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**Local Government Energy Program
Energy audit report**

For

***Hamilton Board of Education
Klockner 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 Klockner Elementary School only.

Klockner Elementary School was built in 1908 with additions built in 1922 and 1927. The school consists of 44,354 square feet of conditioned space. There are approximately 300 students in grades Kindergarten through fifth grade and about 44 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 Klockner Elementary School located at 830 Klockner Rd, Hamilton, NJ 08619. Klockner 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 (September 2007 through September 2008), Klockner Elementary School building consumed approximately 156,795 kwh or \$26,250 worth of electricity and 28,675 therms or \$44,445 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 gas combined, the building consumed 3,402 MMBtu of energy at a total cost of \$70, 695.

SWA benchmarked Klockner 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 57 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 Klockner Elementary School building is 73 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 2 Energy Conservation Measures (ECMs) for Klockner Elementary School. The total investment cost for these ECMs is **\$94,465**. SWA estimates a first year savings of **\$3,800** with a simple payback of **24.9 years**. SWA also estimates that Klockner Elementary School will be able to reduce their carbon footprint by **30,254 lbs of CO2 annually**.

There are various incentives that Klockner Elementary School could apply for that could also help lower the cost of installing the ECMs. SWA recommends that Klockner 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	\$ 91,350	RMeans	0	kWh	1,982	therms	0.0	kW	\$ 3,072	29.7	30	\$ 58,687	-1.2%	21,848
2	Upgrade existing lighting	\$ 3,115	RMeans	4,695	kWh	-	therms	0.0	kW	\$ 728	4.3	20	\$ 14,555	18.4%	8,406
Total	Total Scope of Work	\$ 94,465	-	4,695	-	1,982		0.0	-	\$ 3,800	24.9		\$ 73,242		30,254

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 Electricity = 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

