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Local Government Energy Program
Energy audit report

For

Hamilton Board of Education
Robinson 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 Robinson Elementary School only.

Robinson Elementary School was built in 1962 with additions built in 1987 and consists of 40,073 square feet of conditioned space. There are approximately 300 students in grades Kindergarten through fifth grade and about 43 staff people. 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 Robinson Elementary School located at 495 Gropp Ave, Hamilton, NJ 08610. Robinson Elementary is a one story building. Based on the field visit performed by Steven Winter Associates (SWA) staff on April 15th, 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 (September 2007 through September 2008), Robinson Elementary School building consumed approximately 246,160 kwh or $37,085 worth of electricity and 24,769 therms or $38,391 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 3,317 MMBtu of energy at a total cost of $75,477.

SWA benchmarked Robinson 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 33 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 Robinson Elementary School building is 80 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 September 2007 through September 2008 baseline to track the changes in energy consumption associated with energy improvements.

SWA recommends a total of 3 Energy Conservation Measures (ECMs) for Robinson Elementary School. The total investment cost for these ECMs is **$79,694**. SWA estimates a first year savings of **$4,903** with a simple payback of **16.3 years**. SWA also estimates that Lalor Elementary School will be able to reduce their carbon footprint by **45,570 lbs of CO2 annually.**

There are various incentives that Robinson Elementary School could apply for that could also help lower the cost of installing the ECMs. SWA recommends that Robinson 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	Hot water boiler replacement	$ 76,911	RSMeans	0	kWh	1,608	therms	0.0	kW	$ 2,493	30.9	30	$ 47,625	-1.3%	17,730
2	Upgrade existing lighting	$ 2,525	RSMeans	13,121	kWh	-	therms	1.5	kW	$ 2,034	1.2	20	$ 40,675	75.5%	23,493
3	Vending Miser	$ 258	RSMeans	2,428	kWh	-	therms	0.0	kW	$ 376	0.7	10	$ 3,763	135.9%	4,347
Total	**Total Scope of Work**	**$ 79,694**	**-**	**15,549**	**-**	**1,608**		**1.5**	**-**	**$ 4,903**	**16.3**		**$ 92,064**		**45,570**

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

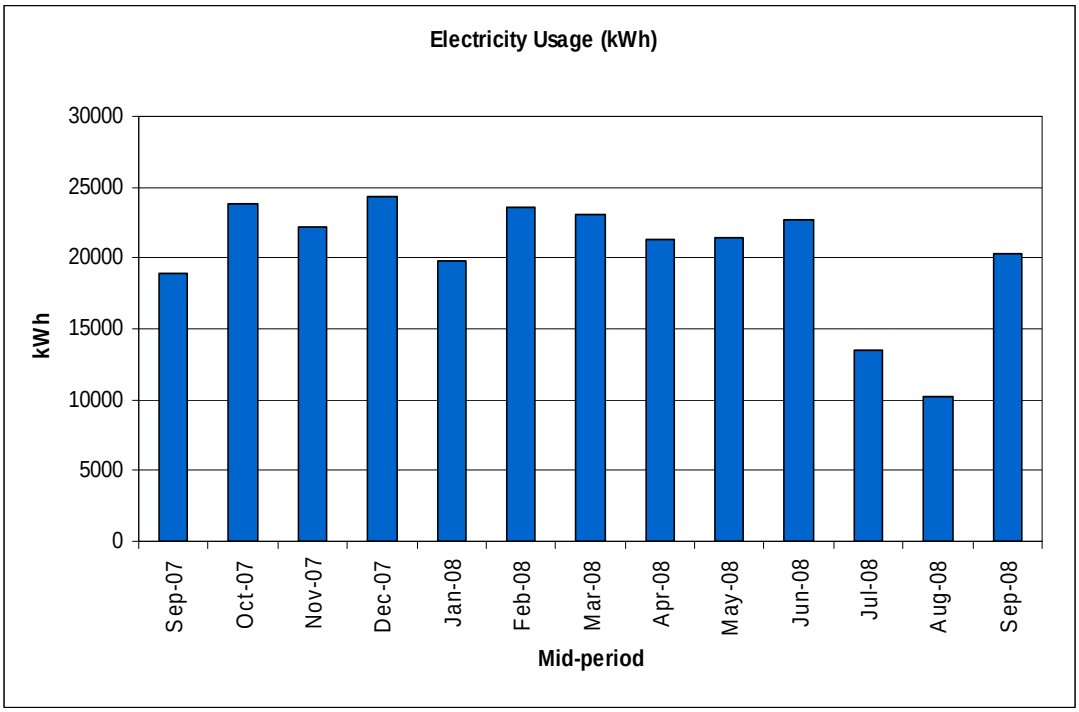
1.1. Energy usage and cost analysis

SWA received and analyzed utility bills from September 2007 through September 2009 that were received from the Hamilton Board of Education.

