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Local Government Energy Program
Energy audit report

For

Hamilton Board of Education
Lalor Elementary School
Hamilton, NJ 08610

Project Number: LGEA01

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INTRODUCTION

On April 13th, 14th, 15th and 16th, 2009, Steven Winter Associates, Inc. (SWA) performed energy audits and assessments of 12 elementary schools within the Hamilton School District located in Hamilton, NJ. Current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The following twelve elementary schools were evaluated under this energy audit: Greenwood, Klockner, Kuser, Lalor, Langtree, Mercerville, Morgan, Robinson, Sayen, Sunnybrae, Yardville, and Yardville Heights. The original construction date, type, and building area of each school vary, since the buildings were constructed to accommodate school district expansion over the years. Construction of the original 12 buildings was undertaken between 1908 and 1966, with additions or modular classroom units added between 1922 and 1995. Floor area ranges from 27,750 square feet up to 51,813 square feet. Typical occupancy includes 300 Kindergarten through fifth grade students and 30 teachers and staff.

Energy data and building information collected in the field were analyzed to determine the baseline energy performance of each building. Using spreadsheet-based calculation methods, SWA estimated the energy and cost savings associated with the installation of each of the recommended energy conservation measures. The findings for each building are summarized in the respective report.

The present report is for Lalor Elementary School only.

Lalor Elementary School was built in 1927 and consists of 36,408 square feet of conditioned space. There are approximately 300 students in grades Kindergarten through fifth grade and about 30 teachers. The building is operated on weekday schedule from 6:30 am to 5:30 pm, about 55 hours a week.

The goal of this energy audit is to provide sufficient information to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the building.

EXECUTIVE SUMMARY

This document contains the energy audit report for Lalor Elementary School located at 25 Barnt Deklyn Avenue, Hamilton, NJ 08610. Lalor Elementary is a two story building. Based on the field visit performed by Steven Winter Associates (SWA) staff on April 14th, 2009 and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling, and electric usage.

In the most recent year full year of data collected (2008), Lalor Elementary School building consumed approximately 145,480 kWh or $22,969 worth of electricity and 19,571 therms or $7,074 worth of natural gas. For purposes of this report, an average gas cost of $1.55/therm was assumed. This unit price represents typical local costs for both consumption and transportation of natural gas. With electricity and natural gas combined, the building consumed 2,454 MMBtu of energy at a total cost of $53,304.

SWA benchmarked Lalor Elementary School using the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The Portfolio Manager generated a benchmark score of 66 for the building, when compared to a national average. The benchmark rating is based on the facility's source energy use, level of business activity, and geographical location. The Portfolio Manager is also capable of generating a site energy use intensity number using 2008 as a baseline year.

In order to compare commercial buildings equitably, the *Portfolio Manager* ratings convey the consumption of each type of energy in a single common unit. The EPA uses source energy to represent the total amount of raw fuel required to operate the building. The site energy use intensity for Lalor Elementary School building is 98.8 kBtu/sq.ft/year. After energy efficiency improvements are made, future utility bills can be added to the Portfolio Manager and the site energy use intensity for a different time period can be compared to the year 2008 baseline to track the changes in energy consumption associated with the energy improvements.

SWA recommends a total of 2 Energy Conservation Measures (ECMs) for Lalor Elementary School. The total investment cost for these ECMs is **$79,405**. SWA estimates a first year savings of **$4,010** with a simple payback of **12.4 years**. SWA also estimates that Lalor Elementary School will be able to reduce their carbon footprint by **37,028 lbs of CO2 annually.**

There are various incentives that Lalor Elementary School could apply for that could also help lower the cost of installing the ECMs. SWA recommends that Lalor Elementary School applies for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy conservation project.

When pursuing incentives through the SmartStart program, SWA encourages building managers to contact the program provider to obtain more detailed information on the program guidelines and request pre-approval for all planned upgrades. At the time of this report, high-efficiency, gas-fired boilers with a capacity between 1500 – 4000 MBH may be eligible for an incentive of $1.00 per MBH. Larger equipment may qualify for a custom incentive package. When replacing gas-fired water heaters, consider upgrading to high-efficiency equipment. Water heaters that are 50 gallons and larger may be eligible for an incentive of $1.00-$2.00 per MBH. Incentives are also available for the installation of occupancy sensors and dimming controls. Incentives for lighting controls vary and are based on the quantity and type of controls installed.

For further information on both custom and prescriptive incentives, please visit:

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/equipment-incentives/equi

The New Jersey Clean Energy website also provides information on incentives for renewable energy. Visit the website to download a copy of the Renewable Energy Incentive Program (REIP) Guidebook. Incentives include up to $1.00 per watt for eligible photovoltaic projects.

Hamilton Board of Education should become familiar with New Jersey Clean Energy programs aimed specifically at schools if they are considering building new facilities or doing major renovations. For further information about specific program information, please visit:
http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/school-construction/about

The following table summarizes the proposed Energy Conservation Measures (ECM) and their economical relevance.

SCOPE OF WORK – SUMMARY TABLE

ECM Table without Incentives

		Installed Cost		1st year energy savings									Lifetime		
ECM#	ECM description	Estimated $	Source	Electric Savings (kWh)	Unit	Natural Gas Savings (therms)	Unit	Demand	Unit	$ Savings/year	SPP	LoM	Cost Savings	ROI	Annual Carbon Reduction (lbs of CO2)
1	Steam boiler replacement	$ 76,675	RSMeans	0	kWh	1,351	therms	0.0	kW	$ 2,094	36.6	30	$ 40,003	-1.6%	14,892
2	Upgrade existing lighting	$ 2,730	RSMeans	12,363	kWh	-	therms	1.4	kW	$ 1,916	1.4	20	$ 38,325	65.2%	22,136
Total	**Total Scope of Work**	**$ 79,405**	**-**	**12,363**	**-**	**1,351**		**1.4**	**-**	**$ 4,010**	**19.8**		**$ 78,329**		**37,028**

Definitions:

SPP: Simple Payback (years)
LoM: Life of Measure (years)
ROI: Return on Investment (%)

Assumptions:

Discount rate:	3.2%	per DOE FEMP guidelines	Average Electric Rate =	0.155	$/kWh	Carbon Dioxide per unit Electriciy =	1.7905	lbs of CO2/kWh
Energy price escalation rate:	0%	per DOE FEMP guidelines	Average Natural Gas Rate =	1.55	$/therm	Carbon Dioxide per unit Nat.l Gas =	11.023	lbs of CO2/therm

1. HISTORIC ENERGY CONSUMPTION

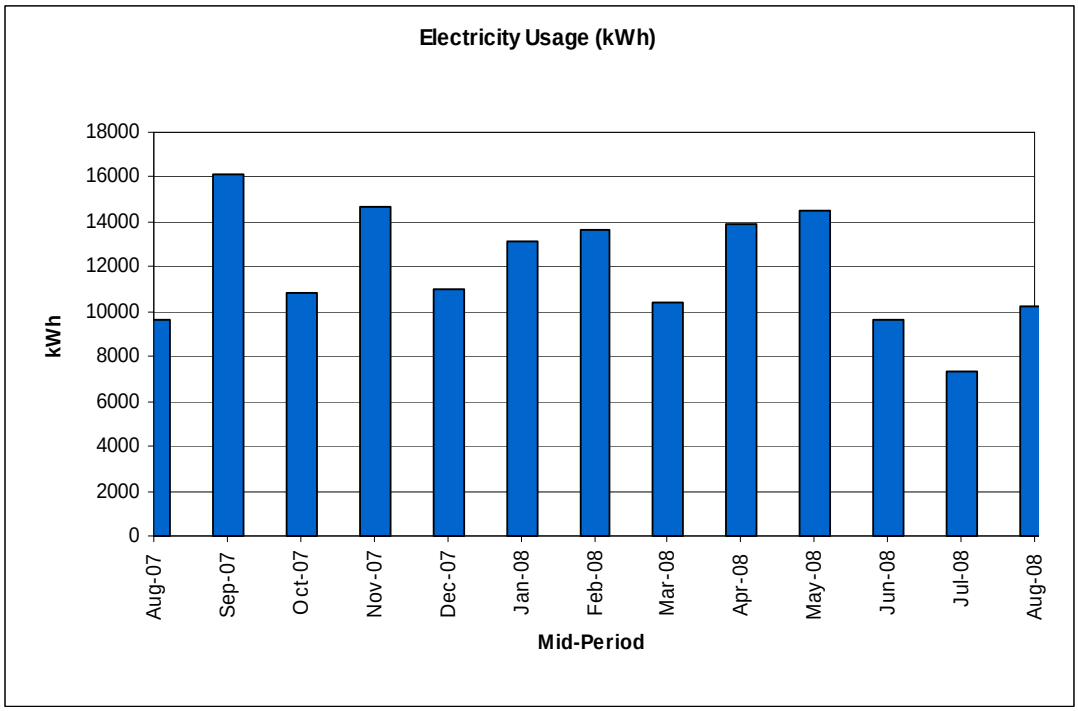
1.1. Energy usage and cost analysis

SWA received and analyzed utility bills from September 2006 through September 2008 that were received from the Hamilton Board of Education.