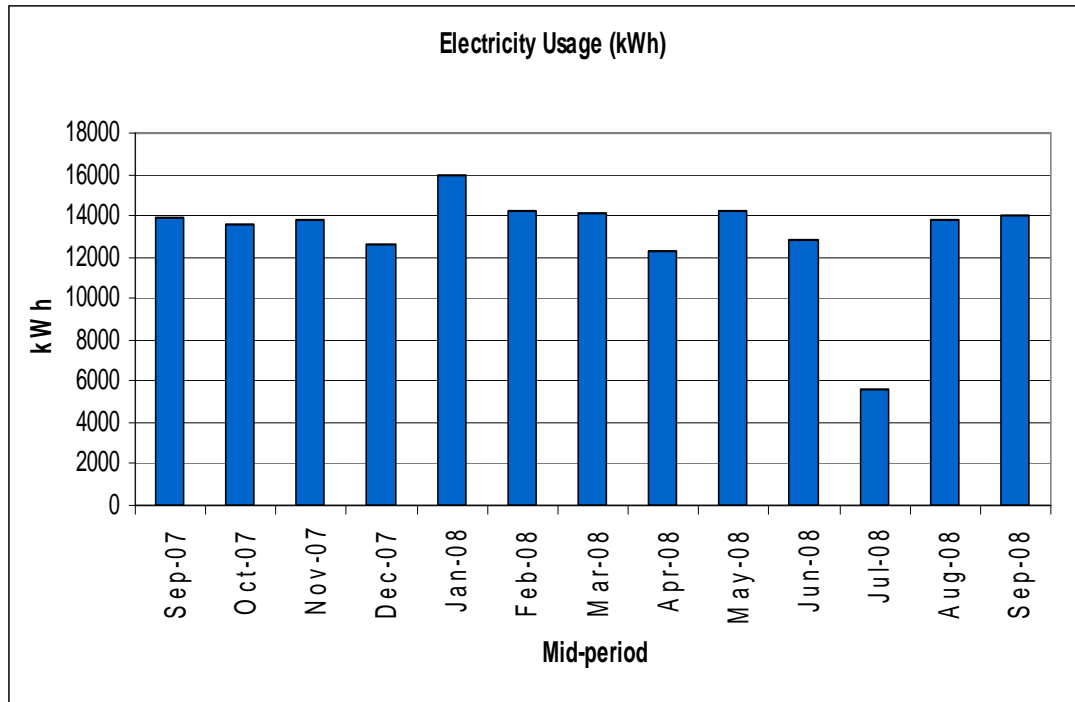
1.1. Energy usage and cost analysis

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

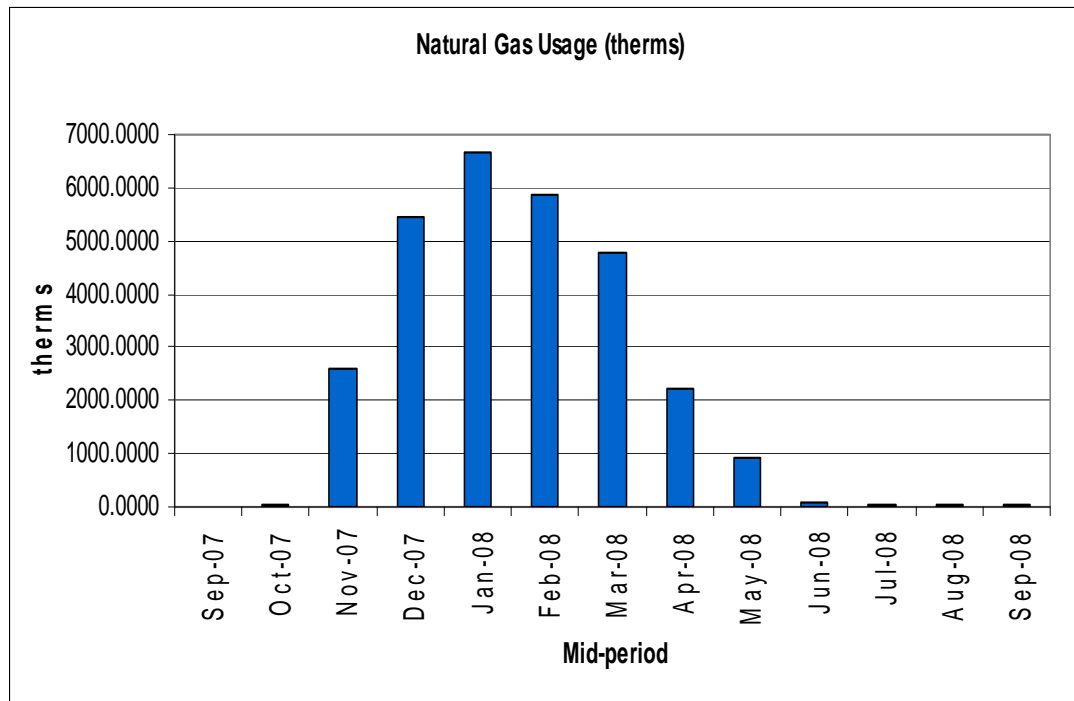
Electricity – Klockner Elementary School has one electric meter for incoming electricity supply. The building purchases electricity from PSE&G at **an average aggregated rate of \$.176/kWh** based on September 2007 through September 2008 electric bills. The building purchased **approximately 156,795 kWh or \$26,250 worth of electricity based on the specified 12 months of utility bills.** Based on the same time period, the building also has **an average monthly demand of 65.9 kW and monthly peak demand of 74.3 kW.**

Natural Gas – Klockner Elementary School has one gas meter for incoming natural gas from PSE&G. Between September 2007 and September 2008, the building purchased **approximately 28,675 therms or \$44,445 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 Klockner Elementary School based on utility bills for the year 2008.



The following chart shows the natural gas usage for Klockner 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

Klockner Elementary School currently buys electricity and gas from PSE&G at the FTLV general service rate (or MD rate). The FTLV general service is a typical rate where customers pay for natural gas based on usage and electricity based on usage with the addition of an electrical charge demand. Klockner Elementary School uses account # 16 62 723 154 57, at the service address of 830 Klockner Rd, Hamilton, NJ 08619 for the building electric and gas. Electricity for the building was billed at an average rate of **\$0.176/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

Klockner 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 57. SWA recommends that the Klockner Elementary School Board of Education maintain the Portfolio Manager account at the link below.

As the account is maintained, SWA can share the Klockner 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



STATEMENT OF ENERGY PERFORMANCE

Klockner Elementary

Building ID: 1761858
 For 12-month Period Ending: August 31, 2008¹
 Date SEP becomes ineligible: N/A

Date SEP Generated: June 26, 2009

Facility
 Klockner Elementary
 830 Klockner Rd
 Trenton, NJ 08619

Facility Owner
 N/A

Primary Contact for this Facility
 N/A

Year Built: 1922
Gross Floor Area (ft²): 44,354

Energy Performance Rating² (1-100) 57

Site Energy Use Summary³

Natural Gas (kBtu) ⁴	2,716,101
Electricity (kBtu)	534,616
Total Energy (kBtu)	3,250,717

Energy Intensity⁵

Site (kBtu/ft ² /yr)	73
Source (kBtu/ft ² /yr)	104

Emissions (based on site energy use)

Greenhouse Gas Emissions (MTCO ₂ e/year)	226
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Electric Distribution Utility

PSE&G - Public Service Elec. & Gas Co

National Average Comparison

National Average Site EUI	78
National Average Source EUI	111
% Difference from National Average Source EUI	-6%
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 Standards⁶ 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.

