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

293 Route 18 South, Suite 330
East Brunswick, NJ 08816

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

April 30, 2012

Local Government Energy Program
Energy Audit Report

Washington Township Public School District

Wedgwood Elementary
236 Hurffville Road
Sewell, NJ 08080

Project Number: LGEA95

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EXECUTIVE SUMMARY

The single-story slab on grade 64,956 square feet Washington Township Wedgwood Elementary School was built in 1970. It is a square shaped building with an open courtyard in the center. The building is made up of two sections built at separate times. The front section is known as the old section, while the rear portion of the building is known at the new section which was built in 1996. This building houses elementary grade classrooms, faculty offices, a gymnasium and library. 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	550,800	23,075	$114,577	64.0	133.0	4,175
Proposed	538,471	23,075	$112,161	63.4	131.7	4,145
Savings	12,329	0	$2,415*	0.6	1.3	42
% Savings	2%	0%	2%	1%	1%	1%
Proposed Renewable Energy**	27,404	0	$7,670	1.4	4.7	94
*Includes operation and maintenance savings; **Includes SRECS						

SWA has entered energy information about the Wedgwood 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 61 and a Site Energy Utilization of 64 kBtu/sqft/yr. This score should be investigated further as there were several estimated utility bills that do not appear to be accurate.

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

Measures	First Year Savings ($)	Initial Investment ($)	Simple Payback Period	CO2 Savings (lbs/yr)
ECMs	$2,415	$16,442	6.8	22,075
Capital Improvements	$0	$735,000	0.0	0
Proposed Renewable Energy	$7,670	$135,000	17.6	49,068
Total	**$10,075**	**$886,442**	**88.0**	**71,143**

In addition to these ECMs, SWA recommends:

- Capital Improvement opportunities – measures that would contribute to reducing energy usage but not require significant capital resources as well as long-term financial planning

    - CI #1 – Install 22.5 kW Solar Photovoltaic system - $135,000
    - CI #2 – Replace existing roof on both Newer and Older building sections - $181,844
    - CI #3 – Replace existing exterior light fixtures - $44,545
    - CI #4 – Replace End-of-Life RTUs and Condensing Units - $232,448
    - CI #5 – Upgrade Heat Timer Control and pneumatic system to DDC Control System - $50,751
    - CI #6 – Replace End-Of-Life American Standard – Kewanee Boiler - $91,237
    - CI #7 – Replace broken glass block windows - $928
    - CI #8 – Replace existing windows with Energy Star® certified windows - $123,247

- Operation and Maintenance (O&M) measures that would contribute to reducing energy usage at low cost - no cost:

    - Calibrate humidity sensors twice per year
    - 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 $606 higher, when compared to the average estimated NJ commercial utility rates. SWA recommends further evaluation with energy suppliers, listed in Appendix K.

Environmental Benefits

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 6 cars from the roads each year or is equivalent of planting 173 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 5 incandescent lamps with CFLs	Direct Install
Replace 15 MH fixtures with LEDs	Direct Install, Smart Start
Replace 19 old LED Exit signs	Direct Install, Smart Start
Install 26 new occupancy sensors	Smart Start

Install 22.5 kW Solar Photovoltaic System	NJ SREC proram

Appendix L 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 Wedgwood Elementary School at 236 Hurffville 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 Wedgwood Elementary facility.

