Steven Winter Associates, Inc.
Building Systems Consultants
www.swinter.com

293 Route 18, Suite 330
East Brunswick, NJ 08816

Telephone (866) 676-1972
Facsimile (203) 852-0741

December 29, 2010

Local Government Energy Program
Energy Audit Final Report

Glen Ridge Public Schools

Forest Avenue School
287 Forest Ave
Glen Ridge, NJ 07028

Project Number: LGEA78

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EXECUTIVE SUMMARY

The Glen Ridge Public Schools Forest Avenue School is a two-story building with a partial basement comprising a total conditioned floor area of 32,093 square feet. The original structure was built in 1928, with additions in 1959 and renovations in 1993. The following table provides an overview of current energy usage in the building based on the analysis period of July 2009 through June 2010:

Table 1: State of Building—Energy Usage

	Electric Usage, kWh/yr	Gas Usage, therms/yr	Other fuel usage, gal/yr	Current Annual Cost of Energy, $	Site Energy Use Intensity, kBtu/sq ft yr	Joint Energy Consumption, MMBtu/yr
Current	143,520	14,981	N/A	$47,454	61.9	1,988
Proposed	106,275	14,931	N/A	$37,630	57.8	1,856
Savings	37,245	50	N/A	$9,824*	4.1	132
% Savings	26%	0%	N/A	21%	7%	7%
Proposed Solar PV	28,654	Includes SRECs		$21,766	3.0	98
*Includes operation and maintenance savings						

There may be energy procurement opportunities for the Glen Ridge Public Schools Forest Avenue School to reduce annual utility costs, which are $3,301 higher, when compared to the average estimated NJ commercial utility rates. Glen Ridge Board of Education should explore the option to participate in the NJSBA ACES program to cooperatively buy both electric and gas, like many other schools throughout New Jersey.

SWA has also entered energy information about the Forest Avenue School in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager Energy benchmarking system. The building is designated as a "K-12 School "space type. The resulting score is 36, which indicates that the building performs better than only 36% of all similar school buildings nationwide.

Based on the current state of the building and its energy use, SWA recommends implementing various energy conservation measures from the savings detailed in Table 1. The measures are categorized by payback period in Table 2 below:

Table 2: Energy Conservation Measure Recommendations

ECMs	First Year Savings ($)	Simple Payback Period (years)	Initial Investment, $	CO2 Savings, lbs/yr
0-5 Year	$2,722	1.5	$4,152	16,374
5-10 Year	$7,052	8.7	$61,925	50,865
Solar PV	$21,766	6.9	$150,938	51,304
Total	$31,589	6.9	$217,014	118,543

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 9 cars from the roads each year or avoiding the need of 288 trees to absorb the annual CO_2 generated.

Other recommendations to increase building efficiency pertaining to operations and maintenance and capital improvements are listed below:

Further Recommendations:

SWA recommends that the Forest Avenue School further explore the following:

Capital Improvements

- Install NEMA premium motors when replacements are required
- Remove abandoned equipment from the Main Attic

Operations and Maintenance

- Clean steam traps and strainers on a regular basis
- Perform cleaning and maintenance service on steam boilers, steam traps and vacuum traps.
- Clean dust and debris and provide access to AHUs for the attic space above the Library Stage.
- Replace copper roof trim with stainless steel as needed
- Install/repair and maintain gutters, downspouts
- Remove any insect nesting on exterior walls and in cavities to prevent deterioration
- Remove sharp rocks and debris from all flat roof surfaces
- Provide water-efficient fixtures and controls
- SWA recommends that the building considers purchasing the most energy-efficient equipment, including ENERGY STAR® labeled appliances
- Use smart power electric strips
- Create an energy educational program

The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for Glen Ridge Public Schools. Based on the requirements of the LGEA program, Glen Ridge Public Schools must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The minimum amount to be spent, net of other NJCEP incentives, is $2,083.75.

Financial Incentives and Other Program Opportunities

The table below summarizes the recommended next steps that Glen Ridge Public Schools can take to achieve greater energy efficiency and reduce operating expenses. It includes the amount in dollars that Glen Ridge Public Schools is required to spend per building according to the LGEA program guidelines. It is important to note that the required 25% expenditure is per building and after the other implementation incentive amounts.

Table 3: Next Steps for the Forest Avenue Elementary School

Recommended ECMs	Incentive Program (Please refer to Appendix F for details)
Lighting ECMS: Install 18 CFL lamps, 19 LED	Direct Install, SmartStart

exit signs, 9 Pulse Start Metal Halide fixtures, 313 T8 fluorescent fixtures with electronic ballasts and 6 wall-mounted occupancy sensors	
Programmable Thermostats	None
Install 24.16 kW rooftop PV system	Renewable Energy Incentive Program

There are various incentive programs that the Glen Ridge Public Schools could apply for that could help lower the cost of installing the ECMs. For the Forest Avenue Elementary School, and contingent upon available funding, SWA recommends the following incentive programs:

New Jersey Clean Energy Pay for Performance – At this time, the project would not qualify for the Pay-for-Performance program with out intensive capital spending to improve source energy by at least 15%. Pay-for-Performance is not recommended for this building at this time.

Energy Efficiency and Conservation Block Grant Rebate Program (EECBG): Provides up to $20,000 per local government toward energy saving measures.

Direct Install 2010 Program: Commercial buildings with peak electric demand below 200kW can receive up to 60% of installed cost of energy saving upgrades. Glen Ridge Board of Education is exempt from this demand requirement if they apply for the EECBG grant before December 31, 2010.

Smart Start: Majority of energy saving equipment and design measures have moderate incentives under this program.

Renewable Energy Incentive Program: Receive up to $0.75/Watt up to 30 kW toward installation cost for PV panels up to 50 kW in size, upon available funding.
AND For each 1,000 kWh generated by renewable energy, receive a credit between $475 and $600.

Utility Sponsored Programs: See available programs with PSE&G. http://www.pseg.com/

Please refer to Appendix F for further details.

INTRODUCTION

Launched in 2008, the Local Government Energy Audit (LGEA) Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize up to 100% of the cost of the audit. The Board of Public Utilities (BPUs) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

Steven Winter Associates, Inc. (SWA) is a 38-year-old architectural/engineering research and consulting firm, with specialized expertise in green technologies and procedures that improve the safety, performance, and cost effectiveness of buildings. SWA has a long-standing commitment to creating energy-efficient, cost-saving and resource-conserving buildings. As consultants on the built environment, SWA works closely with architects, developers, builders, and local, state, and federal agencies to develop and apply sustainable, 'whole building' strategies in a wide variety of building types: commercial, residential, educational and institutional.

SWA performed an energy audit and assessment for the Forest Avenue School at 287 Forest Avenue, Glen Ridge, NJ. The process of the audit included a facility visit on August 11, 2010, benchmarking and energy bills analysis, assessment of existing conditions, energy modeling, energy conservation measures and other recommendations for improvements. The scope of work includes providing a summary of current building conditions, current operating costs, potential savings, and investment costs to achieve these savings. The facility description includes energy usage, occupancy profiles and current building systems along with a detailed inventory of building energy systems, recommendations for improvement and recommendations for energy purchasing and procurement strategies.

The goal of this Local Government Energy Audit is to provide sufficient information to the Glen Ridge Public School Board of Education to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Forest Avenue Elementary School.

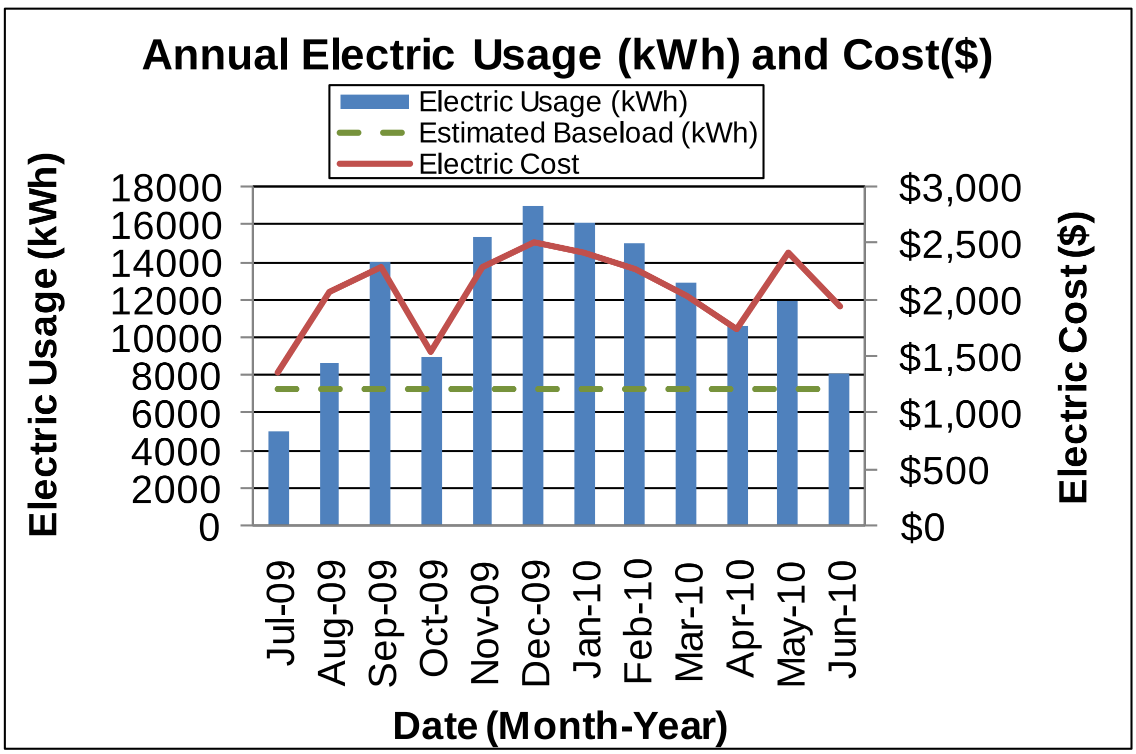
HISTORICAL ENERGY CONSUMPTION

Energy usage, load profile and cost analysis

SWA reviewed utility bills from July 2008 through June 2010 that were received from the utility companies supplying the Forest Avenue School with electric and natural gas. A 12 month period of analysis from July 2009 through June 2010 was used for all calculations and for purposes of benchmarking the building.

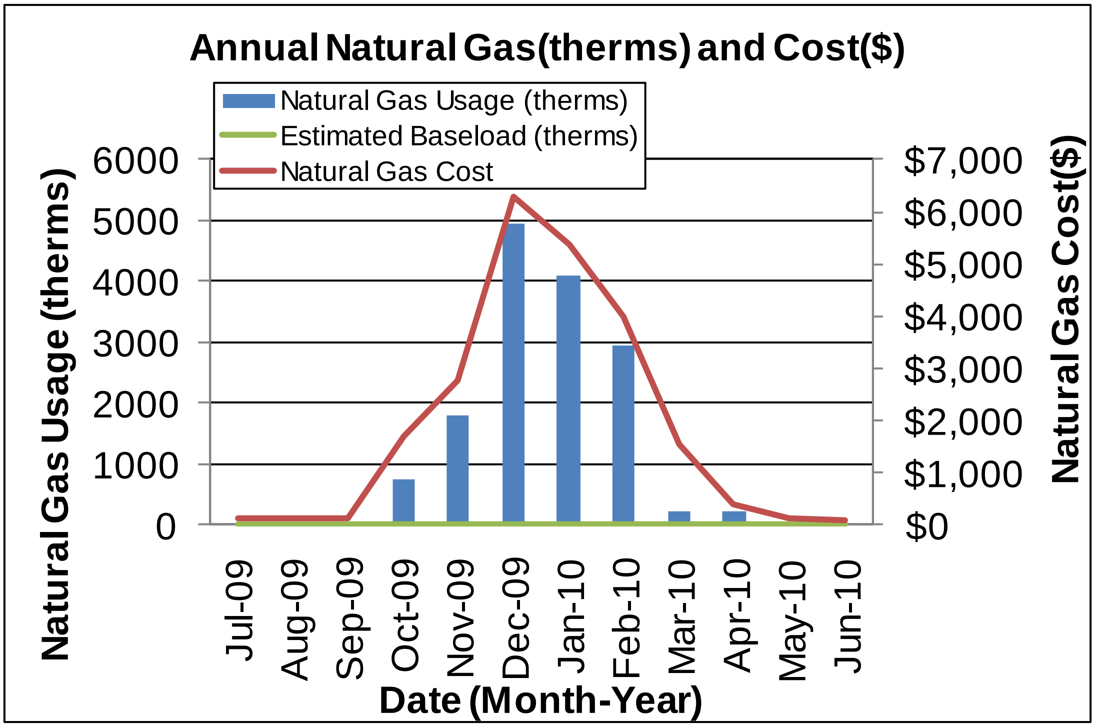
Electricity - The Forest Avenue School is currently served by one electric meter. The Forest Avenue School currently buys electricity from PSE&G at **an average aggregated rate of $0.173/kWh**. The Forest Avenue School purchased **approximately 143,520 kWh, or $24,872 worth of electricity,** in the previous year. The average monthly demand was 49.0 kW and the annual peak demand was 54.9 kW.

