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April 30, 2012

Local Government Energy Program
Energy Audit Report

Washington Township Public School District

Hurffville Elementary
200 Hurffville-Grenloch Road
Sewell, NJ 08080

Project Number: LGEA95

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EXECUTIVE SUMMARY

The single-story slab on grade 65,082 square feet Washington Township Hurffville Elementary School was built in 1967. The school was originally built as an open campus style school with individual buildings that each held a specific grade and were connected by open air walkways. The separate buildings would eventually be connected and referred to as "pods". Each pod currently contains 4 to 6 classrooms for grades 1-5. The school received several renovations between 1988 and 1989, which included enclosing the walkways allowing the separate buildings to be connected as one larger building. The additions included the expansion of the main office, gymnasium, additional classrooms, and other offices. The school also houses guidance offices, a library and an all-purpose room. The following chart provides a comparison of the current building energy usage based on the period from September 2010 through September 2011 with the proposed energy usage resulting from the installation of recommended Energy Conservation Measures (ECMs) excluding any renewable energy:

Table 1: State of Building—Energy Usage

	Electric Usage (kWh/yr)	Gas Usage (therms/yr)	Current Annual Cost of Energy ($)	Site Energy Use Intensity (kBtu/sq ft. /yr)	Source Energy Use Intensity (kBtu/sq ft. /yr)	Joint Energy Consumption (MMBtu/yr)
Current	647,840	20,728	$128,421	66.0	147.0	4,287
Proposed	637,294	20,728	$126,396	65.4	145.7	4,247
Savings*	10,546	0	$2,025	0.6	1.3	40
% Savings	1.6%	0%	1.6%	.9%	1.5%	.9%
Proposed Renewable Energy**	12,315	0	$3,165	0.6	2.0	42
*Includes operation and maintenance savings; **Includes SRECS						

SWA has entered energy information about the Hurffville Elementary facility into the U.S. Environmental Protection Agency's (EPA) Energy Star Portfolio Manager Energy Benchmarking system. The building has an Energy Star Rating of 49 and a Site Energy Utilization of 66 kBtu/sqft/yr.

Recommendations

Based on the current state of the building and its energy use, SWA recommends implementing the following Energy Conservation Measures:

Table 2: Energy Conservation Measure Recommendations

ECMs	First Year Savings ($)	Initial Investment ($)	Simple Payback Period	CO2 Savings (lbs/yr)
Replace 23 incandescent lamps with CFLs	$451	$215	0.5	4,988
Replace 6 incandescent exit signs with new LED exit signs	$280	$723	2.6	3,090
Replace 6 MH fixtures with LEDs	$607	$3,450	5.7	3,210
Install 27 new occupancy sensors	$687	$4,860	7.1	7,594
Total	**$2,025**	**$9,248**	**4.6**	**18,883**

In addition to these ECMs, SWA recommends:

- Capital Improvement opportunities – measures that would contribute to reducing energy usage but require significant capital resources as well as long-term financial planning
    - CI #1 – Install 10 kW Solar Photovoltaic System - $50,600
    - CI #2 – Replace existing roof on both Newer and Older building sections - $182,073
    - CI #3 – Replace existing exterior light fixtures - $22,740
    - CI #4 – Replace End-of-Life RTUs and Condensing Units - $71,265
    - CI #5 – Upgrade Heat Timer Control and pneumatic system to DDC Control System - $81,798

- Operation and Maintenance (O&M) measures that would contribute to reducing energy usage at low or no cost:
    - Check and adjust timers and time clocks monthly
    - Replace motors with NEMA premium efficiency models
    - Unclog and maintain all roof drains/scuppers.
    - Provide water-efficient fixtures and controls
    - Inspect and replace cracked/ineffective caulk.
    - Inspect and maintain sealants at all windows for airtight performance.
    - Inspect and maintain weather-stripping around all exterior doors and roof hatches.
    - Purchase Energy Star® appliances when available
    - Use smart power electric strips
    - Create an energy educational program

There may be energy procurement opportunities for the Washington Township Public School District to reduce annual utility costs, which are $7,774 higher, when compared to the average estimated NJ commercial utility rates. SWA recommends further evaluation with energy suppliers, listed in Appendix G.

Environmental Benefits

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 5 cars from the roads each year or is equivalent of planting 123 trees to absorb CO_2 from the atmosphere.

Energy Conservation Measure Implementation

SWA recommends that Washington Township implement the following Energy Conservation Measures using an appropriate Incentive Program for reduced capital cost:

Recommended ECMs	Incentive Program (APPENDIX K for details)
Replace 23 incandescent lamps with CFLs	Direct Install
Replace 6 incandescent exit signs with new LED exit signs	Direct Install, Smart Start
Replace 6 MH fixtures with LEDs	Direct Install
Install 27 new occupancy sensors	Direct Install, Smart Start
Install 10 kW solar photovoltaic system	NJ SRECs

Appendix K contains an Energy Conservation Measures table

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 39-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 Hurffville Elementary School at 200 Hurffville-Grenloch Road, Sewell, NJ. The process of the audit included a facility visit on January 10th, benchmarking and energy bill analysis, assessment of existing conditions, 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 Washington Township Public School District to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Hurffville Elementary facility.

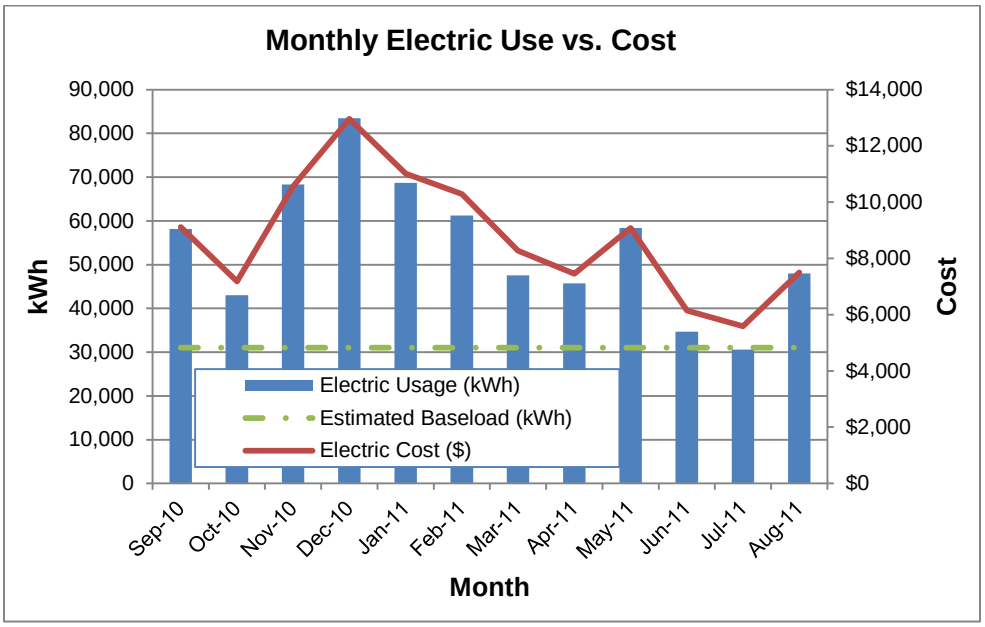
HISTORICAL ENERGY CONSUMPTION

Energy usage, load profile and cost analysis

SWA reviewed utility bills from September 2009 through September 2011 that were received from the utility companies supplying Hurffville Elementary with electricity and natural gas. A 12 month period of analysis from September 2010 through September 2011 was used for all calculations and for purposes of benchmarking the building.

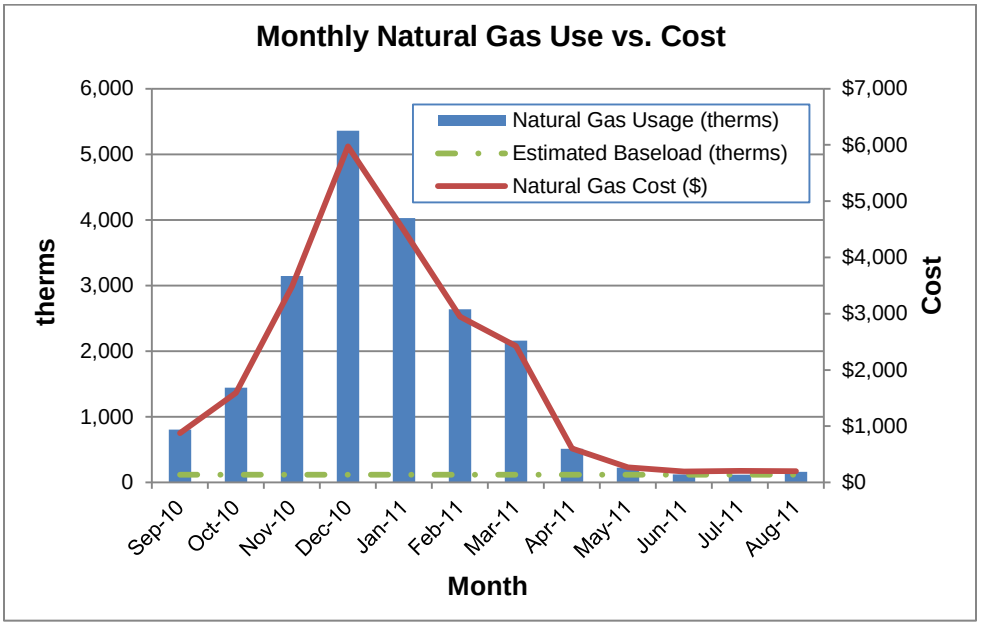
Electricity – Hurffville Elementary is currently served by one electric meter. The school currently purchases electricity from Atlantic City Electric which is responsible for transmission and distribution and from South Jersey Electric which acts as a third party energy supplier. Electricity was purchased at an average aggregated rate of $0.162/kWh and the school consumed approximately 647,840 kWh, or $105,166 worth of electricity, in the previous year. The annual monthly peak demand was 327.2 kW, while the average monthly demand was 320.6 kW.

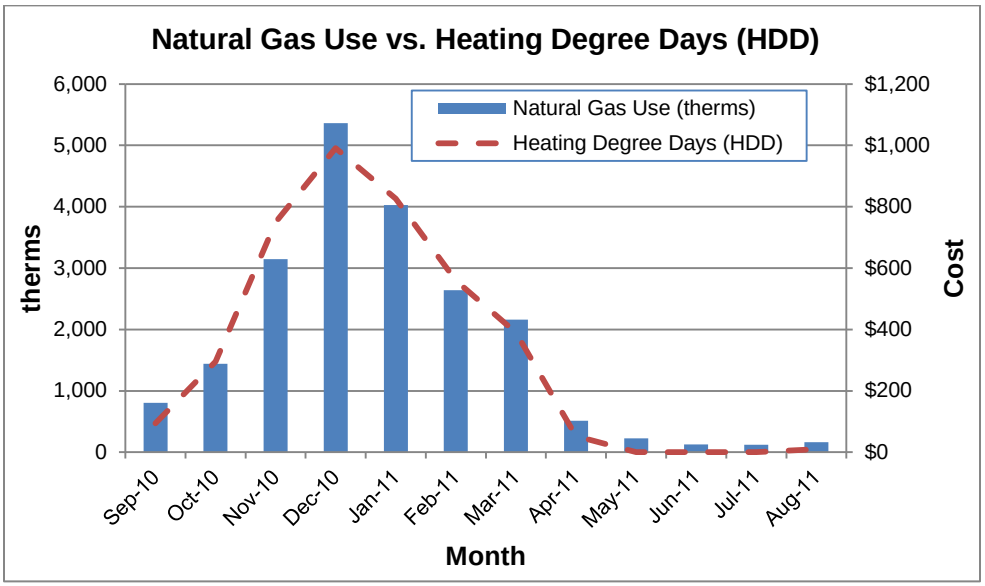
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate Hurffville Elementary school. The baseline usage for the Elementary School is approximately 31,000 kWh. As expected usage peaks in December, when some electricity is being used for heating. Electric usage for October 2010 seems low and is most likely the result of an estimated reading from the electric company. SWA recommends that Washington Township review bills on a monthly basis and ensure that the utility company is accurately billing based on actual meter readings.



Natural gas – Hurffville Elementary School is currently served by one meter for natural gas and currently purchases natural gas from South Jersey Gas which is responsible for transmission and distribution and from Hess which acts as a third party energy supplier. Natural gas was purchased at an average aggregated rate of $1.122/therm and the school consumed approximately 20,728 therms, or $23,255 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 Hurffville

Elementary School. The non-heating gas baseload for the Elementary School is approximately 120 therms. As expected usage peaks in the winter months in conjunction with the operation of the gas fired hot water boiler. The monthly natural gas costs also peak in the winter months in correlation with the increased natural gas usage.

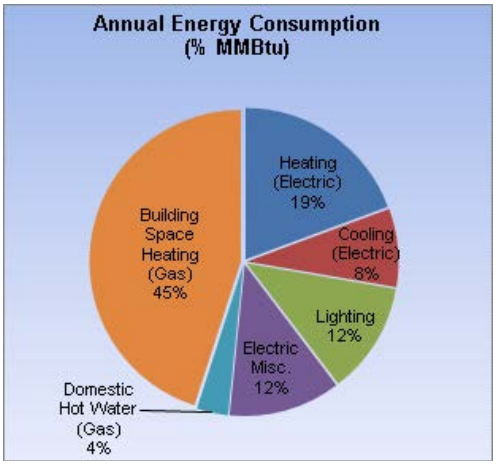


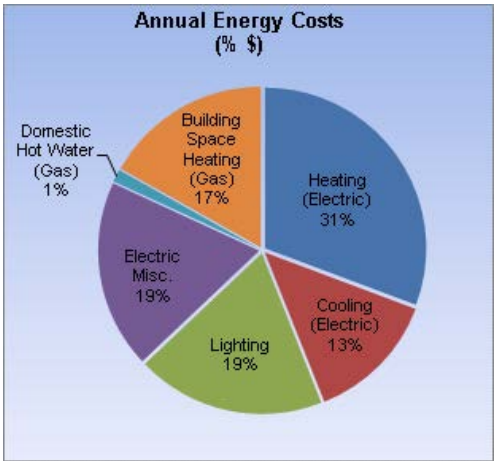


The chart above shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the base temperature. As expected, the natural gas consumption profile follows the HDD curve.