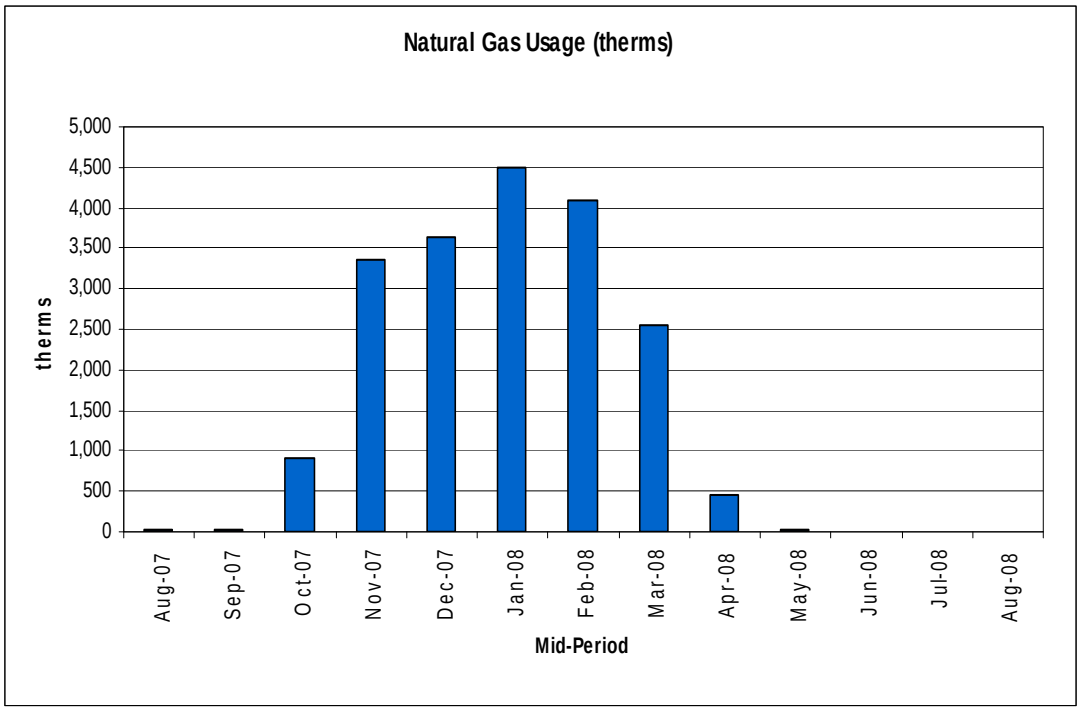
Electricity – Lalor Elementary School has one electric meter for incoming electricity supply. The building purchases electricity from PSE&G at **an average aggregated rate of $.16/kWh** based on September 2008 through September 2007 electric bills. The building purchased **approximately 145,480 kWh or $22,969 worth of electricity between September 2007 and September 2008.** Based on the same time period, the building also had **an average monthly demand of 52.2 kW and monthly peak demand of 66.6 kW.**

Natural Gas – Lalor Elementary School has one gas meter for incoming natural gas from PSE&G. Between September 2007 and September 2008, the building purchased **approximately 19,571 therms or $30,335 worth of natural gas.** To account for the additional costs associated with transportation and delivery fees, an average total gas rate of $1.55 per therm was assumed in this report.

The following chart shows electricity usage for the school based on utility bills for the 2007- 2008 billing period.



The following chart shows the natural gas usage for the school based on utility bills for the year September 2007 to September 2008.



In the above chart, the natural gas usage follows a heating trend as expected. During the summer it is clear that the natural gas usage is very minimal which reflects that heat is not being used and the DHW load is minimal.

1.2. Utility rate

Lalor Elementary School currently buys electricity and gas from PSE&G at the FTLV service rate. The FTLV service is s typical rate where customers pay for natural gas based on usage and electricity based on usage with the addition of an electrical charge demand. Lalor Elementary School uses account #08 62 332 346 10, at the service address of 25 Barnt Deklyn Ave, Hamilton, NJ 08610 for the building electric and gas. Electricity for the building was billed at an average rate of **$0.16/kWh**. As previously noted, a typical regional average gas unit price of $1.55/therm was assumed in this report to address both the consumption and transportation costs of the fuel.

1.3. Energy benchmarking

Lalor Elementary School information and utility data were entered into the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* energy benchmarking system. The performance score generated for the building is 66. SWA recommends that the Lalor Elementary School Board of Education maintain the Portfolio Manager account at the link below. As the account is maintained, SWA can share the Lalor Elementary School facility and allow future data to be added and tracked using the benchmarking tool.

http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Lalor Elementary

Building ID: 1759802
For 12-month Period Ending: August 31, 2008[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: June 11, 2009

Facility
Lalor Elementary
25 Barnt Deklyn Ave
Hamilton, NJ 08610

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1926
Gross Floor Area (ft²): 36,408

Energy Performance Rating[2] (1-100) 66

Site Energy Use Summary[3]	
Natural Gas (kBtu)[4]	1,856,406
Electricity (kBtu)	495,519
Total Energy (kBtu)	2,351,925

Energy Intensity[5]	
Site (kBtu/ft²/yr)	65
Source (kBtu/ft²/yr)	99

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	174

Electric Distribution Utility
PSE&G - Public Service Elec & Gas Co

National Average Comparison	
National Average Site EUI	75
National Average Source EUI	115
% Difference from National Average Source EUI	-14%
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. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12 month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

The government estimates the average time needed to fill out this form is 6 hours (includes the time for entering energy data, PE facility inspection, and notarizing the SEP) and welcomes suggestions for reducing this level of effort. Send comments (referencing OMB control number) to the Director, Collection Strategies Division, U.S., EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

Lalor Elementary School was built approximately 83 years ago. The building is three stories (including the basement) and has a total floor area of 36,408 square feet. The basement holds the boiler room, storage rooms as well as classrooms.

2.2. Building occupancy profiles

During the site visit (spring break week), there were approximately 5 employees observed in the building at once. The building is operated from 7:30am until 3pm, Monday through Friday, unless conditions such as winter weather required the school to be closed. During summer months when school is not in session, there is an average of 5 people in the building including maintenance and administrative staff.

2.3. Building envelope

2.3.1. Exterior walls

The exterior walls consist of a red brick façade with 2"x6" metal framing on the interior, 16 inches on center with no insulation. While insulation could be added to the exterior walls of the main building, it would have a significant impact on building operations and SWA has determined that it is not cost effective to do so at this time. If any portion of the building is renovated or improved as part of a capital improvement plan, SWA recommends increased insulation is added to any walls during construction.

2.3.2. Roof

The roof of the building is pitched and was recently replaced with EPDM rubber roofing on a metal deck. The roof is accessed from the outside via a ladder. On the day of the site visit, the maintenance staff did not the have the capabilities of accessing the roof. From portions of roof that could be observed from the ground, the roof surface appeared to be in good condition and it would not be cost effective to upgrade at this point in time.