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 submitting the SEP) and we have suggestions for reducing this burden. Send comments (including OMB control number) to the Director, Collection Strategies Division, U.S. EPA (2022), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Klockner Elementary School, located at 830 Klockner Road in Hamilton, New Jersey was built in 1909 and was originally approximately 10,584 square feet consisting of two stories and a basement. In 1922, additions totaling 6,488 square feet were built. In 1927 another 27,282 square feet were added. There were extensive interior renovations done in 1990. The building today is comprised of 44,354 square feet of conditioned space that includes approximately seventeen classrooms, 3 offices, a faculty break room, a library, a large multi-purpose room that serves as gymnasium, theatre (with a raised stage) and cafeteria with an adjacent kitchen, and various storage areas and rest rooms. The building is built of concrete masonry units and brick. The exterior is a medium shade red brick that is attractive, well pointed and obviously has been well maintained.

2.2. Building occupancy profiles

Klockner is one of seventeen elementary schools in the Hamilton Township School District. It provides kindergarten through fifth grade education. There is a student enrollment of approximately 300, with a staff of approximately 45 full and part time employees including teachers, administrative, maintenance, educational assistants and lunchroom/playground assistants. According to maintenance staff the building is occupied for approximately 11 hours each weekday from September through June.

2.3. Building envelope

2.3.1. Exterior walls

The exterior walls of both buildings consist of concrete masonry unit structure with a medium red face brick exterior facade. There is no evidence of any insulation in the exterior walls and maintenance staff could not recall ever seeing any wall insulation.

Adding insulation to this type of wall construction is difficult and 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.



Brick exterior on back of school

2.3.2. Roof

The roofs of Klockner School are flat/low slope in one section and pitched in the rest of the building. The flat roof section is covered with a modified bitumen membrane of approximately 80 mils thickness and between 90 and 105 pounds per 100 square feet. The pitched roofs are covered with an asphaltic composition shingle. Again, there is no evidence of any insulation and maintenance staff did not indicate that there was any roof or ceiling insulation. SWA did not have access to any building plans.

SWA evaluated installing ceiling and roof insulation but the high cost of removing the roofing membrane to install rigid board roof insulation is too expensive and cannot be justified by the estimated energy savings. If in the future, there is a need to replace the flat section roofing membrane, at least two inches of a polyisocyanurate, or similar high R-value (R-value is a standard measure of a material's resistance to heat loss) rigid board insulation should be installed before the new membrane is applied. The attic or cockloft above the top floor deck in the pitched roof areas (approximately 16,200 square feet) should be insulated with blown-in fiberglass or cellulose.

2.3.3. Base

The Klockner School's base is a five-inch concrete slab-below-grade in most places and crawl space with post and beam floor construction in others. There is a rock wall foundation in most of the building. There were no reported problems with water penetration or moisture. There is no evidence of any perimeter insulation around the slab or under the slab. Excavation to install additional slab insulation is expensive and would not be cost-effective as a single measure. However, if the perimeter of the building is ever excavated to repair or replace drainage protections, installing two inches of a rigid foam board insulation should be considered.

2.3.4. Windows

The windows at the Klockner School are an atypical application. Rather than a standard window/storm window installation, there are two completely separate single-hung, single glazed windows, each in its own aluminum frame within the same window opening. The two windows are separated by approximately 2.5 inches of space. It was unclear to SWA whether the additional glazing units had been installed to improve comfort, security, aesthetics, or energy-efficiency. Overall, the windows appear to be in very good condition.

In a standard dual glazed window, the air trapped between the panes of glass provides much of the insulating value. In this system, with two completely separate window installations separated by several inches of space, it is difficult to assess the energy performance of the assembly as a whole. Temperature measurements taken in the field did show, however, that the interior surfaces of the windows were between 18 and 21 degrees colder than the ambient temperature of the classroom.

