746
105	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm.255	650	40	1,440	LS	6	F44T8	6	F42T8	59	0.354	32.00	36	1,152	MS	0.32	560

			PRE-INSTALLATION									**POST-INSTALLATION**									
Line Item	**ECM**	**Type of ECM Code** (Refer to ECM Code Worksheet)	**Additional ECM Code (if applicable)**	**Floor**	**Area Description**	**Light Reading** (Record if ECM)	**Usage**	**Baseline Annual Hours**	**Existing Control**	**Pre Fixt. No.**	**Pre Fixt Code**	**Post Fixt No.**	**Post Fixt Code** (Refer to Wattable Table Worksheet)	**Post Watts/ Fixt**	**Post kW / Space**	**Proposed Weekly Hours**	**Proposed Annual Weeks**	**Proposed Annual Hours**	**Proposed Control**	**kW Saved**	**Annual kWh Saved**
Integer line number	(Type 'ECM" if applied)	ECM CODE Worksheet Link	For two ECMs in one line item	Floor fixture is on	Description of location that matches site map	Lux (link to light standards)	hrs/ week	Existing annual hours for the usage group	Pre-installation control device	# of existing fixtures	TypWattage Table Link	# of existing fixtures	TypWattage Table	Watts/Fixt from Wattage Table	(Post Watts/Fixt) * (Post Fixt No.)	Hrs / Wk	Wks/Yr	Proposed annual hours for the usage group	Post-installation control device	Pre kW/Space - Post kW/Space	(PreFixt #*PreWatts/Fixt * Baseline Hrs) - (PostFixt#*PostWatts/Fixt * Proposed Hours)
106	ECM	MS - Install Motion Sensors	DL - Delamping	2	Rm. 256	655	2	72	LS	4	F44T8	4	F42T8	59	0.236	1.60	36	58	MS	0.21	19
113	ECM	MS - Install Motion Sensors	#N/A	2	Main Office-Lobby	628	40	1,680	LS	6	F43T8	6	F43T8	89	0.534	30.00	42.00	1,260	MS	0.00	224
114	ECM	MS - Install Motion Sensors	#N/A	2	Special Education	400	40	1,440	LS	2	F43T8	2	F43T8	89	0.178	30.00	36.00	1,080	MS	0.00	64
115	ECM	MS - Install Motion Sensors	#N/A	2	Dianne List	980	40	1,680	LS	2	F43T8	2	F43T8	89	0.178	30.00	42.00	1,260	MS	0.00	75
116	ECM	MS - Install Motion Sensors	#N/A	2	Book Keeper	1,000	40	1,680	LS	2	F43T8	2	F43T8	89	0.178	30.00	42.00	1,260	MS	0.00	75
117	ECM	MS - Install Motion Sensors	#N/A	2	Principals Office	936	40	1,680	LS	4	F43T8	4	F43T8	89	0.356	30.00	42.00	1,260	MS	0.00	150
124	ECM	MS - Install Motion Sensors	#N/A	1	Cafeteria	450	40	1,440	LS	50	FU3T8	50	FU3T8	89	4.45	18.00	36.00	648	MS	0.00	3,524
126	ECM	RB - Replace Bulb	#N/A	EXT	Exterior Lights	NA	72	3,744	TM	8	MH70	8	QL55	55	0.44	72.00	52.00	3,744	TM	0.32	1,198
127	ECM	RB - Replace Bulb	#N/A	EXT	Portables Exterior	NA	72	3,744	TM	10	MH175	10	QL120	125	1.25	72.00	52.00	3,744	TM	0.90	3,370
									Total Pre Fixt.	**800**		**832**	**Total Post kW**	**7,228.00**	**58.19**				**Total kW Saved**	**24.35**	**73,349.81**

Existing Facilities Program Lighting Form:

Performance Based

Project Number:	98515.11R-006.268		
Facility Name:	Pollard Middle School		
Project Manager	Kaustubh Anil Chabukswar		
Date:	10/10/2011	Square Footage (ft2)	142000

Existing Control Legend	
LS	Light Switch
PS	Photosensor
TM	Timer
MS	Motion/Occupancy Sensor
EC	Emergency Control

INSTRUCTIONS Coding Legend		
CF	Compact Fluorescent	I
F	Fluorescent, linear	LED
H	Halogen	MH
HPS	High Pressure Sodium	MV
I	Incandescent	QL