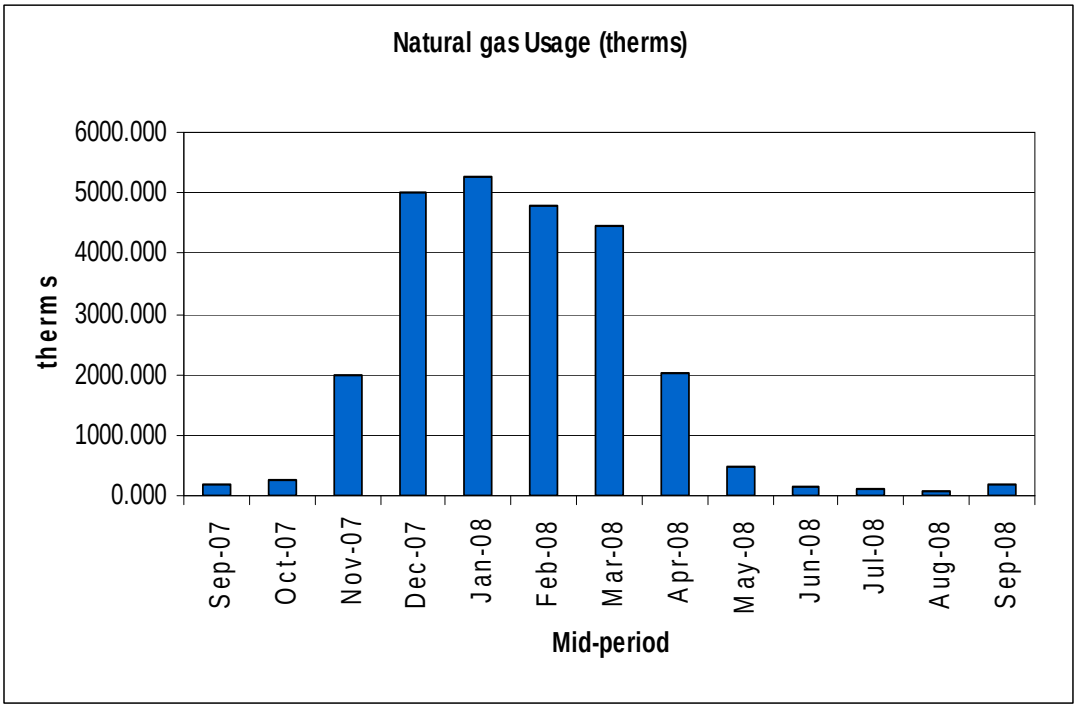
Electricity – Robinson Elementary School has one electric meter for incoming electricity supply. The building purchases electricity from PSE&G at **an average aggregated rate of $.158/kWh** based on September 2007 through September 2008 electric bills. The building purchased **approximately 246,160 kWh or $38,392 worth of electricity from September 2007 through September 2008.** Based on the same time period, the building also had **an average monthly demand of 75.8 kW and monthly peak demand of 91.2 kW.**

Natural Gas – Robinson Elementary School has one gas meter for incoming natural gas from PSE&G. Between September 2007 and September 2008, the building purchased **approximately 24,769 therms or $38,392 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 Robinson Elementary School based on utility bills for the year 2008.



The following chart shows the natural gas usage for Robinson Elementary School base 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

Robinson Elementary School currently buys electricity and gas from PSE&G at the FTLV general service rate (or MD rate). The FTLV general 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. Robinson Elementary School uses account # 13 62 575 150 68, at the service address of 495 Gropp Ave, Hamilton, NJ 08610 for the building electric and gas. Electricity for the building was billed at an average rate of **$0.158/kWh** and gas was billed at an average aggregated rate of **$0.519/therm** for gas consumption only. 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

Robinson 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 33. SWA recommends that the Robinson Elementary School Board of Education maintain the Portfolio Manager account at the link below. As the account is maintained, SWA can share the Robinson 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
Robinson Elementary

Building ID: 1760998
For 12-month Period Ending: August 31, 2008[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: June 26, 2009

Facility
Robinson Elementary
495 Gropp Ave
Trenton, NJ 08610

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1962
Gross Floor Area (ft²): 40,073

Energy Performance Rating[2] (1-100) 33

Site Energy Use Summary[3]	
Natural Gas (kBtu)[4]	2,349,674
Electricity (kBtu)	839,141
Total Energy (kBtu)	3,188,815

Energy Intensity[5]	
Site (kBtu/ft²/yr)	80
Source (kBtu/ft²/yr)	131

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	253

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

National Average Comparison	
National Average Site EUI	69
National Average Source EUI	113
% Difference from National Average Source EUI	16%
Building Type	K-12 School

Stamp of Certifying Professional

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

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

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

Certifying Professional
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.

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

Robinson Elementary School was built approximately 47 years ago (with additions built 22 years ago). The building is one story and has a total floor area of 40.073 square feet.

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 concrete masonry units with brick veneer with no accessible wall insulation. Adding insulation to this type of wall construction is not cost effective. If any portion of the building is renovated or improved as part of a capital improvement plan, it may be possible to installation on the interior side of the walls during construction.

View of exterior wall and ceiling insulation from plenum

2.3.2. Roof

The roof was recently upgraded (2007) to a white rubber membrane and is in excellent condition. Two-thirds of the roof is pitched and one-third is flat.

2 year old White rubber membrane roof

The plenum above the office area between the ceiling and roof was observed and showed some deficiencies in insulation. Below is a photograph of the insulation located on the ceiling, located within the plenum above hallway 3.