SWA recommends that both of the window installations be carefully inspected and any loose or deteriorated weather-stripping be replaced. The perimeter of both window frames should be completely caulked and sealed. Given the configuration, it may be necessary to seal the interior side of the interior unit and the exterior side of the exterior unit, taking care not to seal the weep holes. Although SWA is not aware of the decision-making rationale behind the selection of this installation, it may not provide anticipated energy savings but will likely require additional maintenance to prevent air leakage and condensation problems.



Klockner Windows at Courtyard

2.3.5. Exterior doors

Some of the exterior doors of the building are in satisfactory condition. And some appear to be allowing unconditioned outside air to infiltrate the building interior. Exterior doors are a major source of heat loss in general. SWA recommends checking the weather-stripping of each door on a regular basis and replacing any broken seals immediately. Tight seals around the door will help ensure that the building is kept sealed and insulated over time. This will help ensure that the buildings stay tight and prevent unconditioned air from infiltrating the interior.

2.3.6. Building air tightness

The building seemed to be relatively tight considering the age of the original building and the two additions. As noted above, the windows and the exterior doors should be carefully inspected on a regular basis and any caulking or weather-stripping that is missing or has failed, be replaced.

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. 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.

2.4. HVAC systems

2.4.1. Heating

The school is served by two 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 are also window air conditioner units serving other rooms such as the faculty room, the main office, and various other classrooms. SWA recommends replacing older model units with Energy Star window air conditioners, sized proportionally for the room, with an EER of 12 or better. All window air conditioners should have a gasketed cover. SWA recommends a gasketed air conditioner cover called Chill Stop-R if it is not possible to remove fans or air conditioners when not in use during heating months.

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.

Dedicated exhaust is provided for the kitchen and baths to remove odors.

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 100 gallons of storage and an input of 80 MBtuh. This standard efficiency equipment has an efficiency rating of approximately 78%.

In addition, the building is served by a Bradford White electric water heater with an input rating of 6 kW. The electric water heater serves the Kitchen. A simple, inexpensive 7-day timer can be installed on the tank to shut it off on the weekends and during the hours of the day when hot water is not required for kitchen use.

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 –Most of the lighting at Klockner has been upgraded to include electronic ballasts and T8 (one inch diameter) lamps, a significant improvement over the old magnetic ballasts and 1 ¼ inch fluorescent lamps. There are still some areas that could be improved. Some of the compact fluorescent fixtures can be replaced with circleline lamps that would provide the same amount of illumination while using less power. Also, the remaining magnetic ballasts and T12 lamps should be replaced with electronic ballasts and T8 lamps. Please see the lighting improvement table in the appendix.

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.



Multipurpose room with shades drawn

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.

Educating both students and staff is a great way for schools to save energy while raising awareness about the importance of energy-efficiency. Prizes and challenges can be used to get classes involved in finding creative ways to reduce and monitor energy usage throughout the school. There are many free resources available to help Students, Parents, and School Administrators incorporate energy into school curricula and every day activities.

2.5.3. Elevators

There are no elevators at Klockner 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, 149 HP each	HB Smith	Natural Gas	Building	0%
Distribution System	Floor mounted Unit ventilators/radiators with unit-mounted adjustable valve and fan controls	Herman Nelson	Steam	Each Classroom	Varies
Cooling	No Central Cooling				
Ventilation	Outdoor Intake in Unit Ventilators, Exhaust for kitchens and baths.				
Ventilation	Air Handling Unit			Cafeteria	
Domestic Hot Water	Tank-type Water Heater, 100 gallon,80 Mbtuh	A.O. Smith	Natural Gas	Building	10%
Domestic Hot Water	Tank-type Water Heater, 6 kW	Bradford White	Electric	Kitchen	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.

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 – It 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.
- Time clock on electric water heater – Maintenance staff can install a time clock on the electric water heater to shut-off the equipment on weekends and those hours the equipment is not in use. Savings are greater for areas that have dedicated usage, such as the Cafeteria kitchen.

- Water Efficient Fixtures & Controls - Adding controlled on/off timers on all lavatory faucets is a cost-effective 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. 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: \$91,350
 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		
1,982	therm	0.0	-	\$ 3,072	29.7	30	\$ 50,687	-1.2%	21,848

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:

Klockner Elementary School contains mostly updated, efficient lighting. There are approximately 15 fixtures that could use upgrading; 15 T12 fixtures with magnetic ballasts should be changed to T8 fixtures with electronic ballasts, 1 incandescent bulb should be changed to a CFL and 1 fluorescent exit sign should be changed to an LED exit sign. For a complete existing and retrofit lighting schedule, please see Appendix A.