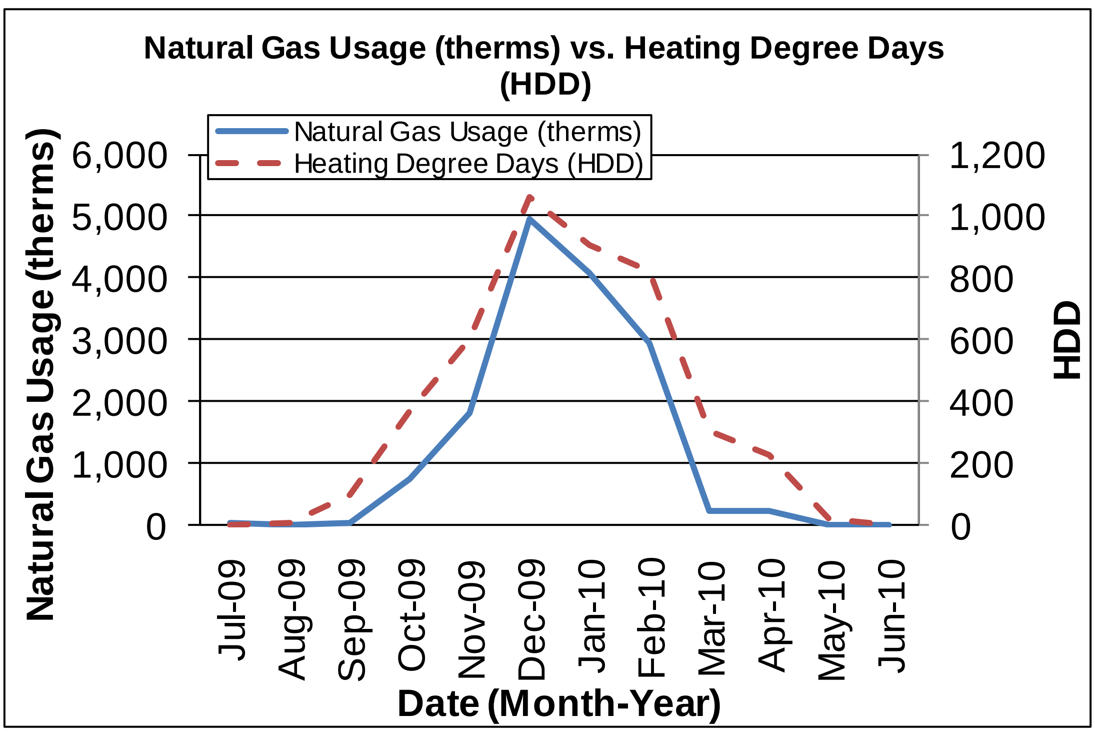
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate the Forest Avenue Elementary School. There are no major electric spikes in the summer because the building has very little cooling.



Natural gas - The Forest Avenue School is currently served by one meter for natural gas. The Forest Avenue School currently buys natural gas from PSE&G through Hess who acts as a third party supplier at **an average aggregated rate of $1.507/therm**. The Forest Avenue School purchased **approximately 14,981 therms, or $22,582 worth of natural gas,** in the previous year.

The chart below shows the monthly natural gas usage and costs. The green line represents the approximate baseload or minimum natural gas usage required to operate the Forest Avenue Elementary School.

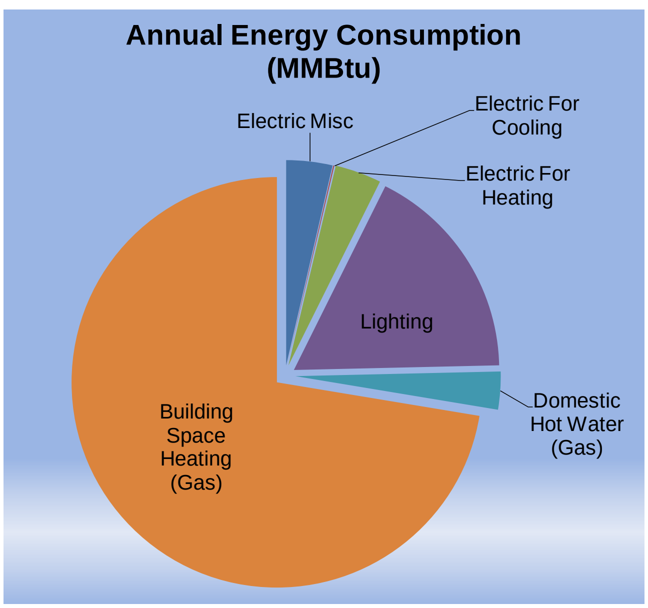


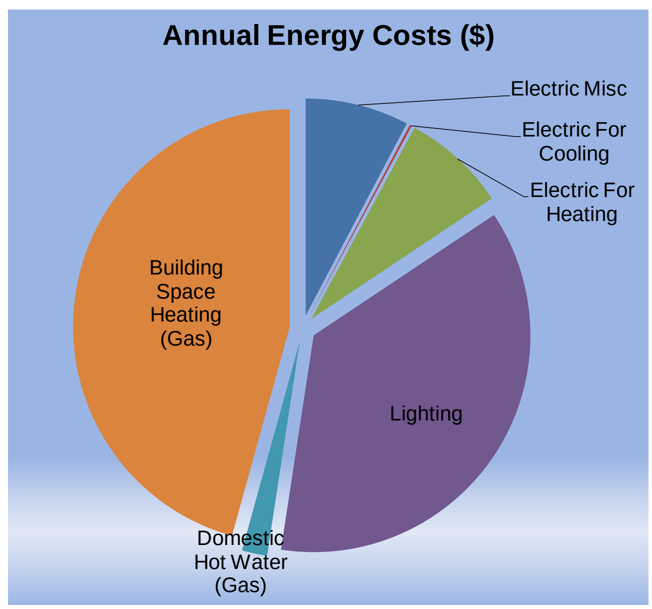


The chart above shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the base temperature. SWA's analysis used a base temperature of 65 degrees Fahrenheit.

The following graphs, pie charts, and table show energy use for the Forest Ave School based on utility bills for the 12 month period. Note: electrical cost at $51/MMBtu of energy is more than 3 times as expensive as natural gas at $15/MMBtu

Annual Energy Consumption / Costs					
	MMBtu	**% MMBtu**	**$**	**% $**	**$/MMBtu**
Electric Miscellaneous	72	4%	$3,662	8%	51
Electric For Cooling	2	0%	$78	0%	51
Electric For Heating	72	4%	$3,681	8%	51
Lighting	344	17%	$17,452	37%	51
Domestic Hot Water (Gas)	59	3%	$893	2%	15
Building Space Heating (Gas)	1,439	72%	$21,689	46%	15
Totals	1,988	100%	$47,454	100%	
Total Electric Usage	490	25%	$24,872	52%	51
Total Gas Usage	1,498	75%	$22,582	48%	15
Totals	1,988	100%	$47,454	100%	

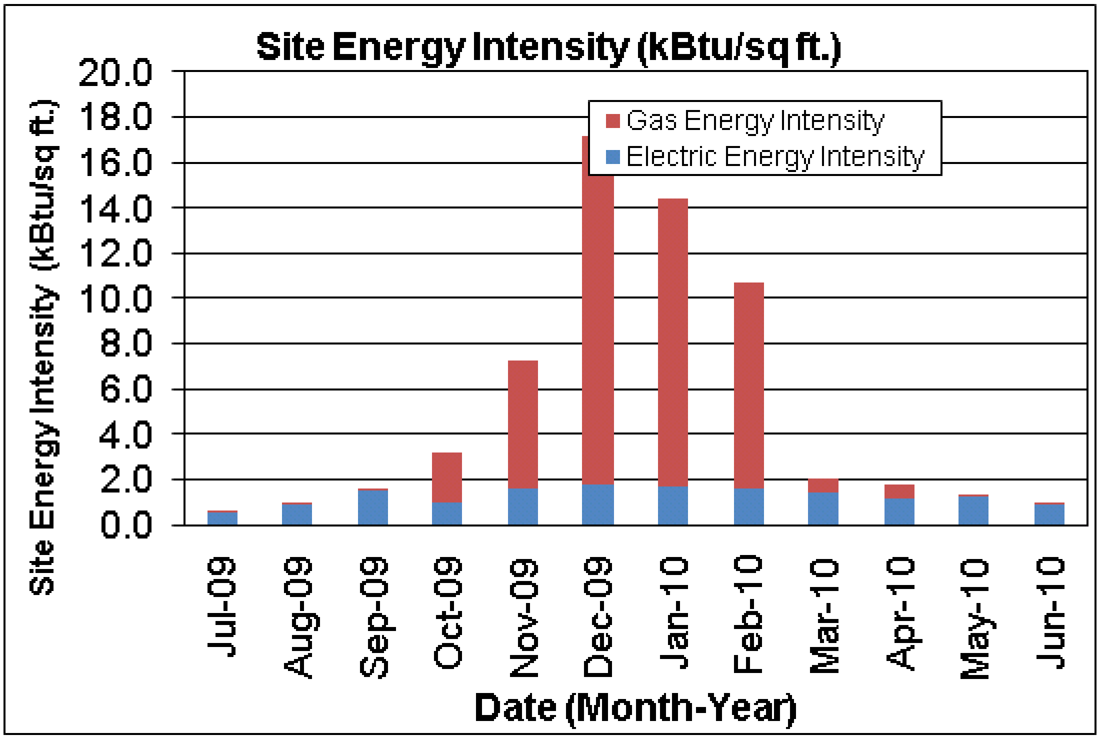




As noted in the above charts, Electric Miscellaneous represents electric loads that are not associated with heating or cooling loads. These miscellaneous loads are mostly associated with various plug-loads such as computers and other electronics. At this building, these loads are typically not monitored and computers are left on with only screensavers to conserve power.

Energy benchmarking

SWA has entered energy information about the Forest Avenue School in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager energy benchmarking system. This facility is categorized as a "K-12 School" space type which is eligible to receive a national energy performance rating. The Energy Performance Rating is 36, meaning that the building performs better than only 36% of similar buildings. The Site Energy Use Intensity is 61.9 kBtu/ft^2-yr compared to the national average of a K-12 School building consuming 55.0 kBtu/ft^2-yr. See ECM section for guidance on how to improve the building's rating.



Per the LGEA program requirements, SWA has assisted the Glen Ridge Public Schools to create an ENERGY STAR® Portfolio Manager account and share the Forest Avenue School facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager account information with the Glen Ridge Public Schools (user name of "GlenRidgeBOE" with a password of "GLENRIDGEBOE") and TRC Energy Services (user name of "TRC-LGEA").

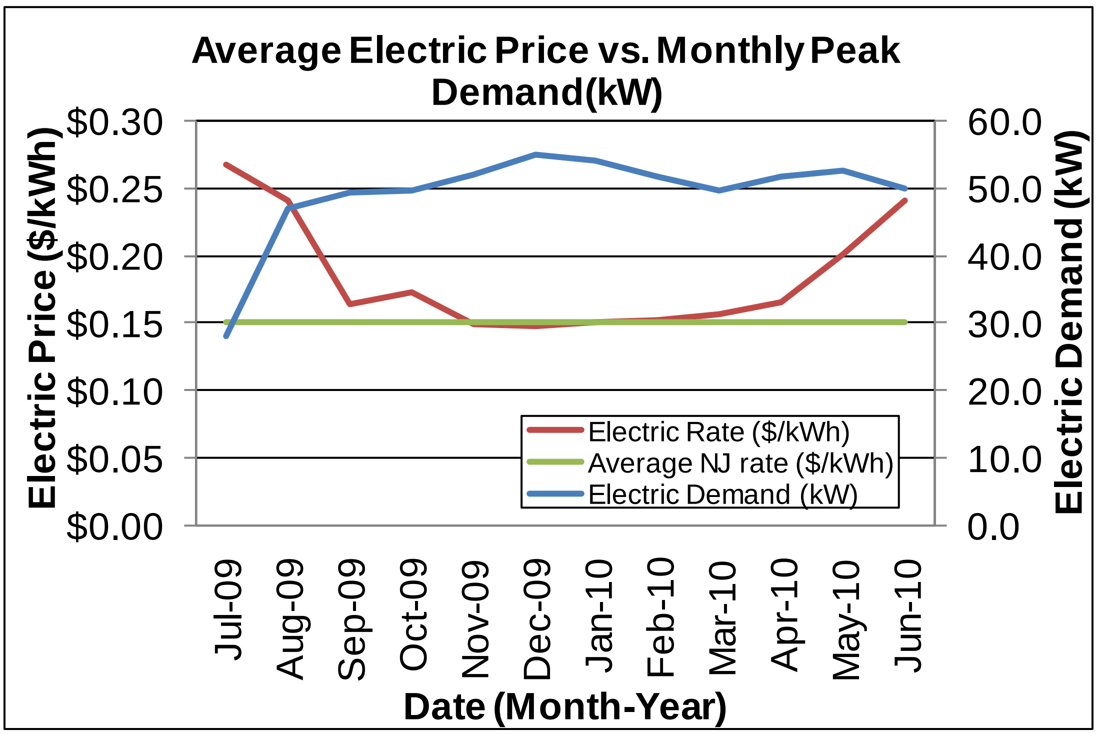
Tariff analysis

Tariff analysis can help determine if the municipality is paying the lowest rate possible for electric and gas service. Tariffs are typically assigned to buildings based on size and building type. Rate fluctuations are expected during periods of peak usage. Natural gas prices often increase during winter months since large volumes of natural gas is needed for heating equipment. Similarly, electricity prices often increase during the summer months when additional electricity is needed for cooling equipment.