PRE-INSTALLATION

Line Item	ECM	Type of ECM Code (Refer to ECM Code Worksheet)	Additional ECM Code (if applicable)	Floor	Area Description	Light Reading (Record if ECM)	Usage	Usage	Existing Control	Pre Fixt. No.	Pre Fixt Code (Refer to Wattable Table Worksheet)	Pre Watts / Fixt	Pre kW / Space	Baseline Annual Hours	Annual kWh Consumed
Integer line number	(Type 'ECM' for lighting retrofit)	ECM CODE Worksheet Link	For two ECMs in one line item	Floor fixture is on	Description of location that matches site map	Lux	hrs/ Week	Wks/Yr	control device (refer to legend above)	# of existing fixtures	TypWattage Table	Watts/Fixt from Wattage Table	(Pre Watts/Fixt) * (Pre Fixt No.)	Existing annual hours used	(PreFixt #*PreWatts/Fixt * Baseline Hrs)
1				1	Lecture Hall	430	20	36	LS	25	FU3T8	89	2.23	720	1,602
2	ECM	RB		1	Lecture Hall	430	20	36	LS	13	I60	60	0.78	720	562
3	ECM	MS	DL	1	Rm. 100	907	40	36	LS	9	F44T8	112	1.01	1,440	1,452
4	ECM	MS	DL	1	Rm. 101	787	40	36	LS	6	F44T8	112	0.67	1,440	968
5	ECM	MS	DL	1	Rm. 102	705	40	36	LS	2	F44T8	112	0.22	1,440	323
6	ECM	MS	DL	1	Rm. 103	560	40	36	LS	9	F44T8	112	1.01	1,440	1,452
7	ECM	MS	DL	1	Rm. 104	1200	40	36	LS	9	F44T8	112	1.01	1,440	1,452
8	ECM	MS	DL	1	Rm. 105	440	40	36	LS	9	F44T8	112	1.01	1,440	1,452
9	ECM	MS	DL	1	Rm. 106	710	40	36	LS	2	F44T8	112	0.22	1,440	323
10	ECM	MS	DL	1	Rm. 107	528	40	36	LS	9	F44T8	112	1.01	1,440	1,452
11	ECM	MS	DL	1	Rm. 108	900	40	36	LS	6	F44T8	112	0.67	1,440	968
12	ECM	MS	DL	1	Rm. 109	650	40	36	LS	6	F44T8	112	0.67	1,440	968
13	ECM	MS	DL	1	Rm. 110	711	40	36	LS	2	F44T8	112	0.22	1,440	323
14	ECM	MS	DL	1	Rm132	213	40	36	LS	4	FU3T8	89	0.36	1,440	513
15				1	Rm 122	314	40	36	LS	14	FU3T8	89	1.25	1,440	1,794
16	ECM	MS	DL	1	Boys Room	365	40	42	LS	1	F44T8	112	0.11	1,680	188
17	ECM	MS	DL	1	Mens Room	344	40	42	LS	1	F44T8	112	0.11	1,680	188
18	ECM	MS		1	Girls Restroom (Near Gym)	450	40	42	LS	1	F42T8	59	0.06	1,680	99
19	ECM	MS		1	Girls Locker Room	500	20	42	LS	12	FU3T8	89	1.07	840	897
20	ECM	MS		1	Girls Locker Room	500	20	42	LS	2	F42T8	59	0.12	840	99
21	ECM	MS		1	Boys Restroom (Near Gym)	205	40	42	LS	1	F42T8	59	0.06	1,680	99
22	ECM	MS		1	Boys Locker Room	500	20	42	LS	12	FU3T8	89	1.07	840	897
23	ECM	MS		1	Boys Locker Room	500	20	42	LS	2	F42T8	59	0.12	840	99
24	ECM	MS	RB	1	Green Gymnasium	277	85	42	LS	10	MH400	458	4.58	3,570	16,351
25	ECM	MS	RB	1	Blue Gym	300	85	42	LS	10	MH400	458	4.58	3,570	16,351
26				1	Coach's Office & bathroom	350	25	42	LS	4	FU3T8	89	0.36	1,050	374
27	ECM	MS		1	Teacher's Break Room	570	45	36	LS	12	F43T8	89	1.07	1,620	1,730
28	ECM	MS		1	Teacher's Break Room	570	45	36	LS	1	FU3T8	89	0.09	1,620	144
29	ECM		DL	1	Kitchen	580	40	36	LS	12	F44T8	112	1.34	1,440	1,935
30				1	Kitchen	580	40	36	LS	5	F42T8	59	0.30	1,440	425
31	ECM	MS		2	Rm. 286	470	40	36	LS	9	F43T8	89	0.80	1,440	1,153
32	ECM	MS		2	Rm. 287	550	40	36	LS	9	F43T8	89	0.80	1,440	1,153
33	ECM	MS		2	Rm. 288	505	40	36	LS	9	F43T8	89	0.80	1,440	1,153
34	ECM	MS		2	Rm. 289	550	40	36	LS	9	F43T8	89	0.80	1,440	1,153

