ENERGY AUDIT
REPORT

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

ENERGY AUDIT REPORT

of

MITCHELL ELEMENTARY SCHOOL
187 Brookline Street
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
kkvadala@emgcorp.com

EMG Project #: 98515.11R-004.268
Date of Report: February 12, 2012
On-Site Date: September 9, 2011

EMG
DECISION INTELLIGENCE
25th ANNIVERSARY

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1. CERTIFICATION

EMG has completed an Energy Audit of Mitchell Elementary School located at 187 Brookline Street in Needham, Massachusetts. EMG visited the site on September 9, 2011.

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: Abdul Basit
Energy Auditor
Project Manager

Reviewed by: Brett Byers, Reviewer for
Kalyana Vadala
Program Manager

2. EXECUTIVE SUMMARY

The purpose of this Energy Audit is to provide Town of Needham and Mitchell Elementary 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.

Mitchell Elementary School is a single 1-story building containing 47,851 square feet. The site area is approximately seven acres. The original construction of the property was completed in 1950; this included the construction of the kindergarten, cafeteria, kitchen, and six classrooms. Later in 1950 the gym and eight more classrooms were added; and in 1969, the media center (library) and six more classrooms were added. There are currently 23 classrooms. Significant renovations to the building include a new steam boiler in 2009.

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.

Per discussions with the town maintenance department during the audit, it was mentioned to EMG that the Town of Needham will completely reconstruct the building around the year 2017. Because the building will be completely reconstructed, energy conservation measures (ECMs) with a payback greater than 5 years that would normally be recommended are provided to the client for informational purposes only in this report and are not considered within the group of recommended ECMs. Only ECMs with a payback less than 5 years are recommended.

Based on the onsite visit, the critical issues with this particular school are poorly constructed windows and the poor condition of a number of entrance doors. For example, some doors are broken and cannot be closed completely; windows are single pane and have substantial air gaps. In addition, the attic/crawlspace area in the school has little or no insulation (0 to 1 inch).

Summary of Existing Energy Performance

Building's Annual Energy Consumption	5,598,371 kBtu
Total Annual Energy Costs	$134,448

EMG has identified seven Energy Conservation Measures (ECMs) for this property. After evaluating the measures, only five of the seven are recommended for implementation. The savings for each measure are calculated using standard engineering methods followed in the industry, and detailed calculations for ECM are provided in Appendix G 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% markup to the implementation costs to account for engineering, design, and contingencies.

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 Initial ECM Investment *(Current Dollars Only)*	$19,740
Estimated Annual Cost Savings Related to ECMs *(Current Dollars Only)*	$11,612
ECM Effective Payback (years)	1.70
Estimated Annual Energy Savings	10%
Estimated Annual Energy Cost Savings	9%

List of Recommended Energy Conservation Measures Mitchell Elementary School								
ECM #	Description of ECM	Projected Initial Investment	Estimated Annual Energy Savings		Estimated Annual Water Savings	Total Energy Savings	Total Estimated Annual Cost Savings	Simple Payback
			No. 2 Oil	Electricity				
		$	Gallons	kWh	kgal	MMBtu	$	Years
No/Low Cost Recommendations								
1	Replace Incandescent Lamps With CFL's Details: Replace Incandescent Lamps in Storage Rooms	$38	0	67	0	0.23	$15	2.57
2	Install Energy Savers on Vending, Snack Machines Details: Install Energy Saver on Soda Machine	$190	0	690	0	2.35	$146	1.30
3	Install Automatic Lighting Controls Details: Install Photosensors in Hallway and Classroom	$632	0	2471	0	8.43	$524	1.21
Totals for No/Low Cost Items		**$860**	**0**	**3228**	**0**	**11**	**$685**	**1.25**
Capital Cost Recommendations								
1	Replace High Intensity Discharge Lamp (HID) with Induction Lighting Details: Replace Wallpacks and Parking Lights with Induction Lighting	$5,720	0	4688	0	16.00	$1,078	5.30
2	Improve Insulation Levels in Attic Details: Install Insulation in Attic	$10,586	4265	0	0	590.65	$11,139	0.95
Total For Capital Cost		**$16,306**	**4265**	**4688**	**0**	**607**	**$12,217**	**1.33**
	Interactive Savings Discount @ 10%		-426	-792		-62	-$1,290	
	Total Contingency Expenses @ 15%	$2,575						
Total for Improvements		**$19,740**	**3,838**	**7124**	**0**	**556**	**$11,612**	**1.70**

Apart from the above recommended measures, EMG has analyzed the following measures for consideration and long term capital planning. These measures are not recommended at the current time due to high initial investment and long payback yielding negative life cycle savings, but are recommended either at the time of equipment replacement or renovation.

Detailed List of Measures Evaluated For Consideration Mitchell Elementary School

ECM #	Description of ECM	Initial Investment	Annual Energy Savings		Annual Water Savings	Total Energy Savings	Total Estimated Annual Cost Savings	Payback
		$	Gallons	kWh	kgal	MMBtu	$	Years
1	Replace External Windows Details: Replace Windows in Gymnasium	$5,649	162	0	0	22.50	$426	13.24
2	Control External Air Leakage In The Building Details: Repair Doors and Install Weather Stripping on Doors	$6,715	34	0	0	4.75	$326	20.57
Total for Improvements		**$12,364**	**197**	**0**	**0**	**27**	**$753**	**16.42**

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 Mitchell Elementary School is performing above the national average level.

Below is the EPA Performance Rating:

Mitchell Elementary School:	50
National Average K-12 School:	50

Rating required to apply for Energy Star Certification:75

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. The building's Statement of Energy Performance follows. Associated energy performance documents may be found in Appendix H.

General Information

Needham: Mitchell Elementary School	
Gross Floor Area Excluding Parking: (ft²)	47,851
Year Built	1950
For 12-month Evaluation Period Ending Date:	June 30, 2011

Facility Space Use Summary

School	
Space Type	K-12 School
Gross Floor Area(ft2)	47,851
Open Weekends?[d]	No
Number of PCs[d]	84
Number of walk-in refrigeration/freezer units	2
Presence of cooking facilities[d]	Yes
Percent Cooled	40
Percent Heated	100
Months[e]	9
High School?	No
School District[e]	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	50	50	75	N/A	50
Energy Intensity					
Site (kBtu/ft²)	117	117	92	N/A	118
Source (kBtu/ft²)	151	151	119	N/A	152
Energy Cost					
$/year	$ 134,448.32	$ 134,448.32	$ 105,616.65	N/A	$ 135,068.11
$/ft²/year	$ 2.81	$ 2.81	$ 2.21	N/A	$ 2.82
Greenhouse Gas Emissions					
$MtCO_2e$/year	438	438	344	N/A	440
$kgCO_2e/ft^2$/year	9	9	7	N/A	9

4. INTRODUCTION

The purpose of this Energy Audit is to provide Mitchell Elementary 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 onsite visual assessment to determine current conditions, itemize the energy consuming equipment (i.e. Boiler, 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, 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

Typically, around 475 people occupy the facility during normal operating hours. The school rents out portions of the school for use by the local community and also for special events during afterhours and during the summer; since the school is closed during the summer, these special events varies for the number of hours the school is open to both the public and to employees.

Facility Occupancy (avg. people/day)	475
Standard Operating Hours/day	10
Maintenance/ Staff Hours/day	10

Summary of Facility Operating Hours

	Hours Open to the Public	Hours Open to Employees
Monday-Friday	7 AM to 5 PM	6 AM to 5 PM
Saturday	Closed	Closed
Sunday	Closed	Closed

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 load-bearing, concrete masonry unit (CMU) exterior walls and interior steel columns. The upper floors and roofs are constructed with wood joists and are sheathed with plywood. The building has structural steel columns supporting the upper floors and roof.

According to the structural drawings, the primary roofs are both steeply sloped and flat. The sloped roofs are finished with gravel over a 4-ply built up roof membrane. The flat portion is gravel. The sloped roof portion is covered in asphalt shingles and was replaced in 2006.

The exterior walls are brick.

Item	Construction Type
Foundation	Slab on grade
Structure	Steel column and steel trusses for sloped roof structure
Exterior Walls	brick
Roof	Asphalt and gravel

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

Building Element	Type Observed	Observed R-values
Attic	Batt insulation	R - 2
Floors	None	None
Exterior Walls Above Grade	Batt insulation	R – 0.91
Basement Walls / Slab Perimeter	None	None
Windows	Single Pane	R-0.91
Exterior Doors	Wood and Insulated Metal	R-4 to R-15

The windows are aluminum-framed single-pane glazed units. The caulking is deteriorated and air infiltration is reported near the windows. The windows have issues with heat loss from the building. If the building was not planned for a complete reconstruction in 2016 or 2017, one recommendation would be to replace all the windows in the building. However, since this would be a relatively expensive capital project with payback in the order of 13 years, it is not recommended at this time.

The main entrance doors are fully solid wood entry doors. Weather stripping was observed around the door openings; the weather stripping was observed to be in poor to fair condition. The additional entrance doors are solid wood entry doors. These doors are also observed to be in poor condition. It is our recommendation that these doors be replaced with new weather stripping during reconstruction.

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

Mitchell elementary school has a central heating system that includes two steam boilers that provide steam to unit vents in classrooms and two air handling units serving the gymnasium and the cafeteria and to the majority of the building. The gym and cafeteria/auditorium air handlers provide heating only. In addition, steam is also passed through a heat exchange system that creates hot water that is used for heating in the “new” section (1969) of the school. There is no central cooling system; each classroom has a window unit for cooling.

The two steam boilers (Smith, model # 28-A12, 26.5 GPH #2 oil) provide low pressure steam – 4 to 6 psi - for heating.

Only one boiler is needed for heating the entire building. Condensate return pumps are (2hp) located in the boiler room and also additional condensate return pumps are located on the condensate return lines within the school (3/4 hp). The condensate tank, located in the boiler room, is approximately 1,000 gallons and is currently insulated.

The supply piping is about 4 to 5 inches in diameter, with lines into classrooms about 1.25 inches in diameter; the supply piping has fiberglass insulation. The return piping is about 3/4" in diameter and is currently not insulated as majority of piping is in crawlspace with presence of asbestos.

Each of the classrooms has one unit vent which has two blower motors. Based on the onsite visit, the unit vents, on average, provide 0.69 cfm/square foot**.** During the onsite visit, the indoor air temperature and relative humidity was 77 degrees F and 57%. The boilers were not operational at time of audit so heating temperatures could not be verified.

The air handling unit in the gymnasium area brings in fresh air and heats the air during winter, with steam supplied from the boiler. The model information for this air handling unit could not be discerned since the air handling unit is located at the gymnasium ceiling. Similarly, there is an air handling unit, located in the attic that supplies fresh air to the auditorium/cafeteria area. This unit is located in the attic and could not be accessed.

The stair wells, bathrooms, and other areas are ventilated by mechanical exhaust fans. Large capacity ventilation fans are mounted on the roof and are connected by concealed ducts to each ventilated space.