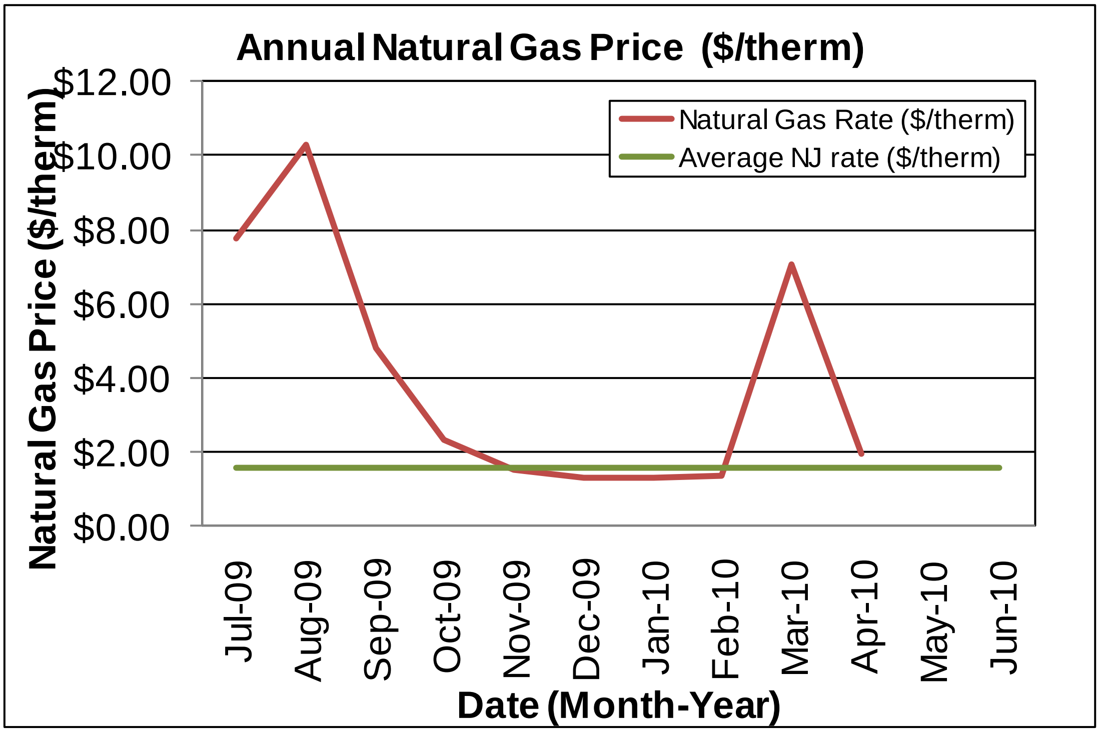
As part of the utility bill analysis, SWA evaluated the current utility rates and tariffs for the Glen Ridge Public Schools. The Forest Avenue School is currently paying a general service rate for natural gas including fixed costs such as meter reading charges. The electric use for the building is direct-metered and purchased at a general service rate with an additional charge for electrical demand factored into each monthly bill. The general service rate is a market-rate based on electric usage and electric demand. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year.

Energy Procurement strategies

Billing analysis is conducted using an average aggregated rate that is estimated based on the total cost divided by the total energy usage for each utility over a 12 month period. Average aggregated rates do not separate demand charges from usage, and instead provide a metric of inclusive cost per unit of energy. Average aggregated rates are used in order to equitably compare building utility rates to average utility rates throughout the state of New Jersey.
The average estimated NJ commercial utility rates for electric are $0.150/kWh, while Forest Avenue School pays a rate of $0.173/kWh. The Forest Avenue School annual electric utility costs are $3,301 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 45% over the most recent 12 month period.



The average estimated NJ commercial utility rates for gas are $1.550/therm, while Forest Avenue School pays a rate of $1.507/therm. Natural gas bill analysis shows fluctuations up to 88% over the most recent 12 month period.



Utility rate fluctuations may have been caused by adjustments between estimated and actual meter readings; others may be due to unusual high and recent escalating energy costs. The rate peaks in August and March are likely due to low usage and set meter costs.

SWA recommends that the Forest Avenue School further explore opportunities of purchasing electricity from third-party suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Forest Avenue Elementary School. Appendix C contains a complete list of third-party energy suppliers for the Glen Ridge Public Schools service area.

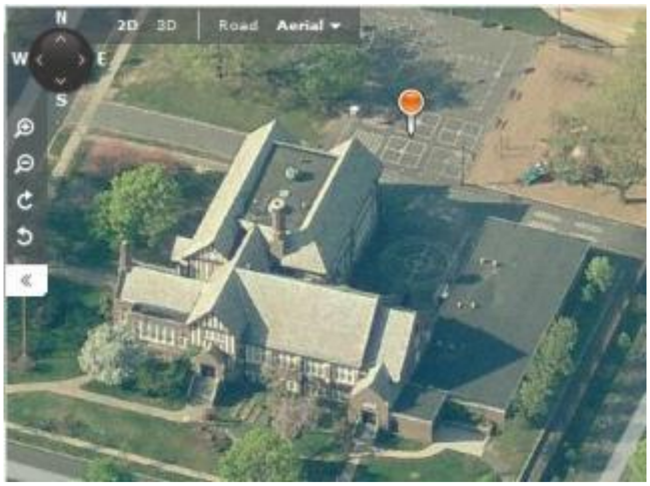
EXISTING FACILITY AND SYSTEMS DESCRIPTION

This section gives an overview of the current state of the facility and systems. Please refer to the Proposed Further Recommendations section for recommendations for improvement.

Based on a visit from SWA on August 10, 2010, the following data was collected and analyzed.

Building Characteristics

The two-story (including a partial basement), 32,093 square foot Forest Avenue Elementary School building was originally constructed in 1928 with additions in 1959 and renovations in 1993. It houses classrooms, offices, bathrooms, and a gymnasium.



Arial View


Front Façade
Partial Rear Façade (typ.)

Partial Rear Façade (typ.)

Left Side Façade

Rear Wing

Main Entrance

Building Occupancy Profiles

Its occupancy is approximately 36 teachers/staff and 258 students from 8:00am to 3:00pm on weekdays during the school year and 2 to 3 custodians in the evening. The building is rarely occupied during the summer and on the weekends.

Building Envelope

Due to unfavorable weather conditions (min. 18 deg. F delta-T in/outside and no/low wind), no exterior envelope infrared (IR) images were taken during the field audit.

Exterior Walls

The exterior wall envelope is mostly constructed of 8 inches solid brick with no insulation. The 1959 Wing addition is constructed of brick veneer over concrete block with no insulation. The interior is mostly painted gypsum wallboard and painted brick in the basement.

Note: Wall insulation levels could not be verified in the field and are based on reports from building management.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall acceptable condition with only a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues.

The following specific exterior wall problem spots and areas were identified:

Missing drain pipe leading to 1st floor gutter

Insect nesting in exterior wall cracks and cavities

Signs of water damage at perimeter walls due to ineffective site drainage

Roof

The building's roof is predominantly a steep-pitch gable type over a wood structure, with a slate shingle finish. There is a small flat section in-between the gable roof sections which is a built-up tar roof with gravel ballast. The slate sections are original and the flat section has been redone several times, the latest during the past 10 years. The Wing section has a flat EPDM, no parapet type roof over steel decking. There was no of visible ceiling insulation in any roof sections and no roof insulation indicated. The entire roof edge has a copper trim which is oxidized in most areas, appearing green.

Note: Roof insulation levels could not be verified in the field, and are based on reports from building management.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall acceptable condition, with only a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues.

The following specific roof problem spots were identified:

Rocks/nails or other sharp objects on roof surface on Wing flat roof

No attic insulation found

No insulation above ceiling

Missing roof shingles & Copper Trim oxidizing, leading to deterioration

Base

The building's base is composed of a below-grade basement with a natural/gravel floor for most of the building, with a small crawl space under wood joist, with a perimeter footing with stone foundation walls and no detectable slab edge/perimeter insulation.

The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall the base was reported to be in acceptable condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues detected in some areas inside.

Windows

The building contains several different types of windows:

1. Approximately 90 double-hung type windows with wood frames, clear/gas-filled, double glazing and interior roller blinds. The windows are located throughout the building and were replaced at least 15 years ago.

2. Approximately 30 awning type windows with non-insulated aluminum frames, clear single glazing and interior roller shades. The windows are located on the wing section and are original.

3. Approximately 10 fixed type windows with wood frames, clear single glazing and no interior or exterior shading devices. The windows are located on the front of the building and are original.

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in poor condition with some signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues.

The following specific window problem spots were identified:

Damaged/aged window frame

Exterior doors

The building contains one main type of exterior door:

1. Seven insulated aluminum with glass light type double doors. They are located throughout the building and were replaced about 17 years ago.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in acceptable condition with no signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues.

Building air-tightness

Overall the field auditors found the building to be reasonably air-tight with only a few areas of suggested improvements, as described in more detail earlier in this chapter.

The air tightness of buildings helps maximize all other implemented energy measures and investments, and minimizes potentially costly long-term maintenance, repair and replacement expenses.

Mechanical Systems

Heating Ventilation Air Conditioning

The Forest Avenue Elementary School has a steam system for heat with cooling limited to a few offices and the library since the building is not occupied for most of the summer. Teachers and staff reported heat and humidity issues during warmer months and a lack of temperature control.

Equipment

The main source of heat for the building is provided by two Cast Iron Weil McLain natural gas steam boilers with a combined capacity of nearly 6,000 MBH steam and 80% thermal efficiency. The boilers were installed in 1993 and appear in good condition.

Cast Iron Steam Boilers

The Wing section, added in 1959, uses hot water as a heating fluid instead of steam, most likely since the system steam pressure is not adequate to reach the Wing section. Steam is used as the heat source in a steam to water heat exchanger. The heat exchanger is flooded with steam as water circulates through coils within the heat exchanger. The heated water is then pumped out to the Wing by two circulation pumps.


Steam to Hot Water Heat Exchanger

The steam is used in unit ventilators, radiators and steam coils to provide heat to the various spaces. Each classroom of the main building has a steam unit ventilator and a ceiling exhaust grill leading to the above ceiling plenum. The Wing classrooms have hot water unit ventilators and supplementary electric heaters in each classroom.


Classroom Unit Ventilators

There are several air handling units (AHUs) in the building which are heating and ventilation only. The Gymnasium has a ceiling suspended Carrier AHU as well as an independent exhaust fan. The fan draws air out of the space as the AHU supplies a mixture of fresh outside air and return air that has been heated.


Gymnasium AHU and Exhaust Fan

The Library/Media Center has two Carrier AHUs mounted in the attic space above which provides heated air for the space. The units are accessible through an opening in the ceiling in a narrow hallway behind the stage. There is not a permanent mechanism to access the units. A wall mounted exhaust fan within the attic purges air based on temperature. This attic acts as a return plenum, yet there is a significant amount of dust and debris in the space. The plenum area should be clean and air tight so that contaminants do not enter the AHUs. Also the area below the hatch should be kept clear at all times and an air tight spring operated hatch should be installed.


Library AHU in attic; Attic exhaust fan with Siemens control

The various spaces of the building are provided ventilation by outside air intake dampers on the AHUs as well as rooftop or wall mounted exhaust fans. There are in excess of 10 rooftop exhaust fans serving classrooms, hallways and toilets. As previously mentioned each classroom has an exhaust grill which leads to a ceiling exhaust plenum. The toilets have a separate fully ducted exhaust fan system. The exhaust fan motors range from 1/6 HP to 1.5 HP and appear in good operating condition.

Rooftop Exhaust Fans

There are also two large exhaust fans, EF-5 and EF-6 installed in the main attic space to draw hot air out of the building which accumulates in the attic. Originally the attic was vented by natural ventilation using two large shafts that terminated on the roof with a copper wind turbine. Wind would cause the turbine to rotate, drawing air up the shaft, also aided by stack effect. A motorized exhaust fan was added to each of these shafts to ensure proper ventilation, although the original copper wind turbines remain in place. There are also several outside air intake grills on the exterior of the building which are ducted to supply fans throughout the building to introduce fresh air.

Copper Wind Turbine

There are several sections of the building with independent cooling. The main office, principal's office and nurse have wall mounted DX split units. The condenser sections are mounted along the exterior wall of the building in the back. The Library has four wall-mounted evaporators which reject heat to two condensers, also mounted outside.

Wall Mounted DX Split System Indoor Unit and Outdoor Condensers

Stairwells, vestibules and hallways have wall or ceiling mounted steam radiators. The new Wing has two ceiling suspended Dayton electric unit heaters at the exit vestibule. As mentioned, classrooms in the new Wing have electric radiators below the blackboards as well to supplement the hot water unit ventilators.

SF-1 OA intake and heater for Main Office; stairwell steam radiator

Electric Radiators in Wing classrooms; Wall Mounted steam radiators

Some equipment was found to be inoperable. All abandoned, inoperable equipment should be disconnected from the system and removed. It is a good practice to remove all abandoned equipment for clearing mechanical space. The equipment can be recycled or broken down to basic components which can be reused or recycled.

Abandoned exhaust fan in Main Attic

Distribution Systems

A heating only air handling unit draws in fresh air and brings it into a mixing box, where it is combined with return air from the building. A small portion of the return air is purged and vented outside prior to entering the mixing box. The mixed air inside the air handler is sent through a filter before passing through the steam coil section. The conditioned air is then distributed into the building spaces.

The buildings ductwork distribution system, limited to the Gymnasium and Library, is a constant volume type with manual dampers for air balancing.