PRE-INSTALLATION

Line Item	ECM	Type of ECM Code (Refer to ECM Code Worksheet)	Additional ECM Code (if applicable)	Floor	Area Description	Light Reading (Record if ECM)	Usage	Usage	Existing Control	Pre Fixt. No.	Pre Fixt Code (Refer to Wattable Table Worksheet)	Pre Watts / Fixt	Pre kW / Space	Baseline Annual Hours	Annual kWh Consumed
Integer line number	(Type 'ECM' for lighting retrofit)	ECM CODE Worksheet Link	For two ECMs in one line item	Floor fixture is on	Description of location that matches site map	Lux	hrs/ Week	Wks/Yr	control device (refer to legend above)	# of existing fixtures	TypWattage Table	Watts/Fixt from Wattage Table	(Pre Watts/Fixt) * (Pre Fixt No.)	Existing annual hours used	(PreFixt #*PreWatts/Fixt * Baseline Hrs)
35	ECM	MS		2	Rm. 290	835	40	36	LS	3	F43T8	89	0.27	1,440	384
36	ECM	MS		2	Rm. 291	550	40	36	LS	9	F43T8	89	0.80	1,440	1,153
37	ECM	MS		2	Rm. 293	535	40	36	LS	6	F43T8	89	0.53	1,440	769
38	ECM	MS		2	Rm. 200	680	40	36	LS	6	F44T8	112	0.67	1,440	968
39	ECM	MS		2	Rm. 201	480	40	36	LS	4	F44T8	112	0.45	1,440	645
40	ECM	MS		2	Rm. 202	1040	40	36	LS	9	F44T8	112	1.01	1,440	1,452
41	ECM	MS	DL	2	Rm. 203	600	40	36	LS	9	F44T8	112	1.01	1,440	1,452
42	ECM	MS	DL	2	Rm. 204	1060	40	36	LS	9	F44T8	112	1.01	1,440	1,452
43	ECM	MS	DL	2	Rm. 205	505	40	36	LS	9	F44T8	112	1.01	1,440	1,452
44	ECM	MS	DL	2	Rm. 206	1000	40	36	LS	6	F44T8	112	0.67	1,440	968
45	ECM	MS	DL	2	Rm. 207	900	40	36	LS	9	F44T8	112	1.01	1,440	1,452
46	ECM	MS	DL	2	Rm. 208	1000	40	36	LS	6	F44T8	112	0.67	1,440	968
47	ECM	MS	DL	2	Rm. 209 (Media Rm.)	600	40	36	LS	8	F44T8	112	0.90	1,440	1,290
48				2	Rm. 210	450	40	36	LS	30	F42T8	59	1.77	1,440	2,549
49				2	Rm. 211	391	40	36	LS	18	F42T8	59	1.06	1,440	1,529
50				2	Rm. 212 (Storage)	NA	1	36	LS	4	F44T8	112	0.45	36	16
51				2	Rm. 212 (Storage)	NA	1	36	LS	4	F42T8	59	0.24	36	8
52				2	Rm.213 (Media Storage)	400	10	36	LS	15	F42T8	59	0.89	360	319
53	ECM	MS	DL	2	Rm.214	NA	20	36	LS	32	F42T8	59	1.89	720	1,359
54	ECM	MS	DL	2	Music Office	NA	20	36	LS	1	F44T8	112	0.11	720	81
55	ECM	MS	DL	2	Band Office	NA	20	36	LS	6	F44T8	112	0.67	720	484
56	ECM	MS	DL	2	Closet	NA	15	36	LS	1	F44T8	112	0.11	540	60
57	ECM	MS		2	Mens & Women Restroom	NA	45	42	LS	2	F42T8	59	0.12	1,890	223
58	ECM	MS		2	Wood Shop	NA	40	36	LS	12	F42T8	59	0.71	1,440	1,020
59	ECM	MS		2	Art Room	NA	40	36	LS	28	F42T8	59	1.65	1,440	2,379
60	ECM	MS		2	Rm. 224	NA	40	36	LS	28	F42T8	59	1.65	1,440	2,379
61	ECM	MS		2	Media Center	510	40	36	LS	90	F42T8	59	5.31	1,440	7,646
62	ECM	MS	DL	2	Rm. 219	520	40	36	LS	4	F44T8	112	0.45	1,440	645
63	ECM	MS	DL	2	Rm. 217	570	40	42	LS	6	F44T8	112	0.67	1,680	1,129
64	ECM	MS	DL	2	Rm.221	440	40	36	LS	4	F44T8	112	0.45	1,440	645
65	ECM	MS	DL	2	RM 223	440	40	36	LS	5	F44T8	112	0.56	1,440	806
66	ECM	MS	DL	2	Rm 219	NA	40	42	LS	1	F44T8	112	0.11	1,680	188
67	ECM	MS	DL	2	Rm.225	635	40	36	LS	5	F44T8	112	0.56	1,440	806
68	ECM	MS	DL	2	Rm. 226	350	40	36	LS	4	F44T8	112	0.45	1,440	645
69	ECM	MS	DL	2	Rm. 227	555	40	36	LS	4	F44T8	112	0.45	1,440	645
70	ECM	MS	DL	2	Rm. 228	450	40	36	LS	6	F44T8	112	0.67	1,440	968
71	ECM	MS	DL	2	Rm.229	350	40	36	LS	2	F44T8	112	0.22	1,440	323
72	ECM	MS	DL	2	Rm.230	455	40	36	LS	6	F44T8	112	0.67	1,440	968
73	ECM	MS	DL	2	Rm. 233	1124	40	36	LS	2	F44T8	112	0.22	1,440	323
74	ECM	MS	DL	2	Rm. 235	1124	40	36	LS	2	F44T8	112	0.22	1,440	323
75	ECM	MS	DL	2	Rm. 237	420	40	36	LS	1	F44T8	112	0.11	1,440	161
76	ECM	MS	DL	2	Rm. 274	400	40	36	LS	6	F44T8	112	0.67	1,440	968
77	ECM	MS	DL	2	Rm. 272	400	40	36	LS	6	F44T8	112	0.67	1,440	968
78	ECM	MS	DL	2	Rm. 270	540	40	36	LS	6	F44T8	112	0.67	1,440	968
79	ECM	MS	DL	2	Rm.276	540	40	36	LS	6	F44T8	112	0.67	1,440	968
80	ECM	MS	DL	2	Rm. 268	540	40	36	LS	4	F44T8	112	0.45	1,440	645
81	ECM	MS	DL	2	Rm. 284	411	40	36	LS	6	F44T8	112	0.67	1,440	968