Installation cost:

Estimated installed cost: \$3,115
 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		
4,695	kWh	0.0	kW	\$ 728	4.3	20	\$ 14,555	18.4%	8,406

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>

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.

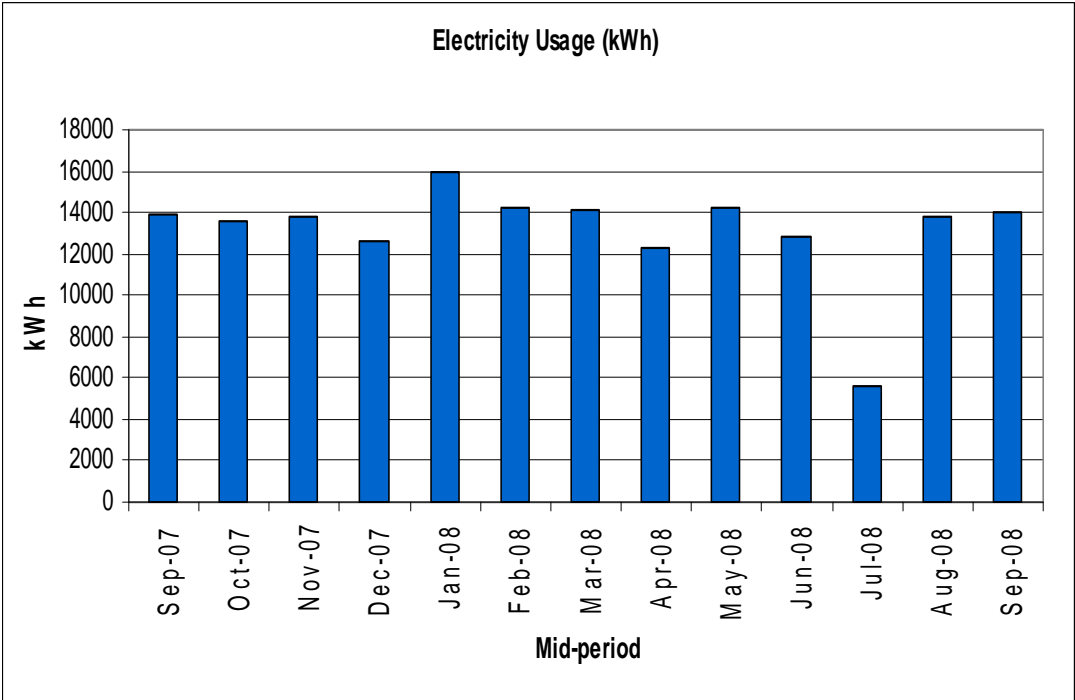
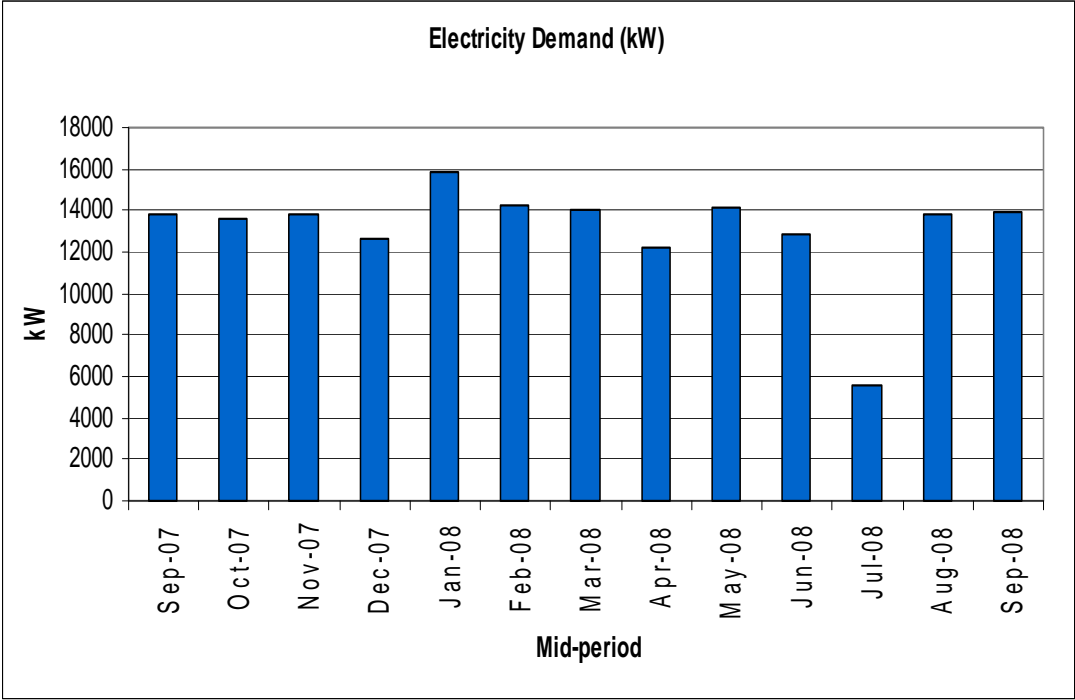
5.6. Wind