The following graphs, pie charts, and table show energy use for Hurffville Elementary School based on utility bills for the 12 month period. Note: electrical cost at $48/MMBtu of energy is more than four times as expensive as natural gas at $11/MMBtu

Annual Energy Consumption / Costs					
	MMBtu	% MMBTu	$	% $	$/MMBtu
Heating (Electric)	829	19%	$39,447	31%	$48
Cooling (Electric)	358	8%	$17,019	13%	$48
Lighting	511	12%	$24,334	19%	$48
Electric Misc.	512	12%	$24,366	19%	$48
Domestic Hot Water (Gas)	144	3%	$1,620	1%	$11
Building Space Heating (Gas)	1,928	45%	$21,636	17%	$11
Totals	4,283	100%	$128,421	100%	-
Total Electric Usage	2,210	52%	$105,166	82%	$48
Total Gas Usage	2,073	48%	$23,255	18%	$11
Totals	4,283	100%	$128,421	100%	-





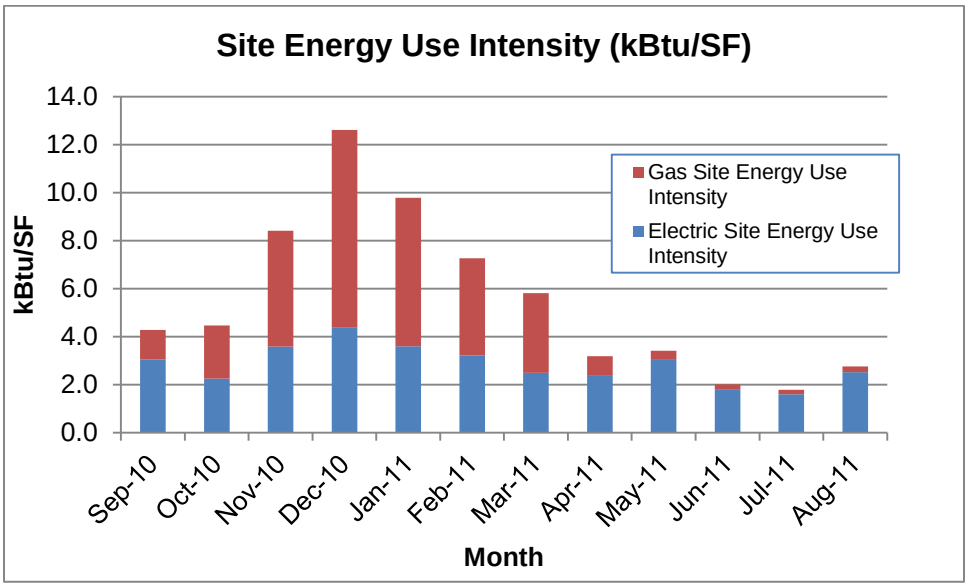
Energy Benchmarking

SWA has entered energy information about Hurffville Elementary School in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager energy benchmarking system. This school facility is categorized as a "K-12 School" space type. Based on the data entered into the Portfolio Manager software, the building has an Energy Performance Rating of 49 out of a possible 100 points. For reference, a score of 69 is required for LEED for Existing Buildings certification and a score of 75 is required for ENERGY STAR® certification.

The ENERGY STAR® Portfolio Manager uses a national survey conducted by the U.S. Energy Information Administration (EIA). This national survey, known as the Commercial Building Energy Consumption Survey (CBECS), is conducted every four years, and gathers data on building characteristics and energy use from thousands of buildings across the United States.

The Portfolio Manager software uses this data to create a database by building type. By entering the building parameters and utility data into the software, Portfolio Manager is able to generate a performance scale from 1-100 by comparing it to similar office buildings. This 100 point scale determines how well the building performs relative to other buildings across the country, regardless of climate and other differentiating factors. A score of 49 shows the building is slightly below the national average of similar facilities.

The Site Energy Use Intensity is 66 kBtu/sqft/yr compared to the national average of a “K-12 School" building consuming 66 kBtu/sqft/yr. This indicates that the school uses energy in a comparable way to the national average. See the recommendations presented in this report for guidance on how to improve the building’s rating.



Per the LGEA program requirements, SWA has assisted the Washington Township Public School District to create an ENERGY STAR® Portfolio Manager account and share the Washington Township Hurffville Elementary School information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager account information with the Washington Township Public School District (user name of “washingtontownship” with a password of “washingtontownship”) 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.

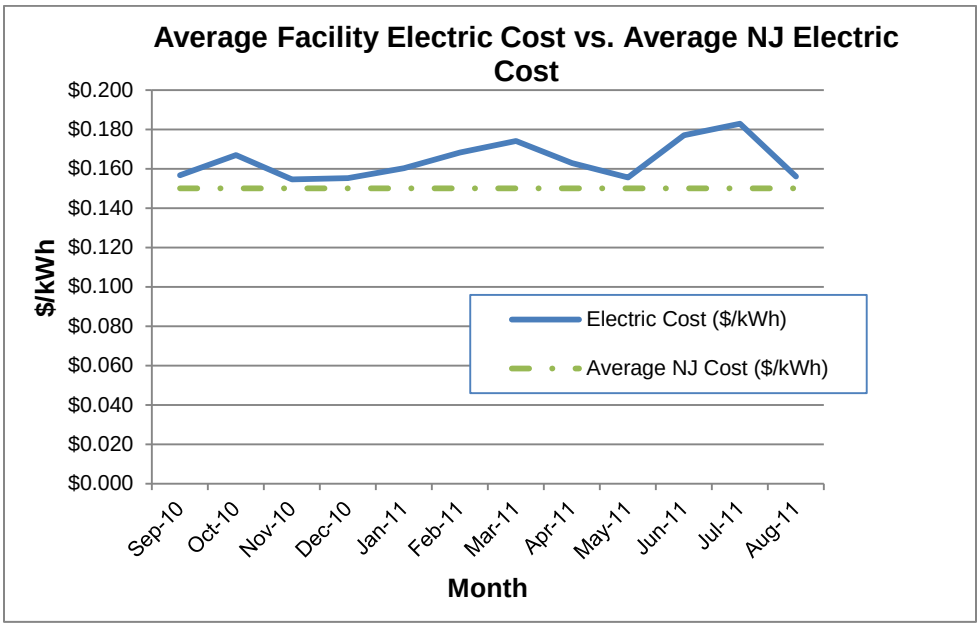
As part of the utility bill analysis, SWA evaluated the current utility rates and tariffs for the Township of Washington. Hurffville Elementary School is currently paying a general service rate for natural gas including fixed costs such as meter reading charges. The electric use for the building is direct-metered 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.

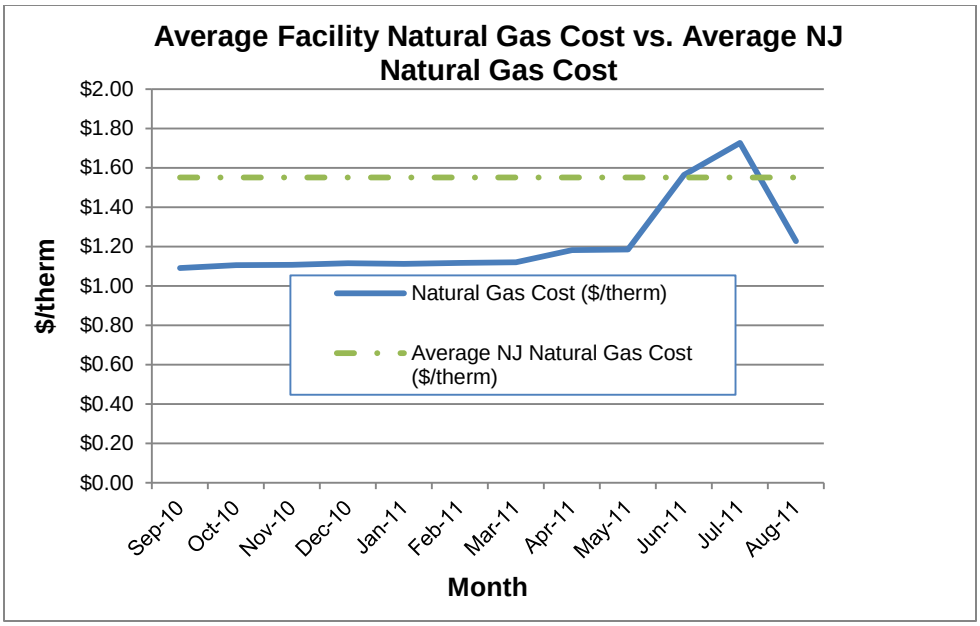
Energy Procurement strategies

Billing analysis was conducted using an average aggregated rate which 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 Hurffville Elementary School pays a rate of $0.162/kWh. Hurffville Elementary School annual electric utility costs are $7,774 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 13% over the most recent 12 month period. Electric rate fluctuations in the winter and spring can be attributed to a combination of demand charges and market rate changes.



The average estimated NJ commercial utility rates for gas are $1.550/therm, while Hurffville Elementary School pays a rate of $1.122/therm. Natural gas bill analysis shows fluctuations up to 13% over the most recent 12 month period. Utility rate fluctuations in the spring and summer months may have been caused by a combination of low usage and the assessment of fixed fees and costs.



SWA recommends that the Hurffville Elementary 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 Hurffville Elementary School. Appendix G contains a complete list of third-party energy suppliers for the Township of Washington 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 visits from SWA on Tuesday, January 10, 2012, the following data was collected and analyzed.

Building Characteristics

The single-story slab on grade 65,082 square feet Hurffville Elementary School was built in 1957. The school was originally built as an “open campus style” school, as each grade at the time was separated by open-air walkways. The separate building would later be referred to as “pods.” Each pod currently contains 4 to 6 classrooms for grades 1 to 5. The school received several renovations between 1988 and 1989, which included enclosing the walkways allowing the separate buildings to be united as one larger building. The additions include the expansion of the main office, gymnasium, additional classrooms, and other offices. The school also houses guidance offices, a library and an all-purpose room.

South Façade

East Façade

North Façade

West Façade

Building Occupancy Profiles

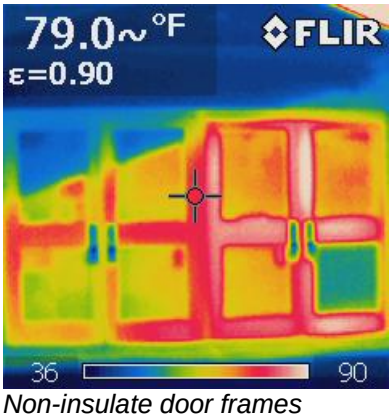
Its occupancy is approximately 537 students from 9:30 AM to 3:30 PM Monday through Friday, 47 teachers and 30 faculty and other staff members from 8:00 AM to 4:00 PM Monday through

Friday. Building operations personnel are present from 6:00 AM to 4:00 PM Monday through Friday and during the nighttime cleaning hours of 3:00 PM to 11:00 PM Monday through Friday.

Building Envelope

Due to favorable weather conditions (min. 18 deg. F delta-T in/outside and no/low wind), exterior envelope infrared (IR) images were taken during the field audit. The images are used to find potential areas with deficiencies.

The following specific envelope problem spots and areas were identified:



Non-insulate door frames


South Façade Entrance

General Note: All findings and recommendations on the exterior envelope (base, walls, roofs, doors and windows) are based on the energy auditors' experience and expertise, on construction document reviews and on detailed visual analysis, as far as accessibility and weather conditions allowed at the time of the field audit.

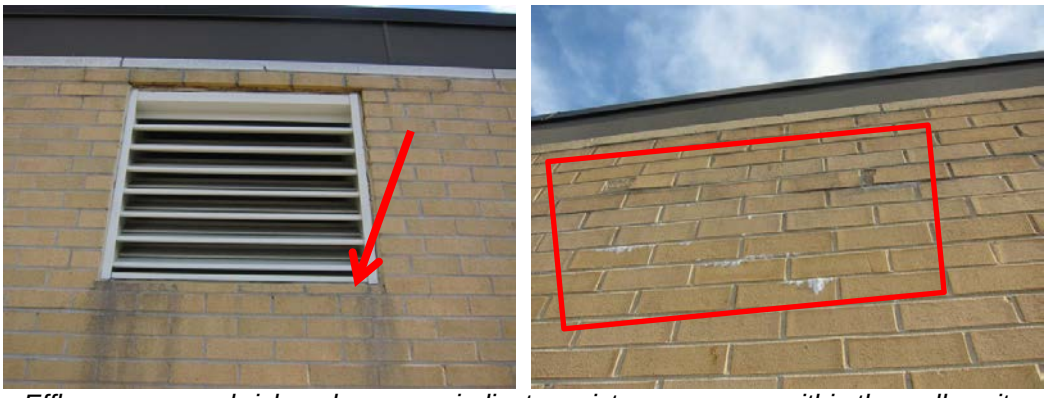
Exterior Walls

The exterior wall envelope is mostly constructed of brick veneer over concrete block with a minimal level of detectable insulation. The interior is predominantly painted CMU (Concrete Masonry Units). Other interior walls are finished with tiles.

Note: Wall insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

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

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



Efflorescence on brick and masonry indicate moisture presence within the wall cavity

Deteriorating bricks, unsealed wall penetrations and sings of uncontrolled roof water runoff

Roof

The building's roof is predominantly a flat and parapet type over steel decking, with a dark-colored EPDM single membrane from Goodyear and Carlisle. It was replaced approximately 15 and 17 years ago, respectively.

Note: Roof insulation levels for the old building could visually be verified in the field by non-destructive methods.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall poor condition, with numerous signs of uncontrolled moisture, air-leakage or other energy-compromising issues on any roof areas. Maintenance reported that the roofs have passed their warranty and is due for a replacement.

The following specific roof problem spots were identified:


Pooling/standing water and foliage clogging roof drains

Signs of pooling/standing water were found throughout all the roof surfaces

Base

The building's base is composed of a slab-on-grade floor with a perimeter footing with concrete block foundation walls and no detectable slab edge/perimeter insulation.

Slab and perimeter insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

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 good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues neither visible on the interior nor exterior.

Windows

The buildings contain several different types of windows:

1. Slider type windows with a non-insulated aluminum frame, low-E coated double glazing and interior roller blinds. The windows are located throughout the building in the classrooms and offices.