Plenum above ceiling

SWA observed an inch of duct board, approximately R-2 or R-3, in the dropped ceiling located in this plenum. SWA has determined that it is not cost-effect to add insulation at this time. If the ceiling or roof is improved as part of a capital improvement plan, SWA recommends installing R-19 batt insulation over the top of this duct board in order to thermally separate the conditioned space from unconditioned air in the plenum.

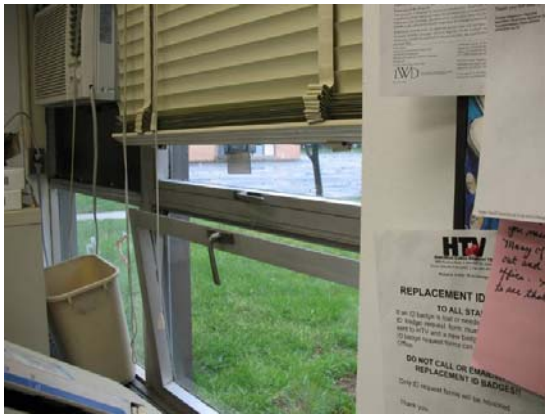
2.3.3. Base

The building's base is 6" concrete slab-on-grade. There were no reported problems with water penetration or moisture.

2.3.4. Windows

All of the windows in the building are original single-pane, metal framed windows. 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 Robinson Elementary School

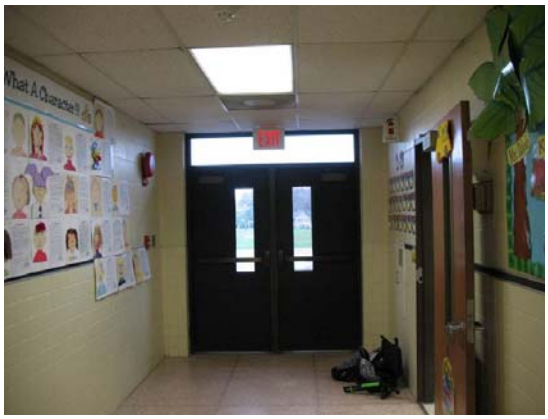


Single pane window located in main office

SWA would also like to make a comment that Robinson Elementary school also had 8 skylights that were currently blocked. Although this does not have much of an energy impact, SWA would like to comment and mention that unblocking skylights allows for more natural light to come into the building. Natural light renders colors better and is also a cheap and inexpensive way to add light to an area

2.3.5. Exterior doors

The entrance ways for Robinson 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 consisted 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 absorbed 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 weatherstripping

2.3.6. Building air tightness

Robinson Elementary School has a leaky shell with poor air sealing to separate conditioned air from outside air. The ceiling provides a poor air and thermal seal from the attic 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.

Note in Multipurpose room

2.4. HVAC systems

2.4.1. Heating

The school is served by three of hot water boilers. These boilers supply hot water 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 hot water 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.

Boilers in Mechanical room

2.4.2. Cooling

There were seven window air conditioner units serving the rooms 7, 8, and 12, the faculty room, the main office, nurse's office, and principal's office. SWA noted many newer air conditioning units and recommends replacing older model units with Energy Star window air conditioners, sized proportionally for the room, with an EER of 12 or better.

Window air conditioning unit

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 intput 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 – All of the fluorescent lighting within the school consisted of T8 lighting with electronic fixtures and does not need to be upgraded at this time. Most of the bathrooms and closets within classrooms used 72W incandescent light bulbs. Areas such as the Custodian's closet and stage house lighting also used 72W, 100W or 150W incandescent lighting which can be reduced drastically by replacing with CFL bulbs. SWA also recommends replacing all remaining fluorescent exit signs with LED signs. For safety reasons, exit lights by code are to remain lit 24 hours per day and therefore present a good opportunity for saving energy. Making these replacements will result in a 2,189 kWh savings and a cost savings of $339 per year. Please see Appendix A for a complete existing and proposed lighting schedule.

SWA recommends taking advantage of lighting on different switches and use only lighting needed in classrooms.

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.

Classroom with shades drawn

There were eight skylights blocked (four in hallway 1 and four in hallway 5). SWA suggests unblocking skylights, replacing glazing as necessary for child safety and utilizing natural lighting to reduce electrical load of lighting in hallways.

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

Currently, there are two different vending machines located in faculty lounge at Langtree Elementary School. Vending machines contain display lighting to remain lit 24/7, which wastes large amounts of energy over time. SWA recommends installing a technology called VendingMiser that uses passive infrared technology to sense motion and turn off the display lighting when no motion is detected for a set period of time

Refrigerators and Vending Machine in Faculty lounge

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.

Computers in classroom

One idea to educate students and teachers is to suggest prizes for the classroom that is able to reduce their kWh (electrical) load. Suggest science classes get involved in finding creative ways to reduce and monitor energy usage throughout the school.

2.5.3. Elevators

Robinson Elementary School is a one story building.

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	(3) Hot Water Boilers, 80 HP each	HB Smith	Natural Gas	Building	0%
Heating	(1) Hot Water Boilers, 80 HP each	A.O. Smith	Natural Gas	Building	0%
Distribution System	Floor mounted Unit ventilators/radiators with unit-mounted adjustable valve and fan controls	Nesbitt	Hot Water	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.