PRE-INSTALLATION															
Line Item	**ECM**	**Type of ECM Code** (Refer to ECM Code Worksheet)	**Additional ECM Code (if applicable)**	**Floor**	**Area Description**	**Light Reading** (Record if ECM)	**Usage**	**Usage**	**Existing Control**	**Pre Fixt. No.**	**Pre Fixt Code** (Refer to Wattable Table Worksheet)	**Pre Watts / Fixt**	**Pre kW / Space**	**Baseline Annual Hours**	**Annual kWh Consumed**
Integer line number	(Type 'ECM' for lighting retrofit)	ECM CODE Worksheet Link	For two ECMs in one line item	Floor fixture is on	Description of location that matches site map	Lux	hrs/ Week	Wks/Yr	control device (refer to legend above)	# of existing fixtures	TypWattage Table	Watts/Fixt from Wattage Table	(Pre Watts/Fixt) * (Pre Fixt No.)	Existing annual hours used	(PreFixt #*PreWatts/Fixt * Baseline Hrs)
82	ECM	MS	DL	2	Rm.285	650	40	36	LS	6	F44T8	112	0.67	1,440	968
83	ECM	MS	DL	2	Rm. 282	555	40	36	LS	6	F44T8	112	0.67	1,440	968
84	ECM	MS	DL	2	Rm. 280	425	40	36	LS	6	F44T8	112	0.67	1,440	968
85	ECM	MS	DL	2	Rm. 278	463	40	36	LS	4	F44T8	112	0.45	1,440	645
86	ECM	MS	DL	2	Rm. 281	496	40	36	LS	6	F44T8	112	0.67	1,440	968
87	ECM	MS	DL	2	Rm. 283	551	40	36	LS	6	F44T8	112	0.67	1,440	968
88	ECM	MS	DL	2	Rm. 260	563	40	36	LS	6	F44T8	112	0.67	1,440	968
89	ECM	MS	DL	2	Rm. 266	574	40	36	LS	6	F44T8	112	0.67	1,440	968
90	ECM	MS	DL	2	Rm. 262	320	40	36	LS	6	F44T8	112	0.67	1,440	968
91	ECM	MS	DL	2	Rm. 264	455	40	36	LS	6	F44T8	112	0.67	1,440	968
92	ECM	MS	DL	2	Rm. 254	451	40	36	LS	6	F44T8	112	0.67	1,440	968
93	ECM	MS	DL	2	Rm. 252	465	40	36	LS	6	F44T8	112	0.67	1,440	968
94	ECM	MS	DL	2	Rm. 253	233	40	36	LS	6	F44T8	112	0.67	1,440	968
95	ECM	MS	DL	2	Rm.251	356	40	36	LS	6	F44T8	112	0.67	1,440	968
96	ECM	MS	DL	2	Rm. 250	5451	40	36	LS	6	F44T8	112	0.67	1,440	968
97	ECM	MS	DL	2	Rm. 248	453	40	36	LS	5	F44T8	112	0.56	1,440	806
98	ECM	MS	DL	2	Rm. 243	373	40	36	LS	1	F44T8	112	0.11	1,440	161
99	ECM	MS	DL	2	Rm. 241	459	40	36	LS	6	F44T8	112	0.67	1,440	968
100	ECM	MS	DL	2	Rm. 239	653	40	36	LS	4	F44T8	112	0.45	1,440	645
101	ECM	MS	DL	2	Rm. 240	463	40	36	LS	4	F44T8	112	0.45	1,440	645
102	ECM	MS	DL	2	Rm. 246	453	40	36	LS	4	F44T8	112	0.45	1,440	645
103	ECM	MS	DL	2	Rm. 242	436	40	36	LS	8	F44T8	112	0.90	1,440	1,290
104	ECM	MS	DL	2	Rm. 244	563	40	36	LS	8	F44T8	112	0.90	1,440	1,290
105	ECM	MS	DL	2	Rm.255	650	40	36	LS	6	F44T8	112	0.67	1,440	968
106	ECM	MS	DL	2	Rm. 256	655	2	36	LS	4	F44T8	112	0.45	72	32
107				2	Staff Restroom	NA	25	36	OS	1	FU3T8	89	0.09	900	80
106				2	Boys Restroom	250	25	36	OS	1	F44T8	112	0.11	900	101
107				2	Girls Restroom	255	22	36	OS	1	F44T8	112	0.11	792	89
108				2	Boys Bathroom	255	20	36	OS	1	F44T8	112	0.11	720	81
109				2	Mens Bathroom	200	20	36	OS	1	F42T8	59	0.06	720	42
110				2	Girls Restroom	190	22	36	OS	1	F44T8	112	0.11	792	89
111				2	Main Office-238	442	40	42	LS	4	F43T8	89	0.36	1,680	598
112				2	Main Office-238	442	40	42	LS	2	FU3T8	89	0.18	1,680	299
113	ECM	MS		2	Main Office-Lobby	628	40	42	LS	6	F43T8	89	0.53	1,680	897
114	ECM	MS		2	Special Education	400	40	36	LS	2	F43T8	89	0.18	1,440	256
115	ECM	MS		2	Dianne List	980	40	42	LS	2	F43T8	89	0.18	1,680	299
116	ECM	MS		2	Book Keeper	1000	40	42	LS	2	F43T8	89	0.18	1,680	299
117	ECM	MS		2	Principals Office	936	40	42	LS	4	F43T8	89	0.36	1,680	598
118				2	Auditorium-Stage	1200	20	36	LS	10	F44T8	112	1.12	720	806
119				2	Auditorium	150	20	36	LS	23	H250	250	5.75	720	4,140
120	ECM	TL			Hallways	350	90	42	LS	16	FU3T8	89	1.42	3,780	5,383