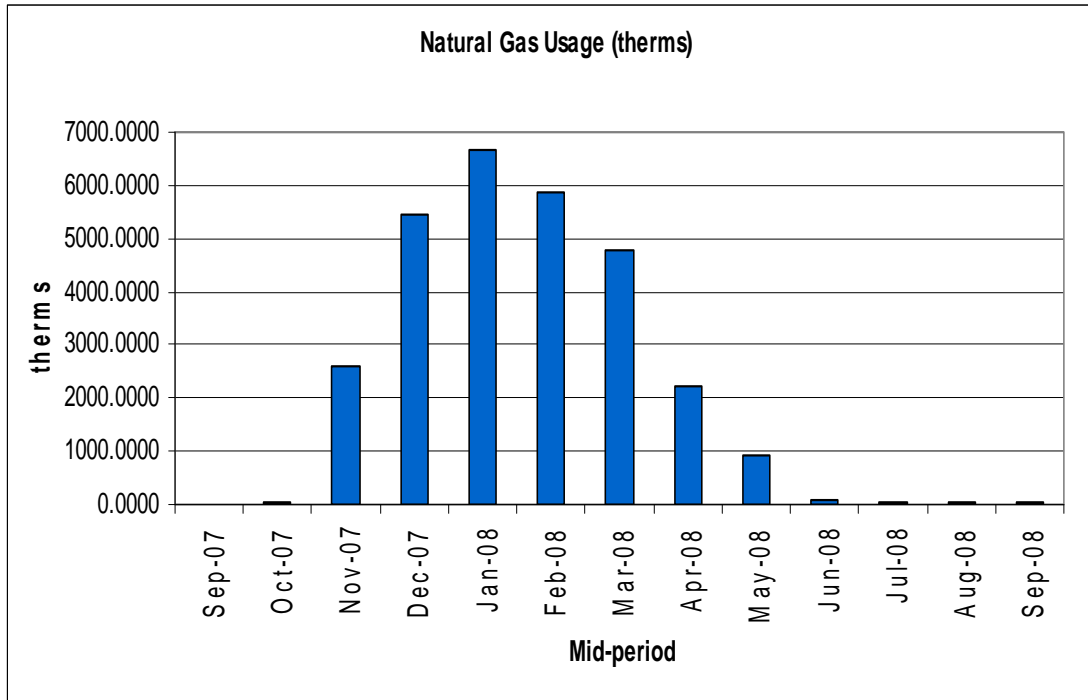
Wind power production is not appropriate for this location because required land is not available for the wind turbine. Also, the available wind energy resource is very low.

6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

The average electrical peak demand for the previous year was 66.1 kW and the maximum peak demand was 74.3 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.