The unit ventilators have an opening to the exterior which draws outside air into the unit using squirrel cage fans. The air passes the steam coils and then continues to the supply grill at the top of the unit.

The steam is used in a heat exchanger to produce hot water for the Wing. There is a pump set in the boiler room to carry the hot water to the unit ventilators in the Wing.

Hot Water Distribution to Wing

Controls

Although there are manual thermostats visible sporadically throughout the building, most of the individual controls are not active or are overridden by a Barber Coleman control system. The interface for the controls is located in the mechanical shop where the space setpoints can be adjusted. There is currently no computer-based monitoring and adjustments are made on the control panel by maintenance staff.

Barber Coleman controller; Gymnasium AHU thermostat

Domestic Hot Water

The domestic hot water (DHW) for the Forest Avenue School is provided by a gas heated, atmospheric AO Smith hot water heater with 38 gal storage and 40 MBH capacity. The heater was installed in 2007 and appears in good condition.

DHW Heater

Electrical systems

Lighting

See attached lighting schedule in Appendix B for a complete inventory of lighting throughout the building including estimated power consumption and proposed lighting recommendations.

As of **July 1, 2010** magnetic ballasts most commonly used for the operation of T12 lamps will no longer be produced for commercial and industrial applications. Also, many T12 lamps will be phased out of production starting July 2012.

Interior Lighting - The Forest Avenue School currently contains mostly T12 fixtures, and sporadic use of incandescent lights. Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas.

Typical Classroom lighting; Gymnasium lighting

Exit Lights - Exit signs were found to be incandescent type.

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a mix of Metal Halide lamp and Incandescent fixtures. Exterior lighting is controlled by photocell sensors.

Exterior Metal Halide

Appliances and process

SWA has conducted a general survey of larger, installed equipment. Appliances and other miscellaneous equipment account for a significant portion of electrical usage within the building. Typically, appliances are referred to as “plug-load” equipment, since they are not inherent to the building’s systems, but rather plug into an electrical outlet. Equipment such as process motors, computers, computer servers, radio and dispatch equipment, refrigerators, vending machines, printers, etc. all create an electrical load on the building that is hard to separate out from the rest of the building’s energy usage based on utility analysis.

Elevators

The Forest Avenue School does not have an installed elevator.

Other electrical systems

There are not currently any other significant energy-impacting electrical systems installed at the Forest Avenue Elementary School.

RENEWABLE AND DISTRIBUTED ENERGY MEASURES

Renewable energy is defined as any power source generated from sources which are naturally replenished, such as sunlight, wind and geothermal. Technology for renewable energy is improving, and the cost of installation is decreasing, due to both demand and the availability of state and federal government-sponsored funding. Renewable energy reduces the need for using either electricity or fossil fuel, therefore lowering costs by reducing the amount of energy purchased from the utility company. Technology such as photovoltaic panels or wind turbines, use natural resources to generate electricity on the site. Geothermal systems offset the thermal loads in a building by using water stored in the ground as either a heat sink or heat source. Solar thermal collectors heat a specified volume of water, reducing the amount of energy required to heat water using building equipment. Cogeneration or CHP allows you to generate electricity locally, while also taking advantage of heat wasted during the generation process.

Existing systems

Currently there are no renewable energy systems installed in the building.

Evaluated Systems

Solar Photovoltaic

Photovoltaic panels convert light energy received from the sun into a usable form of electricity. Panels can be connected into arrays and mounted directly onto building roofs, as well as installed onto built canopies over areas such as parking lots, building roofs or other open areas. Electricity generated from photovoltaic panels is generally sold back to the utility company through a net meter. Net-metering allows the utility to record the amount of electricity generated in order to pay credits to the consumer that can offset usage and demand costs on the electric bill. In addition to generation credits, there are incentives available called Solar Renewable Energy Credits (SRECs) that are subsidized by the state government. Specifically, the New Jersey State government pays a market-rate SREC to facilities that generate electricity in an effort to meet state-wide renewable energy requirements.

Based on a Solar Pathfinder Analysis, less than 7.0% of the roof is covered by shade during the hottest hours of the day, therefore the Forest Avenue School is a good candidate for a 24.15 kW Solar Panel installation. See ECM# 4 for details.

Solar Thermal Collectors

Solar thermal collectors are not cost-effective for this building and would not be recommended due to the insufficient and intermittent use of domestic hot water throughout the building to justify the expenditure.

Wind

The Forest Avenue School is not a good candidate for wind power generation due to insufficient wind conditions in this area of New Jersey.

Geothermal

The Forest Avenue School is not a good candidate for geothermal installation since it would require replacement of the entire existing HVAC system, of which major components still have between 25% and 75% remaining useful life.

Combined Heat and Power

The Forest Avenue School is not a good candidate for CHP installation and would not be cost-effective due to the size and operations of the building. Typically, CHP is best suited for buildings with a high electrical baseload to accommodate the electricity generated, as well as a means for using waste heat generated. Typical applications include buildings with an absorption chiller, where waste heat would be used efficiently.

PROPOSED ENERGY CONSERVATION MEASURES

Energy Conservation Measures (ECMs) are recommendations determined for the building based on improvements over current building conditions. ECMs have been determined for the building based on installed cost, as well as energy and cost-savings opportunities.

Recommendations: Energy Conservation Measures

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1	Install eighteen (18) new CFL lamps
2	Upgrade nine (9) Classroom Thermostats to Programmable type
3	Install nineteen (19) new LED exit signs
	Description of Recommended 5-10 Year Payback ECMs
4	Install 24.15 kW Rooftop Photovoltaic System
5	Install nine (9) new Pulse Start Metal Halide fixtures
6	Install (313) new T8 fluorescent fixtures
7	Install six (6) new Occupancy Sensors

In order to clearly present the overall energy opportunities for the building and ease the decision of which ECM to implement, SWA calculated each ECM independently and did not incorporate slight/potential overlaps between some of the listed ECMs (i.e. lighting change influence on heating/cooling).

ECM#1: Install eighteen (18) new CFL lamps

During the field audit, SWA completed a building lighting inventory (see Appendix B). The existing lighting also contains 18 inefficient incandescent lamps. SWA recommends that each incandescent lamp is replaced with a more efficient, Compact Fluorescent Lamp (CFL). CFLs are capable of providing equivalent or better light output while using less power when compared to incandescent, halogen and Metal Halide fixtures. CFL bulbs produce the same lumen output with less wattage than incandescent bulbs and last up to five times longer. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $169 (includes $94 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

ECM #	Est. installed cost, $	Est. incentives, $	Net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	Therms, 1st yr savings	kBtu/sq ft, 1st yr savings	Est. operating cost, 1st yr savings, $	Total 1st yr savings, $	Life of measure, yrs	Est. lifetime energy cost savings, $	Simple payback, yrs	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal Rate of Return, %	Net present value, $	CO_2 reduced, lbs/yr
1	169	0	169	1,693	0.4	0	0.2	99	391	5	1,957	0.4	1,060	212	231	1,564	3,031

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes an annual maintenance cost for lighting replacements that takes into account the number of burnt out bulbs avoided per year versus fixture lifetime.

Rebates/financial incentives:

- NJ Clean Energy – Direct Install program (Up to 60% of the installed cost)

Please see Appendix F for more information on Incentive Programs.

ECM#2: Upgrade nine (9) Classroom Thermostats to Programmable type

During the field audit, SWA completed a building HVAC controls analysis and observed spaces in the building where temperature is manually controlled without setbacks to reduce energy consumption during unoccupied periods of time, such as evenings and weekends. Programmable thermostats offer an easy way to save energy when correctly used. By turning the thermostat setback 8 to 10 degrees F for eight hours at a stretch (at night), the heating bill can be reduced substantially (by a minimum of 10% per year). The savings from using a programmable thermostat is greater in milder climates than in more extreme climates. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Each of the nine classrooms has a Barber Coleman thermostat which ties to the steam or hot water unit ventilator; however the thermostats do not operate properly. The teachers are not able to adjust the temperature, and maintenance staff must manually dial into the control system to make adjustments. Upgrading the Barber Coleman control systems to a fully automated system will increase occupancy comfort and reduce labor costs. Doing so will also ensure that the equipment will operate at the optimized conditions for each space and can be programmed to shut down during unoccupied hours. The financial calculations below are for converting nine thermostats to a programmable type. It is assumed that there will be evening setbacks for 8 hours a day for which the setpoint adjusts from 70 deg to 62 deg in the winter.

Installation cost:

Estimated installed cost: $1,503 (includes $575 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

ECM #	Est. installed cost, $	Est. incentives, $	Net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	Therms, 1st yr savings	kBtu/sq ft, 1st yr savings	Est. operating cost, 1st yr savings, $	Total 1st yr savings, $	Life of measure, yrs	Est. lifetime energy cost savings, $	Simple payback, yrs	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal Rate of Return, %	Net present value, $	CO_2 reduced, lbs/yr
2	1,503	0	1,503	0	0.0	50	0.2	1,050	1,125	12	13,504	1.3	798	67	75	9,270	551

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA also assumed an aggregated 30 hrs/yr to make manual adjustments vs. an installed programmable thermostat. SWA assumed that temperatures would be setback based on the operation schedule of the building and used Energy Star site: http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=TH , Excel spreadsheet for Savings Calculator

Rebates/financial incentives:

- NJ Clean Energy – Direct Install program (Up to 60% of the installed cost)

Please see Appendix F for more information on Incentive Programs.

ECM#3: Install nineteen (19) new LED exit signs

During the field audit, SWA completed a building lighting inventory (see Appendix B). SWA observed that the building contains approximately 19 incandescent Exit signs. SWA recommends replacing these with LED type. Replacing existing Exit signs with LED Exit signs can result in lower kilowatt-hour consumption, as well as lower maintenance costs. Since Exit signs operate 24 hours per day, they can consume large amounts of energy. In addition, older Exit signs require frequent maintenance due to the short life span of the lamps that light them. LED Exit sign last at least 5 years. In addition, LED Exit signs offer better fire code compliance because they are maintenance free in excess of 5 years. LED Exit signs are usually brighter than comparable incandescent or fluorescent signs, and have a greater contrast with their background due to the monochromatic nature of the light that LEDs emit. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $2,480 (includes $1,534 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

ECM #	Est. installed cost, $	Est. incentives, $	Net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	Therms, 1st yr savings	kBtu/sq ft, 1st yr savings	Est. operating cost, 1st yr savings, $	Total 1st yr savings, $	Life of measure, yrs	Est. lifetime energy cost savings, $	Simple payback, yrs	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal Rate of Return, %	Net present value, $	CO_2 reduced, lbs/yr
3	2,860	380	2,480	7,144	1.5	0	0.8	19	1,255	15	18,823	2.0	659	44	51	12,287	12,791

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes an annual maintenance cost for lighting replacements that takes into account the number of burnt out bulbs avoided per year versus fixture lifetime.

Rebates/financial incentives:

- NJ Clean Energy – SmartStart – LED Exit Signs ($20 per fixture)
    - Maximum Incentive Amount: $380
- NJ Clean Energy – Direct Install program (Up to 60% of the installed cost)

Please see Appendix F for more information on Incentive Programs.

ECM#4: Install 24.15 kW Rooftop Photovoltaic System

Location for installing PV System

Currently, the building does not use any renewable energy systems. Renewable energy systems such as photovoltaic (PV) panels can be mounted on the building roof facing south which can offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, electric demand at a power station is high, due to the amount of air conditioners, lights, and other equipment being used within the region. Demand charges increase to offset the utility's cost to provide enough electricity at that given time. Photovoltaic systems offset the amount of electricity used by a building and help to reduce the building's electric demand, resulting in a higher cost savings. Installing a PV system will offset electric demand and reduce annual electric consumption, while utilizing available state incentives. PV systems are modular and readily allow for future expansions.

The size of the system was determined considering the available roof surface area, without compromising service space for roof equipment and safety, as well as the facilities' annual base load and mode of operation. An analysis was conducted using a Solar Pathfinder shading tool which determines the amount of useable sunlight based on the shading and location of the building.

A PV system could be installed on a portion of the roof with panels facing south as shown in the photo above. A commercial multi-crystalline 230 watt panel has 17.5 square feet of surface area (providing 13.1 watts per square foot). A 24.2 kW system needs approximately 105 panels which would take up 1,842 square feet.

A PV system would reduce the building's electric load and allow more capacity for surrounding buildings as well as serve as an example of energy efficiency for the community. The building is not eligible for a residential 30% federal tax credit. The building owner may want to consider applying for a grant and / or engage a PV generator / leaser who would install the PV system and then sell the power at a reduced rate. Typically, a major utility provides the ability to buy SREC's at $600/MWh or best market offer. However, this option is not available from the local utility. Please see below for more information.

Installation cost:

Estimated installed cost: $150,938 (includes $96,660 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

ECM #	Est. installed cost, $	Est. incentives, $	Net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	Therms, 1st yr savings	kBtu/sq ft, 1st yr savings	Est. operating cost, 1st yr savings, $	Total 1st yr savings, $	Life of measure, yrs	Est. lifetime energy cost savings, $	Simple payback, yrs	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal Rate of Return, %	Net present value, $	CO_2 reduced, lbs/yr
4	169,050	18,113	150,938	28,654	24.2	0	3.0	0	21,766	25	544,143	6.9	261	10	12	127,250	51,304

Assumptions: SWA estimated the cost and savings of the system based on past PV projects. SWA projected physical dimensions based on a typical Polycrystalline Solar Panel (230 Watts, Model ND-U23-C1). PV systems are sized based on 24,150 Watts and physical dimensions for an array will differ with the efficiency of a given solar panel (W/sq ft).