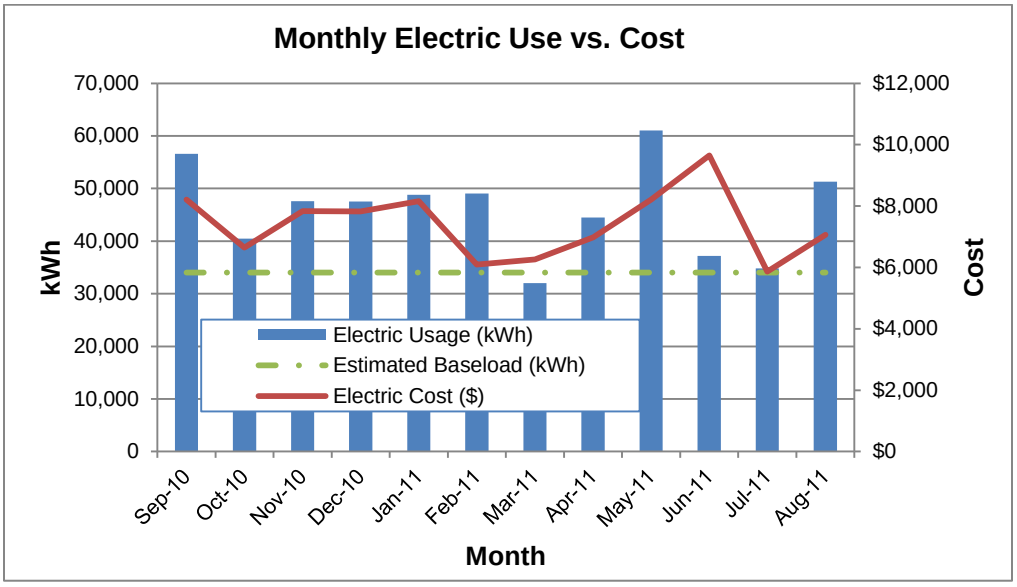
HISTORICAL ENERGY CONSUMPTION

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 Wedgwood 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.

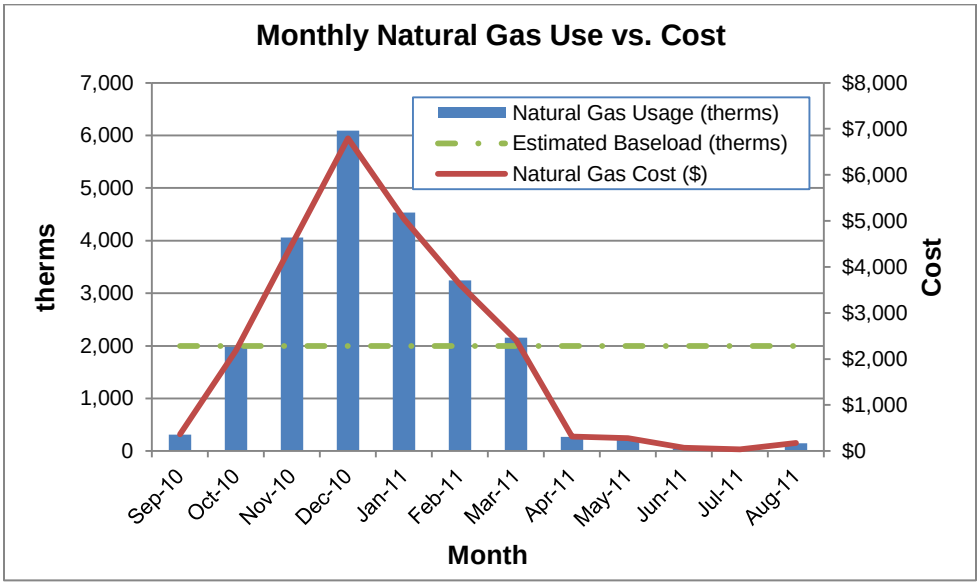
Electricity – Wedgwood Elementary is currently served by one electric meter. The school currently purchases electricity from Atlantic City Electric which is responsible for transmission and distribution and from South Jersey Electric which acts as a third party energy supplier. Electricity was purchased at an average aggregated rate of $0.161/kWh and the school consumed approximately 550,800 kWh, or $88,790 worth of electricity, in the previous year. The annual monthly peak demand was 315.2 kW, while the average monthly demand was 270.4 kW.

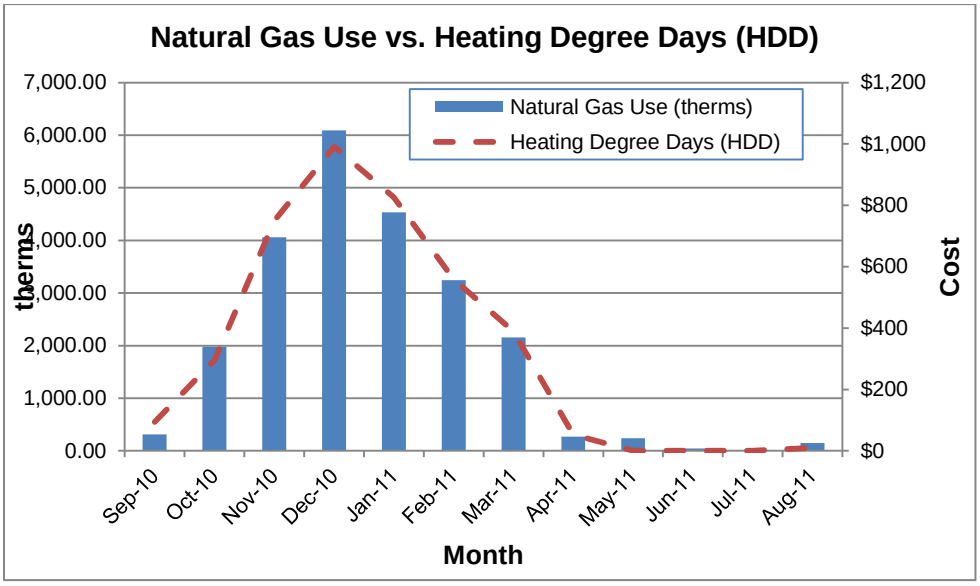
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate Wedgwood Elementary school. The baseline usage for the Elementary School is approximately 34,000 kWh. As expected usage peaks in the May, while the building is using cooling and school is still in session. The utility bills received from Atlantic City Electric showed several months of estimated bills that were later rectified. The amount of electricity shown in the electric bills varies and fluctuates more than expected. 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 every month instead of estimating most bills.