2.3.3. Base

The building has a basement with a 6" concrete base. There were no reported problems with water penetration or moisture.

2.3.4. Windows

All of the windows in the building are single-pane, metal framed windows with plexi-glass inserts for child safety. These windows have a poor insulating quality and allow heat to transfer out of the building during the heating season and allow heat to transfer in during the cooling season. In addition to the windows being poorly insulated, many of the windows were noticed to be poorly sealed to the envelope of the building and daylight could be seen around the frame of the window. Below is a picture showing a typical window for Lalor Elementary School.

Typical classroom window

2.3.5. Exterior doors

The entranceways for Lalor Elementary School consist of a mix of insulated and un-insulated metal doors. A majority of these doors are poor insulators and allow conditioned air to leak out of the building. These doors consist of metal frames as well as metal doors. The doors were observed to be missing weather-stripping so that they did not seal well to the frames. In many cases, the frame assembly was not sealed well to the building and gaps were left between the masonry and the door frame. Areas where there were large gaps between the masonry and door frame were observed to be stuffed with compressed insulation that has a compromised insulation value. SWA recommends air sealing around all of the doors and windows in the office portion of the building in order to prevent conditioned air from leaking outside of the building.

Exterior door needing replacement

2.3.6. Building air tightness

Lalor Elementary School has a leaky shell with poor air sealing to separate conditioned air from the outside air. The ceiling provides a poor air and thermal seal from the plenum above and therefore, the volume of the building that requires heat is expanded. Conditioned air is allowed

to leak into the attic and therefore increases the heating demand on the boiler. The attic essentially creates a large and unnecessary heating load on the heating system.

Any holes or penetrations in the building should be sealed to prevent the loss of conditioned air. All plumbing, wiring, HVAC or ductwork penetrations should be sealed with foam or caulk. The attic plane should be a completely sealed and air tight barrier in order to prevent the loss of conditioned air. All other building penetrations, including fans, air conditioners, pipe, wire, or HVAC penetrations throughout the building should be sealed.

Any asbestos-like-material should be removed from the premises before energy efficient upgrades are conducted, such as air sealing or adding insulation, which may have an effect on air quality within the building.

Asbestos insulation on piping

2.4. HVAC systems

2.4.1. Heating

The school is served by two of steam boilers. These boilers supply steam to floor mounted unit ventilators in each classroom. The heating capacity of each unit ventilators ranges from 60-100 Mbtu. Each unit ventilator has unit-mounted controls that provide adjustment of both the steam valve and the fan. The building is served by pneumatic controls. Boiler On/Off operation can be controlled remotely by an Automated Logic panel located in the mechanical room. See the Equipment Inventory Table for further details.

Asbestos was observed on the piping and equipment in the mechanical room. Although this assessment focuses on energy-efficiency, the health and safety concerns associated with asbestos should be noted. Asbestos abatement is primarily a safety issue and is not directly associated with a cost payback. However, the existence of asbestos very often impacts the ability of building operators to perform routine maintenance procedures without undertaking appropriate safety measures and incurring associated costs.

As a result of asbestos, the efficiency of building systems often suffers from lack of routine maintenance. During the course of this assessment, appropriate safety precautions were taken with regards to the presence of asbestos. In some cases, this prevented SWA from completing a more thorough investigation of the existing systems and equipment. To protect the welfare of

students and staff, SWA recommends that asbestos abatement be addressed prior to undertaking any other significant investments in capital improvements.

2.4.2. Cooling

There were approximately five window air conditioner units observed throughout the building. SWA recommends replacing older model units with Energy Star window air conditioners, sized proportionally for the room, with an EER of 12 or better.

2.4.3. Ventilation

The floor-mounted unit ventilators in each classroom have an outdoor air duct through the exterior wall that delivers air to the rear of the unit. Exterior louvers allow air to be drawn into the unit ventilator and heated within the space. When the unit ventilator fan is operating, the fresh air is distributed to the room. In addition, the classrooms have operable windows to provide ventilation during the summer months.

Exhaust fans in bathrooms throughout the school provide the only air exchange throughout the school. The bathroom and kitchen cafeteria exhaust fans are used to minimize odor.

2.4.4. Domestic Hot Water

Domestic Hot Water for the building is provided by an A.O. Smith natural gas-fired hot water storage tank. The storage tank has a capacity of 60 gallons of storage and an input of 80 MBtuh. This standard efficiency equipment has an efficiency rating of approximately 78%.

It is not cost-effective to replace the existing water heating equipment with higher efficiency equipment. However, higher efficiency water heating equipment will save energy and should be strongly considered upon replacement of the equipment. Energy saving appliances bearing the ENERGY STAR label should be selected to ensure efficiency performance. Incentives may be available to offset any added costs for the installed equipment.

More efficient water-consuming fixtures and appliances save both energy and money through reduced energy consumption for water heating, as well decreased water and sewer bills. SWA recommends adding controlled on/off timers on all lavatory faucets to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and/or low-flow fixtures to reduce hot water consumption. In addition, routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy.

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting – Lalor Elementary School showed a great need for updated lighting throughout many classroom closets, stairwells, and storage areas. Many fixtures appeared to be original to the building and contained inefficient ballasts, as well as inefficient incandescent bulbs. SWA recommends replacing all magnetic ballasts with electronic ballasts and all T12 fluorescent bulbs with T8 fluorescent bulbs. Replacing the magnetic ballasts alone will result in a 15-20% savings per light fixture and replacing T12 bulbs with T8 bulbs will result in an

additional 10-15% savings per light fixture. Incandescent bulbs were found in most classroom closets and storage areas and should be upgraded to compact fluorescent bulbs. The building has approximately 15 exit signs installed, 11 of which are older fluorescent type fixtures. Fluorescent exit signs waste an unnecessary amount of energy since they run 24 hours per day and should be upgraded to newer LED exit signs. SWA recommends replacing all fluorescent exit signs with newer 5W LED models. See the lighting schedule attached in the Appendix A for complete lighting retrofit details.

SWA recommends implementing a school-wide educational program to teach both teachers and students to take advantage of turning off lights to save energy, use blinds to block out unwanted warmth from solar heat gain and other ways to save energy without spending money.

Although natural day lighting has been shown to improve occupant health, solar heat gain and glare from older glazing often negatively impact activities and comfort within the space. During the time of our visit (spring break week) shades were half drawn throughout the school. To understand the comfort concerns and identify those classrooms with the most significant problems, building staff can conduct an occupant survey. For problem areas, it may be beneficial to install tinted glazing or a window film to reduce the glare and solar heat gains. This recommendation will not provide energy savings but may improve occupant comfort.

2.5.2. Appliances and process

Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. For example, Energy Star refrigerators use as little as 315kwh/hr. When compared to the average electrical consumption of older equipment, Energy Star equipment results in a large savings. Look for the Energy Star label when replacing appliances and equipment, including: window air conditioners, refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov

Computers left on in classrooms consume a lot of energy. A typical desk top computer uses 65 to 250 watts and uses the same amount of energy when the screen saver is left on. Televisions in classrooms use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all classrooms appliances (i.e. fridges, coffee makers, televisions, etc.) be plugged in to power strips and turned off each evening just as the lights are turned off. There were at least 5 computers left fully on when the building was audited during spring break week.

Computer left on during spring break week

2.5.3. Elevators

There are no elevators at Lalor Elementary School.

2.5.4. Other electrical systems

There are currently no other electrical systems in the building.

3. EQUIPMENT LIST

Building System	Description	Make/ Model	Fuel	Space served	Estimated Remaining useful life %
Heating	(2) Steam Boilers, 101 HP each	HB Smith	Natural Gas	Building	5%
Distribution System	Floor mounted Unit ventilators/radiators with unit-mounted adjustable valve and fan controls	Nesbitt	Steam	Each Classroom	Varies
Cooling	No Central Cooling				
Ventilation	Outdoor Intake in Unit Ventilators, Exhaust for kitchens and baths.				
Domestic Hot Water	Tank-type Water Heater, 60 gallon, 80 Mbtuh	A.O. Smith	Natural Gas	Building	10%
Lighting	See details appendix A	-	-	-	-

Note:

The remaining useful life of a system (in %) is an estimate based on the system date of built and existing conditions derived from visual inspection.