Rebates/financial incentives:

- NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on $0.75/watt Solar PV application for systems 30.0 kW or less. Incentive amount for this application is $18,113 for the Glen Ridge Public Schools.
  http://www.njcleanenergy.com/renewable-energy/programs/renewable-energy-incentive-program

- NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1,000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. A total of $16,800/year, based on $600/SREC, has been incorporated in the above costs for a period of 15 years; however it requires proof of performance, application approval and negotiations with the utility.

Please see Appendix F for more information on Incentive Programs.

ECM#5: Install nine (9) new Pulse Start Metal Halide fixtures

The exterior lighting contains approximately 9 standard probe start Metal Halide (MH) lamps. SWA recommends replacing the higher wattage MH fixtures with pulse start MH lamps which offer the advantages of standard probe start MH lamps, but minimize the disadvantages. They produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. Due to these characteristics, energy savings can be realized via one-to-one substitution of lower-wattage systems, or by taking advantage of higher light output and reducing the number of fixtures required in the space. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $6,848 (includes $3,736 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

ECM #	Est. installed cost, $	Est. incentives, $	Net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	Therms, 1st yr savings	kBtu/sq ft, 1st yr savings	Est. operating cost, 1st yr savings, $	Total 1st yr savings, $	Life of measure, yrs	Est. lifetime energy cost savings, $	Simple payback, yrs	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal Rate of Return, %	Net present value, $	CO_2 reduced, lbs/yr
5	7,073	225	6,848	2,821	0.6	0	0.3	434	922	15	13,827	7.4	102	7	10	3,876	5,050

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes an annual maintenance cost for lighting replacements that takes into account the number of burnt out bulbs avoided per year versus fixture lifetime.

Rebates/financial incentives:

- NJ Clean Energy – SmartStart – Pulse Start Metal Halide fixtures ($25 per fixture)
    - Maximum Incentive Amount: $225.
- NJ Clean Energy – Direct Install program (Up to 60% of the installed cost)

Please see Appendix F for more information on Incentive Programs.

ECM#6: Install (313) new T8 fluorescent fixtures

The vast majority of the interior lighting consists of inefficient T12 fluorescent fixtures with magnetic ballasts, totaling approximately 313 fixtures. SWA recommends replacing each existing fixture with more efficient, T8 fluorescent fixtures with electronic ballasts. T8 fixtures with electronic ballasts provide equivalent or better light output while reducing energy consumption by 30% when compared to T12 fixtures with magnetic ballasts. T8 fixtures also provide better lumens for less wattage when compared to incandescent, halogen and Metal Halide fixtures. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:
Estimated installed cost: $53,877 (includes $29,397 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

ECM #	Est. installed cost, $	Est. incentives, $	Net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	Therms, 1st yr savings	kBtu/sq ft, 1st yr savings	Est. operating cost, 1st yr savings, $	Total 1st yr savings, $	Life of measure, yrs	Est. lifetime energy cost savings, $	Simple payback, yrs	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal Rate of Return, %	Net present value, $	CO_2 reduced, lbs/yr
6	58,572	4,695	53,877	25,313	5.3	0	2.7	1,703	6,082	15	91,230	8.9	69	5	7	17,141	45,322

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes an annual maintenance cost for lighting replacements that takes into account the number of burnt out bulbs avoided per year versus fixture lifetime.

Rebates/financial incentives:

- NJ Clean Energy – SmartStart – T8 fluorescent lighting with electronic ballast ($15 per fixture)
  - Maximum Incentive Amount: $4,695
- NJ Clean Energy – Direct Install program (Up to 60% of installed cost)

Please see Appendix F for more information on Incentive Programs.

ECM#7: Install six (6) new Occupancy Sensors

SWA completed a lighting inventory for the entire Forest Ave Elementary school. Based on occupancy schedules, SWA recommends that six occupancy sensors are installed. SWA recommends that the occupancy sensors are placed in Classrooms BR (W1, W2, W3, W4), and also in the Men's and Women's bathrooms in the basement. These rooms were selected since they have the most variable occupancy and show the most potential for savings through the use of an occupancy sensor. The recommended occupancy sensor should include Passive Infrared (PIR) technology that will allow the lights to shut off in those rooms after a prescribed amount of time that no occupancy is sensed. Occupancy sensors are not recommended in other parts of the building, since those areas are typically occupied throughout the die and lights are never observed to be left on outside of operating hours. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:
Estimated installed cost: $53,877 (includes $29,397 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

ECM #	Est. installed cost, $	Est. incentives, $	Net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	Therms, 1st yr savings	kBtu/sq ft, 1st yr savings	Est. operating cost, 1st yr savings, $	Total 1st yr savings, $	Life of measure, yrs	Est. lifetime energy cost savings, $	Simple payback, yrs	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal Rate of Return, %	Net present value, $	CO_2 reduced, lbs/yr
7	1,320	120	1,200	275	0.1	0	0.0	0	48	15	720	25.0	-40	-3	-6	-615	492

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis.

Rebates/financial incentives:

- NJ Clean Energy – SmartStart – Wall-mounted occupancy sensors ($20 per sensor)
    - Maximum Incentive Amount: $120
- NJ Clean Energy – Direct Install program (Up to 60% of installed cost)

Please see Appendix F for more information on Incentive Programs.

PROPOSED FURTHER RECOMMENDATIONS

Capital Improvements

Capital Improvements are recommendations for the building that may not be cost-effective at the current time, but that could yield a significant long-term payback. These recommendations should typically be considered as part of a long-term capital improvement plan. Capital improvements should be considered if additional funds are made available, or if the installed costs can be shared with other improvements, such as major building renovations. SWA recommends the following capital improvements for the Forest Avenue Elementary School:

- Upgrade windows - SWA recommends that Glen Ridge Board of Education upgrade all windows to double-pane, argon-filled windows with a low-e coating, frame insulation and a thermal break. When the building was constructed, energy code minimums did not require insulation levels as stringent as recent energy code. Should the school choose to upgrade the roof, recent energy code minimums should be followed. Increasing the level of insulation will result in a more thermal comfort as well as energy savings associated with reducing the amount of insulation through the roof. At this time, this measure would not be cost-effective but should be considered as a capital improvement or if there is an opportunity for additional funding through energy conservation block grants. Based on typical cost estimating practices using RS Means Construction Cost books, to upgrade the insulation of the entire school which would essentially be to replace the entire roof would cost in the ballpark of $252,000 or $7.84 per sqft of roof area.

- Upgrade roof insulation – SWA recommends that Glen Ridge Board of Education upgrade all insulation at the roof level to a minimum of R-30 and wall insulation is increased to recent energy code minimums. At this time, this measure would not be cost-effective but should be considered as a capital improvement or if there is an opportunity for additional funding through energy conservation block grants.

- Install premium motors when replacements are required - Select NEMA Premium motors when replacing motors that have reached the end of their useful operating lives.

- Remove abandoned equipment from Main Attic and reuse any functioning components.

Operations and Maintenance

Operations and Maintenance measures consist of low/no cost measures that are within the capability of the current building staff to handle. These measures typically require little investment, and they yield a short payback period. These measures may address equipment settings or staff operations that, when addressed will reduce energy consumption or costs.

- Install occupancy-based power strips or power management software for computers – The Forest Avenue School contains computers and other electronic devices that consume a significant amount of power. Typically, computers are left on for extended periods of time such as during nights, weekends and holiday breaks with only screensavers to power down the screens. SWA recommends that the school deploy either a power management software that can be programmed to automatically shutdown computers or install occupancy based power strips. New SmartStrips are power strips that contain an occupancy sensor to automatically shutdown computers if no motion is detected within a set period of time.

- Clean steam traps and strainers on a regular basis

- Perform cleaning and maintenance service on steam boilers, steam traps and vacuum traps.

- For attic space above Library Stage:
    - Clean dust and debris in attic and seal all penetrations as the space serves as a return plenum.
    - Install a permanent access the AHU's with a tight-sealing spring operated hatch.

- Replace deteriorated copper roof trim with stainless steel as needed.

- Install/repair and maintain gutters, downspouts and downspout deflectors to minimize uncontrolled roof water run-off causing exterior wall damage.

- Remove any insect nesting on exterior walls and in cavities to prevent deterioration.

- Sharp rocks and debris should be removed from all flat roof surfaces to prevent damage to EPDM finish.

- Provide water-efficient fixtures and 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-consumption fixtures/appliances will reduce energy consumption for water heating, while also decreasing water/sewer bills.

- SWA recommends that the building considers purchasing the most energy-efficient equipment, including ENERGY STAR® labeled appliances, when equipment is installed or replaced. More information can be found in the "Products" section of the ENERGY STAR® website at: http://www.energystar.gov.

- Use smart power electric strips - in conjunction with occupancy sensors to power down computer equipment when left unattended for extended periods of time.

- Create an energy educational program - that teaches how to minimize energy use. The U.S. Department of Energy offers free information for hosting energy efficiency educational programs and plans. For more information please visit: http://www1.eere.energy.gov/education/.

Note: The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for Glen Ridge Public Schools. Based on the requirements of the LGEA program, Glen Ridge Public Schools must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The minimum amount to be spent, net of other NJCEP incentives, is $2,083.75.

APPENDIX A: EQUIPMENT LIST

Inventory

Building System	Description	Model #	Fuel	Location	Space Served	Date Installed	Estimated Remaining Useful Life %
Cooling	AC-1, AC-2 Two (2) DX Split Units, EER 9.8	Fujitsu M#A0UZ4RML, S#011460	Electric	Wall Mounted Outside	principals/main office	1993	15%
Cooling	DX Split Unit, EER 10.1	Goodman M#MUC24-1A, S#0305417244	Electric	Outside, in bushes	offices	1996	30%
Cooling	DX Split Unit, 9400 Btu/hr, EER 9.8	Fujitsu M#ADU9C1, S#003792	Electric	Wall Mounted Outside	nurse office	1993	15%
Cooling	Two (2) DX Split Unit, EER 10.1	Goodman M#MUC24-1A,	Electric	Wall Mounted Outside	Library	1996	30%
Domestic Hot Water	Natural Gas Hot water heater, 40,000 Btu/hr, 38 gallon,	AO Smith M#GCV 40 100, S#F06A051237	Natural Gas	Boiler Rm	All Areas	2007	85%
Heating	Cast Iron Steam Boilers, 2,713 MBH, 15 Psi, 7,038 sqft steam, 80% thermal eff.	Weil McClain, M#988, Cyclonetic Burner, M#JB1G-05-R7795A, S#U31540A-02	Natural Gas	Boiler Rm	All Areas	1993	15%
Heating	Cast Iron Steam Boilers, 3,103 MBH, 15 Psi, 7,933 sqft steam, 80% thermal eff.	Weil McClain, M#1088, Cyclonetic Burner, M#JB1G-05-R7795A, S#U31540A-02	Natural Gas	Boiler Rm	All Areas	1993	15%
Heating	HV-1 Heating and Ventilation Unit with OA damper and steam coils	Carrier Weathermaker, M#3693T42409, S#39LG-06-G-42409	Steam/Electric	Gymnasium	Gymnasium	1993	15%
Heating	HV-2 Heating and Ventilation Unit with OA damper and steam coils	Carrier Weathermaker, M#3693T42411, S#39LG1061GA5021-L	Electric	Attic	Library	1993	15%
Heating	HV-3 Heating and Ventilation Unit with OA damper and steam coils	Carrier Weathermaker, M#3693T42410, S#39LG1061GA5021-L	Electric	Attic	Library	1993	15%
Heating	Recirculation Pumps, 5HP, 1725 RPM, 84% Eff.	Leland Faraday, M730A	Electric	Boiler Rm	All Areas	1990	0%
Heating	Recirculation Pump, 3.0 HP, 1725 RPM, 84% Eff.	Leland Faraday, M-730	Electric	Boiler Rm	All Areas	1990	10%

Building System	Description	Model #	Fuel	Location	Space Served	Date Installed	Estimated Remaining Useful Life %
Heating	SF-1 Outside air supply fan with steam coil	Mitsubishi	Steam/Electric	Main Office Ceiling	Main Office	1993	15%
Heating	Two (2) ceiling mounted Electric Unit Heaters	Dayton	Electric	Wing Vestibule	Wing Vestibule	1993	15%
Heating	Unit Ventilators UV-1 thru UV-9, 1250 CFM, 1/4 HP	Nesbitt	Steam/Electric	Classrooms	Classrooms	1993	15%
Ventilation	1/2 HP, 1550 RPM	Loren Cook, M#100C15DH	Electric	Roof	Hallways & Classrooms	2000	50%
Ventilation	1/2 HP, 1553 RPM	Loren Cook, M#90C15DH	Electric	Roof	Hallways & Classrooms	2000	50%
Ventilation	1/2 HP, 1553 RPM	Loren Cook, M#90C15DH	Electric	Roof	Hallways & Classrooms	2000	50%
Ventilation	1/6 HP, 1625 RPM,	amca M#4HZ37A	Electric	Roof	Hallways & Classrooms	2000	50%
Ventilation	1500 CFM Exhaust Fan, operates with HV-1	NA	Electric	Gymnasium	Gymnasium	1993	15%
Ventilation	EF-4 Exhaust Fan	Centri Master namplate not visible	Electric	Wall Mounted Outside	Room 7 Toilet	1993	15%
Ventilation	EF-5 and 6 Two (2) Large attic exhaust fans installed within former natural ventilation gravity wheel - no namplate	NA	Electric	Attic	Attic	1993	15%
Ventilation	EF-7, 1.5 HP	Centri Master M#PWB245K, S#VRD180509	Electric	Through wall	Attic	1993	15%
Ventilation	NA	Loren Cook, M#855 S38268600	Electric	Roof	Hallways & Classrooms	1985	0%
Ventilation	NA	Loren Cook, M#855 S38194100	Electric	Roof	Hallways & Classrooms	1985	0%

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.