Item	Measured Values
Major Heating system type/capacity	Steam boilers
Major Cooling System type/capacity	Window units
Heating hot water supply temperature	160 degrees F to new section
Outside Air temperature & Relative Humidity (%) at time of audit	77 degrees F and 57%
Interior space temperatures & Relative Humidity (RH%)	77 degrees F and 57%
Supply Air Temperature (SAT)/Return Air Temperature (RAT)	Heating – not running during onsite visit. Normally 68 degrees F during the winter
Avg. Supply Air rate (CFM/Sq.ft)	0.69
Avg. Interior space thermostat set-point	68-72 ^{0}F
Avg. Outside Air rate (% & CFM/Sq.ft or CFM/person)	Varies; estimated 15-20 cfm/person

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

5.4. BUILDING LIGHTING

The interior lighting is T-8 lighting in the hallways, classrooms, offices, restrooms and library. In some storage rooms, 60 watt incandescent lighting is used. The lighting in the classrooms, restrooms and offices is controlled by motion sensors. The classroom lighting sensors are special sensors that are intended to turn the lights off when no motion is detected in the time interval, but would not automatically turn the lights on when motion is detected. The lights have to be manually turned on using the light switch which is an integral part of the sensor assembly. This will ensure that lights won't be automatically turned on but would be turned off. This set up will provide more energy savings than a normal sensor which would turn the lights both on and off based on motion.

It was also observed that there were several areas in the hallways and in some of the classrooms, there were light readings in excess of 700 Lux to 1,800 Lux. It is recommended that photo sensors be installed in these areas so that the lights only turn on when there is not enough outside light.

The exterior building lighting is 100 watt metal halide lights. These lights are controlled with timers and come on from dusk till dawn. It is recommended that these lights be replaced with induction lighting. Property-owned metal light pole provide site lighting.

Space type	Measured Light Levels (Lux/foot candles)	ASHRAE/IESNA Recommended Levels (foot candles)
Hallway area	200 Lux/18 FC	15
Hallway area	1800 Lux/168 FC	15
Classroom area	250 Lux/23 FC	30
Classroom area near windows	1100 Lux/102 FC	30
Library	500 Lux/46 FC	50
Avg. Building Lighting Density, W/Sq.Ft	0.572 W/Sq.Ft	1.2 W/Sq.Ft

Note: 1 foot candle = 10.764 Lux

The Lighting Systems Schedules in Appendix F 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

Not applicable. There are no elevators or conveying systems.

5.6. BUILDING DOMESTIC HOT WATER

The water meters are located in vaults adjacent to the public streets.

Domestic hot water is supplied by one oil fired water heater (AO Smith, model # COF 315A 934, 84 gallons).

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 2.2 GPM. The lavatories are operated by manual controls. There are no shower systems onsite.

DHW type	Water Heater
Storage Tank Capacity	86 gallons
Heating/tank set-point	140 ^{0}F
DHW temperature at faucet	138 ^{0}F
Building faucets, GPM	2.2
Water closets/toilets, GPF	1.6

5.7. BUILDING ELECTRICITY

The electrical supply lines run underground from pad-mounted transformer to interior-mounted electrical meters. The main electrical service size is 600 amps, 208/120-volt, three-phase, four-wire alternating current (AC). The electrical wiring is copper, installed in metallic conduit. Circuit breaker panels are located throughout the building.

Majority of the facility is master-metered for electricity. There are a total of two electric meters at the property.

Electrical Transformer Type (Wye, Delta)	Wye
Mounting	Pad mounted
Location	Front of building
Main Building Electric service	
Primary Volts	208
Secondary Volts	120
Phase	4
Wire	3
Amp	600
Onsite Generator (Y/N)	None
Generator Capacity, KVA	None
Generator Fuel Type	Not Applicable

Electric Meter type (Master/Sub/Direct)	Master	Natural Gas Meter type (Master/Sub/Direct)	Master
Meter Location	Electric Room	Meter Location	Electric Room
Main meter number	5067749	Main meter number	5041699

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-uses 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 Mitchell Elementary School, the following energy rates are utilized in determining existing and proposed energy costs.

Utility Rates used for Cost Analysis

Electricity (Blended Rate)	#2 Oil
$0.21/kWh	$2.60/gallon

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.

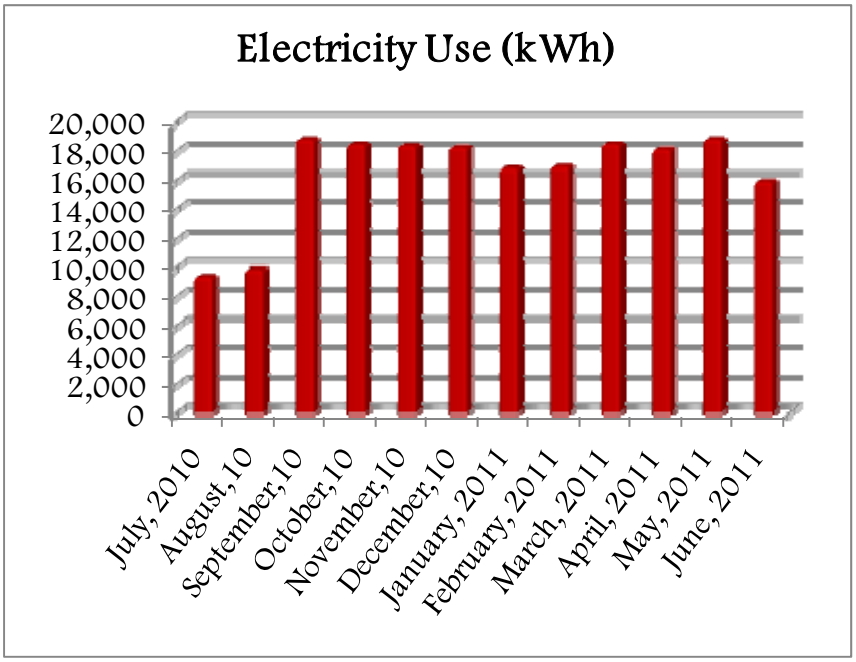
6.1. ELECTRICITY

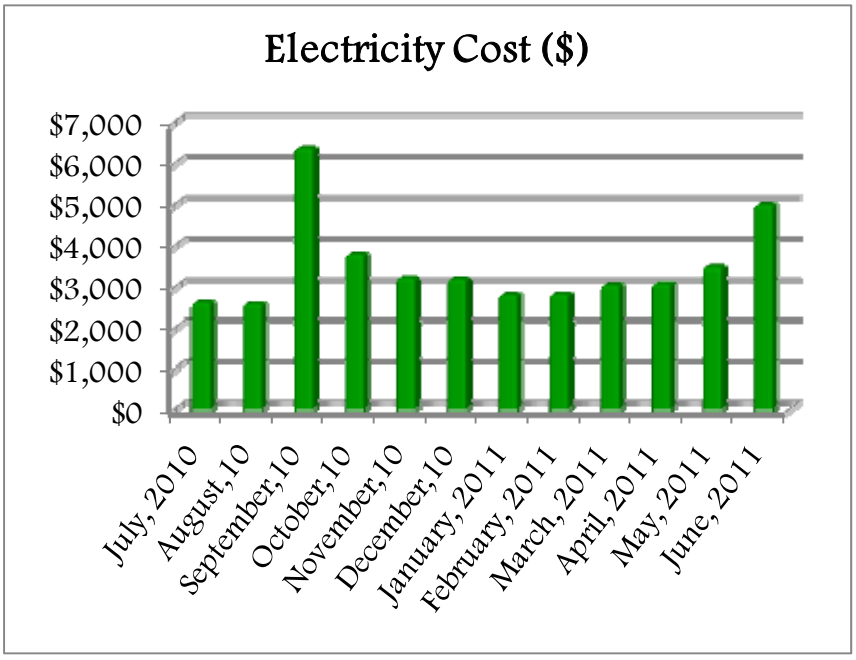
NStar satisfies the electricity requirements of the facility.

Based on the 2010-2011 electric usage & costs, the average price paid during the year was $0.21 per kWh. The total annual electricity consumption for the 12-month period analyzed is 198,549 for a total cost of $42,105.

Electricity Consumption and Cost Data

Billing Month	Consumption (kWh)	Unit Cost/kWh	Total Cost
July, 2010	9,402	$0.28	$2,627.59
August,10	9,889	$0.26	$2,590.81
September,10	18,826	$0.34	$6,387.26
October,10	18,487	$0.20	$3,788.52
November,10	18,402	$0.18	$3,236.49
December,10	18,281	$0.18	$3,207.57
January, 2011	16,841	$0.17	$2,813.39
February, 2011	16,965	$0.17	$2,822.73
March, 2011	18,513	$0.17	$3,058.54
April, 2011	18,149	$0.17	$3,088.59
May, 2011	18,831	$0.18	$3,482.42
June, 2011	15,963	$0.31	$5,001.42
Total	**198,549**	**$0.21**	**$42,105.33**


Electricity Use (kWh)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
July, 2010
August, 10
September, 10
October, 10
November, 10
December, 10
January, 2011
February, 2011
March, 2011
April, 2011
May, 2011
June, 2011


Electricity Cost ($)
$7,000
$6,000
$5,000
$4,000
$3,000
$2,000
$1,000
$0
July, 2010
August, 10
September, 10
October, 10
November, 10
December, 10
January, 2011
February, 2011
March, 2011
April, 2011
May, 2011
June, 2011