ENERGY CONSERVATION MEASURES

Based on the assessment of this building, SWA has separated the investment opportunities into three categories of recommendations:

1. Capital Improvements – Upgrades not directly associated with energy savings
2. Operations and Maintenance – Low Cost/No Cost Measures
3. Energy Conservation Measures – Higher cost upgrades with associated energy savings

Category I Recommendations: Capital Improvements

- Asbestos Abatement – As noted previously, asbestos was observed in the buildings and is considered a health and safety hazard. In addition, the existence of asbestos impacts the ability of the building operations staff to conduct routine maintenance without incurring additional costs associated with proper safety measures. Regardless of the recommendations adopted to upgrade the energy-efficiency of the facility, SWA recommends abatement as the first priority.
- Window Replacement – Some of the buildings in the school district have already undergone upgrades to the windows. In the past, the existing window frames have been maintained and only new glazing was installed. Since the existing window units typically contain only single pane glazing and have metal frames, this upgrade typically offers little energy savings during the heating season. Since the buildings do not have central air conditioning, there are no cost savings associated with windows during the summer months. While window replacement may provide comfort and safety benefits, SWA does not recommend this as a high priority investment with respect to energy efficiency.

Category II Recommendations: Operations and Maintenance

- Pipe Insulation – The energy efficiency of the heating plant and distribution system can be improved by repairing and/or replacing damaged pipe insulation. This recommendation can easily be undertaken by maintenance personal for minimal cost. However, the existence of asbestos impacts the cost associated with this recommendation. For this reason, asbestos abatement has been identified as a high priority investment.
- Steam Traps – Similarly, the energy efficiency of the heating plant and distribution system can be improved by repairing and/or replacing damaged steam traps. SWA recommends that building personnel conduct a steam trap inventory to determine the scope of the project. Project costs will vary, depending on the number of traps and the type of upgrade required. Again, the existence of asbestos impacts the cost associated with this recommendation. For this reason, asbestos abatement has been identified as a high priority investment.
- Controls Optimization – Is is SWA's understanding that the existing Automated Logic Control panel is used to remotely control on/off boiler operation for all buildings by the District Facility Manager. This panel can be optimized and/or expanded to either shut down or reset the boilers based on outdoor temperature. This may require additional sensors and programming by a Controls professional. However, utilization of the existing equipment makes this a relatively simple and cost-effective recommendation.
- Weather Stripping/Air Sealing - SWA observed that exterior door weather-stripping was beginning to deteriorate. Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. The perimeter of all window frames should also be regularly inspected and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frame. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.

- Water Efficient Fixtures & Controls - Adding controlled on/off timers on all lavatory faucets is a cost-effect way to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and/or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consuming fixtures and appliances will save both energy and money through reduced energy consumption for water heating, while also decreasing water and sewer bills.
- Create an educational program that teaches both students and their teachers how to minimize their energy use in the classroom by using window blinds to allow natural light in or keep unwanted heat out. The US Department of Energy offers free information for hosting energy efficiency educational programs and K-12 lesson plans, for more information please visit: http://www1.eere.energy.gov/education/

Category III Recommendations: Energy Conservation Measures

Summary table

ECM#	Description
1	**Replace Existing Steam Boilers: Upgrade the existing steam boilers with new, higher efficiency steam boilers. This recommendation includes optimization of existing remote boiler controls, new local boiler controls, repair/replacement of failed steam traps, and increased pipe insulation. Implementation of this recommendation will require professional design assistance and asbestos abatement.**
2	**Lighting Upgrade; See appendix A for entire lighting retrofit schedule.**

ECM#1: *Replace Existing Steam Boilers*

Description:

The existing steam boilers have been reasonably well-maintained but they are inefficient relative to newer technology and they have reached the end of their useful life. The recommendation provided here cannot be cost justified by energy savings alone. However, the age and condition of the equipment warrant attention and this recommendation is intended to provide guidance to help the building management staff prioritize upgrades within the facility.

The existing equipment is approximately 75% efficient. To improve heating plant energy performance, SWA recommends replacement of the existing boilers with new boilers that have an efficiency of 82% or better. Boiler capacity should be properly sized. Insulation and steam traps on all boiler piping within the mechanical room and any accessible distribution piping should be replaced during this retrofit. As part of this upgrade, a local boiler control should be installed to provide on/off control based on outdoor temperature and boiler sequencing. The existing Automated Logic Control panel should be optimized to provide improved control during remote operation. This may require the installation of local temperature sensors and updated programming by a controls contractor.

Before proceeding with implementation of this recommendation, it will be necessary to abate the asbestos in the mechanical room. Asbestos abatement is outside the scope of this assessment and the cost estimates provided do not include pricing associated with abatement. This recommendation will also require professional design assistance to determine the appropriate equipment and configuration. Costs associated with design have not been included in the estimate provided in this report.

Pneumatic controls are used to regulate the heating system throughout the building, which primarily includes floor-mounted unit ventilators that are quite old. Although there is an opportunity to improve comfort and energy performance by upgrading the building controls and the distribution system, the impact on the building operations negates the cost-effectiveness of this recommendation.

Installation cost:

Estimated installed cost: $76,675
Source of cost estimate: RS *Means*

Economics:

1st year energy savings					SPP	LoM	lifetime		Annual Carbon Reduction (lbs of CO2)
usage	unit	demand	unit	$ savings/yr			cost savings	ROI	
1,351	therm	0.0	kW	$ 2,094	36.6	30	$ 40,003	-1.6%	14,892

Assumptions: SWA calculated the savings for this measure using information collected during the field visit and analysis of historical utility consumption information. SWA estimated the natural gas usage associated with heating only and assumed that this measure will save 7% of the heating usage. Pricing is based on removal of all existing boilers and replacement with an equal number of boilers.

Rebates/financial incentives:

This measure may qualify for an incentive of $1.00 per MBH of boiler capacity. Required boiler capacity will be determined by the design professional.

Options for funding ECM:
Additional information may be found on the NJ Clean Energy website.

ECM#2: *Lighting Upgrade*

Description:

Lalor Elementary School uses a mix of both efficient and inefficient lighting. For the most part, the school used 4' linear T8 fixtures with electronic ballasts that are not in need of upgraded. A few light fixtures still contain magnetic ballasts with T12 bulbs and these should be replaced. One are of concern with regards to lighting is closets and bathrooms. Most classrooms contain a closet, a bathroom or both. The majority of these smaller spaces had incandescent lighting. There were some light bulbs that SWA witnessed burn out on the day of the audit. Some closets were equipped with incandescent bulbs that were much too large, such as a 200W bulb. In most cases, a 20W CFL replacement is recommended and will provide sufficient light. In order to save energy usage, energy costs and also maintenance costs, SWA recommends that all incandescent lighting fixtures be retro-fitted with CFL light bulbs. Lalor Elementary School also contains many fluorescent exit signs that consume 20W of power compared to newer LED models that consume only 5W of power. Switching from fluorescent exit signs to LED exit signs is always cost-effective since they are left on 24/7. SWA recommends that all fluorescent exit signs should also be replaced with LED models. For a complete existing and retrofit lighting schedule, please see Appendix A.

Installation cost:

Estimated installed cost: $2,730
Source of cost estimate: RS *Means*

Economics:

1st year energy savings					SPP	LoM	lifetime	ROI	Annual Carbon Reduction (lbs of CO2)
usage	unit	demand	unit	$ savings/yr			cost savings		
12,363	kWh	1.4	kW	$ 1,916	1.4	20	$ 38,325	65.2%	22,136

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit, and billing analysis.

Rebates/financial incentives:

NJ Clean Energy – Prescriptive Lighting Incentive, Incentive based on installing T5 or T8 lamps with electronic ballasts in existing facilities ($10-$30 per fixture, depending on quantity of lamps).