4. 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.
- 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.
- 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 Hot Water Boilers: Upgrade the existing hot water boilers with new, higher efficiency hot water boilers. This recommendation includes optimization of existing remote boiler controls, new local boiler controls, 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.**
3	**Install VendingMiser technology; VendingMiser technology uses occupancy sensors to turn off Vending machine display lighting when display is not necessary.**

ECM#1: *Replace Existing Hot Water Boilers*

Description:

The existing hot water 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. The insulation 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 outdoor reset of the supply water temperature and boiler sequencing. The existing Automated Logic Control panel should also be optimized to provide improved control during remote operation. This may require the installation of local temperature sensors and programming by a controls contractor to update the system.

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: $76,911
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	
1,608	Therms	0.0	kW	$ 2,493	30.9	30	$ 47,625	-1.3%	17,730

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:

Robinson Elementary School uses mostly efficient fluorescent fixtures for general classroom and hallway lighting. Robinson Elementary School contains 95 incandescent bulbs that use excessive amounts of energy and also contains approximately 10 fluorescent exit signs that consume 20W of power compared to newer LED models that consume only 5W of power. SWA recommends that all incandescent bulbs should be upgraded to CFLs and 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: $2,525
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	
13,121	kWh	0.0	kW	$ 2,034	1.2	20	$ 40,675	75.5%	23,493

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

ECM#3: *Install VendingMiser devices*

Description:

There are currently two vending machines located in the faculty lounge at Langtree Elementary School. These vending machines use excessive lighting for display that remains on 24/7. SWA recommends installing VendingMiser devices that act as an occupancy sensor to turn off the display lighting of these machines when no lighting is necessary.

Installation cost:

Estimated installed cost: $258
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	
2,428	kWh	0.0	kW	$ 376	0.7	10	$ 3,763	135.9%	4,347

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

Rebates/financial incentives:

There are currently no incentives available for this measure at this time.

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

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing systems

There are currently no existing renewable energy systems.

5.2. 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.

5.3. 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.

5.4. Combined Heat and Power

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

5.5. 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.