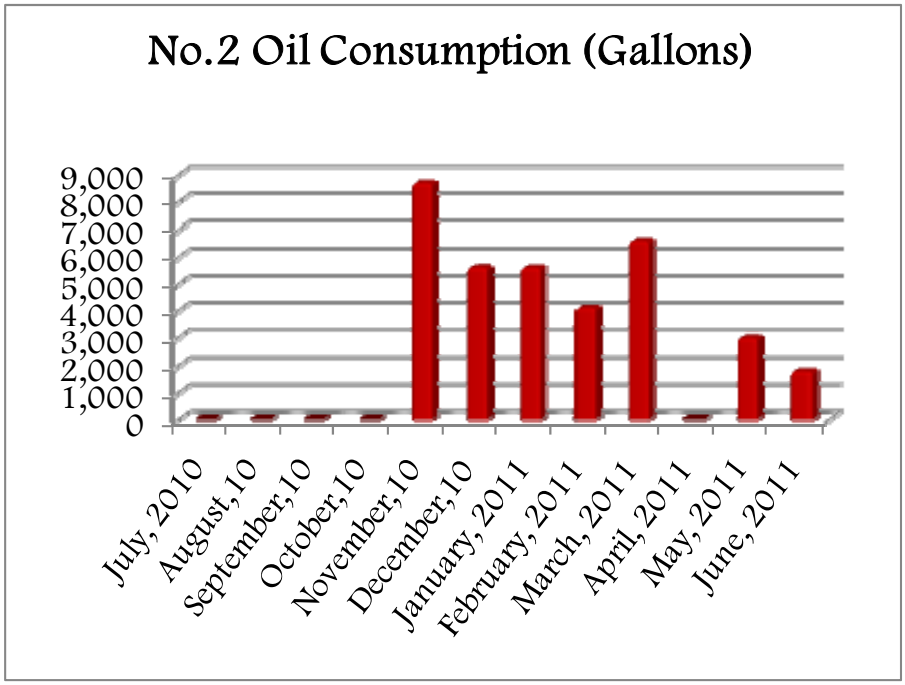
6.2. FUEL OIL

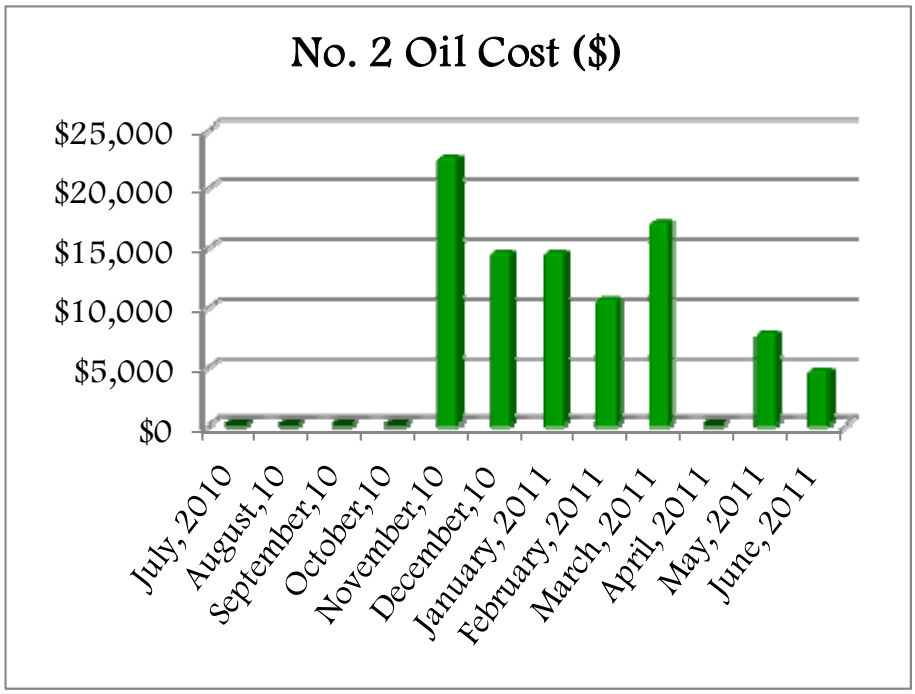
Local petroleum fuel companies satisfy the No. 2 Fuel Oil requirements of the facility. Deliveries are made on a monthly basis or as needed.

Based on the 2010-2011 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 35,530 gallons for a total cost of $92,342.

Oil Consumption and Cost Data

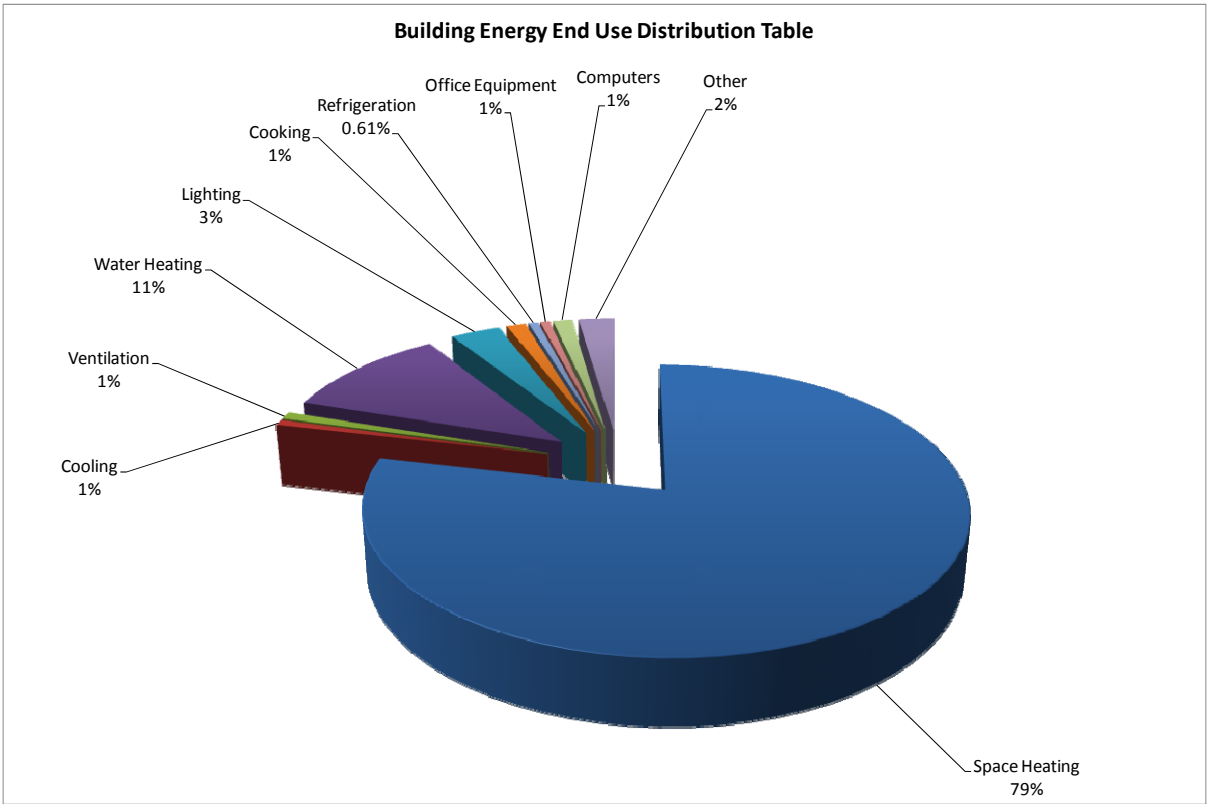
Month	Delivery (gallons)	Unit Cost	Total Cost
July, 2010	0	0	$0.00
August,2010	0	0	$0.00
September,2010	0	0	$0.00
October,2010	0	0	$0.00
November,2010	8,721	$2.60	$22,665.88
December,2010	5,629	$2.60	$14,629.76
January, 2011	5,618	$2.60	$14,600.92
February, 2011	4,121	$2.60	$10,709.96
March, 2011	6,622	$2.60	$17,209.28
April, 2011	0	0	$0.00
May, 2011	3,000	$2.60	$7,796.23
June, 2011	1,820	$2.60	$4,730.96
Total	**35,530**	**$2.60**	**$92,342.99**


No.2 Oil Consumption (Gallons)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
July, 2010
August,10
September,10
October,10
November,10
December,10
January, 2011
February, 2011
March, 2011
April, 2011
May, 2011
June, 2011


No. 2 Oil Cost ($)
$25,000
$20,000
$15,000
$10,000
$5,000
$0
July, 2010
August,10
September,10
October,10
November,10
December,10
January, 2011
February, 2011
March, 2011
April, 2011
May, 2011
June, 2011

7. END USE ENERGY DISTRIBUTION

Components of Annual Energy Use												
	Electricity (1 kWh = 3.412 kBtu)				Fuel Oil				Total Energy		Total Cost	
	%	kWh	kBtu	Cost	%	Gallons	kBtu	Cost	MBtu	% Total	Total- $	% Total
Space Heating	***13.0%***	25,713	87,731	$5,452.73	***87.7%***	*31,162*	4,315,954	80,991	4403.7	***78.7%***	$86,443	***64.3%***
Cooling	***5.2%***	10,350	35,314	$2,194.87			0	0	35.3	***0.6%***	$2,195	***1.6%***
Ventilation	***7.0%***	13,898	47,421	$2,947.37			0	0	47.4	***0.8%***	$2,947	***2.2%***
Water Heating	***0.1%***	181	618	$38.39	***12.3%***	*4,368*	604,968	11,352	605.6	***10.8%***	$11,391	***8.5%***
Lighting	***26.0%***	51,678	176,325	$10,959.10			0	0	176.3	***3.1%***	$10,959	***8.2%***
Cooking	***10.0%***	19,855	67,745	$4,210.53			0	0	67.7	***1.2%***	$4,211	***3.1%***
Refrigeration	***5.0%***	9,927	33,872	$2,105.27			0	0	33.9	***0.6%***	$2,105	***1.6%***
Office Equipment	***5.0%***	9,927	33,872	$2,105.27			0	0	33.9	***0.6%***	$2,105	***1.6%***
Computers	***10.0%***	19,855	67,745	$4,210.53			0	0	67.7	***1.2%***	$4,211	***3.1%***
Other	***18.7%***	37,129	126,683	$7,873.70			0	0	126.7	***2.3%***	$7,874	***5.9%***
Total	100.0%	**198,513**	677,327	$42,097.8	*100.0%*	***35,530***	4,920,922	92,343	**5598.2**	100.0%	**$134,441**	100.0%



8. ENERGY CONSERVATION MEASURES (ECM)

EMG has identified a total of five 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 equal to or 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)	117	kBtu/ft2
Post ECM Site Energy Use Intensity (EUI)	105	kBtu/ft2
Source Energy Use Intensity (EUI)	Rating	
Current Source Energy Use Intensity (EUI)	151	kBtu/ft2
Post ECM Source Energy Use Intensity (EUI)	138	kBtu/ft2
Building Cost Intensity (BCI)	Rating	
Current Building Cost Intensity	$2.81	/ft2
Post ECM Building Cost Intensity	$2.57	/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	7124	kWh
Estimated Annual Thermal Energy Reduction	3838	Gallons
Total CO_2 Emissions Reduced	3	$MtCO_2/yr$
Total Cars Off The Road (Equivalent)*	1	
Total Acres of Pine Trees Planted (Equivalent)*	1	

*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 Mitchell Elementary School

ECM #	Description of ECM	Projected Initial Investment	Estimated Annual Energy Savings		Estimated Annual Water Savings	Total Energy Savings	Estimated Cost Savings	Estimated Annual O&M Savings	Total Estimated Annual Cost Savings	Simple Payback	S.I.R.	Life Cycle Savings	Expected Useful Life (EUL)
			No. 2 Oil	Electricity									
		$	Gallons	kWh	kgal	MMBtu	$	$	$	Years		$	Years
No/Low Cost Recommendations													
1	Replace Incandescent Lamps With CFL's Details: Replace Incandescent Lamps in Storage Rooms	$38	0	67	0	0.23	$14	$0	$15	2.57	1.73	$28	5
2	Install Energy Savers on Vending, Snack Machines Details: Install Energy Saver on Soda Machine	$190	0	690	0	2.35	$146	$0	$146	1.30	9.19	$1,557	15
3	Install Automatic Lighting Controls Details: Install Photosensors in Hallway and Classroom	$632	0	2471	0	8.43	$524	$0	$524	1.21	9.90	$5,624	15
Totals for No/Low Cost Items		**$860**	**0**	**3228**	**0**	**11**	**$685**	**$0**	**$685**	**1.25**			
Capital Cost Recommendations													
1	Replace High Intensity Discharge Lamp (HID) with Induction Lighting Details: Replace Wallpacks and Parking Lights with Induction Lighting	$5,720	0	4688	0	16.00	$994	$84	$1,078	5.30	2.08	$6,149	15
2	Improve Insulation Levels in Attic Details: Install Insulation in Attic	$10,586	4265	0	0	590.65	$11,084	$55	$11,139	0.95	26.94	$274,598	50
Total For Capital Cost		**$16,306**	**4265**	**4688**	**0**	**607**	**$12,078**	**$139**	**$12,217**	**1.33**			
	Interactive Savings Discount @ 10%		-426	-792		-62	-$1,276	-$14	-$1,290				
	Total Contingency Expenses @ 15%	$2,575											
Total for Improvements		**$19,740**	**3,838**	**7124**	**0**	**556**	**$11,486**	**$126**	**$11,612**	**1.70**			

Apart from the above recommended measures, EMG has analyzed the following measures for consideration and long term capital planning. These measures are not recommended at the current time due to high initial investment and long payback yielding negative life cycle savings, but are recommended either at the time of equipment replacement or renovation.