NJ Clean Energy – Prescriptive Lighting Incentive, Incentive based on installing LED Exit signs ($10/$20 per fixture).

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.
http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

4. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

4.1. Existing systems

There are currently no existing renewable energy systems.

4.2. Solar Photovoltaic

Photovoltaic (PV) technology would not be cost beneficial to this project since there is such little electric demand. Also, the school is not in session during the summer when photovoltaic panels would be most beneficial.

4.3. Solar Thermal Collectors

Solar thermal collectors are not cost effective for this project and are not be recommended due to the low amount of domestic hot water use throughout the building.

4.4. Combined Heat and Power

CHP is not applicable to this project because of the HVAC system type and limited domestic hot water usage.

4.5. Geothermal

Geothermal is not applicable to this project because it would require modifications to the existing heat distribution system, which would not be cost effective.

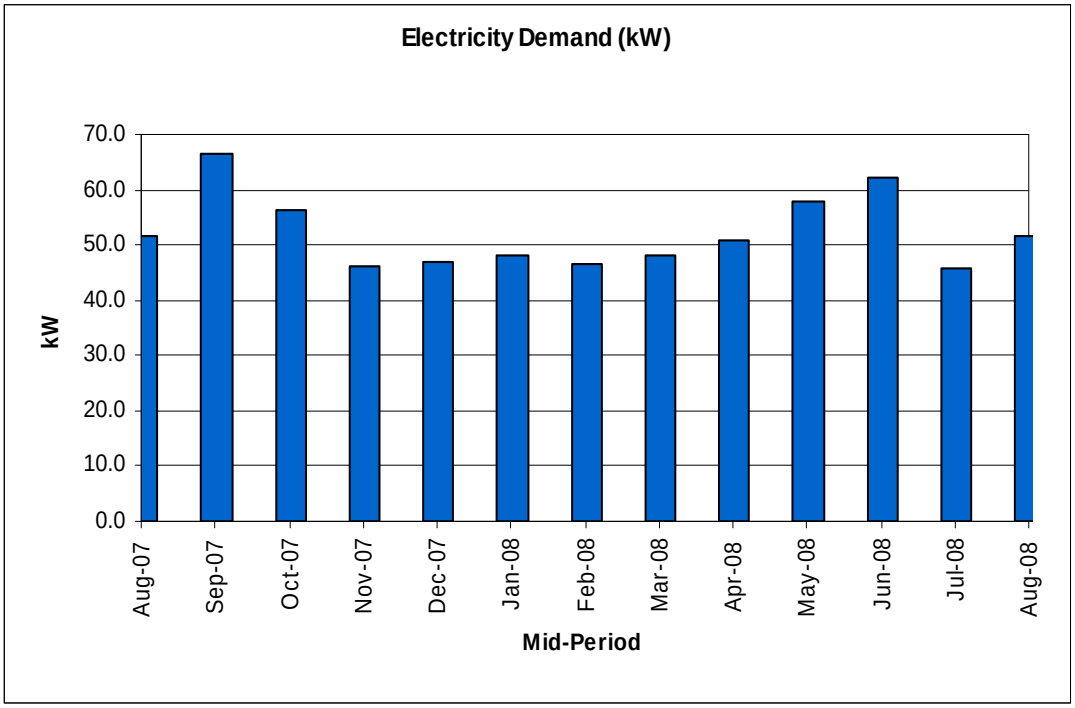
4.6. Wind

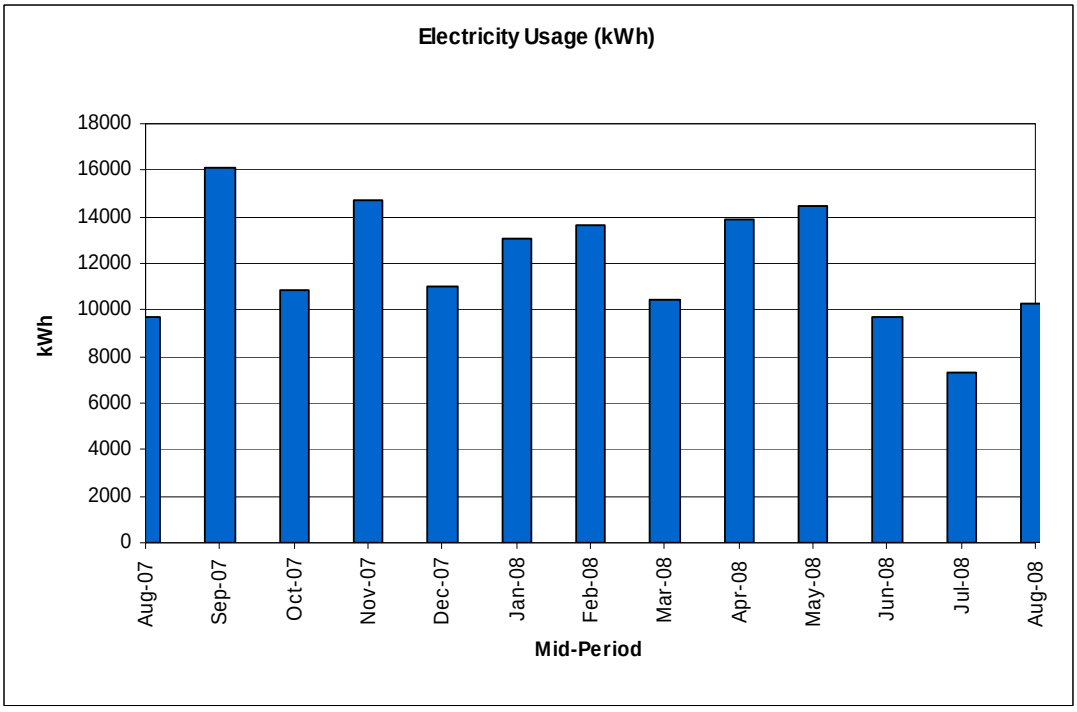
Wind power production is not appropriate for this location because required land is not available for the wind turbine. Also, the available wind energy resource is very low.

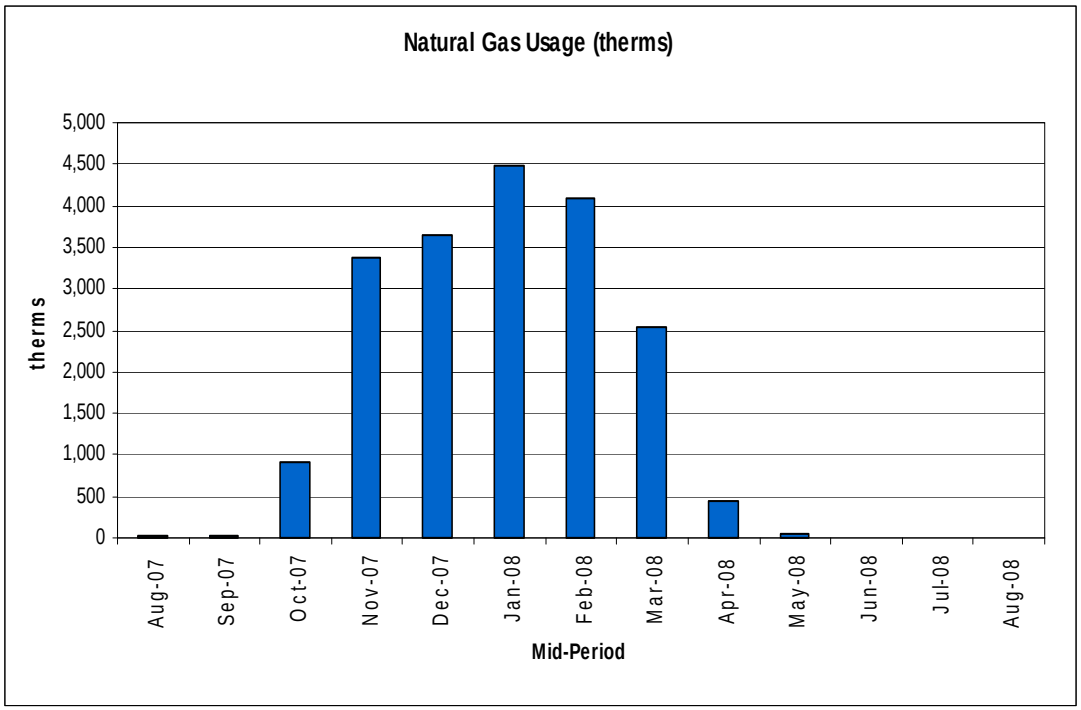
5. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

Load profiles

The average electrical peak demand for the previous year was 52.2 kW and the maximum peak demand was 66.6 kW. The electric and gas load profiles for this project are presented in the following charts. The first chart shows electric demand (in kW) for the previous 12 months and the other two charts show electric and gas usage (in kWh), respectively.