Appendix B: Lighting Study

Location			Existing Fixture Information												Retrofit Information													Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	1	Classroom (W1)	Ceiling Mounted	M	4'T12	23	2	34	Sw	9	190	10	1,799	3,076	T8	Ceiling Mounted	4'T8	E	Sw	23	2	32	9	190	5	1587	2714	362	0	362
2	1	Classroom (W2)	Ceiling Mounted	M	4'T12	23	2	34	Sw	9	190	10	1,799	3,076	T8	Ceiling Mounted	4'T8	E	Sw	23	2	32	9	190	5	1587	2714	362	0	362
3	1	Classroom (W3)	Ceiling Mounted	M	4'T12	23	2	34	Sw	9	190	10	1,799	3,076	T8	Ceiling Mounted	4'T8	E	Sw	23	2	32	9	190	5	1587	2714	362	0	362
4	1	Classroom (W4)	Ceiling Mounted	M	4'T12	23	2	34	Sw	9	190	10	1,799	3,076	T8	Ceiling Mounted	4'T8	E	Sw	23	2	32	9	190	5	1587	2714	362	0	362
5	1	Classroom (5)	Ceiling Suspended	M	8'T12	8	2	96	Sw	9	190	24	1,728	2,955	T8	Ceiling Suspended	8'T8	E	Sw	8	2	59	9	190	7	1000	1710	1245	0	1245
6	1	Classroom (4)	Recessed	M	4'T12	20	4	34	Sw	9	190	10	2,924	5,000	T8	Recessed	4'T8	E	Sw	20	4	32	9	190	5	2660	4549	451	0	451
7	1	Classroom (3)	Recessed	M	4'T12	20	4	34	Sw	9	190	10	2,924	5,000	T8	Recessed	4'T8	E	Sw	20	4	32	9	190	5	2660	4549	451	0	451
8	1	Classroom (7)	Ceiling Mounted	M	8'T12	10	2	96	Sw	9	190	24	2,160	3,694	T8	Ceiling Mounted	8'T8	E	Sw	10	2	59	9	190	7	1250	2138	1556	0	1556
9	1	Classroom (7)	Exit Sign	S	Inc	2	2	20	N	24	365	0	80	701	LEDex	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	604	0	604
10	1	Classroom BR (W1)	Ceiling Mounted	M	2'T12	1	2	20	Sw	9	190	6	46	79	T8	Ceiling Mounted	2'T8	E	OS	1	2	17	7	190	2	36	46	17	15	32
11	1	Classroom BR (W2)	Ceiling Mounted	M	2'T12	1	2	20	Sw	9	190	6	46	79	T8	Ceiling Mounted	2'T8	E	OS	1	2	17	7	190	2	36	46	17	15	32
12	1	Classroom BR (W3)	Ceiling Mounted	M	2'T12	1	2	20	Sw	9	190	6	46	79	T8	Ceiling Mounted	2'T8	E	OS	1	2	17	7	190	2	36	46	17	15	32
13	1	Classroom BR (W4)	Ceiling Mounted	M	2'T12	1	2	20	Sw	9	190	6	46	79	T8	Ceiling Mounted	2'T8	E	OS	1	2	17	7	190	2	36	46	17	15	32
14	1	Hallway	Exit Sign	S	Inc	3	2	20	N	24	365	0	120	1,051	LEDex	Exit Sign	LED	S	N	3	1	5	24	365	1	17	145	907	0	907
15	1	Hallway	Recessed	M	4'T12	12	2	34	Sw	16	190	10	938	2,853	T8	Recessed	4'T8	E	Sw	12	2	32	16	190	5	828	2517	336	0	336
16	1	Hallway Wing	Exit Sign	S	Inc	2	2	20	N	24	365	0	80	701	LEDex	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	604	0	604
17	1	Hallway Wing	Ceiling Mounted	M	4'T12	12	2	34	Sw	9	190	10	938	1,605	T8	Ceiling Mounted	4'T8	E	Sw	12	2	32	9	190	5	828	1416	189	0	189
18	1	Janitor's Closet	Ceiling Mounted	M	2'T12	2	2	20	Sw	2	190	6	92	35	T8	Ceiling Mounted	2'T8	E	Sw	2	2	17	2	190	2	72	27	8	0	8
19	1	Library	Ceiling Mounted	M	8'T12	18	2	96	Sw	9	365	24	3,888	12,772	T8	Ceiling Mounted	8'T8	E	Sw	18	2	59	9	365	7	2250	7391	5381	0	5381
20	1	Library	Exit Sign	S	Inc	5	2	20	N	24	365	0	200	1,752	LEDex	Exit Sign	LED	S	N	5	1	5	24	365	1	28	241	1511	0	1511
21	1	Library Stage Area	Ceiling Mounted	M	8'T12	3	2	96	N	5	190	24	648	616	T8	Ceiling Mounted	8'T8	E	N	3	2	59	5	190	7	375	356	259	0	259
22	1	Office Main	Ceiling Mounted	M	4'T12	4	4	34	Sw	9	190	10	585	1,000	T8	Ceiling Mounted	4'T8	E	Sw	4	4	32	9	190	5	532	910	90	0	90

23	1	Office Principal	Ceiling Mounted	M	4'T12	7	4	34	Sw	9	190	10	1,023	1,750	T8	Ceiling Mounted	4'T8	E	Sw	7	4	32	9	190	5	931	1592	158	0	158
24	1	Staircase	Ceiling Mounted	M	4'T12	2	2	34	Sw	16	190	10	156	475	T8	Ceiling Mounted	4'T8	E	Sw	2	2	32	16	190	5	138	420	56	0	56
25	1	Staircase	Ceiling Mounted	M	8'T12	1	2	96	Sw	16	190	24	216	657	T8	Ceiling Mounted	8'T8	E	Sw	1	2	59	16	190	7	125	380	277	0	277
26	1	Staircase	Ceiling Mounted	S	Inc	1	1	60	Sw	16	190	0	60	182	CFL	Ceiling Mounted	CFL	S	Sw	1	1	20	16	190	0	20	61	122	0	122
27	1	Staircase 5	Ceiling Mounted	M	4'T12	2	2	34	Sw	16	190	10	156	475	T8	Ceiling Mounted	4'T8	E	Sw	2	2	32	16	190	5	138	420	56	0	56
28	1	Staircase 5	Exit Sign	S	Inc	1	2	20	N	24	365	0	40	350	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	302	0	302
29	2	Classroom (8)	Recessed	M	4'T12	8	4	34	Sw	9	190	10	1,170	2,000	T8	Recessed	4'T8	E	Sw	8	4	32	9	190	5	1064	1819	181	0	181
30	2	Classroom (8BR)	Recessed	M	4'T12	1	2	34	Sw	9	190	10	78	134	T8	Recessed	4'T8	E	Sw	1	2	32	9	190	5	69	118	16	0	16
31	2	Classroom (10R)	Recessed	M	8'T12	6	2	96	Sw	9	190	24	1,296	2,216	T8	Recessed	8'T8	E	Sw	6	2	59	9	190	7	750	1283	934	0	934
32	2	Classroom (10S)	Recessed	M	8'T12	1	2	96	Sw	9	190	24	216	369	T8	Recessed	8'T8	E	Sw	1	2	59	9	190	7	125	214	156	0	156
33	2	Classroom (9)	Recessed	M	8'T12	6	2	96	Sw	9	190	24	1,296	2,216	T8	Recessed	8'T8	E	Sw	6	2	59	9	190	7	750	1283	934	0	934
34	2	Classroom (9)	Recessed	M	4'T12	2	2	34	Sw	9	190	10	156	267	T8	Recessed	4'T8	E	Sw	2	2	32	9	190	5	138	236	31	0	31
35	2	Classroom (11)	Ceiling Mounted	M	8'T12	8	2	96	Sw	9	190	24	1,728	2,955	T8	Ceiling Mounted	8'T8	E	Sw	8	2	59	9	190	7	1000	1710	1245	0	1245
36	2	Classroom (12)	Ceiling Mounted	M	8'T12	8	2	96	Sw	9	190	24	1,728	2,955	T8	Ceiling Mounted	8'T8	E	Sw	8	2	59	9	190	7	1000	1710	1245	0	1245
37	2	Hallway	Ceiling Mounted	M	8'T12	7	2	96	Sw	16	190	24	1,512	4,596	T8	Ceiling Mounted	8'T8	E	Sw	7	2	59	16	190	7	875	2660	1936	0	1936
38	2	Hallway	Exit Sign	S	Inc	2	2	20	N	24	365	0	80	701	LEDex	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	604	0	604
39	2	Staircase 8	Ceiling Mounted	M	4'T12	2	2	34	Sw	16	261	10	156	653	T8	Ceiling Mounted	4'T8	E	Sw	2	2	32	16	261	5	138	576	77	0	77
40	Bsmt	Bathroom Men	Ceiling Mounted	M	8'T12	2	2	96	Sw	9	190	24	432	739	T8	Ceiling Mounted	8'T8	E	OS	2	2	59	7	190	7	250	321	311	107	418
41	Bsmt	Bathroom Women	Ceiling Mounted	M	8'T12	2	2	96	Sw	9	190	24	432	739	T8	Ceiling Mounted	8'T8	E	OS	2	2	59	7	190	7	250	321	311	107	418
42	Bsmt	Boiler Rm	Ceiling Suspended	M	8'T12	3	2	96	Sw	2	261	24	648	338	T8	Ceiling Suspended	8'T8	E	Sw	3	2	59	2	261	7	375	196	143	0	143
43	Bsmt	Gymnasium	Ceiling Suspended	M	8'T12	24	2	96	Sw	9	190	24	5,184	8,865	T8	Ceiling Suspended	8'T8	E	Sw	24	2	59	9	190	7	3000	5130	3735	0	3735
44	Bsmt	Gymnasium	Exit Sign	S	Inc	2	2	20	N	24	365	0	80	701	LEDex	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	604	0	604
45	Bsmt	Hallway	Ceiling Mounted	M	8'T12	4	2	96	Sw	16	260	24	864	3,594	T8	Ceiling Mounted	8'T8	E	Sw	4	2	59	16	260	7	500	2080	1514	0	1514
46	Bsmt	Hallway	Exit Sign	S	Inc	2	2	60	N	24	365	0	240	2,102	LEDex	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	2006	0	2006
47	Bsmt	Kitchen	Recessed	M	4'T12	2	4	34	Sw	9	190	10	292	500	T8	Recessed	4'T8	E	Sw	2	4	32	9	190	5	266	455	45	0	45
48	Bsmt	Kitchen	Recessed	M	4'T12	2	2	34	Sw	9	190	10	156	267	T8	Recessed	4'T8	E	Sw	2	2	32	9	190	5	138	236	31	0	31
49	Bsmt	Kitchen	Track	M	Hal	9	1	75	Sw	9	190	17	824	1,408	CFL	Track	CFL	M	Sw	9	1	25	9	190	0	225	385	1023	0	1023

50	Bsmt	Kitchen storage	Chandelier	S	Inc	2	1	60	Sw	9	190	0	120	205	CFL	Chandelier	CFL	S	Sw	2	1	20	9	190	0	40	68	137	0	137
51	Bsmt	Mechanical shop	Ceiling Mounted	M	8'T12	1	2	96	Sw	8	261	24	216	451	T8	Ceiling Mounted	8'T8	E	Sw	1	2	59	8	261	7	125	261	190	0	190
52	Bsmt	Mechanical shop	Ceiling Mounted	M	4'T12	1	2	34	Sw	8	261	10	78	163	T8	Ceiling Mounted	4'T8	E	Sw	1	2	32	8	261	5	69	144	19	0	19
53	Bsmt	Staircase 1	Ceiling Mounted	M	4'T12	3	2	34	Sw	16	261	10	235	980	T8	Ceiling Mounted	4'T8	E	Sw	3	2	32	16	261	5	207	864	115	0	115
54	Bsmt	Staircase 1	Ceiling Mounted	M	4'T12	1	3	34	Sw	16	261	10	112	469	T8	Ceiling Mounted	4'T8	E	Sw	1	3	32	16	261	5	101	422	47	0	47
55	Bsmt	Staircase 1	Wall Mounted	M	4'T12	1	1	34	Sw	16	261	10	44	185	T8	Recessed	4'T8	E	Sw	1	1	32	16	261	5	37	155	30	0	30
56	Bsmt	Staircase 8	Ceiling Mounted	M	4'T12	1	2	34	Sw	16	261	10	78	327	T8	Ceiling Mounted	4'T8	E	Sw	1	2	32	16	261	5	69	288	38	0	38
57	Attic	Storage Rm	Ceiling Mounted	S	Inc	4	1	60	Sw	2	190	0	240	91	CFL	Ceiling Mounted	CFL	S	Sw	4	1	20	2	190	0	80	30	61	0	61
58	Ext	Exterior	Wall Mounted	S	MH	4	1	150	PC	12	365	42	768	3,364	PSMH	Wall Mounted	PSMH	S	PC	4	1	100	12	365	20	480	2102	1261	0	1261
59	Ext	Exterior	Pole Mounted Off Building	S	MH	1	1	400	PC	12	365	112	512	2,243	PSMH	Pole Mounted Off Building	PSMH	S	PC	1	1	250	12	365	50	300	1314	929	0	929
60	Ext	Exterior	Wall Mounted	S	Inc	2	1	60	PC	12	365	0	120	526	CFL	Wall Mounted	CFL	S	PC	2	1	20	12	365	0	40	175	350	0	350
61	Ext	Exterior	Wall Mounted	S	MH	4	1	75	PC	12	365	21	384	1,682	PSMH	Wall Mounted	PSMH	S	PC	4	1	50	12	365	10	240	1051	631	0	631
Totals:						359	126	3,654				864	47,813	105,241						359	118	2,369			328	33,105	67,996	36,970	275	37,245
Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space																														