PRE-INSTALLATION

Line Item	ECM	Type of ECM Code (Refer to ECM Code Worksheet)	Additional ECM Code (if applicable)	Floor	Area Description	Light Reading (Record if ECM)	Usage	Usage	Existing Control	Pre Fixt. No.	Pre Fixt Code (Refer to Wattable Table Worksheet)	Pre Watts / Fixt	Pre kW / Space	Baseline Annual Hours	Annual kWh Consumed
Integer line number	(Type 'ECM' for lighting retrofit)	ECM CODE Worksheet Link	For two ECMs in one line item	Floor fixture is on	Description of location that matches site map	Lux	hrs/ Week	Wks/Yr	control device (refer to legend above)	# of existing fixtures	TypWattage Table	Watts/Fixt from Wattage Table	(Pre Watts/Fixt) * (Pre Fixt No.)	Existing annual hours used	(PreFixt #*PreWatts/Fixt * Baseline Hrs)
121	ECM	TL	DL		Hallways	310	90	42	LS	317	F41T8	31	9.83	3,780	37,146
122	ECM	TL			Hallways	400	90	42	LS	20	F43T8	89	1.78	3,780	6,728
123	ECM	TL	DL		Hallways	Varies	90	42	LS	32	F44T8	112	3.58	3,780	13,548
124	ECM	MS		1	Cafeteria	450	40	36	LS	50	FU3T8	89	4.45	1,440	6,408
125				1	Kitchen Office & Storage	450	40	36	LS	6	F43T8	89	0.53	1,440	769
126	ECM	RB		EXT	Exterior Lights	NA	72	52	TM	8	MH70	95	0.76	3,744	2,845
127	ECM	RB		EXT	Portables Exterior	NA	72	52	TM	10	MH175	215	2.15	3,744	8,050
									Total Pre Fixt.	**1,355**		**Total Pre kW**	**116**	**kWh Consumed**	**219,798**

Light Intensity	0.818	**Usage Intensity**	1.55
	Watt/ ft2		KWh / ft2

APPENDIX H:
ECM CALCULATIONS

UIC	**Replace Inefficient Heating Plant**
EAH 1A	**Details: Replace the Existing Boiler plant with three (3) Condensing Boilers**

Select Type of Heating Fuel	Natural Gas (Select)	
Select Boiler Type:	**Condensing Boiler**	
No. of Heating Units To Be Replaced:	2	Qty
Estimated Actual Heating Fuel Used For Heating:	77,756	Therms
Existing Average Annual Heating Plant Efficiency:	69%	%
Insert I/P MBH rating of The Proposed Boiler:	4,528	MBH
Improved/New Heating Plant Efficiency:	94%	%
Estimated New Heating Fuel Consumption With Improved Efficiency:	56910.77	Therms
Estimated Heating Fuel Savings:	20845.226	Therms
Average Cost/Unit For Heating Fuel:	$1.12	$/Therm
Estimated Annual Cost Savings:	$23,269	$$
Estimated Annual O&M Savings:	$698	$$
Removal of Existing Heating Equipment Cost:	$7,500	
Installation Labor Cost of Installing New Equipment:	$9,000	
Material Cost of New Equipment:	$135,840	
Overhead, Profit, and Contingency Costs:	$18,281	
Estimated Cost of New Heating Plant (or Cost of Improvement)	$170,621	$$
Estimated Total Cost For Replacing All Heating Plants:	$366,493	
Simple Payback:	15.29	years

Type of Recommendation — Capital Cost ECM Recommendation

UIC	Replace High Flow Faucet Aerators To Low Flow Faucet Aerators
EAP2	Details: Install 0.5 GPM Aerators

No. of Residents	829		Number of Occupied Days/Week (Max 7)	5	

KITCHEN FAUCETS			BATHROOM FAUCETS		
Do You Want To Replace Kitchen Faucets Aerators	No	*(Select)*	Do You Want To Replace Bathroom Faucets Aerators	Yes	*(Select)*
Total Number of Faucet Aerators To Be Replaced	0		Total Number of Faucet Aerators To Be Replaced	58	
GPM of Existing Faucet Aerators	2.2	GPM	GPM of Existing Faucet Aerators	1.5	GPM
GPM of Proposed Faucet Aerator	2.2	GPM	GPM of Proposed Faucet Aerator	0.5	GPM
Estimated Number of Uses Per Day	0		Estimated Number of Uses Per Day	2	
Estimated No. of Operational Weeks	0		Estimated No. of Operational Weeks	36	
Estimated Time Per Faucet Use	0.50	Mins	Estimated Time Per Faucet Use	0.16	Mins
Annual Water Savings From Kitchen Faucets	0.00	kGal	Annual Water Savings From Bathroom Faucets	47.75	kGal