Electricity Demand (kW)
kW
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Aug-07
Sep-07
Oct-07
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Mid-Period


Electricity Usage (kWh)
kWh
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Aug-07
Sep-07
Oct-07
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Mid-Period



5.1. Tariff analysis

The school currently buys electricity and gas from PSE&G at the FTLV rate. FTLV is a typical rate structure where customers pay for natural gas based on usage and electricity based on usage with the addition of an electrical demand charge. The FTLV rate is appropriate for this building. No information on gas transportation charges was provided for this analysis.

5.2. Energy Procurement strategies

Billing analysis shows price fluctuations of over 20% over the course of the year for the building electrical and natural gas accounts. Customers that have a large variation in monthly billing rates can often reduce the costs associated with energy procurement by selecting a third party energy supplier. Contact the NJ Energy Choice Program for further information on Energy Services Companies (ESCOs) that can act as third party energy suppliers. Purchasing electricity from an ESCO can reduce electric rate fluctuation and ultimately reduce the annual cost of energy for the school. Appendix C contains a complete list of third party energy suppliers.

The building would not be eligible for enrollment in a Demand Response Program because the minimum electric demand each month does not greatly exceed 50 kW, which is the typical threshold for considering this option.

6. METHOD OF ANALYSIS

6.1. Assumptions and methods

Energy modeling method:	Spreadsheet-based calculation methods
Cost estimates:	RS Means 2009 (Facilities Maintenance & Repair Cost Data) RS Means 2009 (Building Construction Cost Data) RS Means 2009 (Mechanical Cost Data) Note: Cost estimates also based on utility bill analysis and prior experience with similar projects.

6.2. Disclaimer

This engineering audit was prepared using the most current and accurate fuel consumption data available for the site. The estimates that it projects are intended to help guide the owner toward best energy choices. The costs and savings are subject to fluctuations in weather, variations in quality of maintenance, changes in prices of fuel, materials, and labor, and other factors. Although we cannot guarantee savings or costs, we suggest that you use this report for economic analysis of the building and as a means to estimate future cash flow.

THE RECOMMENDATIONS PRESENTED IN THIS REPORT ARE BASED ON THE RESULTS OF ANALYSIS, INSPECTION, AND PERFORMANCE TESTING OF A SAMPLE OF COMPONENTS OF THE BUILDING SITE. ALTHOUGH CODE-RELATED ISSUES MAY BE NOTED, SWA STAFF HAVE NOT COMPLETED A COMPREHENSIVE EVALUATION FOR CODE-COMPLIANCE OR HEALTH AND SAFETY ISSUES. THE OWNER(S) AND MANAGER(S) OF THE BUILDING(S) CONTAINED IN THIS REPORT ARE REMINDED THAT ANY IMPROVEMENTS SUGGESTED IN THIS SCOPE OF WORK MUST BE PERFORMED IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS THAT APPLY TO SAID WORK. PARTICULAR ATTENTION MUST BE PAID TO ANY WORK WHICH INVOLVES HEATING AND AIR MOVEMENT SYSTEMS, AND ANY WORK WHICH WILL INVOLVE THE DISTURBANCE OF PRODUCTS CONTAINING MOLD, ASBESTOS, OR LEAD.