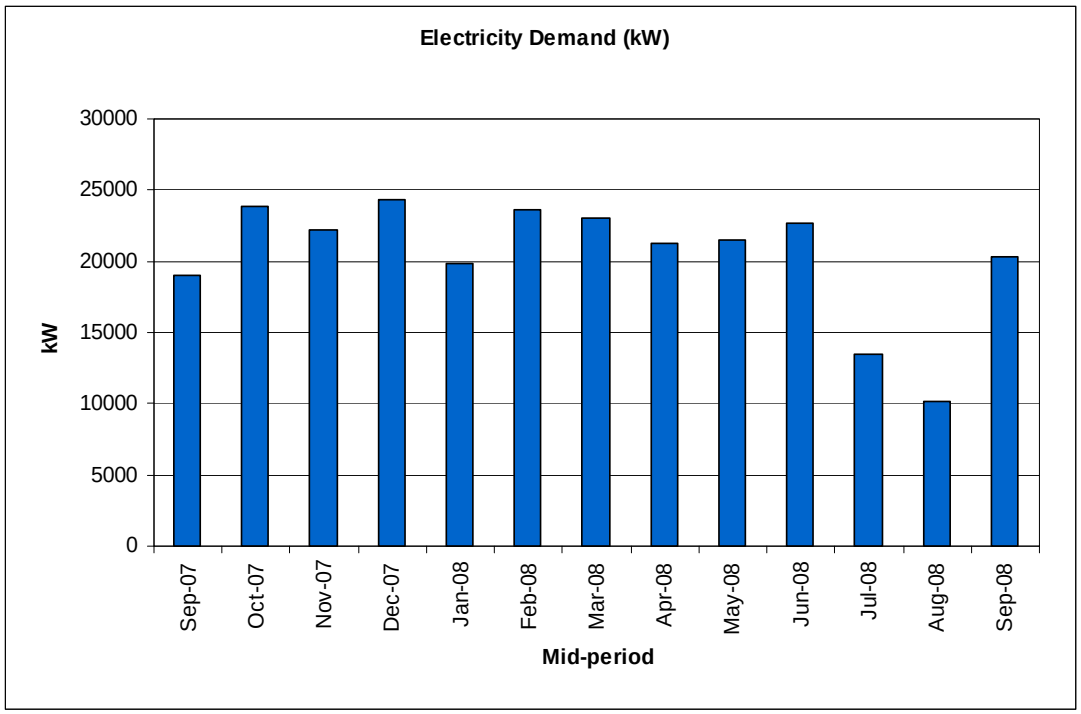
5.6. Wind

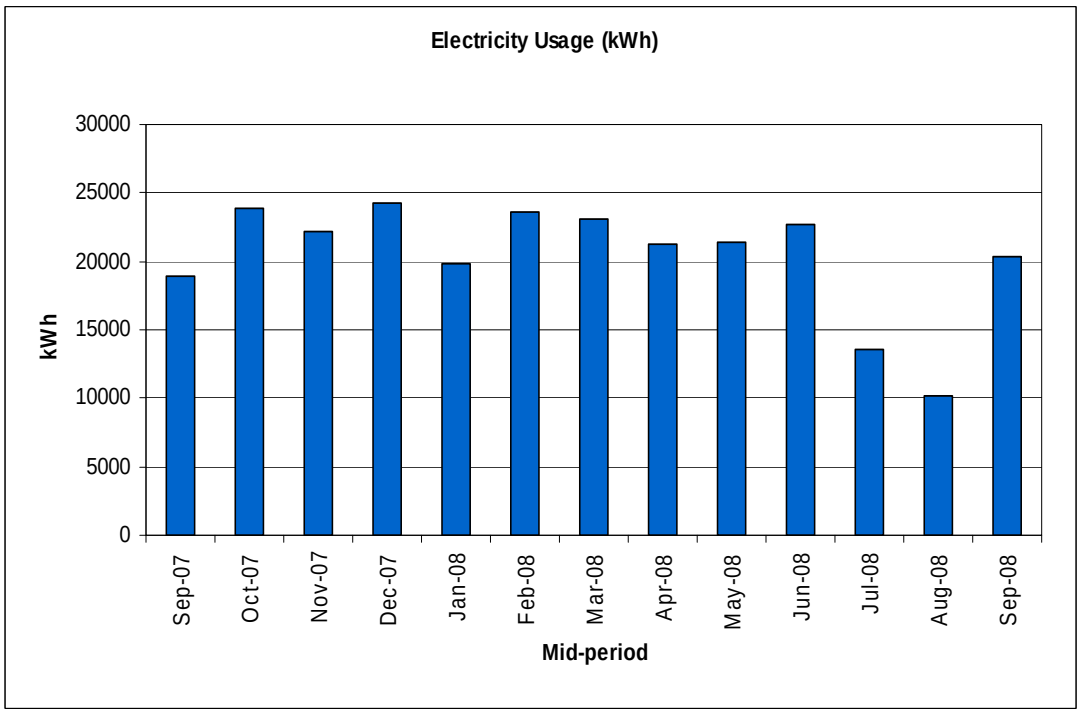
Wind power production is not appropriate for this location because required land is not available for the wind turbine. Also, the available wind energy resource is very low.

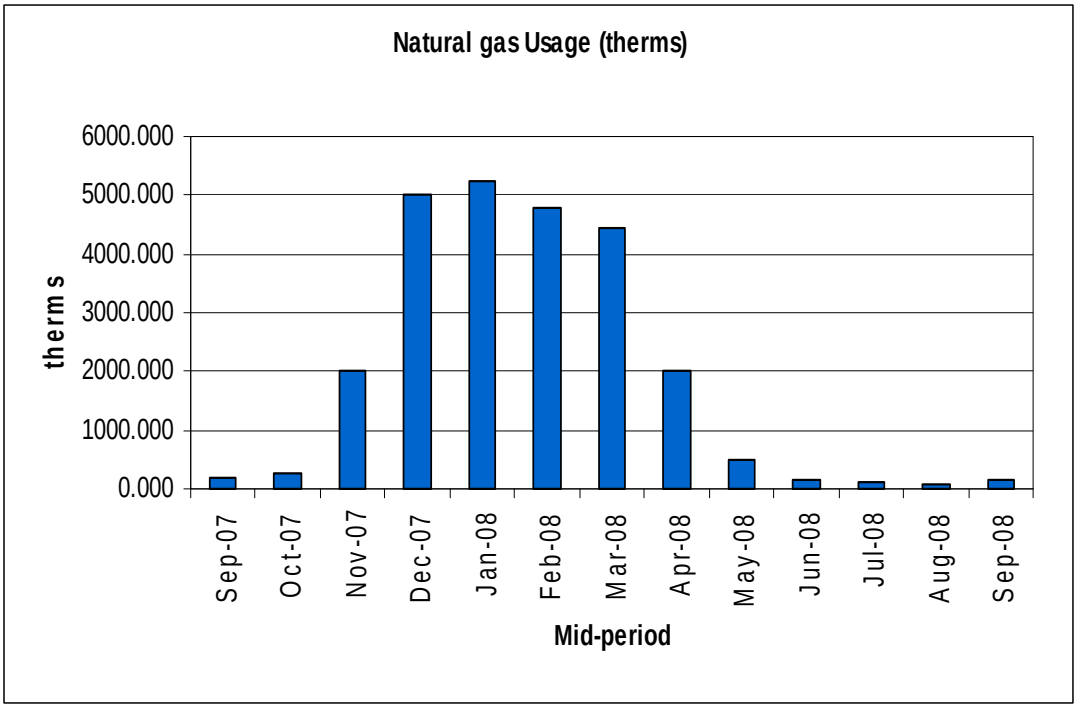
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

The average electrical peak demand for the previous year was 76.6 kW and the maximum peak demand was 91.2 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)
30000
25000
20000
15000
10000
5000
0
kW
Sep-07
Oct-07
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Mid-period


Electricity Usage (kWh)
30000
25000
20000
15000
10000
5000
0
kWh
Sep-07
Oct-07
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Mid-period



6.2. 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.

6.3. 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.

7. METHOD OF ANALYSIS

7.1. 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.