WATER & ENERGY SAVING CALCULATION			COST SAVING CALCULATION		
Select Type of Water Heater Fuel:	Natural Gas	(Select)	Heating Fuel Tariff	$1.116	$/Therm
DHW plant efficiency:	75%		Water Tariff ($/1000 Gal)	**0**	$/kGal
Equivalent Heating Energy savings:	38185.36	kBtu	Annual Cost Savings In Form of Water	$0	$$
Equivalent Heating Fuel Savings:	381.85	Therms	Annual Energy Savings From Water Heater	$426	$$
Annual Water Savings	47.75	kGal			

COST BENEFIT ANALYSIS				
Estimated Total Annual Cost Savings	$426	$$	Estimated Total Installation Cost	$623	$$
Simple Payback Period	1.46	Years	*Type of Recommendation*	No/Low Cost ECM Recommendation	

UIC	**Replace Existing Hot Water Heater With New Energy Efficient Water Heater**
EAD3	**Details: Repalce Old Gas Fired Water Heater**

	Number of Water Heaters Being Replaced:	1	
	Size of Existing Water Heater Storage Tank:	125	gallons
Step 1	**Existing Water Heater Details**		
	Select Existing Hot Water Heater Fuel	Natural Gas	
	Input Existing Water Heater Input Rating	800.00	kBtus
	Input Annual Hours of Operations	175	hrs
	Estimated Annual Current Hot Water Heater Energy Consumption	1,400	Therms
	Total Estimated Annual Operating Energy Costs	$1,562.76	$
Step 2	**Proposed New Water Heater**		
	Proposed Hot Water Heater Fuel	Natural Gas	
	Input Proposed New Water Heater Capacity	125	gallon
	If Natural Gas Fired Select Type: *(Available in 50,60,93,100,125,130 Gall Only)*	Condensing	
	Input Proposed Water Heater Input Rating	285.00	kBtu/hr
	Proposed Annual Hours of Operations	150	hrs
	Annual kBtuh Consumption of the Proposed Water Heater	42750.00	kBtuh
	Estimated Annual Water Heater Fuel Consumption	428	Therms
	Estimated Annual Energy Costs	$477	$
Step 3	**Energy & Cost Saving Calculation**		
	Estimated Cost of New Water Heater/Unit	$10,534	$$
	Estimated Installation Cost Per Heater	$350	$$
	Total Estimated Installation Cost	$11,689	$$
	Total Estimated Annual Cost Savings	$1,086	$
	Simple Pay Back Period	10.77	Years
	Type of Recommendation	Capital Cost ECM Recommendation	

UIC	Replace Existing Air Conditioners with Energy Star Air Conditioners
EAH3	Details: Replace older Rooftop Condensing Units

Type of Air Conditioner: Residential Single/Split Package

Cooling Hrs: 729 Hrs Electric Rate: **$0.19** $/kWh

Serves	Year	Model No.	Existing Tonnage	Existing EER	Existing kWh	Proposed Tonnage	Proposed EER	Proposed kWh	Energy Savings:	Cost Savings:	Cost	Installation	Total Cost:
Secretary's Office	1993	TTRO12C100	1	7	1250	1	16.47	531	719	$134	$390	$1,100	$1,490
Admins Office	1993	TTRO12C100	1	7	1250	1	16.47	531	719	$134	$390	$1,100	$1,490
A/C Nurse	1993	TTR012C1	1	7	1250	1	16.47	531	719	$134	$390	$1,100	$1,490
Rm 258	1995	TTR024C100A1	2	7.5	2333	2	16.47	1062	1271	$237	$390	$1,100	$1,490
Rm 278	1995	TTR036C100	3	8.1	3240	3	18.23	1440	1800	$336	$390	$1,100	$1,490
Rm 200	1995	TTR024C100A1	2	7.6	2302	2	16.47	1062	1240	$231	$390	$1,100	$1,490
Rm 210	1995	TTA048C300	4	8.6	4069	4	18.23	1919	2149	$401	$390	$1,100	$1,490
Rm 220	1995	TTA048C300	2	8.6	2034	2	16.47	1062	972	$181	$390	$1,100	$1,490
Rm.224	1995	TTA048C300	2	8.6	2034	2	16.47	1062	972	$181	$390	$1,100	$1,490
Rm 219,221	1995	TTA060C300	5	9	4860	5	18.23	2399	2461	$459	$390	$1,100	$1,490
Cluster Rm	1995	TTA120B300	10	8.2	10668	10	16	5468	5201	$970	$390	$1,100	$1,490