Appendix A: Lighting study

Existing Lighting Conditions																Proposed Lighting Improvements								
#	School	Building	Level/Floor	Location in Building	Measured Lighting Level in Footcandles	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/Lamp	Hrs/Day	Energy Use (Watt hours/day)	Controls	Daylighting possible?	Total Power (W)	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/Lamp	Hrs/Day	Energy Use (Watt hours/day)	Total Power (W)
1	Lalor ES	Main Building	Second Floor	Room 14	25-45	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	Switch	Yes	768	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	768
2	Lalor ES	Main Building	Second Floor	Room 14 - Closet	6	200W inc. bulb	-	1	1	Incandescent	200	2	400	Switch	No	200	20w CFL	-	1	1	CFL	20	2	40	**20**
3	Lalor ES	Main Building	Second Floor	Hallway-2	35	4' linear T8	electronic	22	4	Fluorescent	32	11	30976	Switch	No	2816	4' linear T8	electronic	22	4	Fluorescent	32	11	30976	2816
4	Lalor ES	Main Building	Second Floor	Hallway-2	15-25	R. Exit Sign	-	2	1	Fluorescent	20	24	960	None	No	40	LED Exit Sign	-	2	1	LED	5	24	240	**10**
5	Lalor ES	Main Building	Second Floor	Boy's Room	15-5	4' linear T8	electronic	1	2	Fluorescent	32	8	512	Switch	No	64	4' linear T8	electronic	1	2	Fluorescent	32	8	512	64
6	Lalor ES	Main Building	Second Floor	Room 13	30-95	4' linear T8	electronic	10	4	Fluorescent	32	4	5120	Switch	Yes	1280	4' linear T8	electronic	10	4	Fluorescent	32	4	5120	1280
7	Lalor ES	Main Building	Second Floor	Room 13 - Closet		100W inc. bulb	-	1	1	Incandescent	100	2	200	Switch	No	100	20w CFL	-	1	1	CFL	20	2	40	**20**
8	Lalor ES	Main Building	Second Floor	Storage (between Room 12 and Stairwell)	17-3	8' linear T12	magnetic	1	2	Fluorescent	72	2	288	Switch	No	144	8' linear T8	electronic	1	2	Fluorescent	59	2	236	**118**
9	Lalor ES	Main Building	Second Floor	Room 12	20-25	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	Switch	Yes	768	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	768
10	Lalor ES	Main Building	Second Floor	Room 12 - Closet	15	100W inc. bulb	-	1	1	Incandescent	100	2	200	Switch	No	100	20w CFL	-	1	1	CFL	20	2	40	**20**
11	Lalor ES	Main Building	Second Floor	Room 11	20-35	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	Switch	Yes	768	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	768
12	Lalor ES	Main Building	Second Floor	Room 11 - Closet	15	100W inc. bulb	-	1	1	Incandescent	100	2	200	Switch	No	100	20w CFL	-	1	1	CFL	20	2	40	**20**
13	Lalor ES	Main Building	Second Floor	Room 10	25-50	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	Switch	Yes	768	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	768
14	Lalor ES	Main Building	Second Floor	Room 10 - Closet	15	60W inc. bulb	-	1	1	Incandescent	60	2	120	Switch	No	60	20w CFL	-	1	1	CFL	20	2	40	**20**
15	Lalor ES	Main Building	Second Floor	Room 9	35-50	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	Switch	Yes	768	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	768
16	Lalor ES	Main Building	Second Floor	Room 9 - Closet	15	100W inc. bulb	electronic	1	1	Incandescent	100	2	200	Switch	No	100	20w CFL	-	1	1	CFL	20	2	40	**20**
17	Lalor ES	Main Building	Second Floor	Storage (211)	11	100W inc. bulb	-	1	1	Incandescent	100	2	200	Switch	No	100	20w CFL	-	1	1	CFL	20	2	40	**20**
18	Lalor ES	Main Building	Second Floor	Storage (212)	11	60W inc. bulb	-	1	1	Incandescent	60	2	120	Switch	No	60	20w CFL	-	1	1	CFL	20	2	40	**20**
19	Lalor ES	Main Building	Second Floor	Room 8	25-35	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	Switch	Yes	768	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	768
20	Lalor ES	Main Building	Second Floor	Room 8 - Closet	5-10	100W inc. bulb	-	1	1	Incandescent	100	2	200	Switch	No	100	20w CFL	-	1	1	CFL	20	2	40	**20**
21	Lalor ES	Main Building	Second Floor	Girl's Room	5-10	4' linear T8	electronic	1	2	Fluorescent	32	8	512	Switch	No	64	4' linear T8	electronic	1	2	Fluorescent	32	8	512	64
22	Lalor ES	Main Building	Second Floor	Room7	20-40	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	Switch	Yes	768	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	768
23	Lalor ES	Main Building	Second Floor	Room 7 - Closet	15	100W inc. bulb	-	1	1	Incandescent	100	2	200	Switch	No	100	20w CFL	-	1	1	CFL	20	2	40	**20**
24	Lalor ES	Main Building	Second Floor	Stairwell (next to Room 13)	5-10	200W inc. bulb	-	5	1	Incandescent	200	11	11000	Switch	No	1000	20w CFL	-	5	1	CFL	20	11	1100	**100**
25	Lalor ES	Main Building	Second Floor	Stairwell (next to Room 13)		R. Exit Sign	-	1	1	Fluorescent	20	24	480	None	No	20	LED Exit Sign	-	1	1	LED	5	24	120	**5**
26	Lalor ES	Main Building	Second Floor	Stairwell (next to Room 7)		200W inc. bulb	-	5	1	Incandescent	200	11	11000	Switch	No	1000	20w CFL	-	5	1	CFL	20	11	1100	**100**
27	Lalor ES	Main Building	Second Floor	Stairwell (next to Room 7)		R. Exit Sign	-	1	1	Fluorescent	20	24	480	None	No	20	LED Exit Sign	-	1	1	LED	5	24	120	**5**
28	Lalor ES	Main Building	First Floor	Back Entrance (next to stage)	15	200W inc. bulb	-	1	1	Incandescent	200	11	2200	Switch	No	200	20w CFL	-	1	1	CFL	20	11	220	**20**
29	Lalor ES	Main Building	First Floor	Back Entrance (next to room 102)		200W inc. bulb	-	1	1	Incandescent	200	11	2200	Switch	No	200	20w CFL	-	1	1	CFL	20	11	220	**20**
30	Lalor ES	Main Building	First Floor	Girl's Room	2-6	4' linear T8	electronic	1	2	Fluorescent	32	8	512	Switch	No	64	4' linear T8	electronic	1	2	Fluorescent	32	8	512	64
31	Lalor ES	Main Building	First Floor	Hallway-1	25-50	4' linear T8	electronic	18	4	Fluorescent	32	11	25344	Switch	No	2304	4' linear T8	electronic	18	4	Fluorescent	32	11	25344	2304
32	Lalor ES	Main Building	First Floor	Hallway-1		R. Exit Sign	-	2	1	Fluorescent	20	24	960	None	No	40	LED Exit Sign	-	2	1	LED	5	24	240	**10**
33	Lalor ES	Main Building	First Floor	Hallway-1		LED Exit Sign	-	2	1	LED	5	24	240	None	No	10	LED Exit Sign	-	2	1	LED	5	24	240	10
34	Lalor ES	Main Building	First Floor	Room 6	15-40	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	Switch	No	768	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	768
35	Lalor ES	Main Building	First Floor	Room 6 - Closet	15	60W inc. bulb	-	1	1	Incandescent	60	2	120	Switch	No	60	20w CFL	-	1	1	CFL	20	2	40	**20**
36	Lalor ES	Main Building	First Floor	Room 5	20-45	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	Switch	Yes	768	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	768
37	Lalor ES	Main Building	First Floor	Room 5 - Closet		100W inc. bulb	-	1	1	Incandescent	100	2	200	Switch	No	100	20w CFL	-	1	1	CFL	20	2	40	**20**
38	Lalor ES	Main Building	First Floor	Room 4	35-50	4' linear T8	electronic	14	2	Fluorescent	32	8	7168	Switch	Yes	896	4' linear T8	electronic	14	2	Fluorescent	32	8	7168	896
39	Lalor ES	Main Building	First Floor	Room 4 - Bath		75W inc. bulb	-	1	1	Incandescent	75	2	150	Switch	No	75	20w CFL	-	1	1	CFL	20	2	40	**20**
40	Lalor ES	Main Building	First Floor	Faculty Room	40-65	4' linear T8	electronic	5	2	Fluorescent	32	8	2560	Switch	No	320	4' linear T8	electronic	5	2	Fluorescent	32	8	2560	320
41	Lalor ES	Main Building	First Floor	Faculty Room - Bath		4' linear T8	electronic	1	2	Fluorescent	32	2	128	Switch	No	64	4' linear T8	electronic	1	2	Fluorescent	32	2	128	64
42	Lalor ES	Main Building	First Floor	Room 2	18-35	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	Switch	Yes	768	4' linear T8	electronic	12	2	Fluorescent	32	8	6144	768
43	Lalor ES	Main Building	First Floor	Room 2 - Closet		60W inc. bulb	-	1	1	Incandescent	60	2	120	Switch	No	60	20w CFL	-	1	1	CFL	20	2	40	**20**
44	Lalor ES	Main Building	First Floor	Boy's Room	5-15	4' linear T8	electronic	1	2	Fluorescent	32	8	512	Switch	No	64	4' linear T8	electronic	1	2	Fluorescent	32	8	512	64
45	Lalor ES	Main Building	First Floor	Room 3	25-95	4' linear T8	electronic	10	4	Fluorescent	32	8	10240	Switch	Yes	1280	4' linear T8	electronic	10	4	Fluorescent	32	8	10240	1280
46	Lalor ES	Main Building	First Floor	Room 3 - Closet	15	75W inc. bulb	-	1	1	Incandescent	75	2	150	Switch	No	75	20w CFL	-	1	1	CFL	20	2	40	**20**
47	Lalor ES	Main Building	First Floor	Room 3 - Bath		4' linear T8	electronic	1	2	Fluorescent	32	2	128	Switch	No	64	4' linear T8	electronic	1	2	Fluorescent	32	2	128	64
48	Lalor ES	Main Building	First Floor	Main Office	20-40	4' linear T8	electronic	5	2	Fluorescent	32	8	2560	Switch	No	320	4' linear T8	electronic	5	2	Fluorescent	32	8	2560	320
49	Lalor ES	Main Building	First Floor	Main Office - Bath		200W inc. bulb	-	1	1	Incandescent	200	2	400	Switch	No	200	20w CFL	-	1	1	CFL	20	2	40	**20**
50	Lalor ES	Main Building	First Floor	Main Office - Bath		75W inc. bulb	-	1	1	Incandescent	75	2	150	Switch	No	75	20w CFL	-	1	1	CFL	20	2	40	**20**
51	Lalor ES	Main Building	First Floor	Principal's Office	40	4' linear T8	electronic	4	2	Fluorescent	32	8	2048	Switch	No	256	4' linear T8	electronic	4	2	Fluorescent	32	8	2048	256
52	Lalor ES	Main Building	Basement	Library	20-55	8' linear T8	electronic	6	2	Fluorescent	59	8	5664	Switch	No	708	8' linear T8	electronic	6	2	Fluorescent	59	8	5664	708
53	Lalor ES	Main Building	Basement	Library		4' linear T8	electronic	2	2	Fluorescent	32	8	1024	Switch	No	128	4' linear T8	electronic	2	2	Fluorescent	32	8	1024	128
54	Lalor ES	Main Building	Basement	Library		4' linear T8	electronic	3	4	Fluorescent	32	8	3072	Switch	No	384	4' linear T8	electronic	3	4	Fluorescent	32	8	3072	384
55	Lalor ES	Main Building	Basement	Library - Speech Class	35	4' linear T8	electronic	3	2	Fluorescent	32	8	1536	Switch	No	192	4' linear T8	electronic	3	2	Fluorescent	32	8	1536	192
56	Lalor ES	Main Building	Basement	Room B8 - Nurse	80-95	Fl. Exit Sign	-	1	1	Fluorescent	20	24	480	None	No	20	LED Exit Sign	-	1	1	LED	5	24	120	**5**
57	Lalor ES	Main Building	Basement	Room B3 - Nurse		4' linear T8	electronic	3	4	Fluorescent	32	8	3072	Switch	No	384	4' linear T8	electronic	3	4	Fluorescent	32	8	3072	384
58	Lalor ES	Main Building	Basement	Room B3 - Bath		4' linear T8	electronic	1	2	Fluorescent	32	2	128	Switch	No	64	4' linear T8	electronic	1	2	Fluorescent	32	2	128	64
59	Lalor ES	Main Building	Basement	Room B4	20-25	4' linear T8	electronic	5	2	Fluorescent	32	8	2560	Switch	No	320	4' linear T8	electronic	5	2	Fluorescent	32	8	2560	320
60	Lalor ES	Main Building	Basement	Room B5	55-80	4' linear T8	electronic	2	4	Fluorescent	32	8	2048	Switch	No	256	4' linear T8	electronic	2	4	Fluorescent	32	8	2048	256
61	Lalor ES	Main Building	Basement	Hallway Connecting B3-B5)		4' linear T8	electronic	2	2	Fluorescent	32	11	1408	Switch	No	128	4' linear T8	electronic	2	2	Fluorescent	32	11	1408	128
62	Lalor ES	Main Building	Basement	Hallway-B		200W inc. bulb	-	6	1	Fluorescent	200	11	13200	Switch	No	1200	20w CFL	-	6	1	CFL	25	11	1650	**150**
63	Lalor ES	Main Building	Basement	Hallway-B		Fl. Exit Sign	-	4	1	Fluorescent	20	24	1920	None	No	80	LED Exit Sign	-	4	1	LED	5	24	480	**20**
64	Lalor ES	Main Building	Basement	Room B6 - RR	40-65	8' linear T8	electronic	8	2	Fluorescent	59	8	7552	Switch	No	944	8' linear T8	electronic	8	2	Fluorescent	59	8	7552	944
65	Lalor ES	Main Building	Basement	Supply Room (B2)	7	75W inc. bulb	-	1	1	Incandescent	75	2	150	Switch	No	75	20w CFL	-	1	1	CFL	20	2	40	**20**
66	Lalor ES	Main Building	Basement	Room B6 - BS	20	8' linear T8	electronic	8	2	Fluorescent	59	8	7552	Switch	No	944	8' linear T8	electronic	8	2	Fluorescent	59	8	7552	944
67	Lalor ES	Main Building	Basement	Cafeteria	25-100	LED Exit Sign	-	2	1	LED	5	24	240	None	No	10	LED Exit Sign	-	2	1	LED	5	24	240	10
68	Lalor ES	Main Building	Basement	Cafeteria		4' linear T8	electronic	20	4	Fluorescent	32	8	20480	Switch	No	2560	4' linear T8	electronic	20	4	Fluorescent	32	8	20480	2560
69	Lalor ES	Main Building	Basement	Cafeteria - Closet	32	4' linear T12	magnetic	1	2	Fluorescent	40	2	160	Switch	No	80	4' linear T8	electronic	1	2	Fluorescent	32	2	128	**64**
70	Lalor ES	Main Building	Basement	Storage (B13)		4' linear T12	magnetic	1	2	Fluorescent	40	2	160	Switch	No	80	4' linear T8	electronic	1	2	Fluorescent	32	2	128	**64**
71	Lalor ES	Main Building	Basement	Boiler Room		LED Exit Sign	-	2	1	LED	5	24	240	None	No	10	LED Exit Sign	-	2	1	LED	5	24	240	10
72	Lalor ES	Main Building	Basement	Boiler Room		200W inc. bulb	-	4	1	Fluorescent	200	2	1600	Switch	No	800	32W CFL	-	4	1	CFL	32	2	256	**128**
73	Lalor ES	Main Building	Basement	Boiler Room		8' linear T12	magnetic	1	2	Fluorescent	72	2	288	Switch	No	144	8' linear T8	electronic	1	2	Fluorescent	59	2	236	**118**
74	Lalor ES	Main Building	Basement	Boiler Room		4' linear T8	electronic	2	2	Fluorescent	32	2	256	Switch	No	128	4' linear T8	electronic	2	2	Fluorescent	32	2	256	128
75	Lalor ES	Main Building	Basement	Boiler Room - Custodian's Office		4' linear T8	electronic	1	2	Fluorescent	32	8	512	Switch	No	64	4' linear T8	electronic	1	2	Fluorescent	32	8	512	64
76	Lalor ES	Main Building	Basement	Boiler Room - Custodian's Office		4' linear T12	electronic	1	2	Fluorescent	40	8	640	Switch	No	80	4' linear T8	electronic	1	2	Fluorescent	32	8	512	**64**
77	Lalor ES	Main Building	Basement	Boiler Room - Storage		4' linear T8	electronic	6	4	Fluorescent	32	2	1536	Switch	No	768	4' linear T8	electronic	6	4	Fluorescent	32	2	1536	768
78	Lalor ES	Main Building	Basement	Basement Stairwell (next to kitchen)		200W inc. bulb	-	1	1	Incandescent	200	11	2200	Switch	No	200	32W CFL	-	1	1	CFL	32	11	352	**32**
79	Lalor ES	Main Building	Basement	Basement Stairwell (next to kitchen)		4' linear T8	electronic	1	2	Fluorescent	32	11	704	Switch	No	64	4' linear T8	electronic	1	2	Fluorescent	32	11	704	64
80	Lalor ES	Main Building	Basement	Basement Stairwell (next to library)		200W inc. bulb	-	1	1	Incandescent	200	11	2200	Switch	No	200	32W CFL	-	1	1	CFL	32	11	352	**32**
81	Lalor ES	Main Building	Basement	Basement Stairwell (next to library)		4' linear T8	electronic	1	2	Fluorescent	32	11	704	Switch	No	64	4' linear T8	electronic	1	2	Fluorescent	32	11	704	64