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

#	School	Building	Level/Floor	Location in Building	Existing Lighting Conditions										Proposed Lighting Improvements										
					Measured Lighting Level (Footcandles)	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/Lamp	Hrs/Day	Energy Use (kWh/Day)	Controls	Total Power (Watts)	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/Lamp	Hrs/Day	Energy Use (kWh/Day)	Total Power (Watts)	
1	Klooner	1922	Basement	Basic Skills #10		4' linear T8	Electronic	17	2	Fluorescent	32	8	8704	Sp Switches	1088	4' linear T8	Electronic	17	2	Fluorescent	32	8	8704	Sp Switches	1088
2	Klooner	1922	Basement	Nurses Office		4' linear T8	Electronic	11	2	Fluorescent	32	8	5632	Sp Switches	704	4' linear T8	Electronic	11	2	Fluorescent	32	8	5632	Sp Switches	704
3	Klooner	1922	Basement	Nurses Office		4' linear T8	Electronic	2	4	Fluorescent	32	8	2048	Sp Switches	256	4' linear T8	Electronic	2	4	Fluorescent	32	8	2048	Sp Switches	256
4	Klooner	1908	Basement	hallway 2		2' linear T8	Electronic	2	2	Fluorescent	32	11	1408	Sp Switches	128	2' linear T8	Electronic	2	2	Fluorescent	32	11	1408	Sp Switches	128
5	Klooner	1927	Basement	Stairs		2' linear T8	Electronic	2	2	Fluorescent	32	11	1408	Sp Switches	128	2' linear T8	Electronic	2	2	Fluorescent	32	11	1408	Sp Switches	128
6	Klooner	1927	Basement	Main Office		4' linear T8	Electronic	6	4	Fluorescent	32	8	6144	Sp Switches	768	4' linear T8	Electronic	6	4	Fluorescent	32	8	6144	Sp Switches	768
7	Klooner	1927	Basement	Principal		4' linear T8	Electronic	3	4	Fluorescent	32	8	3072	Sp Switches	384	4' linear T8	Electronic	3	4	Fluorescent	32	8	3072	Sp Switches	384
8	Klooner	1927	Basement	Library		4' linear T8	Electronic	10	2	Fluorescent	32	8	9216	Sp Switches	1152	4' linear T8	Electronic	10	2	Fluorescent	32	8	9216	Sp Switches	1152
9	Klooner	1927	Basement	Boiler Storage		4' linear T8	Electronic	4	4	Fluorescent	32	2	1024	Sp Switches	512	4' linear T8	Electronic	4	4	Fluorescent	32	2	1024	Sp Switches	512
10	Klooner	1927	Basement	Boiler Room		4' linear T8	Electronic	7	2	Fluorescent	32	2	896	Sp Switches	448	4' linear T8	Electronic	7	2	Fluorescent	32	2	896	Sp Switches	448
11	Klooner	1908	Basement	General Storage	43	4' linear T8	Electronic	1	2	Fluorescent	32	2	128	Sp Switches	64	4' linear T8	Electronic	1	2	Fluorescent	32	2	128	Sp Switches	64
12	Klooner	1908	Basement	General Storage		P8T12	Electronic	3	2	Fluorescent	60	2	720	Sp Switches	360	8' linear T8 (2F59T8)	Electronic	3	2	Fluorescent	48	2	576	Sp Switches	288
13	Klooner	1908	Basement	Faculty Room		4' linear T8	Electronic	14	4	Fluorescent	32	8	14336	Sp Switches	1792	4' linear T8	Electronic	14	4	Fluorescent	32	8	14336	Sp Switches	1792
14	Klooner	1908	Basement	Faculty Room		2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128	2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128
15	Klooner	1927	First Floor	Boys Restroom		4' linear T8	Electronic	2	4	Fluorescent	32	8	2048	Sp Switches	256	4' linear T8	Electronic	2	4	Fluorescent	32	8	2048	Sp Switches	256
16	Klooner	1927	First Floor	Stage		CLT4	Magnetic	1	3	Fluorescent	13	2	78	Sp Switches	39	Circline (FC12-HO)	Electronic	1	1	Fluorescent	13	2	26	Sp Switches	13
17	Klooner	1927	First Floor	Stage		100 Exit	NA	1	1	Incandescent	60	2	120	Sp Switches	60	LED exit sign	Electronic	1	1	LED	5	2	10	Sp Switches	5
18	Klooner	1927	First Floor	Stage		4' linear T8	Electronic	2	2	Fluorescent	32	2	256	Sp Switches	128	4' linear T8	Electronic	2	2	Fluorescent	32	2	256	Sp Switches	128
19	Klooner	1927	First Floor	Multipurpose Room		4' linear T8	Electronic	4	4	Fluorescent	32	8	4096	Sp Switches	512	4' linear T8	Electronic	4	4	Fluorescent	32	8	4096	Sp Switches	512
20	Klooner	1927	First Floor	Multipurpose Room		500 Inc	NA	6	1	Incandescent	500	8	24000	Sp Switches	3000	MH Halide (MH50**)	Electronic	6	1	Fluorescent	150	8	7200	Sp Switches	900
21	Klooner	1927	First Floor	Multipurpose Room Storage		4' linear T8	Electronic	2	4	Fluorescent	32	2	512	Sp Switches	256	4' linear T8	Electronic	2	4	Fluorescent	32	2	512	Sp Switches	256
22	Klooner	1927	First Floor	Kitchen		4' linear T8	Electronic	4	4	Fluorescent	32	8	4096	Sp Switches	512	4' linear T8	Electronic	4	4	Fluorescent	32	8	4096	Sp Switches	512
23	Klooner	1927	First Floor	hallway 4		4' linear T8	Electronic	2	2	Fluorescent	32	11	1408	Sp Switches	128	4' linear T8	Electronic	2	2	Fluorescent	32	11	1408	Sp Switches	128
24	Klooner	1922	First Floor	CR#1		2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128	2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128
25	Klooner	1922	First Floor	CR#1	60	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536