18,221 kWh

Annual Cost Savings: $3,397 Simple Payback: 4.82 Years

Total Cost For Installation: $16,390 Capital Cost ECM Recommendation

UIC	Replace High Intensity Discharge Lamp (HID) with Induction Lighting		
EAL9	Details: Exterior Wall Packs, Blue and Green Gymnasium		
Step:1	Number of 60-100W HID Lamps Replaced by 40W Induction	8	
	Number of 100-150W HID Lamps Replaced by 70W Induction	10	
	Number of 150-200W HID Lamps Replaced by 85W Induction	0	
	Number of 200-250W HID Lamps Replaced by 120W Induction	0	
	Number of 250-300W HID Lamps Replaced by 165W Induction	0	
	Number of 300-400W HID Lamps Replaced by 250W Induction	20	
	Number of 1000W HID Lamps Replaced by (2)300W Induction Lamps	0	
	Installation Cost Analysis		
Step:2	Subtotal Cost of 40 Watt Induction Self Ballast Retrofit	$1,080	
Step:3	Subtotal Cost of 70 Watt Induction Retrofit	$3,700	
Step:4	Subtotal Cost of 85 Watt Induction Retrofit	$0	
Step:5	Subtotal Cost of 120 Watt Induction Retrofit	$0	
Step:6	Subtotal Cost of 165 Watt Induction Retrofit	$0	
Step:7	Subtotal Cost of 250 Watt Induction Retrofit	$11,100	
Step:8	Subtotal Cost of 300 Watt Induction Retrofit	$0	
Step:9	**Total Cost For Retrofit**	$18,086	
	Energy & Cost Saving Analysis		
Step:10	Estimated Annual Energy Savings	31,851	kwh
Step:11	Electric Rate:	$0.19	$
Step:12	Estimated Annual Cost Savings	$5,938	
Step:13	Existing Annual Usage *(For O&M Savings)*	3570	hrs
	Proposed Annual Usage Post Retrofit *(For O&M Savings)*	1050	hrs
	Estimated Annual O&M Savings	$180	$$
Step:14	Total Estimated Annual Cost Savings *(Energy & O&M Savings)*	$6,118	$$
Step:15	Simple Pay back Period	2.96	Yrs

Type of Recommendation — Capital Cost ECM Recommendation

NOTE: Induction Lamps contain 3 to 4 times the life of HID lamps where significant Operation and Maintenance Savings are attained through minimizing frequency of bulb and ballast replacements

UIC	**Install Tandem Lighting System In Hallways**
EAL6A	**Details: Throughout The Hallways**

Total Number of Light Fixtures in Hallways	226	
No. of Fixtures To Be Controlled By Occupancy Sensors	113	
Total Number of Fixtures To Be Left On All Times	113	
Total Number of Linear Florescent Lamps To be Replaced *$5/28W-T8 Lamp*	0	
Total Number of Fixtures To Be Retrofitted with Rapid Start Ballast *$35/Rapid Start Ballast*	113	
Are the Ballast being replaced? (Y/N)	Yes	
Total Number of Lighting Control Sensors To be Installed *Ceiling Mounted Occupancy Sensors $135/ Sensor*	36	
Estimated Total Material Cost For The Proposed Retrofit:	$8,815	
Estimated Labor Cost For The Retrofit:	$7,920.75	
Cost For Installing Parabolic Reflectors	$1,440	
TOTAL ESTIMATED COST FOR RETROFIT	$18,176	
Total Energy Saved	44962.00	kWh
Electric Rate:	**$0.19**	$/kWh
Estimated Annual Cost Savings	$8,383	
Estimated Return on Investment	2.17	Yrs

Type of Recommendation — Capital Cost ECM Recommendation

UIC	Delamp Fixtures In Individual Rooms And Install Lighting Controls
EAL4	Details: All Classrooms, Offices And Media Centers

Total Number of Rooms	100	
Total Number of T12 lamps to Be replaced by T8's in All Rooms	0	
Total Number of Incandescent Lamps to be replaced with CFL's	13	
Total Number of Fixtures To Be Retrofitted with Rapid Start Ballast	687	
Are the Ballast being replaced? (Y/N)	Yes	
Total Number of Lighting Control Sensors To be Installed	105	
Price Per Lamp $6.00/CFL Lamp & $3.00 /T8 Lamp		
Cost / Rapid Start Electronic Ballast	$35.00	
Type of Proposed Lighting Control Sensors	Ceiling Mounted Occupancy Sensor	
Total Cost Of Ceiling Mounted Occupancy Sensor ($135X)	$135.00	
Total Material Cost	$38,265.50	

LABOR COSTS

Total Labor Cost For Installing Lighting Control Sensors ($ 65X)	$6,825.00	
Total Labor Cost For Replacing Ballasts ($50X)	$34,350.00	
Labor Cost For Replacing CFL Lamps ($65/20 Lamps)	$42.25	
Total Labor Cost For Replacing Individual Linear Fluorescent Lamps ($65/12 Lamps)	$0.00	
Total Labor Costs	$41,217.25	
TOTAL INSTALLATION COSTS	$85,364	
Total Energy Savings From Retrofits in Rooms:	40,379.00	kWh
Electric Rate:	**$0.19**	$/kWh
Total Cost Savings	$7,528	
Simple Pay Back Period	**11.34**	Yrs
Type of Recommendation	Capital Cost ECM Recommendation	

UIC	**Replace Existing Motors With High Efficiency Motors**
EAM1	**Details: HV-1, 2 and Cluster AHU**