7.2. 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	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	Robinson ES	Renovation	Main Floor	Room 20	45-80	4' linear T8	electronic	12	4	Fluorescent	32	8	12288	Switch	Yes	1536	4' linear T8	electronic	12	4	Fluorescent	32	8	12288	1536
2	Robinson ES	Renovation	Main Floor	Room 24 - bath		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
3	Robinson ES	Renovation	Main Floor	Room 19	75-115	4' linear T8	electronic	12	4	Fluorescent	32	8	12288	Switch	Yes	1536	4' linear T8	electronic	12	4	Fluorescent	32	8	12288	1536
4	Robinson ES	Renovation	Main Floor	Room 19 - bath		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
5	Robinson ES	Renovation	Main Floor	Room 17	65-80	4' linear T8	electronic	12	4	Fluorescent	32	8	12288	Switch	Yes	1536	4' linear T8	electronic	12	4	Fluorescent	32	8	12288	1536
6	Robinson ES	Renovation	Main Floor	Room 17 - bath		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
7	Robinson ES	Renovation	Main Floor	Room 18	60-130	4' linear T8	electronic	12	4	Fluorescent	32	8	12288	Switch	Yes	1536	4' linear T8	electronic	12	4	Fluorescent	32	8	12288	1536
8	Robinson ES	Renovation	Main Floor	Room 18 - bath		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
9	Robinson ES	Renovation	Main Floor	Room 16	55-80	4' linear T8	electronic	12	4	Fluorescent	32	8	12288	Switch	Yes	1536	4' linear T8	electronic	12	4	Fluorescent	32	8	12288	1536
10	Robinson ES	Renovation	Main Floor	Room 16 - bath		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
11	Robinson ES	Renovation	Main Floor	Room 15	60-110	4' linear T8	electronic	12	4	Fluorescent	32	8	12288	Switch	Yes	1536	4' linear T8	electronic	12	4	Fluorescent	32	8	12288	1536
12	Robinson ES	Renovation	Main Floor	Room 15 - bath		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
13	Robinson ES	Renovation	Main Floor	Resource Room	85-130	4' linear T8	electronic	8	4	Fluorescent	32	8	8192	Switch	No	1024	4' linear T8	electronic	8	4	Fluorescent	32	8	8192	1024
14	Robinson ES	Renovation	Main Floor	Speech	65-115	4' linear T8	electronic	4	4	Fluorescent	32	8	4096	Switch	No	512	4' linear T8	electronic	4	4	Fluorescent	32	8	4096	512
15	Robinson ES	Renovation	Main Floor	Room 26 - Arithmetic	65-110	4' linear T8	electronic	24	4	Fluorescent	32	8	24576	Switch	No	3072	4' linear T8	electronic	24	4	Fluorescent	32	8	24576	3072
16	Robinson ES	Renovation	Main Floor	Guidance	140-160	4' linear T8	electronic	4	4	Fluorescent	32	8	4096	Switch	No	512	4' linear T8	electronic	4	4	Fluorescent	32	8	4096	512
17	Robinson ES	Renovation	Main Floor	SGI-6	55-110	4' linear T8	electronic	4	4	Fluorescent	32	8	4096	Switch	No	512	4' linear T8	electronic	4	4	Fluorescent	32	8	4096	512
18	Robinson ES	Renovation	Main Floor	SGI-4	55-110	4' linear T8	electronic	4	4	Fluorescent	32	8	4096	Switch	No	512	4' linear T8	electronic	4	4	Fluorescent	32	8	4096	512
19	Robinson ES	Renovation	Main Floor	Room 21 - Special Ed.	60-100	4' linear T8	electronic	15	4	Fluorescent	32	8	15360	Switch	No	1920	4' linear T8	electronic	15	4	Fluorescent	32	8	15360	1920
20	Robinson ES	Renovation	Main Floor	Library	75-94	4' linear T8	electronic	27	4	Fluorescent	32	8	27648	Switch	No	3456	4' linear T8	electronic	27	4	Fluorescent	32	8	27648	3456
21	Robinson ES	Renovation	Main Floor	Library - office		4' linear T8	electronic	4	4	Fluorescent	32	8	4096	Switch	No	512	4' linear T8	electronic	4	4	Fluorescent	32	8	4096	512
22	Robinson ES	Renovation	Main Floor	Library - storage		4' linear T8	electronic	1	4	Fluorescent	32	8	1024	Switch	No	128	4' linear T8	electronic	1	4	Fluorescent	32	8	1024	128
23	Robinson ES	Renovation	Main Floor	Bathroom by Library		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
24	Robinson ES	Renovation	Main Floor	Custodian's Closet by Library	10	72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
25	Robinson ES	Original	Main Floor	Room 5	55-95	4' linear T8	electronic	20	4	Fluorescent	32	8	20480	Switch	No	2560	4' linear T8	electronic	20	4	Fluorescent	32	8	20480	2560
26	Robinson ES	Original	Main Floor	Room 5 - closet		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
27	Robinson ES	Original	Main Floor	Room 5 - bath		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
28	Robinson ES	Original	Main Floor	Room 6	50-90	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	Switch	No	1152	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	1152