Detailed List of Measures Evaluated For Consideration For Mitchell Elementary School

ECM #	Description of ECM	Initial Investment	Annual Energy Savings		Annual Water Savings	Cost Savings	Estimated Annual O&M Savings	Total Estimated Annual Cost Savings	Payback	S.I.R.	Life Cycle Savings	Expected Useful Life (EUL)
		$	Gallons	kWh	kgal	$	$	$	Years		$	Years
1	Replace External Windows Details: Replace Windows in Gymnasium	$5,649	162	0	0	$422	$4	$426	13.24	$2	$3,425	35.00
2	Control External Air Leakage In The Building Details: Repair Doors and Install Weather Stripping on Doors	$6,715	34	0	0	$89	$237	$326	20.57	$0	-$5,955	10.00
Total for Improvements		**$12,364**	**197**	**0**	**0**	**$511**	**$242**	**$753**	**16.42**			

If all of the above mentioned ECM's are implemented, Mitchell Elementary School could potentially save approximately $11,612 per year with an investment of $22,135, yielding a net effective payback of 1.92 years.

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 475 people.
- Annual Heating Equipment Operating Hours are derived from actual consumption and equipment input rates to be 2,500 hours/year
- Annual Cooling Equipment Operating Hours are derived from actual consumption and equipment input rates to be 300 hours/year
- Typical lighting operating hours are assumed to be 8 per day or 2,080 hours per year.

8.2. NO/LOW COST ECM DESCRIPTIONS

EMG has identified 3 No/Low Cost Energy Conservation Measures (ECMs) for this property. This includes all measures which can be implemented below the cost threshold of $1,000. The following paragraphs describe each of these ECMs.

8.2.1. Replace Incandescent Lights in Storage Areas with Fluorescent Lighting

Fluorescent lighting is recommended for areas where color sensitivity is an important criterion (e.g., offices or small parts assembly rooms). Screw-in fluorescent lamps are available to replace incandescent lamps. Power savings are typically 60%. Screw-in self-contained lamps, with a 10,000-hour life, can replace flood lights that have a 7,000-hour life. Screw-in circle light fixtures are also available.

Screw-in fluorescent lamps are generally not compatible with dimmers. New energy-efficient fluorescent lamps are continually being introduced. It is important to stay abreast of this technology so that the most efficient products may be used.

There are ten 60-watt incandescent lamps located in various storage rooms in the building. EMG recommends replacing all the incandescent lamps with CFL lamps as specified in the lighting ECM work sheet attached in the Appendix. Based on the calculations from the EMG lighting work sheet, it is estimated that the proposed retrofit of the specified incandescent lamps shall result in an annual energy savings of 67 kWh.

8.2.2. Install Energy Controls on Soda Machine

Vending machines are usually designed to operate all day round irrespective of the occupancy level in the office. This means that the vending machines operate for more than 12 hours a day when not required in case of commercial establishments.

There is one vending machine located in the teacher lounge and is not an energy star certified. EMG recommends installing vend misers on these vending machines, which will automatically reduce the running time of these machines during weekends and unoccupied hours. There are two types of vend misers; one has a timer in it, which is programmed to turn off or tune down the vending machines after the office hours and bring it back up an hour before the office opens.

The other is a motion sensor based system that tunes down the machines upon detecting no-occupancy for a pre-programmed duration of time. In the case of vending machines storing chilled products, the vend miser does not turn off the machine entirely, but reduces the operating time of the compressor, such that the machine maintains the products at a minimum tolerable temperature.

8.2.3. Install Photo-sensors in Select Classrooms and Hallway

One of the best ways to save energy is to turn off lights that are not needed. This saves energy, as well as extends the replacement time on lamps. (While frequent switching may in some cases shorten lamp life, the savings in electrical power will more than compensate).

The operating time of lighting systems can be reduced either automatically or manually. Automated controls are more reliable for ensuring that energy savings are achieved. Local switches can be labeled to encourage occupants to turn off lights when leaving an area. Individual switches in perimeter offices permit occupants to reduce lighting levels on sunny days. Sophisticated lighting control systems are available, but they are costly to retrofit. They should be considered when the lighting system is being replaced. With the exception of security lights, storeroom lighting can be placed on timed switches that shut off after the selected interval. All exterior lighting, as well as interior lighting in glass-enclosed vestibules, should be placed on photocell and/or timer control.

There were a number of classrooms that had lights on that were within 10 feet of windows; these windows provided sufficient outside light (greater than 500 Lux light reading) and would not require these lights to be on during the day. It is recommended that photo-sensors should be installed on classroom light fixtures near the windows so that the lights only come on when there is not enough outside natural light.

In addition, there is a section of hallway with window on both sides that also provides over 1,000 LUX light reading. It is recommended that these hallway lights should also be placed on photo-sensors control.

8.3. CAPITAL COST ECM DESCRIPTIONS

EMG has identified two Capital Cost Energy Conservation Measures (ECMs) for this property. This list includes recommended measures which have an estimated implementation cost equal to or greater than $1,000. The following paragraphs describe each of these ECMs.

8.3.1. Replace Exterior Building Wallpacks and Parking Lights with Induction Lighting

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: λ>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 metal halide lights are used in the exterior building wall-packs and the parking area. It is recommended that these lights should be replaced with induction lighting to reduce electrical energy usage and costs. Though this measure has more than 5 years of payback period, EMG recommends that these lights be left in place even during renovation phase.

8.3.2. Install Insulation in Attic

The amount of heat conduction through ceiling and roof is proportional to its overall heat transfer coefficient (commonly called the U-factor) and the temperature difference between the conditioned space and its surrounding, modified by the effect of solar intensity and wind velocity on the exterior surfaces. One of the most effective ways to reduce heat transfer through ceilings and roofs is to retard heat conduction by adding insulation.

Where the existing roof is sound and directly accessible from an attic or ceiling void, polyurethane foam or mineral fiber may be sprayed on the underside, with rigid batt or other applicable insulation for the inside surface. Insulation, typically fiber-glass batt, may also be laid on the top of a ceiling, taking care not to cover up light fixtures. It is generally not practical to insulate the exterior of the roof unless the roof needs to be replaced. In this case, rigid insulation may be used, and protected with a new roof membrane. As buildings become more insulated, the heat transfer through structural members becomes more significant, especially for buildings with metal structural members. Un-insulated structural members can degrade the performance of the insulation up to 20%, and resultant condensation can cause the structure to deteriorate. Therefore, care should be taken to properly insulate the structural members. Often more energy can be conserved by insulating the ceiling rather than the roof unless the attic is being used for special storage, frequent access is required, or a moderate attic temperature is desired. However, if only the ceiling is insulated, any ducting or piping should be insulated to avoid excessive heat transfer or freezing. It is important to be sure that the attic is ventilated by providing one to two inches of ventilation area per square foot of attic.

The attic area in the building is poorly insulated. Most of the visible attic space had batt insulation that was less than 1-inch thickness. Further, there were portions of the attic area that did not have any insulation.

8.4. MEASURES RECOMMENDED FOR CONSIDERATION

EMG has identified two measures that do not meet the financial screening criteria. The following paragraphs describe each of these measures.

8.4.1. Replace Windows in the Gymnasium

In the winter, the heat in the building is lost when cold outside air conducts the colder temperatures through the glass and infiltrates around the edges of windows. The cold drafts and the cold window pane surfaces may make the interior occupants uncomfortable. This effect is measured by the window assembly's U-value (insulating property). The U-value is a measure of the rate of non-solar heat flow through a window assembly by conduction. The commonly used term R-value is a measure of the resistance to heat flow and is the inverse of the U-factor. U-factors provide a means to compare the heat transfer properties of different window assemblies. U-factor values generally range from 0.25 to 1.35 and are measured in Btu/h·ft²·°F. The lower the U-factor, the better the assembly insulates. Factors affecting the insulating property of a window assembly are: 1) the type of glazing material (e.g., glass, plastic, treated glass), 2) the number of layers of glass, 3) the size and gas content of the space between the layers of glass, and 4) the thermal resistance or conductance of the frame and spacer materials. The "tightness" of the installation, including the fit and air sealing at the perimeters does not affect the U-value of the assembly but has a substantial effect on the air infiltration in the building.

A single pane glass window with an aluminum frame without thermal spacers will have a U=factor of approximately 1.3. Two sheets of glass with an air or gas-filled space between them have better insulating properties than a single pane of glass. Gases resist changes in temperature, giving them a better insulating value than air. Window frames made of vinyl, fiberglass, or wood composites reduce heat transfer and improve insulation.

Energy efficient windows avoid frames made of aluminum or other metals that easily transmit heat and cold. Also, spacers inserted between multi-pane windows reduce heat transfer and the formation of condensation thus increasing the insulating property of the window assembly. A U-value of 0.33 or less is recommended. Additional savings are achieved by properly installing and sealing the windows, thereby reducing the air infiltration rate into the building.

8.4.2. Control Air Leakage by Installing and Repairing Entrance Doors

One of the most commonly used methods for reducing air leakage through building structures is caulking and weather stripping.

Particularly effective measures include caulking cracks around windows and door frames and weather stripping around windows and doors. Weather-stripping and caulking of doors and windows, helps in thermally isolating of the building with the outside atmosphere. This prevents the infiltration of external un-conditioned air along with moisture and humidity into the conditioned space at the same time, prevents the conditioned air from escaping out. A precisely thermally isolated building directly affects the cooling and heating load on the facilities HVAC system as it has to put in less effort in maintaining the desired temperature inside the facility. As per ASHRAE a well insulated and ventilated building should have an air change rate not more than 0.35 per hour.

During the site visit it was observed that most of the entrance doors had poor weather stripping; and further, some of the doors did not close properly which is resulting in significantly large gaps for heating loss during the winter. It is recommended that these doors be repaired or replaced to reduce heating loss through the building.

EMG also recommends installation of door sweeps under the main doors so as to prevent infiltration of external air into the conditioned zone. The exterior windows in the gymnasium should be replaced with new windows. Because this is a large area, there will be substantial heat loss during the winter from the gaps in the windows.

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.

Building Envelope

1. Caulking and weather stripping are barely functional and are mostly ineffective. This includes issues with the windows, which are single pane as well as having poor caulking, and also doors that have air gaps or are broken and cannot be closed properly.

Heating and Cooling

1. The burners cleaned and fuel/air ratios optimized during routine maintenance checks
2. Boiler tubes inspected and cleaned annually
3. Temperature settings are reduced in unoccupied areas and set points seasonally adjusted by using the central building management system.
4. Control valves and dampers checked for functionality monthly and repaired, when needed
5. Equipment inspected for worn or damaged parts as part of a monthly maintenance check
6. Hot air registers and return air ductwork clean and unobstructed
7. Air filters inspected monthly and replaced prior to excessive visual buildup (May increase filter costs, but will reduce fan energy costs)
8. Supply piping for steam distribution is insulated; the client is currently in the process of insulating the return piping.