2. Fixed type windows with a non-insulated frame, low-E coated double glazing and with no interior or exterior shading devices. The windows are located in the hallways.

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 good condition, with only a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problem spots were identified:

Typical fixed type windows with a non-insulated frame

Exterior doors

The buildings contain several different types of exterior doors:

1. Aluminum type exterior doors with single-pane glass panels and a non-insulated frame. They are located at the hallway exits.

2. Single-pane glass doors with non-insulated aluminum frames. They are located in the main entrance.

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 good condition with only a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:

Missing/worn weather-stripping

Building air-tightness

Overall the field auditors found the building to be reasonably air-tight, considering the building's use and occupancy, 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.

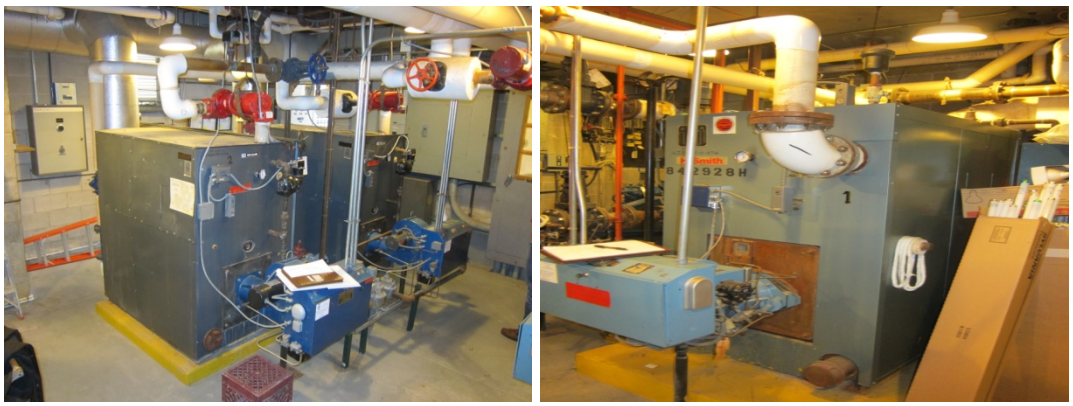
Mechanical Systems

Heating Ventilation Air Conditioning

All spaces in Hurffville Elementary School are mechanically ventilated, heated and cooled. The school contains several “pods” or clusters of buildings that were originally were only connected by exterior walkways but have now been combined to form one building. Since the building has been connected over time, there are two distinct heating systems that serve different areas; including a hot water based heating system as well as areas served primarily by electric heat. Ventilation and cooling are provided to the building via unit ventilators in classrooms and rooftop units for other areas including the multi-purpose room, gymnasium and hallways. During the field visit there were no major comfort issues reported.

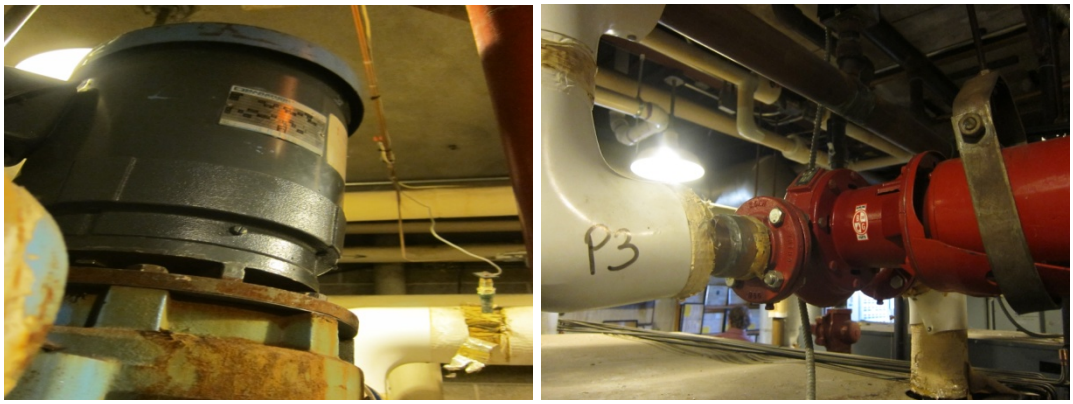
Equipment

Heating – Hurffville Elementary School is heated by a total of three boilers as well as electric resistance heat in some areas. In general, the hot water heating system serves pods that contain Rooms 108-113, Rooms 114-117, as well as the gymnasium, music and art rooms. There are three boilers in total; one HB Smith boiler (B-1) and two identical Weil-McLain boilers (B-2 and B-3). All boilers were installed in 1989 and the HB Smith boiler has a heating input of 1,139 MBH with a thermal efficiency of 80%, while the Weil-McLain boilers have a heating input of 1,632 MBH each and a nameplate thermal efficiency of 79.6%. Boilers provide heating hot water to unit ventilators, baseboard heaters and heating coils located in rooftop packaged units throughout the building. Aside from hot water heating, there are also several pods (Rooms 104-107, Rooms 121-124, Rooms 126-129 and Rooms 130-135) that are served by electric resistance unit ventilators and baseboard heaters.



Weil-McLain boilers (L); HB Smith Boiler (R)

Hot water is circulated through the building via two 5 HP Marathon Electric motors to circulate heating hot water through the building. One motor is used as the primary pump and is used when the school is in operation. The second motor is used as a backup pump and is also operated at night and on the weekends. The Weil-McLain boiler primarily loop uses two smaller ¾ HP Bell & Gossett motors to circulate heating hot water from the B-2 and B-3.



Marathon Electric pump motor (L); Bell & Gossett pump motor (R)

Cooling and Ventilation – All spaces are heated, ventilated and cooled. The building does not contain a central cooling plant and therefore each space is cooled using direct expansion (DX) cooling. Unit ventilators contain a refrigerant loop served by roof-mounted condensing units, while packaged rooftop units contain both an evaporator and a DX coil. Exhaust air is removed from the building by small rooftop exhaust fans located directly above bathrooms as well a gravity relief ventilators located on the roof directly above corridors.

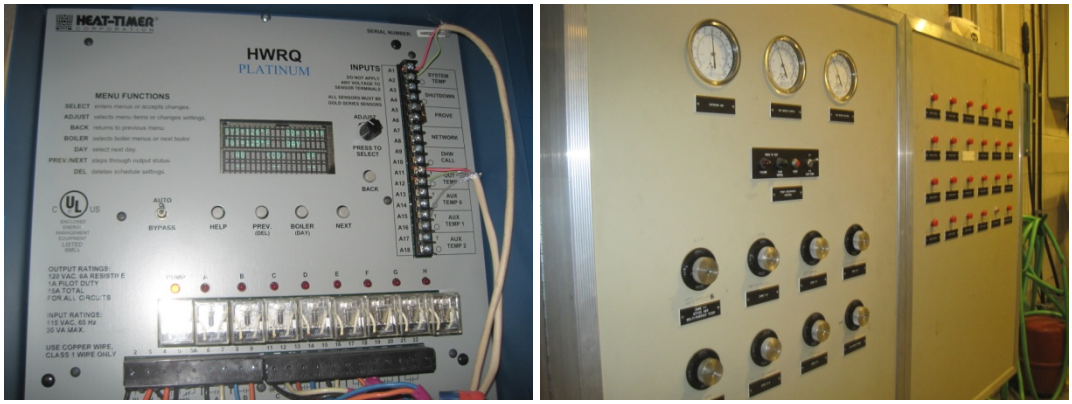
Typical rooftop unit (L); Typical rooftop condensers for unit ventilators (R)

All perimeter classrooms have either unit ventilators or baseboard “wall wash” units. Classrooms and special rooms that do not contain unit ventilators are heated using baseboard heating as well as rooftop units.

Controls

Hurffville Elementary School is unlike other elementary schools in the Washington Township and does not have an electronic control system. Instead, the heating plant is operated with

a Heat Timer HWRQ Platinum control system that adjusts heating setpoint based on a thermostat located in an interior space as well as aquastats measuring the temperature of the hot water return loop. The Heat Timer control also monitors has an outside air temperature sensors in to ensure that heating does not occur above an outside air temperature of 60°F. In addition to the Heat Timer control, the building operates all valves and actuators pneumatically using a Johnson Controls compressed air system.



Heat-Timer Control (L); Johnson compressed air system (R)

All unit ventilators and packaged units are controlled by thermostats located in the areas that each piece of equipment serves. Thermostats are generally set for 72°F during the winter and 74°F during the summer; however, occupants are only capable of adjusting the temperature +/- 2°F in either direction from the setpoint.

Unit ventilators and packaged units located on the pneumatic system are controlled locally with limits. A time clock controls these units so that they operate at a setpoint during occupied periods only. Heating for freeze protection is enabled during unoccupied mode in the heating season.

Domestic Hot Water

Hurffville Elementary School provides domestic hot water (DHW) to bathrooms throughout the building via a central DHW heater located in the boiler room. This Lochinvar Shield condensing water heater was installed in 2010 and is capable of reaching thermal efficiencies of up to 96% when in condensing mode. This unit has a heating input of 199,990 BTUH and a capacity of 93 gallons. In addition to the DHW heater, domestic hot water is generated and stored in an estimated 300 gallon Old Dominion lined storage tank at a temperature of 140°F.


Lochinvar Condensing DHW heater (L); Old Dominion storage tank (R)

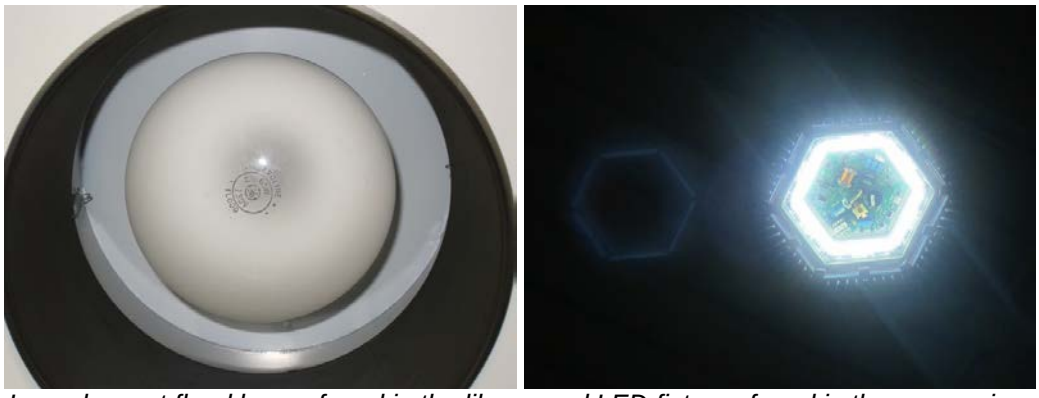
Electrical systems

Lighting

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

Interior Lighting - The primary interior lighting at the Hurffville Elementary School is electronically ballasted T8 lamped fixtures. The hallways currently have T8 u-shaped lamps, while the classrooms have suspended linear T8 fixtures. Incandescent, compact fluorescent (CFLs) were also found throughout the building. The building recently underwent a lighting upgrade that installed 9 LED high bay fixtures in the gymnasium in order to replace 15 250W existing metal halide fixtures. Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas.


Typical interior u-shaped and linear T8 lighting



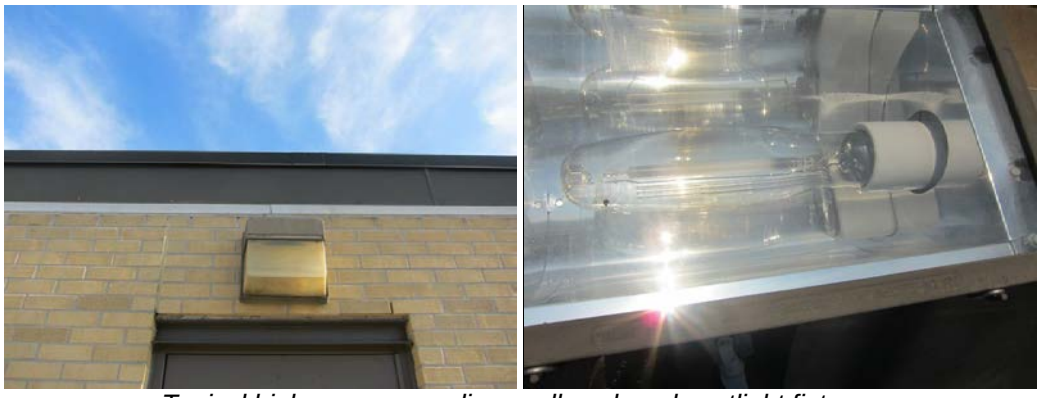
Incandescent flood lamps found in the library and LED fixtures found in the gymnasium

Exit Lights - Exit signs were found to be a mix of older LED, newer LED, and incandescent types.

Typical new LED exit sign (L) and typical old LED exit signs (R)

Incandescent exit sign

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a combination of probe star metal halide, High Pressure Sodium (HPS) and CFL fixtures. Exterior lighting is controlled by both photocells and timers.



Typical high pressure sodium wall pack and spotlight fixtures

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 and printers 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.

Hurffville Elementary school contains two refrigerators, a small walk-in freezer and a washing machine.

Compact refrigerators located in an office and in the cafeteria

Small walk-in freezer

Elevators

Hurffville Elementary School is only 1 story and therefore does not contain an elevator.

Other electrical systems

There are not currently any other significant energy-impacting electrical systems installed at Hurffville 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 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. Solar photovoltaic panels and wind turbines use natural resources to generate electricity. Geothermal systems offset the thermal loads in a building by using water stored in the ground as either a heat sink or heat source. Cogeneration or Combined Heat and Power (CHP) allows for heat recovery during electricity generation.

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 utility analysis and a study of roof conditions, the Washington Township Hurffville Elementary facility is a good candidate for a 10 kW Solar Panel installation. See CI# 1.

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

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

Geothermal

Hurffville Elementary School is not a good candidate for geothermal installation since it would require replacement of the entire existing HVAC system, as well as extensive installation of geothermal wells and pumping equipment.

Combined Heat and Power

Hurffville Elementary 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 constant electrical baseload to accommodate the electricity generated, as well as a means for using waste heat generated. Additionally, the seasonal occupancy schedule of the Elementary School is not well suited for a CHP installation.

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.

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. Capital improvements may also constitute equipment that is currently being operated beyond its useful lifetime. 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.