29	Robinson ES	Original	Main Floor	Room 6 - bath		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
30	Robinson ES	Original	Main Floor	Room 4	50-90	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	Switch	No	1152	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	1152
31	Robinson ES	Original	Main Floor	Room 4 - bath		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
32	Robinson ES	Original	Main Floor	Room 3	55-130	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	Switch	No	1152	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	1152
33	Robinson ES	Original	Main Floor	Room 3 - closet		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
34	Robinson ES	Original	Main Floor	Room 3 - bath		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
35	Robinson ES	Original	Main Floor	Room 2	60-80	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	Switch	No	1152	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	1152
36	Robinson ES	Original	Main Floor	Room 2 - bath		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
37	Robinson ES	Original	Main Floor	Room 1	50-75	4' linear T8	electronic	24	2	Fluorescent	32	8	12288	Switch	No	1536	4' linear T8	electronic	24	2	Fluorescent	32	8	12288	1536
38	Robinson ES	Original	Main Floor	Room 1 - bath		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
39	Robinson ES	Original	Main Floor	Faculty	20-35	4' linear T8	electronic	6	2	Fluorescent	32	8	3072	Switch	No	384	4' linear T8	electronic	6	2	Fluorescent	32	8	3072	384
40	Robinson ES	Original	Main Floor	Main Office - secretary	80-100	4' linear T8	electronic	6	4	Fluorescent	32	8	6144	Switch	No	768	4' linear T8	electronic	6	4	Fluorescent	32	8	6144	768
41	Robinson ES	Original	Main Floor	Main Office - hallway		4' linear T8	electronic	1	2	Fluorescent	32	8	512	Switch	No	64	4' linear T8	electronic	1	2	Fluorescent	32	8	512	64
42	Robinson ES	Original	Main Floor	Nurse	77	4' linear T8	electronic	6	2	Fluorescent	32	8	3072	Switch	No	384	4' linear T8	electronic	6	2	Fluorescent	32	8	3072	384
43	Robinson ES	Original	Main Floor	Nurse - bath		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
44	Robinson ES	Original	Main Floor	Main Office - Principal	60	4' linear T8	electronic	4	2	Fluorescent	32	8	2048	Switch	No	256	4' linear T8	electronic	4	2	Fluorescent	32	8	2048	256
45	Robinson ES	Original	Main Floor	Main Office - Men's Room		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
46	Robinson ES	Original	Main Floor	Main Office - Women's Room		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
47	Robinson ES	Original	Main Floor	Main Office - Closet	8	72W inc. bulb	-	2	1	Incandescent	72	2	288	Switch	No	144	20w CFL	-	2	1	CFL	20	2	80	40
48	Robinson ES	Original	Main Floor	Main Lobby - Display Case		4' linear T8	electronic	1	2	Fluorescent	32	24	1536	Switch	No	64	4' linear T8	electronic	1	2	Fluorescent	32	24	1536	64
49	Robinson ES	Original	Main Floor	Gymnasium	10-35			16	1		500	5	40000	Switch	No	8000			16	1		500	5	40000	8000
50	Robinson ES	Original	Main Floor	Gymnasium		Fluorescent Exit Sign	-	3	1	Fluorescent	20	24	1440	None	No	60	LED Exit Sign	-	3	1	LED	5	24	360	15
51	Robinson ES	Original	Main Floor	Kitchen/Serving Room	35	100 W Inc.	-	9	1	Incandescent	100	8	7200	Switch	No	900	20w CFL	-	9	1	CFL	20	8	1440	180
52	Robinson ES	Original	Main Floor	Kitchen - Back rinse area	40	72W inc. bulb	-	3	1	Incandescent	72	8	1728	Switch	No	216	20w CFL	-	3	1	CFL	20	8	480	60
53	Robinson ES	Original	Main Floor	Kitchen - Bathroom		72W inc. bulb	-	1	1	Incandescent	72	2	144	Switch	No	72	20w CFL	-	1	1	CFL	20	2	40	20
54	Robinson ES	Original	Main Floor	Custodian's Office - near gym	40	4' linear T8	electronic	1	2	Fluorescent	32	2	128	Switch	No	64	4' linear T8	electronic	1	2	Fluorescent	32	2	128	64
55	Robinson ES	Original	Main Floor	Boiler Room	5-8	CFL	electronic	3	1	CFL	2	0	0	Switch	No	0	CFL	electronic	3	1	CFL	2	0	0	0
56	Robinson ES	Original	Main Floor	Boiler Room		2' U-shaped T8	electronic	2	1	Fluorescent	32	2	128	Switch	No	64	2' U-shaped T8	electronic	2	1	Fluorescent	32	2	128	64
57	Robinson ES	Original	Main Floor	Multipurpose Room - Stage	15-20	100 W Inc.	-	36	1	Incandescent	100	2	7200	Switch	No	3600	20w CFL	-	36	1	CFL	20	2	1440	720
58	Robinson ES	Original	Main Floor	Multipurpose Room - Stage		150 W Inc.	-	4	1	Incandescent	150	2	1200	Switch	No	600	20w CFL	-	4	1	CFL	20	2	160	80