Proposed Lighting Summary Table			
Total Gross Floor Area (SF)	32,093		
Average Power Cost ($/kWh)	0.1730		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	7,814	4,643	**3,171**
Exterior Power (watts)	1,784	1,060	**724**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	97,427	63,353	**34,074**
Lighting Power (watts)	46,029	32,045	**13,984**
Lighting Power Density (watts/SF)	1.43	1.00	**0.44**
Estimated Cost of Fixture Replacement ($)	63,373		
Estimated Cost of Controls Improvements ($)	1,200		
Total Consumption Cost Savings ($)	**8,698**		

Legend							
Fixture Type		**Lamp Type**			**Control Type**	**Ballast Type**	**Retrofit Category**
Ceiling Suspended	Recessed	CFL	3'T12	8'T5	Autom. Timer (T)	S (Self)	N/A (None)
Exit Sign	Sconce	Inc	3'T12 U-Shaped	8'T5 U-Shaped	Bi-Level (BL)	E (Electronic)	T8 (Install new T8)
High Bay	Spotlight	LED	3'T5	8'T8	Contact (Ct)	M (Magnetic)	T5 (Install new T5)
Parabolic Ceiling Mounted	Track	HPS	3'T5 U-Shaped	8'T8 U-Shaped	Daylight & Motion (M)		CFL (Install new CFL)
Parabolic Ceiling Suspended	Vanity	MH	3'T8	Circline - T5	Daylight & Switch (DLSw)		LEDex (Install new LED Exit)
Pendant	Wall Mounted	MV	3'T8 U-Shaped	Circline - T8	Daylight Sensor (DL)		LED (Install new LED)
Recessed Parabolic	Wall Suspended	1'T12	4'T5	Circline - T12	Delay Switch (DSw)		D (Delamping)
Ceiling Mounted	Wallpack	1'T12 U-Shaped	4'T5 U-Shaped	Fl.	Dimmer (D)		C (Controls Only)
Chandelier		1'T5	6'T12	Hal	Motion Sensor (MS)		PSMH (Install new Pulse-Start Metal Halide)
Equipment / Fume Hood		1'T5 U-Shaped	6'T12 U-Shaped	Induction	Motion& Switch (MSw)		
Flood		1'T8	6'T5	Infrared	None (N)		
Landscape		1'T8 U-Shaped	6'T5 U-Shaped	LPS	Occupancy Sensor (OS)		
Low Bay		2'T12 U-Shaped	6'T8	Mixed Vapor	Occupancy Sensor - CM (OSCM)		
Parabolic Wall Mounted		2'T5	6'T8 U-Shaped	Neon	Photocell (PC)		
Pole Mounted		2'T5 U-Shaped	8'T12	Quartz Halogen	Switch (Sw)		
Pole Mounted Off Building		2'T8 U-Shaped	8'T12 U-Shaped				

APPENDIX C: THIRD PARTY ENERGY SUPPLIERS

http://www.state.nj.us/bpu/commercial/shopping.html

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) 556-8457 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 Princeton, NJ 08450	(212) 538-3124 www.creditsuisse.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07926	(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
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	(888) 536-3876 www.metroenergy.com
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830 **Liberty Power Delaware, LLC** Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663 **Liberty Power Holdings, LLC** Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(877) 763-9977 www.integrysenergy.com (866) 769-3799 www.libertypowercorp.com (800) 363-7499 www.libertypowercorp.com

Third Party Electric Suppliers for PSEG Service Territory	Telephone & Web Site
Pepco Energy Services, Inc. 112 Main St. 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

Third Party Gas Suppliers for PSEG Service Territory	Telephone & Web Site
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

APPENDIX D: GLOSSARY AND METHOD OF CALCULATIONS

Net ECM Cost: The net ECM cost is the cost experienced by the customer, which is typically the total cost (materials + labor) of installing the measure minus any available incentives. Both the total cost and the incentive amounts are expressed in the summary for each ECM.

Annual Energy Cost Savings (AECS): This value is determined by the audit firm based on the calculated energy savings (kWh or Therm) of each ECM and the calculated energy costs of the building.

Lifetime Energy Cost Savings (LECS): This measure estimates the energy cost savings over the lifetime of the ECM. It can be a simple estimation based on fixed energy costs. If desired, this value can factor in an annual increase in energy costs as long as the source is provided.

Simple Payback: This is a simple measure that displays how long the ECM will take to break-even based on the annual energy and maintenance savings of the measure.

ECM Lifetime: This is included with each ECM so that the owner can see how long the ECM will be in place and whether or not it will exceed the simple payback period. Additional guidance for calculating ECM lifetimes can be found below. This value can come from manufacturer's rated lifetime or warranty, the ASHRAE rated lifetime, or any other valid source.

Operating Cost Savings (OCS): This calculation is an annual operating savings for the ECM. It is the difference in the operating, maintenance, and / or equipment replacement costs of the existing case versus the ECM. In the case where an ECM lifetime will be longer than the existing measure (such as LED lighting versus fluorescent) the operating savings will factor in the cost of replacing the units to match the lifetime of the ECM. In this case or in one where one-time repairs are made, the total replacement / repair sum is averaged over the lifetime of the ECM.

Return on Investment (ROI): The ROI is expresses the percentage return of the investment based on the lifetime cost savings of the ECM. This value can be included as an annual or lifetime value, or both.

Net Present Value (NPV): The NPV calculates the present value of an investment's future cash flows based on the time value of money, which is accounted for by a discount rate (assumes bond rate of 3.2%).

Internal Rate of Return (IRR): The IRR expresses an annual rate that results in a break-even point for the investment. If the owner is currently experiencing a lower return on their capital than the IRR, the project is financially advantageous. This measure also allows the owner to compare ECMs against each other to determine the most appealing choices.

Gas Rate and Electric Rate ($/therm and $/kWh): The gas rate and electric rate used in the financial analysis is the total annual energy cost divided by the total annual energy usage for the 12 month billing period studied. The graphs of the monthly gas and electric rates reflect the total monthly energy costs divided by the monthly usage, and display how the average rate fluctuates throughout the year. The average annual rate is the only rate used in energy savings calculations.

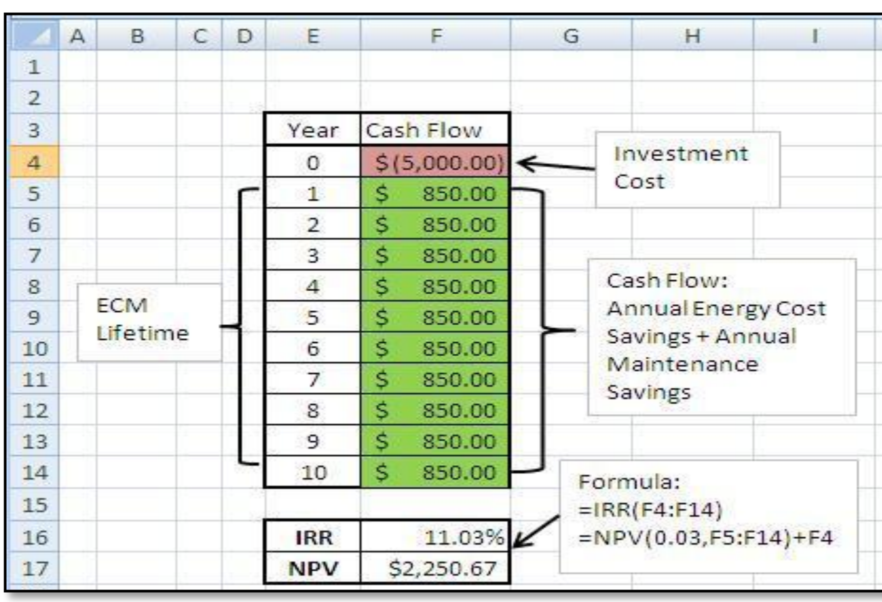
Calculation References

Term	Definition
ECM	Energy Conservation Measure
AOCS	Annual Operating Cost Savings
AECS	Annual Energy Cost Savings
LOCS*	Lifetime Operating Cost Savings
LECS	Lifetime Energy Cost Savings
LCS	Lifetime Cost Savings
NPV	Net Present Value
IRR	Internal Rate of Return
DR	Discount Rate
Net ECM Cost	Total ECM Cost – Incentive
LECS	AECS X ECM Lifetime
AOCS	LOCS / ECM Lifetime
LCS	LOCS+LECS
Simple Payback	Net ECM Cost / (AECS + AOCS)
Lifetime ROI	(LECS + LOCS – Net ECM Cost) / Net ECM Cost
Annual ROI	(Lifetime ROI / Lifetime) = [(AECS + OCS) / Net ECM Cost – (1 / Lifetime)]

* The lifetime operating cost savings are all avoided operating, maintenance, and/or component replacement costs over the lifetime of the ECM. This can be the sum of any annual operating savings, recurring or bulk (i.e. one-time repairs) maintenance savings, or the savings that comes from avoiding equipment replacement needed for the existing measure to meet the lifetime of the ECM (e.g. lighting change outs).

Excel NPV and IRR Calculation

In Excel, function =IRR (values) and =NPV(rate, values) are used to quickly calculate the IRR and NPV of a series of annual cash flows. The investment cost will typically be a negative cash flow at year 0 (total cost - incentive) with years 1 through the lifetime receiving a positive cash flow from the annual energy cost savings and annual maintenance savings. The calculations in the example below are for an ECM that saves $850 annually in energy and maintenance costs (over a 10 year lifetime) and takes $5,000 to purchase and install after incentives:



Solar PV ECM Calculation

There are several components to the calculation:

Solar Pathfinder Results Summary

Solar Site Analysis Report

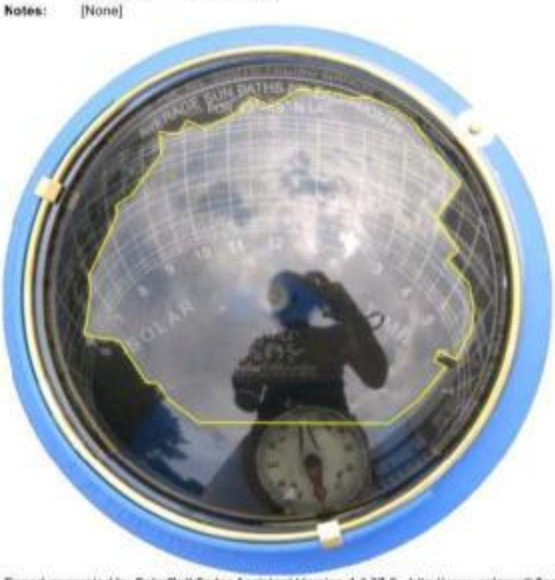
1

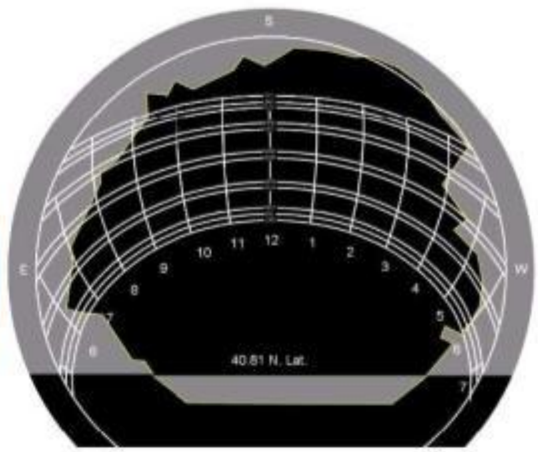
Image File IMG_6726.jpg

Solar Obstruction Data

Month	Unshaded % of Ideal Site Azimuth=180 Tilt=40.81	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=40.81 KWH/m²/day	Actual AC Energy (KWH) w/ shading Azimuth=180.00 Tilt=40.81	Actual AC Energy (KWH) w/o shading Azimuth=180.0 Tilt=40.81	Ideal AC Energy (KWH) w/o shading Azimuth=180.0 Tilt=40.81	Solar Cost Savings 0.05 ($/KWH)	PVWatts Unshaded % Actual Site Azimuth=180.0 Tilt=40.81	Actual Site Efficiency % Azimuth=180.0 Tilt=40.81	Ideal Site Efficiency % Azimuth=180.0 Tilt=40.81
January	88.23%	2.79	1,755.60	1,969.00	1,969.00	$87.78	88.13 %	88.13 %	88.13 %
February	90.15%	3.78	2,155.99	2,351.00	2,351.00	$107.80	90.33 %	89.90 %	89.90 %
March	94.68%	4.56	2,736.42	2,838.00	2,838.00	$136.82	94.47 %	94.47 %	94.47 %
April	97.99%	4.92	2,734.91	2,747.00	2,747.00	$136.75	97.93 %	97.93 %	97.93 %
May	98.15%	5.09	2,807.37	2,825.00	2,825.00	$140.37	98.07 %	98.07 %	98.07 %
June	97.63%	5.49	2,891.39	2,918.00	2,918.00	$144.57	97.46 %	97.46 %	97.46 %
July	98.06%	5.09	2,708.43	2,719.00	2,719.00	$135.42	97.86 %	97.86 %	97.86 %
August	98.04%	5.06	2,745.69	2,754.00	2,754.00	$137.28	98.17 %	98.17 %	98.17 %
September	94.67%	4.48	2,406.93	2,490.00	2,490.00	$120.35	94.46 %	94.46 %	94.46 %
October	91.78%	4.28	2,474.26	2,677.00	2,677.00	$123.71	91.68 %	91.29 %	91.29 %
November	87.66%	2.78	1,611.75	1,853.00	1,853.00	$80.59	86.12 %	86.12 %	86.12 %
December	87.15%	2.66	1,624.81	1,868.00	1,868.00	$81.24	86.71 %	86.71 %	86.71 %
Totals	**93.68%**	**50.98**	**28,653.55**	**30,009.00**	**30,009.00**	**$1,432.68**	**93.45 %**	**93.38 %**	**93.38 %**
	Unweighted Yearly Avg	**Effect: 94.16% Sun Hrs: 4.25**					**Unweighted Yearly Avg**	**Unweighted Yearly Avg**	**Unweighted Yearly Avg**