Recommendations: Energy Conservation Measures

#	Energy Conservation Measures
ECM 1	Replace 23 incandescent lamps with CFLs
ECM 2	Replace 6 incandescent exit signs with new LED exit signs
ECM 3	Replace 6 high bay metal halide lighting fixtures with LEDs
ECM 4	Install 27 new occupancy sensors
	Capital Improvement Measures
CI 1	Install 10 kW Solar Photovoltaic system
CI 2	Replace existing roof surface
CI 3	Replace existing exterior light fixtures
CI 4	Replace End-of-Life RTUs and Condensing Units
CI 5	Upgrade Heat Timer Control and pneumatic system to DDC Control System

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: Replace 23 incandescent lamps with CFLs

On the day of the site visit, SWA completed a lighting inventory of the Hurffville Elementary School (see Appendix C). The existing lighting inventory contained a total of 23 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.

Installation cost:

Estimated installed cost: $215 (includes $80 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

Economics:

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
$215	2,786	0.0	0	0.1	$0	$451	5	$2,257	0.5	950%	190%	209%	$141	4,988

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 – Direct Install program (Up to 70% of installed costs)

Please see APPENDIX J for more information on Incentive Programs.

ECM #2: Replace 6 incandescent exit signs with new LED exit signs

On the day of the site visit, SWA completed a lighting inventory of Hurffville Elementary School (see Appendix C). In total, 6 incandescent exit signs were found. Exit signs present a favorable opportunity for cost savings since they are operated 24 hours per day. Newer LED exit signs are available in wattages as low as 5W.

Installation cost:

Estimated installed cost: $723 (includes $263 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

Economics:

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
$723	1,726	0.0	0	0.1	$0	$280	10	$2,796	2.6	287%	29%	27%	$87	3,090

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 – LED Exit signs ($10 per sign) – Maximum incentive amount is $60.
- NJ Clean Energy – Direct Install program (Up to 70% of installed costs)

Please see APPENDIX J for more information on Incentive Programs.

ECM #3: Replace 6 high bay metal halide lighting fixtures with LED fixtures

On the day of the site visit, SWA completed a lighting inventory of Hurffville Elementary School (see Appendix C). The All-Purpose Room lighting consists of standard probe start Metal Halide (MH) lamps. SWA recommends replacing the interior higher wattage MH fixtures with LED lamps which offer better performance characteristics. They produce higher light output both initially and over time, operate more efficiently, produce whiter light, last much longer 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.

*Washington Township Board of Education replaced metal halide fixtures in the gymnasium of Hurffville Elementary School already with LED fixtures and it is recommended that the same fixtures are used in the All-Purpose Room.

Installation cost:

Estimated installed cost: $3,450
Source of cost estimate: Washington Township BOE previous lighting retrofit

Economics:

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
$3,450	1,793	0.0	0	0.1	$317	$607	10	$6,075	5.7	76%	8%	12%	$190	3,210

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 – Direct Install program (Up to 70% of installed costs)

Please see APPENDIX J for more information on Incentive Programs.

ECM #4: Install 27 new occupancy sensors

On the days of the site visits, SWA completed a lighting inventory of Hurffville Elementary School (see Appendix C). The building contains several areas that could benefit from the installation of occupancy sensors. These areas consisted of various storage rooms, bathrooms and offices that are used sporadically throughout the day and could show energy savings by having the lights turn off after a period of no occupancy. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advanced micro-phonic lighting sensors include sound detection as a means to controlling lighting operation.

Installation cost:

Estimated installed cost: $5,400 (includes $1,814 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Economics:

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
$4,860	4,241	2.0	0	0.2	$0	$687	10	$6,870	7.1	41%	4%	7%	$215	7,594

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 control)
    - Maximum Incentive Amount: $540.
- NJ Clean Energy – Direct Install (Up to 70% of installed costs)

Please see APPENDIX J for more information on Incentive Programs.

CI #1: Install 10 kW Solar Photovoltaic system

Currently, Hurffville Elementary School 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. A commercial multi-crystalline 230 watt panel has 17.5 square feet of surface area (providing 13.1 watts per square foot). A 10.0 kW system needs approximately 44 panels which would take up 770 square feet. Additionally, PV system installations should be accompanied by an evaluation of the roof's structural stability.

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. Utility companies in New Jersey buy Solar Renewable Energy Credits (SRECs) at the best market rate. In addition to selling electricity generated by the solar PV system, SRECs are earned every time that 1 MWh or 1,000 kWh are generated from the renewable system. Based on the lowest market value of SRECs sold in NJ in the past 12 months, SRECs are currently valued at $145/MWh.

The red rectangles above represent potential space for a PV system installation.

Installation cost:
Net estimated installed cost: $50,600 (includes $16,698 of labor)
Source of cost estimate: RS Means; Published and established costs; Similar projects

Economics:

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
$50,600	12,315	8.0	0	0.6	-$500	$3,165	25	$62,432	16.0	23%	2%	2%	-$5,481.56	22,050

Annual Solar PV Financial Breakdown						
Rated Capacity (kW)	10.12	SRECs are earned for the first 15 years of Solar PV lifetime only				
Rated Capacity (kWh)	12,315.12					
Annual Capacity Loss	0%					
Electric Cost ($/kWh)	$0.162					
SRECs Value ($/MWh)	$145					
SREC Sales Commission (%)	4%					
Year	kWh generated	kWh revenue	SRECs earned	SRECs Revenue - Commission	Installation and Maintenance Costs	Total Costs
0	0	$0	0	$0	($180,000)	($180,000)
1	12,315	$1,995	12	$1,670	($500)	$3,165
2	12,315	$1,995	12	$1,670	($500)	$3,165
3	12,315	$1,995	12	$1,670	($500)	$3,165
4	12,315	$1,995	12	$1,670	($500)	$3,165
5	12,315	$1,995	12	$1,670	($500)	$3,165
6	12,315	$1,995	12	$1,670	($500)	$3,165
7	12,315	$1,995	12	$1,670	($500)	$3,165
8	12,315	$1,995	12	$1,670	($500)	$3,165
9	12,315	$1,995	12	$1,670	($500)	$3,165
10	12,315	$1,995	12	$1,670	($500)	$3,165
11	12,315	$1,995	12	$1,670	($500)	$3,165
12	12,315	$1,995	12	$1,670	($500)	$3,165
13	12,315	$1,995	12	$1,670	($500)	$3,165
14	12,315	$1,995	12	$1,670	($500)	$3,165

15	12,315	$1,995	12	$1,670	($500)	$3,165
16	12,315	$1,995	0	$0	($500)	$1,495
17	12,315	$1,995	0	$0	($500)	$1,495
18	12,315	$1,995	0	$0	($500)	$1,495
19	12,315	$1,995	0	$0	($500)	$1,495
20	12,315	$1,995	0	$0	($500)	$1,495
21	12,315	$1,995	0	$0	($500)	$1,495
22	12,315	$1,995	0	$0	($500)	$1,495
23	12,315	$1,995	0	$0	($500)	$1,495
24	12,315	$1,995	0	$0	($500)	$1,495
25	12,315	$1,995	0	$0	($500)	$1,495
TOTAL	**307,878**	**49,876**	**180**	**$25,056**	**-$192,500**	**-$117,568**

Month	SREC Auction Price
Apr-11	$640.00
May-11	$640.00
Jun-11	$640.00
Jul-11	$555.00
Aug-11	$564.99
Sep-11	$606.56
Oct-11	$670.00
Nov-11	$670.00
Dec-11	$225.00
Jan-12	$245.00
Feb-12	$250.00
Mar-12	$145.00
LOW	**$145.00**

Assumptions: SWA estimated the cost and savings of the system based on past PV projects. Installed costs were estimated at $6/Watt installed. In order to remain conservative due to fluctuating market prices, SRECs are evaluated for calculations at $145/MWh, based on the lowest SREC value occurring during the previous 12 month period (March 2012). SWA projected physical dimensions based on a typical Polycrystalline Solar Panel (230 Watts, Model ND-U23-C1). PV systems are sized based on 10.12 kW 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 - 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 $1,670/year, based

on $145/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 J for more information on Incentive Programs.

CI #2: Replace existing roof on both Newer and Older building sections

The existing roof is an EPDM rubber type roof surface. Based on maintenance records, this roof surface is beyond the manufacturer's warrant and is recommended to be replaced. SWA recommends upgrading the existing roof with a high solar reflectance and increased insulation. Replacing the roof will result in some energy savings; however, due to the high capital costs, this measure will not be justified based on energy savings alone. SWA estimates the roof replacements to cost $182,073 based on the total footprint of 65,082 SF for the building.

CI #3: Replace existing exterior light fixtures

Exterior lighting is predominantly made up of high pressure sodium fixtures. Although the rugged exterior fixtures are meant to endure long runtime hours, better technology is now available that can reduce energy consumption, as well as operation and maintenance costs. SWA recommends replacing the existing fixtures with LED street-type lighting. Replacing the existing fixtures will result in energy savings; however, due to the nature of exterior lighting, the existing lights are in okay condition and are not expected to fail in the near future. The high cost of replacing the existing fixtures is not justified at this time by energy savings alone. The project is estimated to cost $22,740 to replace the existing wall pack and wall-mounted fixtures. .

CI #4: Replace End-of-Life RTUs and Condensing Units

During the audit, a complete mechanical inventory was completed and all equipment was evaluated for replacement. In total, there were 14 HVAC units that were found to be operating beyond their useful lifetime and are recommended for replacement as they fail. Equipment to be replaced consists of equipment located on the roof that was installed from 1988 – 1992. SWA recommends that this equipment is replaced with in-kind units of the same capacity with the highest efficiency achievable. In addition to a better performing unit, new units will also utilize R-410A refrigerant that has a smaller negative impact on the environment compared to R-22 that is no longer being manufactured and is slated to be phased out completely by January 1, 2010. Due to the high replacement costs, the increased efficiency will not provide an attractive payback. Implementation costs and units to be replaced are presented below:

Replacement Component	Installed Cost
Replacement of two 6 ton RTUs	$18,830
Replacement of one 15 ton RTU	$21,775
Replacement of three 2 ton condensing units	$6,662
Replacement of one 2.5 ton condensing units	$2,420
Replacement of six 3 ton condensing units	$16,511
Replacement of one 5 ton condensing unit	$5,067
Total Replacement Costs	**$71,265**

CI #5: Upgrade Heat Timer Control and pneumatic system to DDC Control System

The newer section of the building was built in 1996 and a pneumatic control system was installed to control unit ventilators, valves, rooftop units and control setpoints. SWA recommends that Washington Township install a newer electronic DDC controller with key control points to allow the newer section to be tied into the existing Niagara Talon BMS system. SWA recommends installing a controller as well as temperature sensors, and duct pressure sensors as a minimum and additional control points as time and budget allow. This recommendation consists of an estimated number of control points to tie the newer section into the existing BMS system and may not include all necessary control points. This estimate should be considered a minimum relative estimate. This measure is recommended as a Capital Improvement due to the high implementation cost and extensive capital improvement planning required to successfully implement a new control system. Implementation costs are presented below:

Replacement Component	Installed Cost
Installation of Controller MUX panel with 128 point input	$8,262
Installation of 40 space temperature sensors	$30,302
Installation of 40 analog inputs	$29,348
Installation of 40 pneumatic analog outputs	$13,886
Total Replacement Costs	**$81,798**

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.

- Check and adjust timers and time clocks monthly – During the site visit, several time clocks that control HVAC equipment were left on due to incorrect time settings. During power surges or outages, digital clocks are reset and require setting to ensure that timers remain accurate.

- Replace motors with NEMA premium efficiency models – SWA observed several motors as that were not NEMA premium efficiency models and are beyond their useful lifetime. Since these motors have been maintained well, SWA recommends replacing them with high efficiency models as part of routine O&M the next time that they fail.

- Unclog and maintain all roof drains/scuppers.

- 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.

- Inspect and replace cracked/ineffective caulk.

- Inspect and maintain sealants at all windows for airtight performance.

- Inspect and maintain weather-stripping around all exterior doors and roof hatches.

- 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/.

APPENDIX A: EQUIPMENT LIST

Inventory

Building System	Description	Model #	Fuel	Location	Space Served	Date Installed	Expected Useful Lifetime (Years)	Estimated Remaining Useful Life %
Heating	B-1; HB Smith firetube boiler, 6 sections, 1,139,100 Btuh output, 1596 MBH gas input, 79% thermal efficiency	HB Smith, Series 28, NJ007810-074, Serial #842928H	Natural Gas	Boiler Room	Front Section	1989	30	23%
Heating	Peabody Gordon-Piatt burner for B-1 boiler, 1597 MBH gas input	Peabody Gordon-Piatt, Model #HR8.1-G0-07, Burner #U592	Natural Gas	Boiler Room	Front Section	1989	30	23%
Heating	B-2; Weil-McLain sealed combustion boiler, 2049 MBH input, 1,632 MBH gross output, 1,419 MBH net input, 80% thermal efficiency	Weil-McLain, Size #BGL 788-W-S, Serial #89-2181-H, NJ-010153-07H	Natural Gas	Boiler Room	East Sections	1989	30	23%
Heating	Power Flame burner for B-2 boiler, 2,200 MBH input	Power Flame, Model #WCR2-G0-15, Serial #108843530	Natural Gas	Boiler Room	East Sections	1989	30	23%
Heating	B-3; Weil-McLain sealed combustion boiler, 2049 MBH input, 1,632 MBH gross output, 1,419 MBH net input, 80% thermal efficiency	Weil-McLain, Size #BGL 788-W-S, Serial #89-2182-H, NJ-010154-07H	Natural Gas	Boiler Room	East Sections	1989	30	23%
Heating	Power Flame burner for B-3 boiler, 2,200 MBH input	Power Flame, Model #WCR2-G0-15, Serial #108843529	Natural Gas	Boiler Room	East Sections	1989	30	23%
Heating	HWP-3 - Bell & Gossett hot water pump motor for B-2, 3/4 HP, 1725 RPM	Bell & Gossett, Model #9VH48T17D173A, Part #903S83	Electricity	Boiler Room	East Sections	2010	10	80%
Heating	HWP-4 - Bell & Gossett hot water pump motor for B-3, 3/4 HP, 1725 RPM	Bell & Gossett, Model #7VM48T17D164D, Part #903583	Electricity	Boiler Room	East Sections	2010	10	80%
Heating	HWP-5 - Bell & Gossett hot water pump	Bell & Gossett, Model #7VL56T17D10	Electricity	Boiler Room	Front Section	2010	10	80%