26	Klooner	1922	First Floor	CR#2		2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128	2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128
27	Klooner	1922	First Floor	CR#2	60	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536
28	Klooner	1908	First Floor	CR#3		2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128	2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128
29	Klooner	1908	First Floor	CR#3	55	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536
30	Klooner	1908	First Floor	CR#4		2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128	2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128
31	Klooner	1908	First Floor	CR#4	55	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536
32	Klooner	1927	First Floor	CR#5		2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128	2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128
33	Klooner	1927	First Floor	CR#5	55	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536
34	Klooner	1927	First Floor	CR#6		2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128	2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128
35	Klooner	1927	First Floor	CR#6	55	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536
36	Klooner	1927	First Floor	Girls Restroom		4' linear T8	Electronic	2	4	Fluorescent	32	8	2048	Sp Switches	256	4' linear T8	Electronic	2	4	Fluorescent	32	8	2048	Sp Switches	256
37	Klooner	1927	First Floor	CR#7		2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128	2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128
38	Klooner	1927	First Floor	CR#7	55	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536
39	Klooner	1927	First Floor	CR#8		2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128	2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128
40	Klooner	1927	First Floor	CR#8	55	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536
41	Klooner	1927	First Floor	Front Entry		2' linear T8	Electronic	1	2	Fluorescent	32	11	704	Sp Switches	84	2' linear T8	Electronic	1	2	Fluorescent	32	11	704	Sp Switches	84
42	Klooner	1928	First Floor	Front Entry		4' linear T8	Electronic	1	4	Fluorescent	32	11	1408	Sp Switches	128	4' linear T8	Electronic	1	4	Fluorescent	32	11	1408	Sp Switches	128
43	Klooner	1929	First Floor	Corridor at CR 1-4		4' linear T8	Electronic	3	4	Fluorescent	32	11	4224	Sp Switches	384	4' linear T8	Electronic	3	4	Fluorescent	32	11	4224	Sp Switches	384
44	Klooner	1930	First Floor	Opposite Stairwell		2' linear T8	Electronic	2	2	Fluorescent	32	11	1408	Sp Switches	128	2' linear T8	Electronic	2	2	Fluorescent	32	11	1408	Sp Switches	128
45	Klooner	1931	First Floor	Stairwell		4' linear T8	Electronic	1	4	Fluorescent	32	11	1408	Sp Switches	128	4' linear T8	Electronic	1	4	Fluorescent	32	11	1408	Sp Switches	128
46	Klooner	1932	First Floor	Coat Closets		2' linear T8	Magnetic	10	2	Fluorescent	48	2	1920	Sp Switches	960	4' linear T8 (2F27B)	Electronic	10	2	Fluorescent	32	2	1280	Sp Switches	640
47	Klooner	1927	First Floor	SIG #8A		4' linear T8	Electronic	4	2	Fluorescent	32	8	4096	Sp Switches	512	4' linear T8	Electronic	4	2	Fluorescent	32	8	4096	Sp Switches	512
48	Klooner	1927	Second Floor	Music Room	43	4' linear T8	Electronic	1	2	Fluorescent	32	8	512	Sp Switches	64	4' linear T8	Electronic	1	2	Fluorescent	32	8	512	Sp Switches	64
49	Klooner	1927	Second Floor	Music Room		P8T12	NA	1	2	Fluorescent	60	8	960	Sp Switches	120	8' linear T8 (2F59T8)	Electronic	1	2	Fluorescent	48	8	768	Sp Switches	96
50	Klooner	1922	Second Floor	CR#9		2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128	2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128
51	Klooner	1922	Second Floor	CR#9	55	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536
52	Klooner	1922	Second Floor	CR#10		2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128	2' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Sp Switches	128
53	Klooner	1922	Second Floor	CR#10	55	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	1536	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	Sp Switches	

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 Hamington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Integrus Energy Services, Inc. 99 Wood Ave South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrusenergy.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.southjerseveenergy.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 Thomall 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 Thomall 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.southjerseveenergy.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