Natural gas – Wedgwood 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 $1.118/therm and the school consumed approximately 23,075 therms, or $25,786 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 Wedgwood Elementary School during the heating season. The non-heating gas baseload for the Elementary School is approximately 2,000 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.

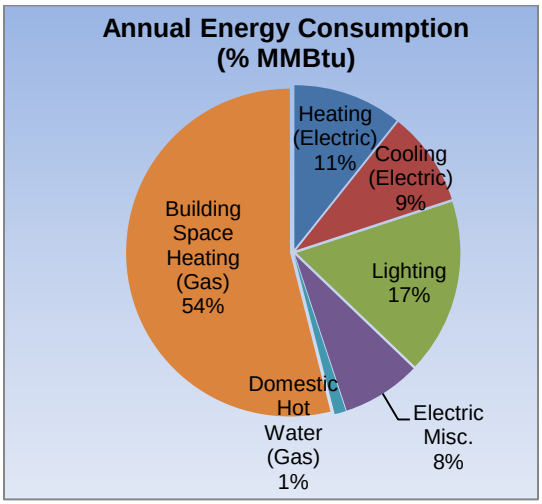


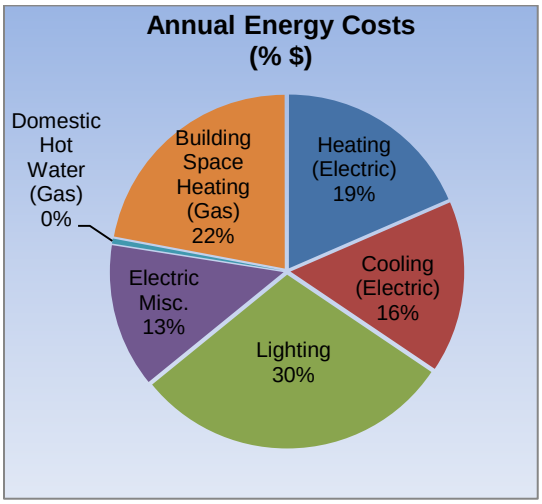


The chart above shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the base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

The following graphs, pie charts, and table show energy use for Wedgwood Elementary School based on utility bills for the 12 month period. Note: electrical cost at $47/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)	448	11%	$21,185	18%	$47
Cooling (Electric)	387	9%	$18,277	16%	$47
Lighting	720	17%	$34,025	30%	$47
Electric Misc.	324	8%	$15,303	13%	$47
Domestic Hot Water (Gas)	48	1%	$536	0%	$11
Building Space Heating (Gas)	2,259	54%	$25,250	22%	$11
Totals	4,187	100%	$114,577	100%	-
Total Electric Usage	1,879	45%	$88,790	77%	$47
Total Gas Usage	2,307	55%	$25,786	23%	$11
Totals	4,187	100%	$114,577	100%	-