Notes: [None]





Report generated by SolarPathfinder Assistant Version 4.1.27.0. http://www.solarpathfinder.com
Page: 3/4

Costs:	Material of PV system including panels, mounting and net-metering + Labor
Energy Savings:	Reduction of kWh electric cost for life of panel, 25 years
Incentive 1:	NJ Renewable Energy Incentive Program (REIP), for systems of size 50kW or less, $1/Watt incentive subtracted from installation cost
Incentive 2:	Solar Renewable Energy Credits (SRECs) – Market-rate incentive. Calculations assume $600/Megawatt hour consumed per year for a maximum of 15 years; added to annual energy cost savings for a period of 15 years. (Megawatt hour used is rounded to nearest 1,000 kWh)

Assumptions: A Solar Pathfinder device is used to analyze site shading for the building and determine maximum amount of full load operation based on available sunlight. When the Solar Pathfinder device is not implemented, amount of full load operation based on available sunlight is assumed to be 1,180 hours in New Jersey.

Total lifetime PV energy cost savings =
kWh produced by panel * [$/kWh cost * 25 years + $600/Megawatt hour /1000 * 15 years]

Annual Solar PV Cost Savings Breakdown

Rated Capacity (kW)	24.2
Rated Capacity (kWh)	28,654
Annual Capacity Loss	0%

Year	kWh Capacity	Installed Cost	Incentives	Electric Savings ($)
0		$169,050	$18,113	
1	28,654		$16,800	$4,966
2	28,654		$16,800	$4,966
3	28,654		$16,800	$4,966
4	28,654		$16,800	$4,966
5	28,654		$16,800	$4,966
6	28,654		$16,800	$4,966
7	28,654		$16,800	$4,966
8	28,654		$16,800	$4,966
9	28,654		$16,800	$4,966
10	28,654		$16,800	$4,966
11	28,654		$16,800	$4,966
12	28,654		$16,800	$4,966
13	28,654		$16,800	$4,966
14	28,654		$16,800	$4,966
15	28,654		$16,800	$4,966
16	28,654		$0	$4,966
17	28,654		$0	$4,966
18	28,654		$0	$4,966
19	28,654		$0	$4,966
20	28,654		$0	$4,966
21	28,654		$0	$4,966
22	28,654		$0	$4,966
23	28,654		$0	$4,966
24	28,654		$0	$4,966
25	28,654		$0	$4,966
	kWh	Cost	Saving	
Lifetime Total	**716,350**	**($169,050)**	**$270,113**	**$124,145**

ECM and Equipment Lifetimes

Determining a lifetime for equipment and ECM's can sometimes be difficult. The following table contains a list of lifetimes that the NJCEP uses in its commercial and industrial programs. Other valid sources are also used to determine lifetimes, such as the DOE, ASHRAE, or the manufacturer's warranty.

Lighting is typically the most difficult lifetime to calculate because the fixture, ballast, and bulb can all have different lifetimes. Essentially the ECM analysis will have different operating cost savings (avoided equipment replacement) depending on which lifetime is used.

When the bulb lifetime is used (rated burn hours / annual burn hours), the operating cost savings is just reflecting the theoretical cost of replacing the existing case bulb and ballast over the life of the recommended bulb. Dividing by the bulb lifetime will give an annual operating cost savings.

When a fixture lifetime is used (e.g. 15 years) the operating cost savings reflects the avoided bulb and ballast replacement cost of the existing case over 15 years minus the projected bulb and ballast replacement cost of the proposed case over 15 years. This will give the difference of the equipment replacement costs between the proposed and existing cases and when divided by 15 years will give the annual operating cost savings.

New Jersey Clean Energy Program Commercial & Industrial Lifetimes

Measure	Life Span
Commercial Lighting — New	15
Commercial Lighting — Remodel/Replacement	15
Commercial Custom — New	18
Commercial Chiller Optimization	18
Commercial Unitary HVAC — New - Tier 1	15
Commercial Unitary HVAC — Replacement - Tier 1	15
Commercial Unitary HVAC — New - Tier 2	15
Commercial Unitary HVAC — Replacement Tier 2	15
Commercial Chillers — New	25
Commercial Chillers — Replacement	25
Commercial Small Motors (1-10 HP) — New or Replacement	20
Commercial Medium Motors (11-75 HP) — New or Replacement	20
Commercial Large Motors (76-200 HP) — New or Replacement	20
Commercial VSDs — New	15
Commercial VSDs — Retrofit	15
Commercial Comprehensive New Construction Design	18
Commercial Custom — Replacement	18
Industrial Lighting — New	15
Industrial Lighting — Remodel/Replacement	15
Industrial Unitary HVAC — New - Tier 1	15
Industrial Unitary HVAC — Replacement - Tier 1	15
Industrial Unitary HVAC — New - Tier 2	15
Industrial Unitary HVAC — Replacement Tier 2	15
Industrial Chillers — New	25
Industrial Chillers — Replacement	25
Industrial Small Motors (1-10 HP) — New or Replacement	20
Industrial Medium Motors (11-75 HP) — New or Replacement	20
Industrial Large Motors (76-200 HP) — New or Replacement	20
Industrial VSDs — New	15
Industrial VSDs — Retrofit	15
Industrial Custom — Non-Process	18
Industrial Custom — Process	10
Small Commercial Gas Furnace — New or Replacement	20
Small Commercial Gas Boiler — New or Replacement	20
Small Commercial Gas DHW — New or Replacement	10
C&I Gas Absorption Chiller — New or Replacement	25
C&I Gas Custom — New or Replacement (Engine Driven Chiller)	25
C&I Gas Custom — New or Replacement (Gas Efficiency Measures)	18
O&M savings	3
Compressed Air (GWh participant)	8

APPENDIX E: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Glen Ridge BOE - Forest Avenue School

ENERGY STAR

Building ID: 2403915
For 12-month Period Ending: June 30, 2010[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: August 26, 2010

Facility
Glen Ridge BOE - Forest Avenue School
287 Forest Avenue
Glen Ridge, NJ 07028

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1928
Gross Floor Area (ft²): 32,093

Energy Performance Rating[2] (1-100) 36

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	487,965
Natural Gas (kBtu)[4]	1,499,622
Total Energy (kBtu)	1,987,587

Energy Intensity[5]	
Site (kBtu/ft²/yr)	62
Source (kBtu/ft²/yr)	100

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	154

Electric Distribution Utility
Public Service Elec & Gas Co

National Average Comparison	
National Average Site EUI	55
National Average Source EUI	89
% Difference from National Average Source EUI	12%
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.

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

EPA Form 5900-16

APPENDIX F: INCENTIVE PROGRAMS

New Jersey Clean Energy Pay for Performance

The NJ Clean Energy Pay for Performance (P4P) Program relies on a network of Partners who provide technical services to clients. LGEA participating clients who are not receiving Direct Energy Efficiency and Conservation Block Grants are eligible for P4P. SWA is an eligible Partner and can develop an Energy Reduction Plan for each project with a whole-building traditional energy audit, a financial plan for funding the energy measures and an installation construction schedule.

The Energy Reduction Plan must define a comprehensive package of measures capable of reducing a building's energy consumption by 15+%. P4P incentives are awarded upon the satisfactory completion of three program milestones: submittal of an Energy Reduction Plan prepared by an approved Program Partner, installation of the recommended measures and completion of a Post-Construction Benchmarking Report. Theincentives for electricity and natural gas savings will be paid based on actual savings, provided that the minimum 15%performance threshold savings has been achieved.

For further information, please see: http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/existing-buildings .

Direct Install 2010 Program*

Direct Install is a division of the New Jersey Clean Energy Programs' Smart Start Buildings. It is a turn-key program for small to mid-sized facilities to aid in upgrading equipment to more efficient types. It is designed to cut overall energy costs by upgrading lighting, HVAC and other equipment with energy efficient alternatives. The program pays **up to 60%** of the retrofit costs, including equipment cost and installation costs.

Eligibility:

- Existing small and mid-sized commercial and industrial facilities with peak electrical demand **below 200 kW** within 12 months of applying
- Must be located in New Jersey
- Must be served by one of the state's public, regulated or natural gas companies
    - Electric: Atlantic City Electric, Jersey Central Power & Light, Orange Rockland Electric, PSE&G
    - Natural Gas: Elizabethtown Gas, New Jersey Natural Gas, PSE&G, South Jersey Gas

For the most up to date information on contractors in New Jersey who participate in this program, go to: http://www.njcleanenergy.com/commercial-industrial/programs/direct-install

Smart Start

New Jersey's SmartStart Building Program is administered by New Jersey's Office of Clean Energy. The program also offers design support for larger projects and technical assistance for smaller projects. If your project specifications do not fit into anything defined by the program, there are even incentives available for custom projects.

There are a number of improvement options for commercial, industrial, institutional, government, and agricultural projects throughout New Jersey. Alternatives are designed to enhance quality while building in energy efficiency to save money. Project categories included in this program are New Construction and Additions, Renovations, Remodeling and Equipment Replacement.

For the most up to date information on how to participate in this program, go to: http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings.

Renewable Energy Incentive Program*

The Renewable Energy Incentive Program (REIP) provides incentives that reduce the upfront cost of installing renewable energy systems, including solar, wind, and sustainable biomass. Incentives vary depending upon technology, system size, and building type. Current incentive levels, participation information, and application forms can be found at the website listed below.

Solar Renewable Energy Credits (SRECs) represent all the clean energy benefits of electricity generated from a solar energy system. SRECs can be sold or traded separately from the power, providing owners a source of revenue to help offset the cost of installation. All solar project owners in New Jersey with electric distribution grid-connected systems are eligible to generate SRECs. Each time a system generates 1,000 kWh of electricity an SREC is earned and placed in the customer's account on the web-based SREC tracking system.

For the most up to date information on how to participate in this program, go to: http://www.njcleanenergy.com/renewable-energy/home/home.

Utility Sponsored Programs

Check with your local utility companies for further opportunities that may be available.

Other Federal and State Sponsored Programs

Other federal and state sponsored funding opportunities may be available, including BLOCK and R&D grant funding. For more information, please check http://www.dsireusa.org/.

*Subject to availability. Incentive program timelines might not be sufficient to meet the 25% in 12 months spending requirement outlined in the LGEA program.

APPENDIX G: ENERGY CONSERVATION MEASURES

	ECM #	ECM description	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
0-5 Year Payback	1	Install eighteen (18) new CFL lamps	0	169	1,693	0.4	0	0.2	99	391	5	1,957	0.4	1,060	212	231	1,564	3,031
	2	Upgrade nine (9) Classroom Thermostats to Programmable type	0	1,503	0	0.0	50	0.2	1,050	1,125	12	13,504	1.3	798	67	75	9,270	551
	3	Install nineteen (19) new LED exit signs	380	2,480	7,144	1.5	0	0.8	19	1,255	15	18,823	2.0	659	44	51	12,287	12,791

	ECM #	ECM description	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
5-10 Year Payback	4	Install 24.15 kW Rooftop Photovoltaic System	18,113	150,938	28,654	24.2	0	3.0	0	21,766	25	544,143	6.9	261	10	12	127,250	51,304
	5	Install nine (9) new Pulse Start Metal Halide fixtures	225	6,848	2,821	0.6	0	0.3	434	922	15	13,827	7.4	102	7	10	3,876	5,050
	6	Install (313) new T8 fluorescent fixtures	4,695	53,877	25,313	5.3	0	2.7	1,703	6,082	15	91,230	8.9	69	5	7	17,141	45,322
	7	Install six (6) new Occupancy Sensors	120	1,200	275	0.1	0	0.0	0	48	15	720	25.0	-40	-3	-6	-615	492

APPENDIX H: METHOD OF ANALYSIS

Assumptions and tools

Energy modeling tool:	Established/standard industry assumptions
Cost estimates:	RS Means 2009 (Facilities Maintenance & Repair Cost Data) RS Means 2009 (Building Construction Cost Data) RS Means 2009 (Mechanical Cost Data) Published and established specialized equipment material and labor costs Cost estimates also based on utility bill analysis and prior experience with similar projects

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.