Domestic Hot Water

1. Domestic hot water heater temperature is set at 140 degrees. It is recommended that the temperature should be set to 120 degrees.
2. Hot water piping checked routinely for damaged insulated and leaks

Lighting

1. Over-lit areas in some classrooms and parts of the hallway should be managed by photocell controls
2. Only energy-efficient replacement lamps used and in-stock for replacement
3. Lighting fixture reflective surfaces and translucent covers clean
4. Walls clean and bright to maximize lighting effectiveness
5. Timers are 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

10. APPENDICES

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

APPENDIX A:
PHOTOGRAPHIC RECORD

EMG PHOTOGRAPHIC RECORD

Project No.: 98515.11R-004.268 **Project Name: Mitchell Elementary School**

Photo #1:	Front of building – facing south

Photo #2:	Parking lot in front of building

Photo #3:	Playground area on west side of building

Photo #4:	Closer view of front of building

Photo #5:	Side of building – facing west

Photo #6:	Roof – replaced in 2011

EMG PHOTOGRAPHIC RECORD

Project No.: 98515.11R-004.268 **Project Name: Mitchell Elementary School**

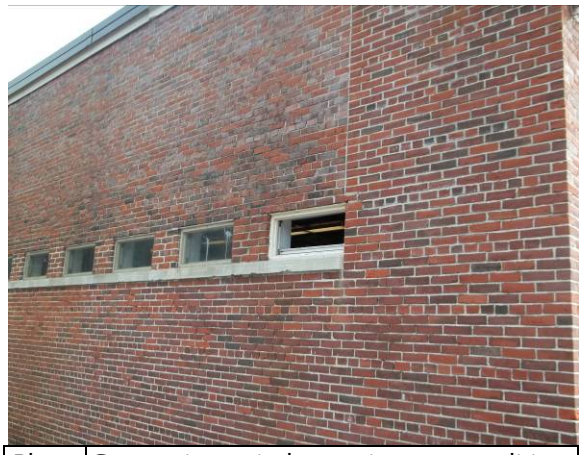


Photo #7:	Gymnasium windows – in poor condition recommend replacement

Photo #8:	One of several entrance doors that should be replaced

Photo #9:	Single pane window

Photo #10:	Another entrance door that should be replaced with a new door

Photo #11:	Hallway portion with sufficient outside light so that interior hallway lights should be on photo-sensors

Photo #12:	Courtyard area

EMG PHOTOGRAPHIC RECORD

Project No.: 98515.11R-004.268 **Project Name: Mitchell Elementary School**

Photo #13:	Additional view of front of building

Photo #14:	Courtyard area

Photo #15:	Unit vent – external grill (issues with air drafts through grill)

Photo #16:	View of main hallway from front doors

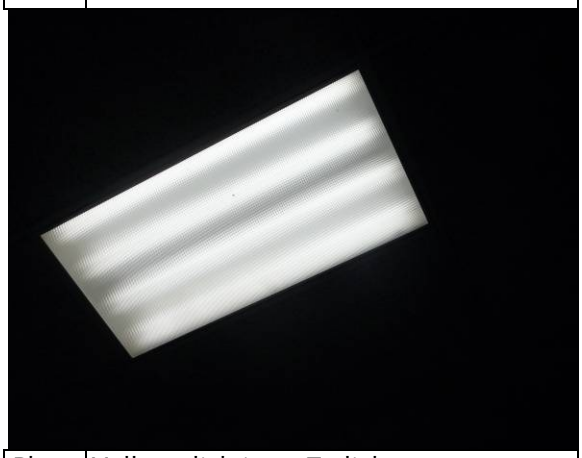


Photo #17:	Hallway lighting – T8 lights

Photo #18:	Internal view of hallway – recommend photo-sensors on these hallway lights

EMG PHOTOGRAPHIC RECORD

Project No.: 98515.11R-004.268 **Project Name: Mitchell Elementary School**

Photo #19:	Single pane windows

Photo #20:	Hallway with T8 lighting

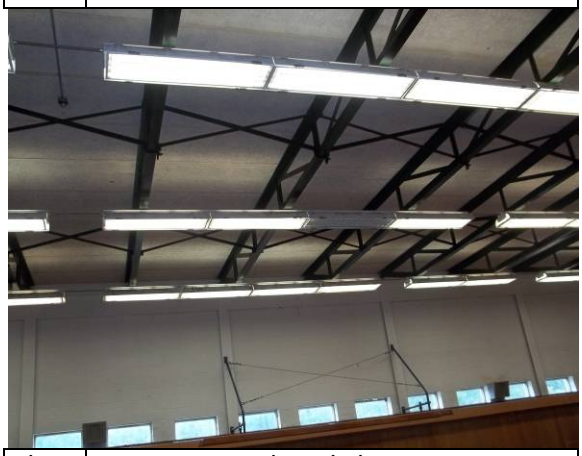


Photo #21:	Gymnasium with T8 lighting

Photo #22:	Air handling unit for gymnasium – can be heated with steam from central system

Photo #23:	Internal view of door with air leakage issue – recommend weather stripping

Photo #24:	One of 23 classrooms

EMG PHOTOGRAPHIC RECORD

Project No.: 98515.11R-004.268 **Project Name: Mitchell Elementary School**

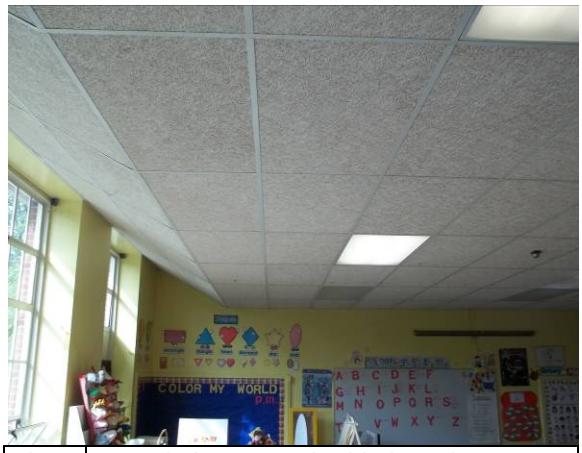


Photo #25:	Several classrooms had lights adjacent to windows that provided enough light – recommend photo-sensors

Photo #26:	Window unit in classroom – 10,800 BTUH

Photo #27:	Teacher lounge

Photo #28:	Another classroom

Photo #29:	Unit vent – based on onsite calculations, the cfm/square foot is

Photo #30:	Internal system of unit vent.

EMG PHOTOGRAPHIC RECORD

Project No.: 98515.11R-004.268 **Project Name: Mitchell Elementary School**

Photo #31:	Hydraulic door closer is broken resulting in the door not closing properly

Photo #32:	Cafeteria and auditorium

Photo #33:	Kitchen

Photo #34:	Fresh air unit for kitchen

Photo #35:	Heating for hallways – using steam from central boiler system

Photo #36:	Attic – little or no insulation (this part of the attic has no insulation)

EMG

EMG PHOTOGRAPHIC RECORD

Project No.: 98515.11R-004.268 **Project Name: Mitchell Elementary School**

Photo #37:	Another part of the attic –no insulation

Photo #38:	This part of the attic has less than 1 inch insulation

Photo #39:	Boiler room

Photo #40:	One of two #2 fuel oil-fired boilers used for heating - only one boiler needed for heating entire building

Photo #41:	Condensate return pump

Photo #42:	Additional view of condensate return pump

EMG PHOTOGRAPHIC RECORD

Project No.: 98515.11R-004.268 **Project Name: Mitchell Elementary School**

Photo #43:	Second boiler

Photo #44:	Domestic water heater – oil fired. 86 gallons - currently set at 140 degrees

Photo #45:	Temperature gage for domestic water – 140 degrees F

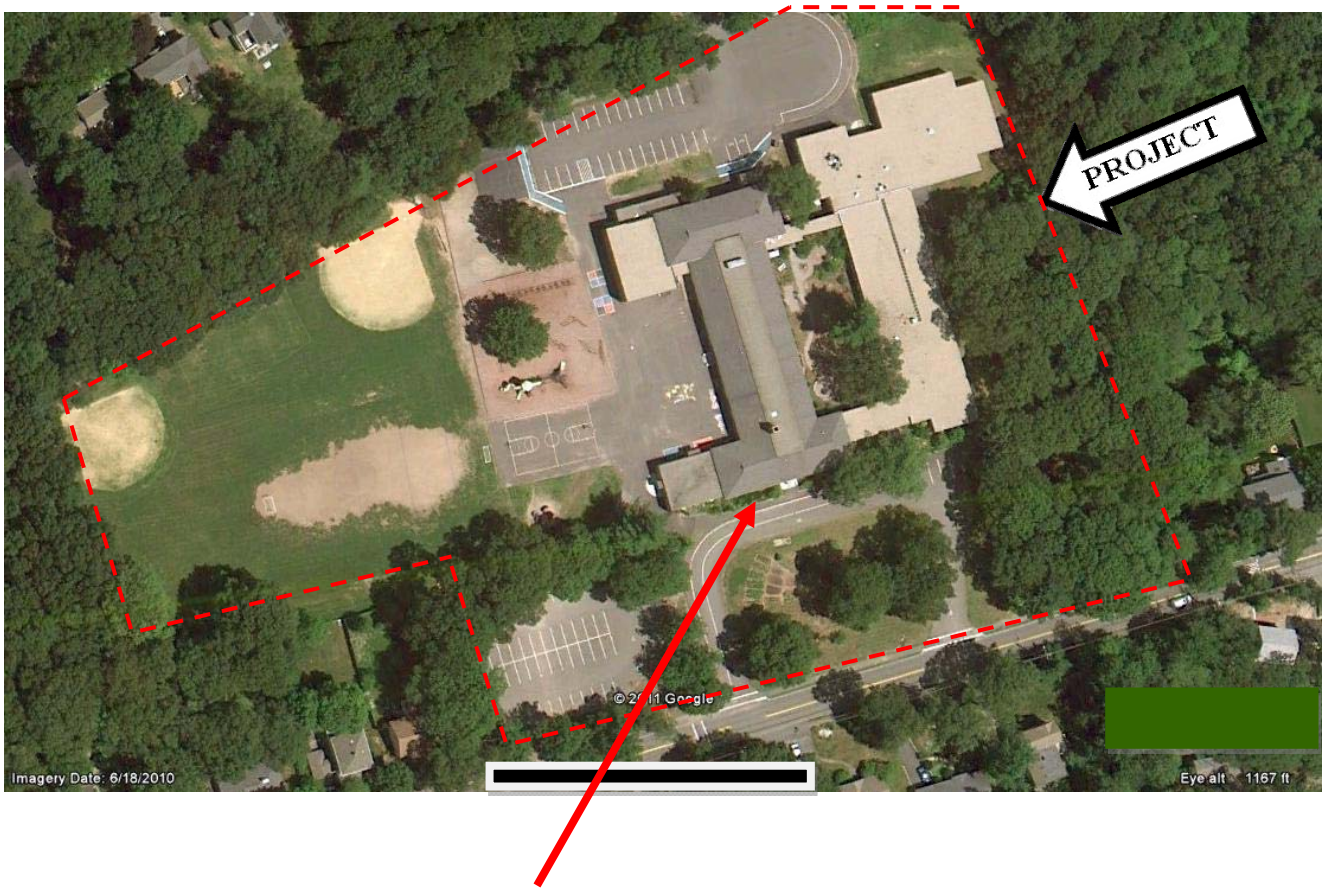
Photo #46:	Additional condensate pumps located on return line - located in storage room

Photo #47:	Toilet with 1.6 GPF toilets and 2.2 GPM faucet

Photo #48:	Another restroom at the school

APPENDIX B:
SITE PLAN

Site Plan



Front of Building

EMG	**Source:** Border	**Project Number:** **98515.11R-004.268**
N	**The north arrow indicator is an approximation of 0° North.**	**Project Name:** **Mitchell Elementary School**
		On-Site Date: **September 9, 2011**

APPENDIX C:
RECORDS OF COMMUNICATION

RECORD OF COMMUNICATION

Date:	**September 9, 2011**	**Time:**	**9 AM**
Project Number:	**98515.11R-004.268**	**Recorded by:**	**Abdul Basit, Field Observer/Project Manager**
Project Name:	**Mitchell Elementary School**		

Communication with: John Gass
of: Town of Needham
Phone: 781 727 0010

Communication via:

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

RE:

Summary of Communication:

APPENDIX D:
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) Investment 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).