	motor for B-1, 3/4 HP, 1725 RPM	31A, Part #131012-083						
Heating	P-1 - Marathon Electric pump motor for B-1, 5 HP, 1725 RPM	Marathon Electric, Model #NA	Electricity	Boiler Room	Front Section	2003	10	10%
Heating	P-2 - Marathon Electric pump motor for B-1, 5 HP, 1725 RPM	Marathon Electric, Model #NA	Electricity	Boiler Room	Front Section	2003	10	10%
Controls	Heat-Timer controls, Outside temperature, system temperature, auxiliary temperature inputs	Heat-Timer Platinum, Model #HWRQ	Electricity	Boiler Room	Back (New) Section	1996	30	47%
Domestic Hot Water	Lochinvar condensing domestic hot water heater, 199,999 Btuh input, circulating tank water heater, 232 gallons/hour recover, 1.87%/hour standby losses, 88.5 gallons, 96% thermal efficiency	Lochinvar Shield, Model #SNR200-100, Serial #D11C2002767 5, Control #M-9	Natural Gas	Boiler Room	All Areas	2010	10	80%
Domestic Hot Water	Old Dominion domestic hot water storage tank (approximately 300 gallons), DHW stored at 140°F	Old Dominion, Serial #PP-1521-DD	DHW	Boiler Room	All Areas	1988	30	20%
Domestic Hot Water	Armstrong recirculating pump motor, 1/6 HP, 1725 RPM	Armstrong, Model #116637-061, Catalog #160287	Electricity	Boiler Room	All Areas	2010	10	80%
HVAC	RTU; Westinghouse packaged rooftop unit, 2 compressors, R-22, 15 tons, old and needs to be replaced	Westinghouse, Model #SD180A0T, Style #353A383G02, Serial #G09202	HW/ Electricity	Rooftop	Library	1970	15	0%
HVAC	RTU-1-1; Lennox packaged rooftop unit, R-22, 2 compressors, 6 tons, 9.0 EER	Lennox, Model #CHA16-823-1G	HW/ Electricity	Rooftop	All Purpose Room	1989	15	0%
HVAC	RTU-1-2; Lennox packaged rooftop unit, R-22, 2 compressors, 6	Lennox, Model #CHA16-823-1G	HW/ Electricity	Rooftop	All Purpose Room	1989	15	0%

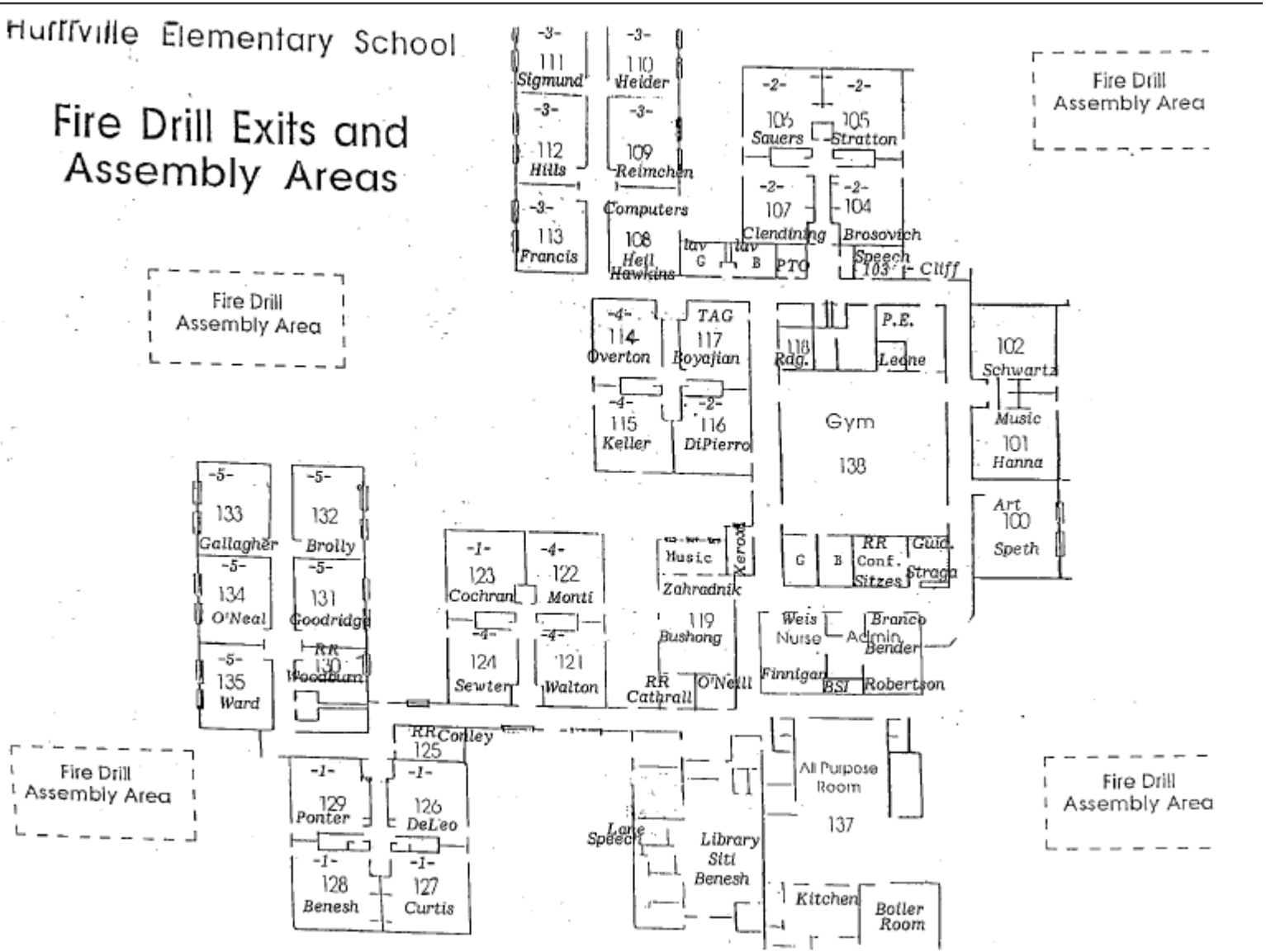
	tons, 9.0 EER							
Cooling	Trane condensing unit, 1 compressor, R-22,3 tons	Trane, Model #TTA036A300A0, Serial #D31222056	Electricity	Rooftop	Room 117	1989	15	0%
Cooling	Trane condensing unit, nameplate not accessible	Trane, Model #NA	Electricity	Exterior on Ground	Room 100 - Art	1992	15	0%
Cooling	Trane condensing unit, R-22, 1 compressor, 2 tons	Trane, XE1000, Model #TTR024C100A0, Serial #G34275969	Electricity	Exterior on Ground	Room 103/104 - Speech	1992	15	0%
Cooling	Carrier condensing unit, R-22, 1 compressor, 2 tons	Carrier, Model #24ABS342A600, Serial #2608E13274	Electricity	Exterior on Ground	Room 105	2008	15	73%
Cooling	Carrier condensing unit, R-22, 1 compressor, 2 tons	Carrier, Model #24ABS342A600, Serial #2608E13260	Electricity	Exterior on Ground	Room 106	2008	15	73%
Cooling	Carrier condensing unit, R-410A, 1 compressor, 2 tons	Carrier, Model #24ABB342A600, Serial #3910E07390	Electricity	Exterior on Ground	Room 107	2010	15	87%
Cooling	Carrier condensing unit, R-410A, 1 compressor, 2 tons	Carrier, Model #24ABB342A600, Serial #3809E06998	Electricity	Exterior on Ground	Room 108	2009	15	80%
Cooling	Trane condensing unit, R-22, 1 compressor, 3 tons	Trane, Model #NA	Electricity	Exterior on Ground	Room 109	1992	15	0%
Cooling	Carrier condensing unit, R-22, 1 compressor, 3 tons	Carrier, Model #38CKC036610, Serial #0503E03103	Electricity	Exterior on Ground	Room 110	2009	15	80%
Cooling	Carrier condensing unit, R-22, 1 compressor, 3 tons	Carrier, Model #38CKC036630, Serial #1203E42326	Electricity	Exterior on Ground	Room 111	2009	15	80%
Cooling	Trane condensing unit, R-22, 1 compressor, 3 tons	Trane, Model #TTA36C400A0, Serial #G35286290	Electricity	Exterior on Ground	Room 112	1992	15	0%
Cooling	Condensing unit for AMU-1; EMI Enviro Master International condensing unit	EMI Eniro Master International, America Series, Model #NA	Electricity	Rooftop	Kitchen Office Area	2005	15	53%
HVAC	Trane packaged rooftop unit, no model nameplate	Trane, Model #NA	HW/ Electricity	Rooftop	Gymnasium/ Classroom	1996	15	0%

Cooling	Goodman Manufacturing condensing unit, R-22, 1 compressor, 2 tons, 13.0 SEER	Goodman Manufacturing, Model #GSC130301A, Serial #0602676942	Electricity	Rooftop	All Purpose Room	2002	15	33%
Cooling	Carrier condensing unit, 1 compressor, R-22, 3 tons	Carrier, Model #561CE036-B, Serial #110E13782	Electricity	Exterior on Ground	Room 113	1994	15	0%
Cooling	Carrier condensing unit, 1 compressor, R-410A, 3.5 tons	Carrier, Model #24ABB342A600, Serial #3910E07383	Electricity	Exterior on Ground	Room 114	2010	15	87%
Cooling	Carrier condensing unit, 1 compressor, R-22, 3.5 tons	Carrier, Model #24ABS342A600, Serial #2608E13250	Electricity	Exterior on Ground	Room 116	2008	15	73%
Cooling	Trane condensing unit, R-22, 1 compressor, 3 tons	Trane, XE800, Model #TTB736A100A0, Serial #C47227695	Electricity	Rooftop	Rooms near All Purpose Room	1988	15	0%
Cooling	Trane condensing unit, R-22, 1 compressor, 2.5 tons	Trane, XE800, Model #TTB730A100A0, Serial #C46220099	Electricity	Rooftop	Classroom	1988	15	0%
Cooling	Carrier condensing unit, R-22, 1 compressor, 3 tons	Carrier, Model #PA10JA036-C, Serial #1804E10702	Electricity	Rooftop	Classroom	2002	15	33%
HVAC	Carrier split-system unit air cooled condenser, R-22, 2 compressors, 20 tons	Carrier Gemini, Model #38AH-024---610AA, Serial #0698F23011	Electricity	Rooftop	Gymnasium	1998	15	7%
Cooling	Trane condensing unit, 3 tons, R-22, 1 compressor	Trane, Model #TTA036A300A0, Serial #D31222057	Electricity	Rooftop	Classroom	1989	15	0%
Cooling	Sanyo condensing unit, R-22, 1 compressor, 2 tons	Sanyo, Model #C2422, Serial #0009821	Electricity	Rooftop	Classroom	1989	15	0%
Cooling	Trane condensing unit, R-22, 1 compressor, 2 tons	Trane, XE1000, Model #TTR024C100A0, Serial #G34275940	Electricity	Exterior on Ground	Classroom	1992	15	0%
Cooling	Carrier condensing unit, R-22, 1 compressor, 2 tons	Carrier, Model #24ABS342A600, Serial #2608E13262	Electricity	Exterior on Ground	Classroom	2008	15	73%
Cooling	Carrier condensing unit, R-22, 1 compressor, 2 tons	Carrier, Model #24ABR342A600, Serial #1606E02518	Electricity	Exterior on Ground	Classroom	2008	15	73%
Cooling	Carrier condensing unit, R-22, 1 compressor, 2 tons	Carrier, Model #24ABR342A600, Serial #1606E22965	Electricity	Exterior on Ground	Classroom	2008	15	73%

Cooling	Carrier condensing unit, R-22, 1 compressor, 2 tons	Carrier Comfort Series, Model #24ACB342A300, Serial #1909E00424	Electricity	Exterior on Ground	Classroom	2009	15	80%
Cooling	Trane condensing unit, R-22, 1 compressor, 3 tons	Trane, Model #TTA036D400A0, Serial #Z385M4R3F	Electricity	Exterior on Ground	Classroom	2001	15	27%
Cooling	Trane condensing unit, R-22, 1 compressor, 3 tons	Trane, Model #TTA036C400A0, Serial #635286294	Electricity	Exterior on Ground	Classroom	1992	15	0%
Cooling	Trane condensing unit, R-22, 1 compressor, 3 tons	Trane, XB 13, Model #2TTA3036A4000AA, Serial #8153WEA3F	Electricity	Exterior on Ground	Classroom	2008	15	73%
Cooling	Trane condensing unit, R-22, 1 compressor, 3 tons	Trane, Model #TTA036D400A0, Serial #R50411M3F	Electricity	Exterior on Ground	Classroom	2000	15	20%
Cooling	Trane condensing unit, R-22, 1 compressor, 2 tons	Trane, XE 1000, Model #TTR024C100A0, Serial #G34275966	Electricity	Exterior on Ground	Classroom	1992	15	0%
Cooling	Carrier condensing unit, R-410A, 1 compressor, 2 tons	Carrier, Model #24ABB342A600, Serial #3910E07384	Electricity	Exterior on Ground	Classroom	2010	15	87%
Cooling	Carrier condensing unit, R-410A, 1 compressor, 2 tons	Carrier, Model #24ABB342A600, Serial #3910E07378	Electricity	Exterior on Ground	Classroom	2010	15	87%
Cooling	Carrier condensing unit, R-410A, 1 compressor, 2 tons	Carrier, Model #24ABB342A600, Serial #3809E06987	Electricity	Exterior on Ground	Classroom	2009	15	80%
Refrigeration	Condensing unit for Trenton Refrigeration Products, walk-in freezer - freezer section, 1 compressor, R-404A refrigerant, air cooled condenser	Trenton Refrigeration Products, Model #TEHA020L6-HS2A-F, Serial #062203239	Electricity	Kitchen	Kitchen	2007	15	67%
Refrigeration	Condensing unit for Trenton Refrigeration Products walk-in freezer - refrigerator section, 1 compressor, R-404A refrigerant, air cooled condenser	Trenton Refrigeration Products, Model #TEHA008E6-HS2A-B, Serial #060102827	Electricity	Kitchen	Kitchen	2007	15	67%