Totals		
Existing Usage (kWh/year)	69,474	
Proposed Usage (kWh/year)	57,111	
Existing Est. Cost ($/year)	$ 11,293.74	
Proposed Est. Cost ($/year)	$ 9,366.29	
Total kWh Savings	12,363	
Total $ Savings	$ 2,027.45	

Existing Lighting Total Power (Watts)	32954	Watts
Existing Lighting Power Density (W/sqft)	0.91	W/sqft
Proposed Lighting Total Power (Watts)	27091	Watts
Proposed Lighting Power Density (W/sqft)	0.74	W/sqft

Appendix B: Third Party Energy Suppliers (ESCOs)

Third Party Electric Suppliers for PSEG Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 665-8457 www.commerceenergy.com
ConEdison Solutions 535 State Highway 38 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Credit Suisse, (USA) Inc. 700 College Road East East Princeton, NJ 08450	(212) 547-2722 www.creditsuisses.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morriston, NJ 07962	(800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Integrys Energy Services, Inc. 99 Wood Ave South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 www.sel.com
Suez Energy Resources NA, Inc. 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com

Third Party Gas Suppliers for PSEG Service Territory	Telephone & Web Site
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 www.cooperativenet.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
Dominion Retail, Inc. 395 Highway 170, Suite 125 Lakewood, NJ 08701	(866) 275-4240 www.retail.dom.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com
Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateastern.com
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Hudson Energy Services, LLC 545 Route 17 South Ridgewood, NJ 07450	(877) 483-7669 www.hudsonenergyservices.com
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 www.intelligentenergy.org
Keil & Sons 1 Bergen Blvd. Fairview, NJ 07002	(877) 797-8786 www.systrumenergy.com
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	(888) 536-3876 www.metroenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 www.mxenergy.com
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	(800) 840-4427 www.natgasco.com
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Stuyvesant Energy LLC 10 West Ivy Lane, Suite 4 Englewood, NJ 07631	(800) 646-6457 www.stuyfuel.com
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	(800) 557-1121 www.woodruffenergy.com