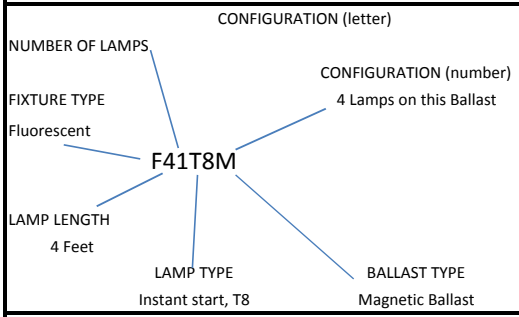
APPENDIX E:
MECHANICAL EQUIPMENT INVENTORY

Mechanical Equipment Inventory								
Equipment	**Manufacturer**	**Age**	**Location**	**Model/ Type**	**Capacity**	**Serves**	**Operating Hours/Year**	**Remarks**
Steam Boilers (2)	Smith	2011 and 1990	Boiler Room	28A-12	26.5 GPH	Heating for Building	2500	
Condensate Return Pumps				10-158998-02	2hp	Condensate return	2500	
Domestic water heater	AO Smith	2011	Boiler Room					
Air Handling Unit - Gym	Unknown					Gym	2500	Not accessible
Air Handling Unit - Auditorium	Unknown					Auditorium / Cafeteria	2500	Not accessible
Window Units	Various	Various	Classrooms and Offices	Various	10,800 BTUH		300	
Condensate Return Pumps	Boston Electric	Unknown	Storage Room	P48K2E	0.75 hp		2500	
Outside Air Unit for kitchen	Unknown		Kitchen			Fresh Air for Kitchen		

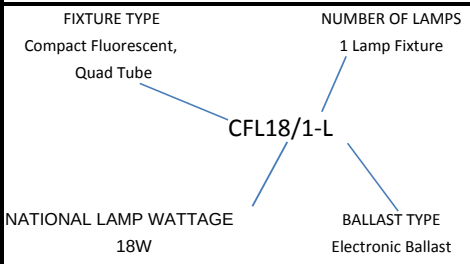
APPENDIX F:
LIGHTING SYSTEMS SCHEDULES

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 Number:	98515.11R-004.268		
Facility Name:	Mitchell Elementary School		
Project Manager	Abdul Basit		
Date: 9/9/2011	Square Footage (ft2)	54175	

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	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	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					Classrooms	250	24	LS	46	F44T8	112	5.15	1,248	6,430
2					Classrooms	250	24	MS	90	F42T8	59	5.31	1,248	6,627
3	ECM	PS			Classrooms	1100	24	LS	16	F44T8	112	1.79	1,248	2,236
4	ECM	RB			Storage Rooms		3	LS	10	I60/1	60	0.60	156	94
5					Library	500	27	LS	27	F44T8	112	3.02	1,404	4,246
6					Offices	400	18	MS	18	F44T8	112	2.02	936	1,887
7					Restrooms	200	15	MS	27	F42T8	59	1.59	780	1,243
8					Kitchen		25	LS	7	F42T8	59	0.41	1,300	537
9					Cafeteria/Auditorium		35	LS	32	F42T8	59	1.89	1,820	3,436
10					Stage Area		10	LS	4	CFL26	33	0.13	520	69
11					Hallway	200	40	LS	35	F44T8	112	3.92	2,080	8,154
12	ECM	PS			Hallway	1800	40	LS	5	F44T8	112	0.56	2,080	1,165
13					Gym		30	LS	28	F42T8	59	1.65	1,560	2,577
14					Exit Signs		168	EC	18	ELED5/2	10	0.18	8,736	1,572
15	ECM	RB			Exterior Building Wallpacks		80	TM	14	MH100	128	1.79	4,160	7,455
16	ECM	RB			Parking Lights		80	TM	5	MH150	190	0.95	4,160	3,952
								Total Pre Fixt.	**382**		**Total Pre kW**	**31**	**kWh Consumed**	**51,678**

Light Intensity	0.572 Watt/ ft2	**Usage Intensity**	0.95 KWh / ft2

Existing Facilities Program Lighting Form:

Performance Based

Project Name: 98515.11R-004.268

Facility Name: Mitchell Elementary School

Date: 9/9/2011 Project Manager Abdul Basit

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**	**Proposed Weekly 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	hrs / wk	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*		*Motion Sensor*	*0.26*	*765*
3	ECM	PS - Install Photo Sensor	#N/A	-	Classrooms	1,100	24	1,248	LS	16	F44T8	16	F44T8	112	6.00	PS	0.00	1,677
4	ECM	RB - Replace Bulb	#N/A	-	Storage Rooms	-	3	156	LS	10	I60/1	10	CFL13	17	3.00	LS	0.43	67
12	ECM	PS - Install Photo Sensor	#N/A	-	Hallway	1,800	40	2,080	LS	5	F44T8	5	F42T8	59	25.00	PS	0.27	781
15	ECM	RB - Replace Bulb	#N/A	-	Exterior Building Wallpacks	-	80	4,160	TM	14	MH100	14	QL85	85	80.00	TM	0.60	2,504
16	ECM	RB - Replace Bulb	#N/A	-	Parking Lights	-	80	4,160	TM	5	MH150	5	QL85	85	80.00	TM	0.53	2,184
									Total Pre Fixt.	**50**		**50**	**Total Post kW**	**358.00**		**Total kW Saved**	**1.82**	**7,214.01**

APPENDIX G:
ECM CALCULATIONS

UIC	Replace External Windows
EAE2	Details: Replace Windows in Gymnasium

ENTER EXISTING CONDITIONS

Existing and Proposed Window Properties

Total Sq.Ft window area:	104	sq.ft
Approximate number of windows:	13	
Total existing window area:	104	Sq.Ft
Select The Existing Window Type	Metal Frame & Single Glazing	*(Select)*
Existing U-value of window: (1/R)	1.31	Btu/ ft²·°F·h
Select Property Location Zone	Zone-5	*(Select)*
New U-value with Double pane Low E window: (1/R)	0.33	Btu/ ft²·°F·h
AHRAE 90.1 Recommended Value		

Existing & Proposed Air Leakage Through Windows

Insert Existing Estimated Air Change Rate/Hr (ACH 1):	0.75	
(Existing Air Changes Per Hour, 3 is very leaky and 0.35 ideal)		
Insert Proposed Estimated Air Change Rate/Hr (ACH 2):	0.35	
Estimated Space Volume Under Consideration	70000.00	Cu. Ft
Is the Property Cooled ?	No	*(Select)*

WINTER

Select Type of Heating Fuel	Oil	*(Select)*
Net heating plant & distribution system efficiency:	80.00	%
Annual Heating Hours::	800	
Estimated Total Annual Input Heating Energy Savings By Replacing Windows	0.74	Gallons
Estimated Total Annual Input Heating Energy Savings Achieved By Controling Air Leakage Through Windows	161.73	Gallons
Estimated Total Input Heating Fuel Savings From Replacing Windows	162.47	Gallons

SUMMER

Select Type of Cooling Fuel	Electric	*(Default)*
Cooling Plant Efficiency (EER):	0.00	EER
Annual Cooling Hours:	412	
Annual Total Input Cooling Fuel Savings During Summer Season By Replacing Windows		Kwh
Estimated Total Annual Input Cooling Energy Savings Achieved By Controling Air Leakage Through Windows	0.00	kWh
Estimated Total Input Cooling Fuel Savings From Replacing Windows	0.00	kWh

ENERGY & COST ANALYSIS

Insert Cost of Heating Fuel: (Cost/Unit)	$2.60	$	Annual Heating Cost Savings:	$422.26	$$
Insert Cost of Cooling Fuel: (Cost/Unit)	$0.21	$	Annual Cooling Cost Savings:	0	$$
Total Annual Cost Savings	$426		Total Annual Cost Savings From Heating & Cooling:	$422	$$
Cost of window upgrade:	$5,649		Estimated Annual O&M Savings	$4.22	$
Simple payback:	13.24	**years**	*Type of Recommendation*	Capital Cost ECM Recommendation	

UIC	Improve Insulation Levels in Attic
EAE3	Details: Install Insulation in Attic

ENTER EXISTING CONDITION

Select Climatic Zone Related To The Property Location:	Zone-5	(Select)	ASHRAE 90.1 Attic- Insulation Requirement:	R-38	
Enter Total Surface Area Under Consideration:	10000	Sq.Ft	Existing Net Effective R-Value: (Sq.Ft deg F/btu)	2	
Proposed Type of Insulation To Be Added:	Batt Insulation	(Select)	Proposed Insulation Recommendation:	Partial Upgrade	(Select)
Recommended Level of Insulation To Be Added:	R-30		Proposed Net Effective R-Value: (Sq.Ft deg F/btu)	20	

ENTER CLIMATIC & SYSTEM DATA

Annual Cooling Degree Days (CDD):	1199		Estimated Annual Cooling Plant Efficiency (EER):	10.00	EER
Annual Heating Degree Days (HDD):	5469		Estimated Annual Heating Plant Efficiency: %	80.00	%

WINTER			SUMMER		
Select Type of Heating Fuel	No-2 Oil	(Select)	Is the Property Cooled ?	No	(Select)
Annual Conduction Losses From Existing Insulation	656280	kBtu	Annual Conduction Losses From Existing Insulation	143880	Kbtu
Annual Conduction Losses From Proposed Insulation	65628	kBtu	Annual Conduction Losses From Proposed Insulation	14388	kBtu
Savings In Conduction Losses After Adding Insulation	590652	kBtu	Savings In Conduction Losses After Adding Insulation	0	kBtu
Estimated Total Annual Input Heating Energy Savings	4265	Gallons	Estimated Total Annual Input Cooling Energy Savings	0	kWh
Cost of Heating Fuel/Unit: Gallons	$2.60	$$	Cost of Electricity/Unit	$0.21	$$
Annual Heating Cost Savings	$11,084	$$	Annual Cooling Cost Savings	$0.00	$$

COST ANALYSIS

Estimated O&M Savings	$55.42	$$	Estimated Cost To Add Insulation on	$13,400	
Total Estimated Annual Cost Savings	$11,139	$$	Estimated Total Installation Cost	$10,586	$$
Simple Pay Back Period	0.95	Years	*Type of Recommendation*	Capital Cost ECM Recommendation	

UIC	Control External Air Leakage In The Building
EAE4	Details: Repair Doors and Install Weather Stripping on Doors

ENTER EXISTING CONDITION

Insert Existing Estimated Air Change Rate/Hr (ACH 1): *(Existing Air Changes Per Hour, 3 is very leaky and 0.35 ideal)*	2.50	Cubic Feet/Min (CFM 1):	320.00
Insert Proposed Estimated Air Change Rate/Hr (ACH 2):	2.30	Cubic Feet/Min (CFM 2):	294.40
Estimated Space Volume Under Consideration	7680.00 Cu.Ft	Is The Building Cooled?	No (Select)