Enter The Number of Existing Motors	3	
Enter Horse Power of Existing Motor:	5	hp
Enter Existing Annual Hours of Operation:	1140	Hrs
Enter Existing Name Plate Efficiency:	86.5%	
Type of Current Supplied	Single Phase Current	
Enter The Number of Proposed Motors	3	
Enter Horse Power of Proposed Motor:	5	hp
Enter Proposed Annual Hours of Operation:	1140	Hrs
No. of Poles of the Proposed Motor:	**4 Pole (1800 RPM)**	
Select Type of Motor:	**Totally Enclosed Fan Cooled**	
Enter NEMA Premium Efficiency of Proposed Motor :	90.2%	
Peak kW savings with Premium Motor:	0.45	kW
Annual kWh Savings From All Premium Motors:	514	kWh
Electricity Cost/kWh:	**$0.19**	per kWh
Estimated Annual Cost Savings From Energy:	$96	$$
Estimated Annual O &M Savings:	$5	$$
Estimated annual cost savings:	$101	$$
Estimated cost to replace *one* motor w/Premium motor: *(Material And Installation Cost)*	$938	$$
Total Replacement Cost	$3,023	$$
Simple Payback:	30.03	Yrs
Type of Recommendation	Capital Cost ECM Recommendation	

UIC	Install On-Demand Ventilation on Air Handlers
EAC1	Details: AHU Serving Rm. 220,222,224,212,216, AHU-6, Green Gym And Cafeteria

ENTER EXISTING CONDITION

Estimated Facility Sq.Ft Under Consideration:	15,065	Sq.ft	No. of Sensors To Be Installed (One/AHU)	8	Qty
Outside Air Intake CFM (Cubic Feet/Min):	5,273	CFM	Estimated Savings From On-Demand Ventilation	15%	CFM

WINTER			SUMMER		
Select Type of Heating Fuel	Natural Gas (Select)		Is The Building Cooled?	Yes (Select)	
Estimated Annual Heating Plant Efficiency % *(COP in Case of Heat Pumps Only Max 4.5)*	80.00	%	Estimated Annual Cooling Plant Efficiency (EER)	7.80	EER
Annual Heating Degree Days(HDD):	5,641		Annual Cooling Degree Days(CDD):	678	
Estimated Annual Energy Consumed For Heating Outside Air During Winter	770,954	kbtu/Yr	Estimated Annual Energy Consumed For Cooling Outside Air During Summer	92,662	kbtu/Yr
Estimated Annual Input Heating Energy Savings By Use of On-Demand Ventilation System	1,446	kbtu/Yr	Estimated Annual Input Cooling Energy Savings By Use of On-Demand Ventilation System	1,782	kbtu/Yr
Estimated Intake Annual Heating Fuel Savings:	14.46	Therms	Estimated Annual Intake Cooling Fuel Savings:	228.46	kWh
Cost/Unit of Heating Fuel:	$1.12	$/Therm	Cost/Unit For Electricity	$0.19	$$
Estimated Annual Heating Cost Savings	16.14	$$	Estimated Annual Cooling Cost Savings	42.59	$$

COST ANALYSIS

Estimated Annual O&M Savings	$2.94	$$	Estimated Installation Cost (Including Labor)	$7,600	$$
Total Estimated Annual Cost Savings	$62	$$	Total Estimated Installation Cost	$8,162	$$
Simple Pay Back Period	132.36	Yrs	*Type of Recommendation*	Capital Cost ECM Recommendation	

UIC	Install Variable Frequency Drives (VFD)
EAC4	Details: Install VFD's on Front Boiler Room Pumps

Cost/kWh: **$0.19**

Existing Motor

No. of Motors:	2		Are Motors To be Replaced?	Yes
Individual Motor HP:	15	HP	No. of Motors To be Replaced?	2
Existing Motor Effi:	89.50%		Cost of New Motor (Includes Installation)	$2,025
Proposed Motor Effi:	93.00%		Cost For All New Motors:	$4,051
Load Factor:	85%		No. of VFD To Be Installed:	2
Existing Motor Power:	10.63	kW	Cost Per VFD (Excluding Installation):	$2,125
Proposed Motor Power:	10.23	kW	Estimated Labor cost/VFD:	$1,685
Hrs of Operation/Yr:	2397.00	Hrs		

% Load	% hours	Hours	VFD Factor	Full Load kW	Fraction of full load power (kW) with VFD	kW Reduction with VFD	kWh Savings with VFD
0%	0%	-	-	10.63	0.00	10.63	-
10%	1%	24	0.03	10.63	0.31	10.32	247
20%	2%	48	0.07	10.63	0.72	9.91	475
30%	2%	48	0.13	10.63	1.33	9.30	446
40%	5%	120	0.21	10.63	2.15	8.48	1,016
50%	20%	479	0.30	10.63	3.07	7.56	3,624
60%	20%	479	0.41	10.63	4.19	6.43	3,085
70%	20%	479	0.54	10.63	5.52	5.10	2,447
80%	15%	360	0.68	10.63	6.95	3.67	1,321
90%	10%	240	0.83	10.63	8.49	2.14	513
100%	5%	120	1.00	10.63	10.23	0.40	48
Total		**2,397**					**13,221**

Total Installation Cost:	$42,069		Number of Valves To Be Converted From 3 Way to 2	50
Average kW Reduction:	8.16			*($550/Valve)*
Annual kWh Savings Per Motor:	13221	per VFD	Select Type Of Motor Configuration	
			Motors Run In Lead Lag Configuration	
Total Savings From All Motors:	13,221	kWh		
Estimated annual cost savings:	$2,465	$$		
Simple Payback:	17.07	years		
Type of Recommendation	Capital Cost ECM Recommendation			

APPENDIX I:
SUPPORTING DOCUMENTS

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