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: Hurffville Floor Plan



Appendix C: 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	Office (MAIN OFFICE)	Recessed Parabolic	E	4'T8	5	3	32	Sw	8	241	5	505	974	N/A	Recessed Parabolic	4'T8	E	Sw	5	3	32	8	241	5	505	974	0	0	0
2	1	Office Area (MAIN OFFICE AREA)	Recessed Parabolic	E	4'T8	9	3	32	Sw	8	241	5	909	1,753	N/A	Recessed Parabolic	4'T8	E	Sw	9	3	32	8	241	5	909	1753	0	0	0
3	1	Office (PRINCIPAL)	Recessed Parabolic	E	4'T8	3	3	32	Sw	8	241	5	303	584	C	Recessed Parabolic	4'T8	E	OS	3	3	32	6	241	5	303	438	0	146	146
4	1	Office (GUIDANCE)	Recessed Parabolic	E	4'T8	4	3	32	Sw	8	241	5	404	779	C	Recessed Parabolic	4'T8	E	OS	4	3	32	6	241	5	404	584	0	195	195
5	1	Office (CHILD STUDY)	Recessed Parabolic	E	4'T8	3	3	32	Sw	8	241	5	303	584	C	Recessed Parabolic	4'T8	E	OS	3	3	32	6	241	5	303	438	0	146	146
6	1	Nurse's Station (NURSE)	Recessed Parabolic	E	4'T8 U-Shaped	2	2	32	Sw	8	241	5	138	266	N/A	Recessed Parabolic	4'T8 U-Shaped	E	Sw	2	2	32	8	241	5	138	266	0	0	0
7	1	Nurse's Station (NURSE)	Recessed Parabolic	E	4'T8	8	3	32	Sw	8	241	5	808	1,558	N/A	Recessed Parabolic	4'T8	E	Sw	8	3	32	8	241	5	808	1558	0	0	0
8	1	Hallway (HALL)	Recessed Parabolic	E	4'T8	65	3	32	Sw	12	241	5	6,565	18,986	N/A	Recessed Parabolic	4'T8	E	Sw	65	3	32	12	241	5	6565	18986	0	0	0
9	1	Hallway (HALL)	Recessed Parabolic	S	Inc	13	1	60	Sw	12	241	0	780	2,256	CFL	Recessed Parabolic	CFL	S	Sw	13	1	20	12	241	0	260	752	1504	0	1504
10	1	Office Area (XEROX)	Recessed Parabolic	E	4'T8	4	3	32	Sw	8	241	5	404	779	C	Recessed Parabolic	4'T8	E	OS	4	3	32	6	241	5	404	584	0	195	195
11	1	Gymnasium (GYM)	Parabolic Ceiling Suspended	S	LED	9	1	150	Sw	8	241	15	1,485	2,863	N/A	Parabolic Ceiling Suspended	LED	S	Sw	9	1	150	8	241	15	1485	2863	0	0	0
12	1	Locker Room (LOCKER BOYS)	Recessed Parabolic	E	4'T8	2	3	32	Sw	8	241	5	202	389	C	Recessed Parabolic	4'T8	E	OS	2	3	32	6	241	5	202	292	0	97	97
13	1	Locker Room (LOCKER BOYS)	Recessed Parabolic	E	4'T8	2	2	32	Sw	8	241	5	138	266	C	Recessed Parabolic	4'T8	E	OS	2	2	32	6	241	5	138	200	0	67	67
14	1	Locker Room (LOCKER GIRLS)	Recessed Parabolic	E	4'T8	2	3	32	Sw	8	241	5	202	389	C	Recessed Parabolic	4'T8	E	OS	2	3	32	6	241	5	202	292	0	97	97
15	1	Locker Room (LOCKER GIRLS)	Recessed Parabolic	E	4'T8	2	2	32	Sw	8	241	5	138	266	C	Recessed Parabolic	4'T8	E	OS	2	2	32	6	241	5	138	200	0	67	67
16	1	Office (OFFICE)	Recessed Parabolic	E	4'T8	2	3	32	Sw	8	241	5	202	389	C	Recessed Parabolic	4'T8	E	OS	2	3	32	6	241	5	202	292	0	97	97
17	1	Office (118)	Recessed Parabolic	E	4'T8	4	3	32	Sw	8	241	5	404	779	C	Recessed Parabolic	4'T8	E	OS	4	3	32	6	241	5	404	584	0	195	195
18	1	Storage Closet (STORAGE)	Parabolic Ceiling Suspended	E	4'T8	1	2	32	Sw	2	241	5	69	33	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	1	2	32	2	241	5	69	33	0	0	0
19	1	Bathroom Men (BOYS)	Recessed Parabolic	E	4'T8	1	3	32	Sw	8	241	5	101	195	C	Recessed Parabolic	4'T8	E	OS	1	3	32	6	241	5	101	146	0	49	49
20	1	Bathroom Women (GIRLS)	Recessed Parabolic	E	4'T8	1	3	32	Sw	8	241	5	101	195	C	Recessed Parabolic	4'T8	E	OS	1	3	32	6	241	5	101	146	0	49	49
21	1	Lunch Room (FACULTY)	Recessed Parabolic	E	4'T8	8	3	32	Sw	8	241	5	808	1,558	C	Recessed Parabolic	4'T8	E	OS	8	3	32	6	241	5	808	1168	0	389	389
22	1	Storage Room (GYM STORAGE)	Recessed Parabolic	E	4'T8	5	3	32	Sw	2	241	5	505	243	N/A	Recessed Parabolic	4'T8	E	Sw	5	3	32	2	241	5	505	243	0	0	0
23	1	Office (103)	Recessed Parabolic	E	4'T8	4	3	32	Sw	8	241	5	404	779	C	Recessed Parabolic	4'T8	E	OS	4	3	32	6	241	5	404	584	0	195	195
24	1	Classroom (104)	Parabolic Ceiling Suspended	E	4'T8	15	2	32	Sw	8	241	5	1,035	1,995	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	15	2	32	8	241	5	1035	1995	0	0	0
25	1	Classroom (105)	Parabolic Ceiling Suspended	E	4'T8	15	2	32	Sw	8	241	5	1,035	1,995	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	15	2	32	8	241	5	1035	1995	0	0	0
26	1	Classroom (106)	Parabolic Ceiling Suspended	E	4'T8	15	2	32	Sw	8	241	5	1,035	1,995	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	15	2	32	8	241	5	1035	1995	0	0	0
27	1	Classroom (107)	Parabolic Ceiling Suspended	E	4'T8	15	2	32	Sw	8	241	5	1,035	1,995	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	15	2	32	8	241	5	1035	1995	0	0	0
28	1	Bathroom Men (BOYS2)	Parabolic Ceiling Mounted	E	4'T8	2	3	32	Sw	8	241	5	202	389	C	Parabolic Ceiling Mounted	4'T8	E	OS	2	3	32	6	241	5	202	292	0	97	97
29	1	Bathroom Women (GIRLS2)	Parabolic Ceiling Mounted	E	4'T8	2	3	32	Sw	8	241	5	202	389	C	Parabolic Ceiling Mounted	4'T8	E	OS	2	3	32	6	241	5	202	292	0	97	97
30	1	Bathroom Men (BOYS3)	Parabolic Ceiling Mounted	E	4'T8	2	3	32	Sw	8	241	5	202	389	C	Parabolic Ceiling Mounted	4'T8	E	OS	2	3	32	6	241	5	202	292	0	97	97
31	1	Bathroom Women (GIRLS3)	Parabolic Ceiling Mounted	E	4'T8	2	3	32	Sw	8	241	5	202	389	C	Parabolic Ceiling Mounted	4'T8	E	OS	2	3	32	6	241	5	202	292	0	97	97
32	1	Storage Closet (PTO STORAGE)	Parabolic Ceiling Suspended	E	4'T8	1	2	32	Sw	2	241	5	69	33	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	1	2	32	2	241	5	69	33	0	0	0
33	1	Classroom (114)	Parabolic Ceiling Suspended	E	4'T8	15	2	32	Sw	8	208	5	1,035	1,722	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	15	2	32	8	208	5	1035	1722	0	0	0
34	1	Classroom (115)	Parabolic Ceiling Suspended	E	4'T8	15	2	32	Sw	8	208	5	1,035	1,722	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	15	2	32	8	208	5	1035	1722	0	0	0
35	1	Classroom (116)	Parabolic Ceiling Suspended	E	4'T8	15	2	32	Sw	8	208	5	1,035	1,722	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	15	2	32	8	208	5	1035	1722	0	0	0
36	1	Classroom (117)	Parabolic Ceiling Suspended	E	4'T8	15	2	32	Sw	8	208	5	1,035	1,722	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	15	2	32	8	208	5	1035	1722	0	0	0
37	1	Classroom (108)	Recessed Parabolic	E	4'T8	12	4	32	Sw	8	208	5	1,596	2,656	N/A	Recessed Parabolic	4'T8	E	Sw	12	4	32	8	208	5	1596	2656	0	0	0
38	1	Classroom (109)	Recessed Parabolic	E	4'T8	12	4	32	Sw	8	208	5	1,596	2,656	N/A	Recessed Parabolic	4'T8	E	Sw	12	4	32	8	208	5	1596	2656	0	0	0
39	1	Classroom (110)	Recessed Parabolic	E	4'T8	12	4	32	Sw	8	208	5	1,596	2,656	N/A	Recessed Parabolic	4'T8	E	Sw	12	4	32	8	208	5	1596	2656	0	0	0
40	1	Classroom (111)	Recessed Parabolic	E	4'T8	12	4	32	Sw	8	208	5	1,596	2,656	N/A	Recessed Parabolic	4'T8	E	Sw	12	4	32	8	208	5	1596	2656	0	0	0
41	1	Classroom (112)	Recessed Parabolic	E	4'T8	12	4	32	Sw	8	208	5	1,596	2,656	N/A	Recessed Parabolic	4'T8	E	Sw	12	4	32	8	208	5	1596	2656	0	0	0
42	1	Classroom (113)	Recessed Parabolic	E	4'T8	12	4	32	Sw	8	208	5	1,596	2,656	N/A	Recessed Parabolic	4'T8	E	Sw	12	4	32	8	208	5	1596	2656	0	0	0
43	1	Classroom (121)	Recessed Parabolic	E	4'T8	12	4	32	Sw	8	208	5	1,596	2,656	N/A	Recessed Parabolic	4'T8	E	Sw	12	4	32	8	208	5	1596	2656	0	0	0
44	1	Classroom (122)	Recessed Parabolic	E	4'T8	12	4	32	Sw	8	208	5	1,596	2,656	N/A	Recessed Parabolic	4'T8	E	Sw	12	4	32	8	208	5	1596	2656	0	0	0
45	1	Classroom (124)	Recessed Parabolic	E	4'T8	12	4	32	Sw	8	208	5	1,596	2,656	N/A	Recessed Parabolic	4'T8	E	Sw	12	4	32	8	208	5	1596	2656	0	0	0
46	1	Classroom (121)	Parabolic Ceiling Suspended	E	4'T8	15	2	32	Sw	8	208	5	1,035	1,722	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	15	2	32	8	208	5	1035	1722	0	0	0
47	1	Classroom (122)	Parabolic Ceiling Suspended	E	4'T8	15	2	32	Sw	8	208	5	1,035	1,722	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	15	2	32	8	208	5	1035	1722	0	0	0
48	1	Classroom (123)	Parabolic Ceiling Suspended	E	4'T8	15	2	32	Sw	8	208	5	1,035	1,722	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	15	2	32	8	208	5	1035	1722	0	0	0
49	1	Classroom (124)	Parabolic Ceiling Suspended	E	4'T8	15	2	32	Sw	8	208	5	1,035	1,722	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	15	2	32	8	208	5	1035	1722	0	0	0
50	1	Bathroom Men (BOYS4)	Parabolic Ceiling Mounted	E	4'T8	2	3	32	Sw	8	241	5	202	389	C	Parabolic Ceiling Mounted	4'T8	E	OS	2	3	32	6	241	5	202	292	0	97	97
51	1	Bathroom Women (GIRLS4)	Parabolic Ceiling Mounted	E	4'T8	2	3	32	Sw	8	241	5	202	389	C	Parabolic Ceiling Mounted	4'T8	E	OS	2	3	32	6	241	5	202	292	0	97	97
52	1	Classroom (126)	Parabolic Ceiling Suspended	E	4'T8	15	2	32	Sw	8	208	5	1,035	1,722	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	15	2	32	8	208	5	1035	1722	0	0	0
53	1	Classroom (127)	Parabolic Ceiling Suspended	E	4'T8	15	2	32	Sw	8	208	5	1,035	1,722	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	15	2	32	8	208	5	1035	1722	0	0	0
54	1	Classroom (128)	Parabolic Ceiling Suspended	E	4'T8	15	2	32	Sw	8	208	5	1,035	1,722	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	15	2	32	8	208	5	1035	1722	0	0	0
55	1	Classroom (129)	Parabolic Ceiling Suspended	E	4'T8	15	2	32	Sw	8	208	5	1,035	1,722	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	15	2	32	8	208	5	1035	1722	0	0	0
56	1	Bathroom Men (BOYS5)	Parabolic Ceiling Mounted	E	4'T8	2	3	32	Sw	8	241	5	202	389	C	Parabolic Ceiling Mounted	4'T8	E	OS	2	3	32	6	241	5	202	292	0	97	97
57	1	Bathroom Women (GIRLS5)	Parabolic Ceiling Mounted	E	4'T8	2	3	32	Sw	8	241	5	202	389	C	Parabolic Ceiling Mounted	4'T8	E	OS	2	3	32	6	241	5	202	292	0	97	97
58	1	Classroom (131)	Recessed Parabolic	E	4'T8	12	4	32	Sw	8	208	5	1,596	2,656	N/A	Recessed Parabolic	4'T8	E	Sw	12	4	32	8	208	5	1596	2656	0	0	0
59	1	Classroom (132)	Recessed Parabolic	E	4'T8	12	4	32	Sw	8	208	5	1,596	2,656	N/A	Recessed Parabolic	4'T8	E	Sw	12	4	32	8	208	5	1596	2656	0	0	0