WINTER			SUMMER		
Select Type of Heating Fuel	Oil (Select)		Select Type of Cooling Fuel	ELECTRICITY (Default)	
Estimated Annual Heating Plant Efficiency	80.00 %		Estimated Annual Cooling Plant Efficiency	0 EER	
Annual Heating Degree Days(HDD):	5724		Annual Cooling Degree Days(CDD):	992	
Estimated Total Annual Input Heating Energy Savings	34.28 Gallons		Estimated Total Annual Input Cooling Energy Savings	0.00 kWh	
Cost/Unit of Heating Fuel: Gallons	$138.50 $$		Cost/Unit For Electricity	$0.21 $$	
Estimated Annual Heating Cost Savings	4747.71 $$		Estimated Annual Cooling Cost Savings	0.00 $$	

Cost Analysis

Estimated Annual O&M Savings	$237.39	Estimated Installation Cost (Including Labor)	$8,500.00
Total Estimated Annual Cost Savings	4985.100288	Total Cost For Controlling Air Leakage	$6,715
Simple Pay Back Period	1.347014024	*Type of Recommendation*	Capital Cost ECM Recommendation

UIC	Install Energy Savers on Vending, Snack Machines
EAC8	Details: Install Energy Saver on Soda Machine

No. of Vending Machines: 0.00 Qty

No. of Beverage Cooling Machines: 1.00 Qty

No. of Snack Machines 0.00 Qty

Vending Machines (Cold Beverage Vending Machines)

Estimated Annual kWh Consumption of Vending Machine:	3500.00	kWh
Estimated Annual kWh of Vending Machine With VendMiser:	1890.00	kWh
Total annual kWh savings:	1610.00	kWh
Total Annual kWh Savings for All Vending Machines:	0.00	kWh

Beverage Cooling Machines

Estimated Annual kWh Consumption of Beverage Cooling Machine:	2300.00	kWh
Estimated Annual kWh of Cooling Machine With CoolerMiser:	1610.00	kWh
Total Annual kWh savings:	690.00	kWh
Total Annual kWh Savings For All Cooling Machines:	690.00	kWh

Snack Vending Machines

Estimated Annual kWh Consumption of Individual Snack Machine:	873.60	kWh
Estimated Annual kWh of Individual Snack Machines With VendMiser:	366.91	kWh
Total Annual kWh savings:	506.69	kWh
Total Annual kWh Savings For All Water Fountain Coolers:	0.00	kWh

Cost Analysis

Total estimated annual kWh savings withEnergy Misers:	**690.00**	kWh
Cost/kWh:	**$0.21**	
Estimated Cost of Vendmiser/ Vending Machine:	$200	
Estimated Cost of Coolermiser/ Water cooler:	$190	
Estimated Cost of Vendmiser/ Snack Machine:	$70	
Estimated total installed cost of all VendMisers:	**$190**	
Estimated Total Annual Electricity Savings Using VendingMisers and CoolerMisers:	**$146**	
Simple Payback:	1.30	years

Type of Recommendation No/Low Cost ECM Recommendation

UIC	Replace Incandescent Lamps With CFL's			
EAL 1A	Details: Replace Incandescent Lamps in Storage Rooms			
Step:1	Number of Lamps to Be Replaced		10	
Step:2	Current Wattage of Lamp		60.00	watt
Step:3	Proposed Replacement		13.00	watt
Step:4	Total labor Cost For Replacing lamps *Estimated Rate of $35/hr To Replace 20 Lamps/Hr*		$17.50	
Step:5	Estimated Cost Per Lamp	*(Select)*	$3.00	$$
Step:6	**Total Cost For Retrofit**		$37.53	
Step:7	Estimated Annual Energy Savings		67.00	kwh
Step:8	Current Electric Tarriff Per kWh		$0.21	$$
Step:9	Existing Annual Usage *(For O&M Savings)*		50	hrs
	Proposed Annual Usage Post Retrofit *(For O&M Savings)*		50	hrs
	Estimated Annual O&M Savings		$0.38	$$
Step:10	Estimated Annual Cost Savings		$14.58	
Step:11	Simple Pay back Period		2.57	Yrs
Type of Recommendation	No/Low Cost ECM Recommendation			

UIC	**Install Automatic Lighting Controls**		
EAL5	**Details: Install Photosensors in Hallway and Classroom**		
	Type of Sensor	Internal Photosensors	
Step: 1	Total Number of Sensors	10	
Step: 2	Purchase Cost/Lighting Control Sensors	$15	
Step: 3	Installation Cost /Sensor	$65	
Step:4	Total Installation Costs	$632.00	
Step:5	Total Energy Savings	2471.00	kWh
Step:6	Electric Tariff Rate	**$0.21**	$
Step:7	Total Cost Savings	$524.01	
Step:8	Simple Pay Back Period	1.21	Years
Type of Recommendation		No/Low Cost ECM Recommendation	

UIC	Replace High Intensity Discharge Lamp (HID) with Induction Lighting
EAL9	Details: Replace Wallpacks and Parking Lights with Induction Lighting

Step:1	Number of 60-100W HID Lamps Replaced by 40W Induction	0	
	Number of 100-150W HID Lamps Replaced by 70W Induction	5	
	Number of 150-200W HID Lamps Replaced by 85W Induction	**14**	
	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	**0**	
	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	$0	
Step:3	Subtotal Cost of 70 Watt Induction Retrofit	$1,850	
Step:4	Subtotal Cost of 85 Watt Induction Retrofit	$5,390	
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	$0	
Step:8	Subtotal Cost of 300 Watt Induction Retrofit	$0	
Step:9	**Total Cost For Retrofit**	$5,720	
	Energy & Cost Saving Analysis		
Step:10	Estimated Annual Energy Savings	4688.00	kwh
Step:11	Current Electric Price Per kWh	$0.21	$
Step:12	Estimated Annual Cost Savings	$994	
Step:13	Existing Annual Usage *(For O&M Savings)*	0	hrs
	Proposed Annual Usage Post Retrofit *(For O&M Savings)*	0	hrs
	Estimated Annual O&M Savings	$84	$$
Step:14	Total Estimated Annual Cost Savings *(Energy & O&M Savings)*	$1,078	$$
Step:15	Simple Pay back Period	5.30	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 Maintanence Savings are attained through minimizing frequency of bulb and ballast replacements

APPENDIX H:
SUPPORTING DOCUMENTS

COMMERCIAL OIL-FIRED WATER HEATERS

FEATURES

MEETS OR EXCEEDS THE THERMAL EFFICIENCY AND STANDBY LOSS REQUIREMENTS OF THE U.S. DEPARTMENT OF ENERGY AND CURRENT EDITION ASHRAE/IESNA 90.1

LIME TAMER™ MODELS INHIBIT LIME AND SEDIMENT BUILDUP—Lime Tamer™ models are warranted against tank failure due to sedimentbuildup for three years.

GLASS-LINED TANK— Maximizes tank life. 160psi working pressure.

180° ADJUSTABLE THERMOSTAT— Has upper and lower sensingbulbs to average water temperatures at top and bottom of heater formaximum temperature control (120°-180°).

SAFETY SHUTOFF— Limits temperature buildup.

UL LISTED OIL BURNER— Precision engineered to match the units they are used with; designed to fire 1.75 to 5.0 gallons of oil per hour. All models equipped with single phase continuous duty motor 120 volt AC60 Hz, 3450 rpm with manual overload switch and interrupted ignition. Standard burners equipped with single stage pump with 1 or 2 line capability. Flame retention principle assures high rate of combustion efficiency, yet maintains low operating noise levels. Fuel unit includes pump, strainer, pressure regulating valve and ignition transformer. Transformer rated at 120 volt AC, 60 Hz with 10,000 volt secondary, UL listed for use with No. 1 and 2 commercial grade fuel oil. Burner mounted cadmium cell relay for flame detection - 15 second safety switch timing eliminates the need for RA890F Electronic Safeguard. Complies with UL A708.5-32/33.

EFFICIENT COMBUSTION CHAMBER— Precast, high temperature combustion chamber made of alumina silica ceramic fiber. Engineered for maximum insulation and heat reflection. Unique design assures more complete combustion by stabilizing flame pattern.

INTERRUPTED IGNITION— Reduces electrical consumption.

OIL SOLENOID SAFETY VALVE— Standard on COF-455 and 700.

3/4" DRAIN VALVE— Provided in lower tank for fast draining.

TWO HAND-HOLE CLEANOUTS—Allows easy cleaning on standard models COF-385 and larger and ASME models.

ANODIC PROTECTION—For longer tank life.

FLAME OBSERVATION PORT—Permits convenient flame check.

FOAM INSULATION—Saves fuel, helps maintain constant temperature.

JACKET—Heavy gauge steel with baked enamel finish over bonderized undercoat. Not approved for installation on combustible flooring.

EASY TO INSTALL BURNER—Three bolt mounting of burner assures easy installation.

BAROMETRIC DRAFT REGULATOR

CSA CERTIFIED AND ASME RATED T&P RELIEF VALVE

OTHER FEATURES

- Two Stage Pump - For use with underground oil storage tanks or JP-5 fuel
- ASME Construction Available - All models are rated 160 psi max working pressure
- CAUTION: Units must be installed on noncombustible surface.

THREE-YEAR LIMITED TANK WARRANTY

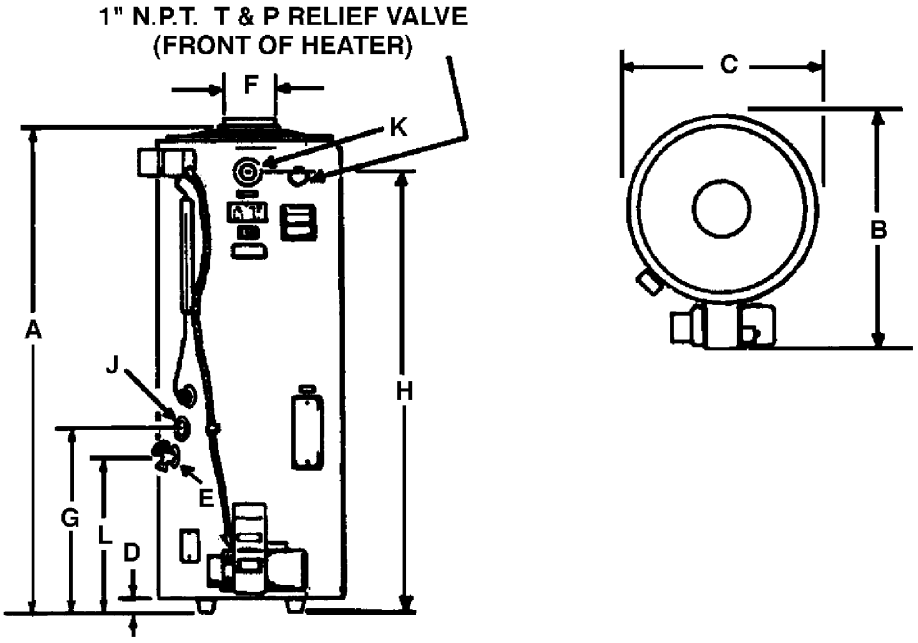
- Factory Start-Up included - Required for activating warranty and assuring maximum operating performance. Contact your local sales representative or Authorized Start-Up Agent to arrange a FREE Certified Start-Up.
- For complete warranty information, consult written warranty shipped with water heater, or contact A. O. Smith