59	Robinson ES	Original	Main Floor	Multipurpose Room - Stage		LED Exit Sign	-	1	1	LED	5	24	120	Switch	No	5	LED Exit Sign	-	1	1	LED	5	24	120	5
60	Robinson ES	Original	Main Floor	Girl's Room	8-12	72W inc. bulb	-	3	2	Incandescent	72	8	3456	Switch	No	432	20w CFL	-	3	2	CFL	20	8	960	120
61	Robinson ES	Original	Main Floor	Boy's Room	8-12	72W inc. bulb	-	2	1	Incandescent	72	8	1152	Switch	No	144	20w CFL	-	2	1	CFL	20	8	320	40
62	Robinson ES	Original	Main Floor	SGI-1	55-90	4' linear T8	electronic	2	4	Fluorescent	32	8	2048	Switch	No	256	4' linear T8	electronic	2	4	Fluorescent	32	8	2048	256
63	Robinson ES	Original	Main Floor	Storage in front of Girl's Room	4	72W inc. bulb	-	1	2	Incandescent	72	2	288	Switch	No	144	20w CFL	-	1	2	CFL	20	2	80	40
64	Robinson ES	Original	Main Floor	SGI-2	60	4' linear T8	electronic	2	4	Fluorescent	32	8	2048	Switch	No	256	4' linear T8	electronic	2	4	Fluorescent	32	8	2048	256
65	Robinson ES	Original	Main Floor	Custodian's Closet in front of Boy's Room	10	100 W Inc.	-	1	1	Incandescent	100	2	200	Switch	No	100	20w CFL	-	1	1	CFL	20	2	40	20
66	Robinson ES	Original	Main Floor	Room 8	50-70	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	Switch	No	1152	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	1152
67	Robinson ES	Original	Main Floor	Room 7	60-95	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	Switch	No	1152	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	1152
68	Robinson ES	Original	Main Floor	Room 10	45-75	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	Switch	No	1152	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	1152
69	Robinson ES	Original	Main Floor	Room 9	55-95	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	Switch	No	1152	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	1152
70	Robinson ES	Original	Main Floor	Room 12	50-70	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	Switch	No	1152	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	1152
71	Robinson ES	Original	Main Floor	Room 11	70-95	4' linear T8	electronic	10	4	Fluorescent	32	8	10240	Switch	No	1280	4' linear T8	electronic	10	4	Fluorescent	32	8	10240	1280
72	Robinson ES	Original	Main Floor	Room 14	50-85	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	Switch	No	1152	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	1152
73	Robinson ES	Original	Main Floor	Room 13	60-95	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	Switch	No	1152	4' linear T8	electronic	18	2	Fluorescent	32	8	9216	1152
74	Robinson ES	Original	Main Floor	Hallway-5	10	2' linear T8	electronic	10	4	Fluorescent	17	11	7480	Switch	No	680	2' linear T8	electronic	10	4	Fluorescent	17	11	7480	680
75	Robinson ES	Original	Main Floor	Hallway-6		Fluorescent Exit Sign	-	3	1	Fluorescent	20	24	1440	Switch	No	60	LED Exit Sign	-	3	1	LED	5	24	360	15
76	Robinson ES	Original	Main Floor	Lobby/Entrance	8-15	2' linear T8	electronic	6	6	Fluorescent	17	11	6732	Switch	No	612	2' linear T8	electronic	6	6	Fluorescent	17	11	6732	612
77	Robinson ES	Original	Main Floor	Hallway-1+3	6-25	2' linear T8	electronic	8	6	Fluorescent	17	11	8976	Switch	No	816	2' linear T8	electronic	8	6	Fluorescent	17	11	8976	816
78	Robinson ES	Original	Main Floor	Hallway-1+3		4' linear T8	electronic	16	2	Fluorescent	32	11	11264	Switch	No	1024	4' linear T8	electronic	16	2	Fluorescent	32	11	11264	1024
79	Robinson ES	Original	Main Floor	Hallway-1	6-25	Fluorescent Exit Sign	-	2	1	Fluorescent	20	24	960	Switch	No	40	LED Exit Sign	-	2	1	LED	5	24	240	10
80	Robinson ES	Original	Main Floor	Hallway-3	60	Fluorescent Exit Sign	-	2	1	Fluorescent	20	24	960	Switch	No	40	LED Exit Sign	-	2	1	LED	5	24	240	10
81	Robinson ES	Whole Building	Exterior	Exterior		40-W Halogen Bulb	-	6	1	Halogen	40	24	5760	Timer	No	240	26-W refl. CFL	-	6	1	CFL	20	24	2880	120
82	Robinson ES	Whole Building	Exterior	Exterior		150 W Inc.	-	8	1	Incandescent	150	24	28800	Timer	No	1200	35w CFL	-	8	1	CFL	25	24	4800	200

Totals		
Existing Usage (kWh/year)		124,145
Proposed Usage (kWh/year)		111,024
Existing Ert. Cost ($/year)	$	20,259.81
Proposed Ert. Cost ($/year)	$	18,207.97
Total kWh Savings		13,121
Total $ Savings	$	2,151.84

Existing Lighting Total Power (Watts)	62481	Watts
Existing Lighting Power Density (W/sqft)	1.56	W/sqft
Proposed Lighting Total Power (Watts)	55191	Watts
Proposed Lighting Power Density (W/sqft)	1.38	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