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)
60	1	Classroom (133)	Recessed Parabolic	E	4'T8	12	4	32	Sw	8	208	5	1,596	2,656	N/A	Recessed Parabolic	4'T8	E	Sw	12	4	32	8	208	5	1596	2656	0	0	0
61	1	Classroom (134)	Recessed Parabolic	E	4'T8	12	4	32	Sw	8	208	5	1,596	2,656	N/A	Recessed Parabolic	4'T8	E	Sw	12	4	32	8	208	5	1596	2656	0	0	0
62	1	Classroom (135)	Recessed Parabolic	E	4'T8	12	4	32	Sw	8	208	5	1,596	2,656	N/A	Recessed Parabolic	4'T8	E	Sw	12	4	32	8	208	5	1596	2656	0	0	0
63	1	Classroom (130)	Recessed Parabolic	E	4'T8	6	3	32	Sw	8	208	5	606	1,008	N/A	Recessed Parabolic	4'T8	E	Sw	6	3	32	8	208	5	606	1008	0	0	0
64	1	Bathroom Men (BOYS6)	Parabolic Ceiling Mounted	E	4'T8	2	3	32	Sw	8	241	5	202	389	C	Parabolic Ceiling Mounted	4'T8	E	OS	2	3	32	6	241	5	202	292	0	97	97
65	1	Bathroom Women (GIRLS6)	Parabolic Ceiling Mounted	E	4'T8	2	3	32	Sw	8	241	5	202	389	C	Parabolic Ceiling Mounted	4'T8	E	OS	2	3	32	6	241	5	202	292	0	97	97
66	1	Classroom (119)	Recessed Parabolic	E	4'T8	16	4	32	Sw	8	241	5	2,128	4,103	N/A	Recessed Parabolic	4'T8	E	Sw	16	4	32	8	241	5	2128	4103	0	0	0
67	1	Office (MUSIC OFFICE)	Recessed Parabolic	E	4'T8	14	4	32	Sw	8	241	5	1,862	3,590	C	Recessed Parabolic	4'T8	E	OS	14	4	32	6	241	5	1862	2692	0	897	897
68	1	Library (LIBRA)	Recessed Parabolic	E	4'T8	26	4	32	Sw	8	241	5	3,458	6,667	N/A	Recessed Parabolic	4'T8	E	Sw	26	4	32	8	241	5	3458	6667	0	0	0
69	1	Library (LIBRA)	Recessed Parabolic	E	Hal	10	1	75	Sw	8	241	17	915	1,764	CFL	Recessed Parabolic	CFL	E	Sw	10	1	25	8	241	0	250	482	1282	0	1282
70	1	Library (LIBRA)	Parabolic Ceiling Mounted	E	4'T8	18	2	32	Sw	8	241	5	1,242	2,395	N/A	Parabolic Ceiling Mounted	4'T8	E	Sw	18	2	32	8	241	5	1242	2395	0	0	0
71	1	Library (LIBRA)	Recessed Parabolic	E	2'T8	9	4	17	Sw	8	241	2	630	1,215	N/A	Recessed Parabolic	2'T8	E	Sw	9	4	17	8	241	2	630	1215	0	0	0
72	1	Bathroom Men (BOYS7)	Parabolic Ceiling Mounted	E	4'T8	2	3	32	Sw	8	241	5	202	389	N/A	Parabolic Ceiling Mounted	4'T8	E	Sw	2	3	32	8	241	5	202	389	0	0	0
73	1	Bathroom Women (GIRLS7)	Parabolic Ceiling Mounted	E	4'T8	2	3	32	Sw	8	241	5	202	389	N/A	Parabolic Ceiling Mounted	4'T8	E	Sw	2	3	32	8	241	5	202	389	0	0	0
74	1	Storage Room (RECEIVING)	Parabolic Ceiling Suspended	E	4'T8	4	2	32	Sw	8	241	5	276	532	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	4	2	32	8	241	5	276	532	0	0	0
75	1	Storage Closet (STORAGE2)	Parabolic Ceiling Suspended	E	4'T8	1	2	32	Sw	8	241	5	69	133	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	1	2	32	8	241	5	69	133	0	0	0
76	1	Classroom (125)	Recessed Parabolic	E	4'T8	6	3	32	Sw	8	241	5	606	1,168	N/A	Recessed Parabolic	4'T8	E	Sw	6	3	32	8	241	5	606	1168	0	0	0
77	1	Cafeteria (ALL PURPOSE)	Recessed Parabolic	S	MH	6	1	250	Sw	8	241	70	1,920	3,702	LED	Recessed Parabolic	LED	S	Sw	6	1	150	8	241	15	990	1909	1793	0	1793
78	1	Kitchen (KITCHEN)	Recessed Parabolic	E	4'T8	10	4	32	Sw	8	241	5	1,330	2,564	N/A	Recessed Parabolic	4'T8	E	Sw	10	4	32	8	241	5	1330	2564	0	0	0
79	1	Office (KITCHEN OFFICE)	Recessed Parabolic	E	4'T8	3	4	32	Sw	8	241	5	399	769	C	Recessed Parabolic	4'T8	E	OS	3	4	32	6	241	5	399	577	0	192	192
80	1	Hallway (HALL)	Recessed Parabolic	E	4'T8 U-Shaped	6	2	32	Sw	12	241	5	414	1,197	N/A	Recessed Parabolic	4'T8 U-Shaped	E	Sw	6	2	32	12	241	5	414	1197	0	0	0
81	1	Office (100)	Recessed Parabolic	E	4'T8	4	3	32	Sw	8	241	5	404	779	C	Recessed Parabolic	4'T8	E	OS	4	3	32	6	241	5	404	584	0	195	195
82	1	Classroom (101)	Parabolic Ceiling Suspended	E	4'T8	15	2	32	Sw	8	241	5	1,035	1,995	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	15	2	32	8	241	5	1035	1995	0	0	0
83	1	Boiler Room (Boiler Room)	Ceiling Suspended	S	CFL	9	1	13	Sw	2	241	0	117	56	N/A	Ceiling Suspended	CFL	S	Sw	9	1	13	2	241	0	117	56	0	0	0
84	1	Exterior	Recessed	S	CFL	28	1	13	T	12	241	0	364	1,053	N/A	Recessed	CFL	S	T	28	1	13	12	241	0	364	1053	0	0	0
85	1	Exterior	Wallpack	S	HPS	9	1	250	T	12	241	50	2,700	7,808	PSMH	Wallpack	PSMH	S	T	9	1	150	12	241	30	1620	4685	3123	0	3123
86	1	Hallway	Exit Sign	S	LED	11	1	5	N	24	365	1	61	530	N/A	Exit Sign	LED	S	N	11	1	5	24	365	1	61	530	0	0	0
87	1	Hallway	Exit Sign	S	LED	4	1	25	N	24	365	3	110	964	LEDex	Exit Sign	LED	S	N	4	1	5	24	365	1	22	193	771	0	771
88	1	Hallway	Exit Sign	S	Inc	2	1	60	N	24	365	0	120	1,051	LEDex	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	955	0	955
Totals:						792	235	3,292				539	77,750	149,899						792	235	3,002			447	74,555	137,955	7,702	4,241	11,943

Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space

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	FI.	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 D: SOLAR PV SHADING ANALYSIS

Site Report

Report Name	Washington Township - Hurffville Elementary School
Report Date	2/23/2012 8:27:25 PM
Declination	0d 00m
Location	SEWELL, NJ 08080
Lat/Long	39.755 / -75.202
Weather Station	Philadelphia Intl AP, PA, Elevation: 7 Feet, (39.867/-75.233)
Site distance	8 Miles
Report Type	PV
Array Type	Fixed
Tilt Angle	39.76 deg
Ideal Tilt Angle	39.76 deg
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Electric Cost	0.162 ($/KWH)
Panel Make	Sharp
Panel Model	ND-230UC1
Panel Count	44
DC Rate (per panel)	230.0 W
Total System Size	10,120.0 W
Inverter Make	Sharp
Inverter Model	JH-3500U
Inverter Count	1
Derate Method	Using Components
Derate Factor	0.761
Layout Configuration	Custom
Layout Point Count	1

Notes: LGEA Energy Audit

System Picture Layout

Layout Type Custom
Layout Point Count 1

Report generated by SolarPathfinder Assistant Version 4.1.27.0. http://www.solarpathfinder.com
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Solar Site Analysis Report

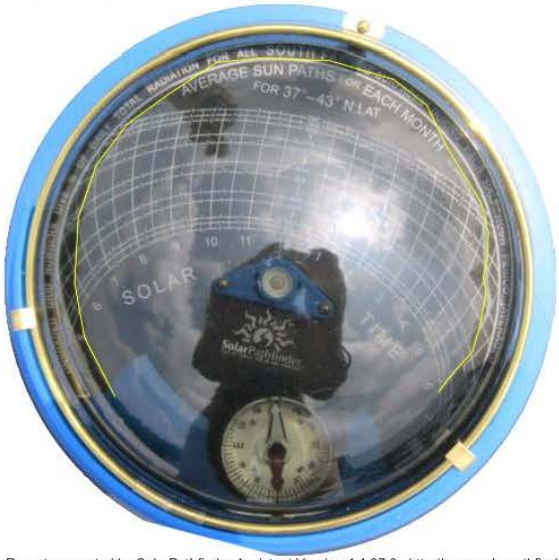
1

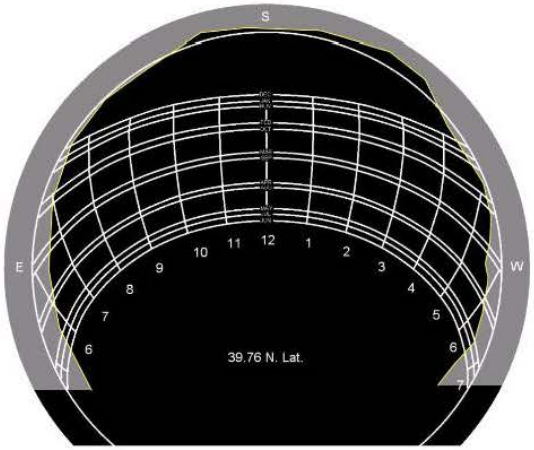
Image File IMG_6301.jpg

Solar Obstruction Data

Month	Unshaded % of Ideal Site Azimuth=180 Tilt=39.76	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=39.76 KWH/m^2 /day	Actual AC Energy (KWH) w/ shading Azimuth=180.00 Tilt=39.76	Actual AC Energy (KWH) w/o shading Azimuth=180.0 Tilt=39.76	Ideal AC Energy (KWH) w/o shading Azimuth=180.0 Tilt=39.76	Solar Cost Savings 0.162 ($/KWH)	PVWatts Unshaded % Actual Site Azimuth=180.0 Tilt=39.76	Actual Site Efficiency % Azimuth=180.0 Tilt=39.76	Ideal Site Efficiency % Azimuth=180.0 Tilt=39.76
January	100.00%	3.51	870.00	870.00	870.00	$140.94	99.93 %	99.93 %	99.93 %
February	99.84%	4.03	872.04	873.00	873.00	$141.27	99.77 %	99.53 %	99.53 %
March	99.90%	4.72	1,093.00	1,093.00	1,093.00	$177.07	99.95 %	99.95 %	99.95 %
April	99.48%	5.07	1,107.57	1,108.00	1,108.00	$179.43	99.56 %	99.56 %	99.56 %
May	99.37%	5.39	1,180.00	1,180.00	1,180.00	$191.16	99.47 %	99.47 %	99.47 %
June	99.26%	5.61	1,164.00	1,164.00	1,164.00	$188.57	99.32 %	99.14 %	99.14 %
July	99.26%	5.24	1,109.00	1,109.00	1,109.00	$179.66	99.33 %	99.14 %	99.14 %
August	99.21%	5.72	1,222.77	1,223.00	1,223.00	$198.09	99.42 %	99.42 %	99.42 %
September	99.10%	5.09	1,066.54	1,068.00	1,068.00	$172.78	99.14 %	98.95 %	98.95 %
October	100.00%	4.56	1,049.00	1,049.00	1,049.00	$169.94	99.92 %	99.05 %	99.05 %
November	100.00%	3.58	825.00	825.00	825.00	$133.65	100.00 %	99.73 %	99.73 %
December	99.61%	3.15	756.20	757.00	757.00	$122.50	99.46 %	99.46 %	99.46 %
Totals	**99.59%**	**55.66**	**12,315.12**	**12,319.00**	**12,319.00**	**$1,995.05**	**99.61 %**	**99.44 %**	**99.44 %**
	Unweighted Yearly Avg	**Effect: 99.40% Sun Hrs: 4.64**					**Unweighted Yearly Avg**	**Unweighted Yearly Avg**	**Unweighted Yearly Avg**

Notes: [None]





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Summary Report

Solar Obstruction Data

Month	Unshaded % of Ideal Site Azimuth=180 Tilt=39.76	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=39.76 KWH/m ^{2} /day	Actual AC Energy (KWH) w/ shading Azimuth=180.00 Tilt=39.76	Actual AC Energy (KWH) w/o shading Azimuth=180.0 Tilt=39.76	Ideal AC Energy (KWH) w/o shading Azimuth=180.0 Tilt=39.76	Solar Cost Savings 0.162 ($/KWH)	PVWatts Unshaded % Actual Site Azimuth=180.0 Tilt=39.76	Actual Site Efficiency % Azimuth=180.0 Tilt=39.76	Ideal Site Efficiency % Azimuth=180.0 Tilt=39.76
January	100.00%	3.51	870.00	870.00	870.00	$140.94	99.93 %	99.93 %	99.93 %
February	99.84%	4.03	872.04	873.00	873.00	$141.27	99.77 %	99.53 %	99.53 %
March	99.90%	4.72	1,093.00	1,093.00	1,093.00	$177.07	99.95 %	99.95 %	99.95 %
April	99.48%	5.07	1,107.57	1,108.00	1,108.00	$179.43	99.56 %	99.56 %	99.56 %
May	99.37%	5.39	1,180.00	1,180.00	1,180.00	$191.16	99.47 %	99.47 %	99.47 %
June	99.26%	5.61	1,164.00	1,164.00	1,164.00	$188.57	99.32 %	99.14 %	99.14 %
July	99.26%	5.24	1,109.00	1,109.00	1,109.00	$179.66	99.33 %	99.14 %	99.14 %
August	99.21%	5.72	1,222.77	1,223.00	1,223.00	$198.09	99.42 %	99.42 %	99.42 %
September	99.10%	5.09	1,066.54	1,068.00	1,068.00	$172.78	99.14 %	98.95 %	98.95 %
October	100.00%	4.56	1,049.00	1,049.00	1,049.00	$169.94	99.92 %	99.05 %	99.05 %
November	100.00%	3.58	825.00	825.00	825.00	$133.65	100.00 %	99.73 %	99.73 %
December	99.61%	3.15	756.20	757.00	757.00	$122.50	99.46 %	99.46 %	99.46 %
Totals	**99.59%**	**55.66**	**12,315.12**	**12,319.00**	**12,319.00**	**$1,995.05**	**99.61 %**	**99.44 %**	**99.44 %**
	Unweighted	**Effect: 99.40%**					**Unweighted**	**Unweighted**	**Unweighted**
	Yearly Avg	**Sun Hrs: 4.64**					**Yearly Avg**	**Yearly Avg**	**Yearly Avg**