COF-199 through COF-700

Lime Tamer™

ASME
(OPTIONAL)

Commercial Oil-Fired Water Heaters



Dimensions in Inches

Models	A	B	C	D	E	F	G	H	J	K	L	Approx. Ship. Wt. (Lbs)	
												Standard	ASME
COF-199	74 1/2	36 3/4	27 3/4	2	3/4 NPT	8	26 5/8	74 1/2	1 1/2 NPT	1 1/2 NPT	22 3/4	553	-
COF-245	74 1/2	36 3/4	27 3/4	2	3/4 NPT	8	26 5/8	74 1/2	1 1/2 NPT	1 1/2 NPT	22 3/4	554	-
COF-315	74 1/2	36 3/4	27 3/4	2	3/4 NPT	8	26 5/8	74 1/2	1 1/2 NPT	1 1/2 NPT	22 3/4	554	657
COF-385	73 3/4	36 3/4	27 3/4	2	3/4 NPT	8	24 3/4	73 3/4	1 1/2 NPT	1 1/2 NPT	23 7/16	624	742
COF-455	73 3/4	36 3/4	27 3/4	2	3/4 NPT	8	24 3/4	73 3/4	1 1/2 NPT	1 1/2 NPT	23 7/16	700	747
COF-700	73 3/4	36 3/4	27 3/4	2	3/4 NPT	10	30 3/16	79 3/16	1 1/2 NPT	1 1/2 NPT	28 7/8	739	822

Specifications And Recovery Capacities

Models	Firing Rate GPH	Tank Storage (US Gal.)	Input* BTU/H	Recovery Rates at °F Rise											Motor HP
				40	50	60	70	80	90	100	110	120	130	140	
COF-199	1.42	86	199,000	477	381	318	272	238	212	191	173	159	147	136	1/8
COF-245	1.75	86	245,000	587	469	391	335	293	261	235	213	196	181	168	1/8
COF-315	2.25	84	315,000	754	604	503	431	377	335	302	274	251	232	216	1/8
COF-385	2.75	75	385,000	922	738	615	527	461	410	369	335	307	284	263	1/8
COF-455	3.25	75	455,000	1090	872	727	623	545	484	436	396	363	335	311	1/8
COF-700	5.00	69	700,000	1677	1341	1118	958	838	745	671	610	559	516	479	1/8

*Based on No. 2 fuel oil. Capacity rating are actual heater performance at 80% thermal efficiency.
NOTE: Above 2000' altitude, input ratings should be reduced 4% for each 1000' above sea level.

SUGGESTED SPECIFICATION

Water heater(s) shall be commercial oil model number _____ or equivalent. Heater(s) shall have a minimum oil firing rate of _____ gph at 100°F temperature rise and a storage capacity of _____ gallons. The 160 psi working pressure tank shall be glass-lined with the alkaline borosilicate composition being fused to the steel at 1600° and be equipped with 1 1/2" water inlet and outlet openings, and 2 3/4" x 3 3/4" boiler-type hand-hole cleanout (2) on COF-315 and larger or ASME models. The tank shall be insulated with 2" fiber glass insulation. The outer jacket shallhave baked enamel finish over a bonderized undercoating. The burner shall be Underwriters' Laboratories listed and have a _____ (one or two) stage oil pump. The burner shall have flame retention, interrupted ignition and be equipped with primary controls which will provide for 15 second safety shutdown in the event of flame failure. The heater(s) shall be factory equipped with primary controls which will provide for 15 second safety shutdown in the event of flame failure. The heater(s) shall be factory equipped with temperature limiting device, drain valve, flame observation port and 180° adjustable thermostat having upper and lower sensing bulbs which average the water temperatures at the top and bottom of the tank for maximum water temperature control. A CSA Certified and ASME Rated T&P Relief Valve shall be furnished and installed by the factory. Heater tank shall have a 3 year limited warranty against corrosion and tank failure due to sediment buildup as outlined in the warranty.

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Needham: Mitchell Elementary School

Building ID: 2857431
For 12-month Period Ending: June 30, 2011[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: October 03, 2011

Facility
Needham: Mitchell Elementary School
187 Brookline Street
Needham, MA 02492

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1990
Gross Floor Area (ft²): 54,175

Energy Performance Rating[2] (1-100) 67

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	677,449
Fuel Oil (No. 2) (kBtu)	4,927,812
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	5,605,261

Energy Intensity[5]

Site (kBtu/ft²/yr)	103
Source (kBtu/ft²/yr)	134

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	438

Electric Distribution Utility
NSTAR Electric Co

National Average Comparison

National Average Site EUI	122
National Average Source EUI	157
% Difference from National Average Source EUI	-15%
Building Type	K-12 School

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Certifying Professional
N/A

Meets Industry Standards[6] **for Indoor Environmental Conditions:**

Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Values represent energy intensity, annualized to a 12-month period.
5. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) or a Registered Architect (RA) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE or RA in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.
NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Needham: Mitchell Elementary School	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	K-12 School	Is this an accurate description of the space in question?		☐
Location	187 Brookline Street, Needham, MA 02492	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐
School (K-12 School)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	54,175 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Open Weekends?	No (Default)	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	95 (Default)	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	1 (Default)	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	Yes (Default)	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	100 % (Default)	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 % (Default)	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	N/A(Optional)	Is this school in operation for at least 8 months of the year?		☐

High School?	No	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: NSTAR Electric Co

Fuel Type: Electricity

Meter: 25920741003 (kWh (thousand Watt-hours))
Space(s): Entire Facility
Generation Method: Grid Purchase

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
06/01/2011	06/30/2011	15,963.00
05/01/2011	05/31/2011	18,831.00
04/01/2011	04/30/2011	18,149.00
03/01/2011	03/31/2011	18,513.00
02/01/2011	02/28/2011	16,965.00
01/01/2011	01/31/2011	16,841.00
12/01/2010	12/31/2010	18,281.00
11/01/2010	11/30/2010	18,402.00
10/01/2010	10/31/2010	18,487.00
09/01/2010	09/30/2010	18,826.00
08/01/2010	08/31/2010	9,889.00
07/01/2010	07/31/2010	9,402.00
25920741003 Consumption (kWh (thousand Watt-hours))		**198,549.00**
25920741003 Consumption (kBtu (thousand Btu))		**677,449.19**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**677,449.19**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Fuel Oil (No. 2)

Meter: Fuel Oil (Gallons)
Space(s): Entire Facility

Start Date	End Date	Energy Use (Gallons)
05/30/2011	06/30/2011	1,820.00
04/30/2011	05/29/2011	3,000.00
03/30/2011	04/29/2011	0.00
03/01/2011	03/29/2011	6,622.00
01/30/2011	02/28/2011	4,121.00
12/30/2010	01/29/2011	5,618.00
11/30/2010	12/29/2010	5,629.00
10/30/2010	11/29/2010	8,721.00
09/30/2010	10/29/2010	0.00
08/30/2010	09/29/2010	0.00

07/30/2010	08/29/2010	0.00
06/30/2010	07/29/2010	0.00
Fuel Oil Consumption (Gallons)		**35,531.00**
Fuel Oil Consumption (kBtu (thousand Btu))		**4,927,812.16**
Total Fuel Oil (No. 2) Consumption (kBtu (thousand Btu))		**4,927,812.16**
Is this the total Fuel Oil (No. 2) consumption at this building including all Fuel Oil (No. 2) meters?		☐

Additional Fuels	
Do the fuel consumption totals shown above represent the total energy use of this building? Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.	☐

On-Site Solar and Wind Energy	
Do the fuel consumption totals shown above include all on-site solar and/or wind power located at your facility? Please confirm that no on-site solar or wind installations have been omitted from this list. All on-site systems must be reported.	☐

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same PE or RA that signed and stamped the SEP.)

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
Needham: Mitchell Elementary School
187 Brookline Street
Needham, MA 02492

Facility Owner
N/A

Primary Contact for this Facility
N/A

General Information

Needham: Mitchell Elementary School	
Gross Floor Area Excluding Parking: (ft^2)	54,175
Year Built	1990
For 12-month Evaluation Period Ending Date:	June 30, 2011

Facility Space Use Summary

School	
Space Type	K-12 School
Gross Floor Area(ft^2)	54,175
Open Weekends?[d]	No
Number of PCs[d]	95
Number of walk-in refrigeration/freezer units[d]	1
Presence of cooking facilities[d]	Yes
Percent Cooled[d]	100
Percent Heated[d]	100
Months[o]	N/A
High School?	No
School District[o]	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 Average**
Energy Performance Rating	67	67	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	103	103	95	N/A	122
Source (kBtu/ft^2)	134	134	123	N/A	157
Energy Cost					
$/year	$ 134,448.32	$ 134,448.32	$ 123,819.28	N/A	$ 158,344.18
$/$ft^2$/year	$ 2.48	$ 2.48	$ 2.28	N/A	$ 2.92
Greenhouse Gas Emissions					
$MtCO_2e$/year	438	438	403	N/A	516
$kgCO_2e/ft^2$/year	8	8	7	N/A	9

More than 50% of your building is defined as K-12 School. Please note that your rating accounts for all of the spaces listed. The National Average column presents energy performance data your building would have if your building had an average rating of 50.

Notes:
o - This attribute is optional.
d - A default value has been supplied by Portfolio Manager.

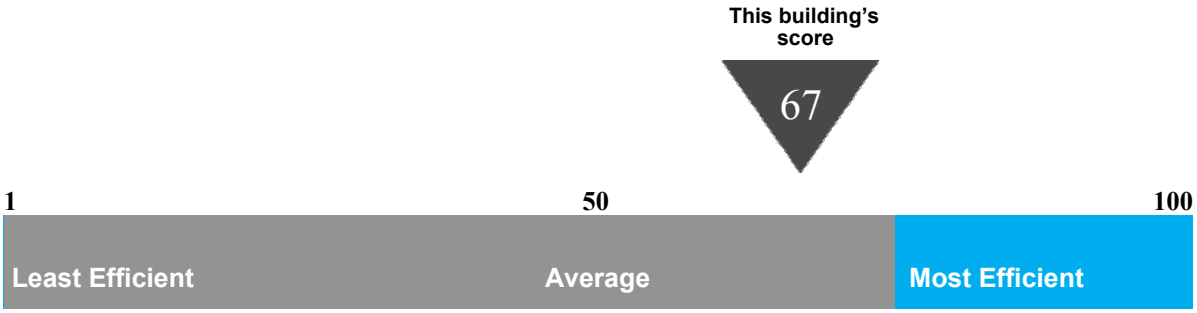
Statement of Energy Performance

2011

Needham: Mitchell Elementary School
187 Brookline Street
Needham, MA 02492

Portfolio Manager Building ID: 2857431

The energy use of this building has been measured and compared to other similar buildings using the Environmental Protection Agency's (EPA's) Energy Performance Scale of 1–100, with 1 being the least energy efficient and 100 the most energy efficient. For more information, visit energystar.gov/benchmark.



This building uses 134 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending June 2011

Buildings with a score of 75 or higher may qualify for EPA's ENERGY STAR.

I certify that the information contained within this statement is accurate and in accordance with U.S. Environmental Protection Agency's measurement standards, found at energystar.gov

Date of certification

EPA United States Environmental Protection Agency

Date Generated: 10/03/2011