Notes: LGEA Energy Audit

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APPENDIX E: COST WORKS COST ESTIMATES

Washington Township BOE
200 Hurffville-Grenloch Road
Sewell,
NJ, 08080
Year 2011 Quarter 4

Date: 24-Feb-12

Unit Detail Report

Hurffville Elementary

Cost Estimate Report
CostWorks®
RSMeans

Prepared By:
Dan Carmichael
Steven Winter Associates Inc

LineNumber			Description	Quantity	Unit	Total Incl O&P	Ext Total Incl O&P
Division 07 Thermal and Moisture Protection							
070150101600			Roof Coatings, reflective, white, elastomeric, 50 sf/gallon	1,301.64	Gal.	$17.89	$23,286.34
075323204800			Ethylene-propylene-diene-monomer roofing, (EPDM), 0.40 P.S.F., fully adhered with adhesive, 60 mils	650.82	Sq.	$243.98	$158,787.06
Division 07 Subtotal							**$182,073.40**
Division 23 Heating, Ventilating, and Air Conditioning (HVAC)							
230923100130			Control Components/DDC Systems, analog inputs, sensors (avg. 50' run in 1/2" EMT), space temperature	40.00	Ea.	$757.56	$30,302.40
230923101020			Control Components/DDC Systems, subcontractor's quote incl. material & labor, analog outputs, (avg. 50' run in 1/2" EMT), material in MUX	40.00	Ea.	$347.16	$13,886.40
230923101030			Control Components/DDC Systems, subcontractor's quote incl. material & labor, analog outputs, (avg. 50' run in 1/2" EMT), pneumatic, excl. control device	40.00	Ea.	$733.70	$29,348.00
230923103110			Control Components/DDC Systems, subcontractor's quote incl. material & labor, controller MUX panel, 128 point, incl. function boards	1.00	Ea.	$8,261.53	$8,261.53
236213100100			Condensing unit, air cooled, compressor, 2 ton, includes standard controls	3.00	Ea.	$2,220.74	$6,662.22
236213100200			Condensing unit, air cooled, compressor, 2.5 ton, includes standard controls	1.00	Ea.	$2,420.09	$2,420.09
236213100300			Condensing unit, air cooled, compressor, 3 ton, includes standard controls	6.00	Ea.	$2,751.75	$16,510.50
236213100500			Condensing unit, air cooled, compressor, 5 Ton, includes standard controls	1.00	Ea.	$5,067.40	$5,067.40
237433101145			Rooftop air conditioner, single zone, electric cool, gas heat, 6 ton cooling, 140 MBH heating, includes, standard controls, curb and economizer	2.00	Ea.	$9,415.16	$18,830.32
237433101180			Rooftop air conditioner, single zone, electric cool, gas heat, 15 ton cooling, 270 MBH heating, includes, standard controls, curb and economizer	1.00	Ea.	$21,775.18	$21,775.18
Division 23 Subtotal							**$153,064.04**
Division 26 Electrical							
260150813200			Lighting fixture, maintenance, remove and replace (reinstall), incl. remove, disconnect wire terminations, store, reinstall and reconnect wire terminations	9.00	Ea.	$222.76	$2,004.84
265619209250			Roadway area luminaire, LED fixture, high power, replaces high pressure sodium 250 watt, incl lamp	9.00	Ea.	$2,303.90	$20,735.10

LineNumber			Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P

Division 26 Subtotal $22,739.94

APPENDIX F: UPCOMING EQUIPMENT PHASEOUTS

LIGHTING:

- 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.

- As of **January 1, 2012** 100 watt incandescent bulbs will be phased out in accordance with the Energy Independence and Security Act of 2007.

- Starting **July 2012** many non energy saver model T12 lamps will be phased out of production.

- As of **January 1, 2013** 75 watt incandescent bulbs will be phased out in accordance with the Energy Independence and Security Act of 2007.

- As of **January 1, 2014** 60 and 40 watt incandescent bulbs will be phased out in accordance with the Energy Independence and Security Act of 2007.

- Energy Independence and Security Act of 2007 incandescent lamp phase-out exclusions:
  1. Appliance lamp (e.g. refrigerator or oven light)
  2. Black light lamp
  3. Bug lamp
  4. Colored lamp
  5. Infrared lamp
  6. Left-hand thread lamp
  7. Marine lamp
  8. Marine signal service lamp
  9. Mine service lamp
  10. Plant light lamp
  11. Reflector lamp
  12. Rough service lamp
  13. Shatter-resistant lamp (including a shatter-proof lamp and a shatter-protected lamp)
  14. Sign service lamp
  15. Silver bowl lamp
  16. Showcase lamp
  17. 3-way incandescent lamp
  18. Traffic signal lamp
  19. Vibration service lamp
  20. Globe shaped “G” lamp (as defined in ANSI C78.20-2003 and C79.1-2002 with a diameter of 5 inches or more
  21. T shape lamp (as defined in ANSI C78.20-2003 and C79.1-2002) and that uses not more than 40 watts or has a length of more than 10 inches
  22. A B, BA, CA, F, G16-1/2, G-25, G30, S, or M-14 lamp (as defined in ANSI C79.1-2002 and ANSI C78.20-2003) of 40 watts or less
  23. Candelabra incandescent and other lights not having a medium Edison screw base.

- When installing compact fluorescent lamps (CFLs), be advised that they contain a very small amount of mercury sealed within the glass tubing and EPA guidelines concerning cleanup and safe disposal of compact fluorescent light bulbs should be followed. Additionally, all lamps to be disposed should be recycled in accordance with EPA guidelines through state or local government collection or exchange programs instead.

HCFC (Hydrochlorofluorocarbons):

- As of **January 1, 2010,** no production and no importing of R-142b and R-22, except for use in equipment manufactured before January 1, 2010, in accordance with adherence to the Montreal Protocol.

- As of **January 1, 2015,** No production and no importing of any HCFCs, except for use as refrigerants in equipment manufactured before January 1, 2010.

- As of **January 1, 2020** No production and no importing of R-142b and R-22.

APPENDIX G: THIRD PARTY ENERGY SUPPLIERS

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

Third Party Electric Suppliers for Atlantic City Electric 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
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
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com
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
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 South Jersey Gas 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
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com
Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateastern.com
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 www.intelligentenergy.org
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	(877) 750-7046 www.metromediaenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270	(800) 375-1277 www.mxenergy.com

Edison, NJ 08837	
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
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	(800) 557-1121 www.woodruffenergy.com

APPENDIX H: 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 measures (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.

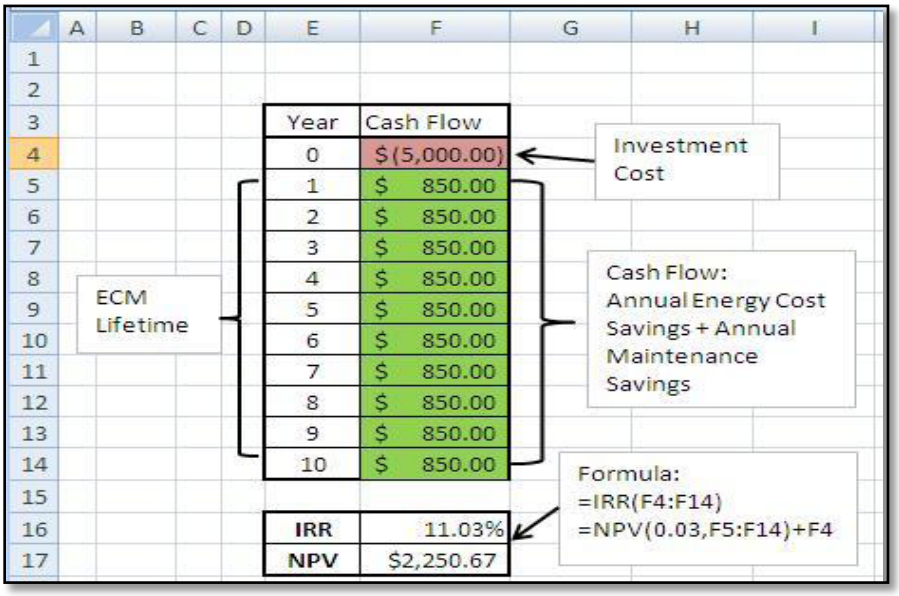
Calculation References

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:

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 Solar Renewable Energy Credits (SRECs) – Market-rate incentive. Calculations assume $608/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 + $608/Megawatt hour /1000 * 15 years]

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 Equipment Life Span

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 I: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Hurffville Elementary School

Building ID: 2844838
For 12-month Period Ending: August 31, 2011[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: February 23, 2012

Facility
Hurffville Elementary School
200 Hurffville Grenloch Road
Sewell, NJ 08080

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1957
Gross Floor Area (ft²): 65,082

Energy Performance Rating[2] (1-100) 49

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	2,208,407
Natural Gas (kBtu)[4]	2,079,034
Total Energy (kBtu)	4,287,441

Energy Intensity[4]

Site (kBtu/ft²/yr)	66
Source (kBtu/ft²/yr)	147

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	423

Electric Distribution Utility
Atlantic City Electric Co [Pepco Holdings Inc]

National Median Comparison

National Median Site EUI	66
National Median Source EUI	146
% Difference from National Median Source EUI	0%
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[5] **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. Values represent energy intensity, annualized to a 12-month period.
5. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

EPA Form 5900-16

APPENDIX J: 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. The incentives for electricity and natural gas savings will be paid based on actual savings, provided that the minimum 15% performance threshold savings has been achieved.

Energy Provider Incentives

- **South Jersey Gas** - Offers financing up to $100,000 on the customer's portion of project cost through private lender. In addition to available financing, it provides matching incentive on gas P4P incentives #2 and #3 up to $100,000 (not to exceed total project cost).

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

Direct Install 2011 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 70%** of the retrofit costs, including equipment cost and installation costs. Each project is limited to $75,000 in incentives.

Eligibility:

- Existing small and mid-sized commercial and industrial facilities with peak electrical demand **below 150 kW** within 12 months of applying (the 150 kW peak demand threshold has been waived for local government entities who receive and utilize their Energy Efficiency and Conservation Block Grant in conjunction with Direct Install)
- Must be located in New Jersey
- Must be served by one of the state's public, regulated or natural gas companies

Energy Provider Incentives

- **South Jersey Gas** – Program offers financing up to $25,000 on customer's 40% portion of the project and combines financing rate based on portion of the project devoted to gas

and electric measures. All gas measures financed at 0%, all electric measures financed at normal rate. Does not offer financing on projects that only include electric measures.
- **Atlantic City Electric –** Provides a free audit, and additional incentives up to 20% of the current incentive up to a maximum of $5,000 per customer.

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 or visit the utility web sites.

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.

Energy Provider Incentives
- **South Jersey Gas –** Program to finance projects up to $25,000 not covered by incentive
- **New Jersey Natural Gas** – Will match SSB incentives on gas equipment
  PSE&G - Provides funding for site-specific uses of emerging technology. The incentives are determined on a case by case basis.

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.

Combined Heat and Power (CHP)

Energy Provider Incentives

- South Jersey Gas - Provides additional incentive of $1.00/watt up to $1,000,000 on top of NJCEP incentive.

Utility Sponsored Programs

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

Energy Efficiency and Conservation Block Grant Rebate Program

The Energy Efficiency and Conservation Block Grant (EECBG) Rebate Program provides supplemental funding up to $20,000 for eligible New Jersey local government entities to lower the cost of installing energy conservation measures. Funding for the EECBG Rebate Program is provided through the American Recovery and Reinvestment Act (ARRA).

For the most up to date information on how to participate in this program, go to: http://njcleanenergy.com/EECBG.

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 K: ENERGY CONSERVATION MEASURES

#	ECM Description	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 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
ECM 1	Replace 23 incandescent lamps with CFLs	$215	$0	$215	2,786	0.0	0	0.1	$0	$451	5	$2,257	0.5	950%	190%	209%	$141	4,988
ECM 2	Replace 6 incandescent exit signs with new LED exit signs	$783	$60	$723	1,726	0.0	0	0.1	$0	$280	10	$2,796	2.6	287%	29%	27%	$87	3,090
ECM 3	Replace 6 MH fixtures with LEDs	$3,450	$0	$3,450	1,793	0.0	0	0.1	$317	$607	10	$6,075	5.7	76%	8%	12%	$190	3,210
ECM 4	Install 27 new occupancy sensors	$5,400	$540	$4,860	4,241	2.0	0	0.2	$0	$687	10	$6,870	7.1	41%	4%	7%	$215	7,594
CI 1	Install 10 kW Solar Photovoltaic System	$50,600	$0	$50,600	12,315	8.0	0	0.6	-$500	$3,165	25	$62,432	16.0	23%	1%	16%	$2,747	22,050
CI 2	Replace existing roof	$146,388	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CI 3	Replace existing exterior light fixtures	$76,849	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CI 4	Replace End-of-Life RTUs, AHUs and Condensers	$71,265	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CI 5	Upgrade Heat Timer Control and pneumatic system to DDC Control System	$81,798																
Totals:		**$436,748**	**$600**	**$436,148**	**22,861**	**10.0**	**0**	**1.2**	**-$183**	**$5,191**	**-**	**$80,430**	**31.8**	**-**	**-**	**-**	**-**	**40,933**

Assumptions: Discount Rate: 3.2%; Energy Price Escalation Rate: 0%
Note: A 0.0 electrical demand reduction/month indicates that it is very low/negligible

APPENDIX L: METHOD OF ANALYSIS

Assumptions and tools

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.