Energy Benchmarking

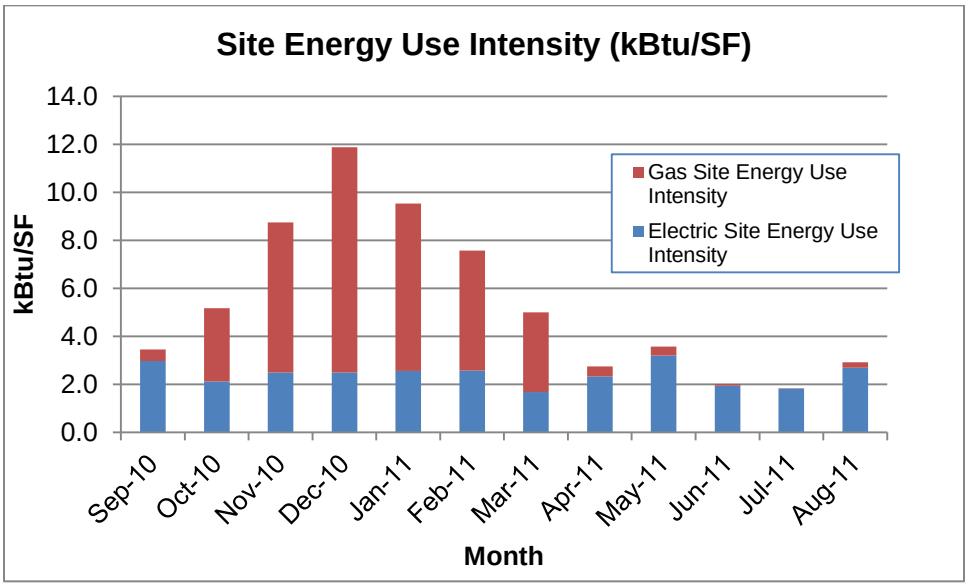
SWA has entered energy information about Wedgwood Elementary School in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager energy benchmarking system. This school facility is categorized as a "K-12 School" space type. Based on the data entered into the Portfolio Manager software, the building has an Energy Performance Rating of 61 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.

A score of 61 is higher than expected for Wedgwood Elementary school. In comparison with other schools of similar size and operation in the Washington Township school district, this score is likely higher than actual score. Utility bills received from Atlantic City Electric showed

many fluctuations due to estimated readings and it is possible that they show incorrect values for electric use. SWA recommends that Washington Township track utility bills on a monthly basis and contact Atlantic City Electric whenever there are anomalies in the utility bills due to estimated readings.

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 61 shows the building is 10% below the national average.

The Site Energy Use Intensity is 64 kBtu/sqft/yr compared to the national average of a “K-12 School" building consuming 71 kBtu/sqft/yr. This is a 10% difference between the buildings intensity and 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 Wedgwood 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

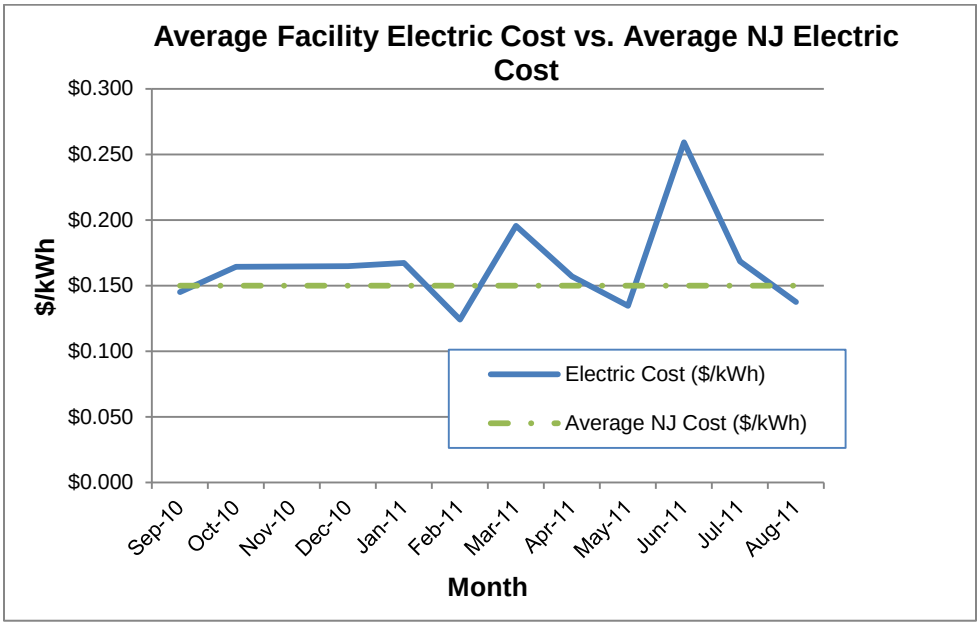
increase during winter months since large volumes of natural gas is needed for heating equipment. Similarly, electricity prices often increase during the summer months when additional electricity is needed for cooling equipment.

As part of the utility bill analysis, SWA evaluated the current utility rates and tariffs for the Township of Washington. Wedgwood 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

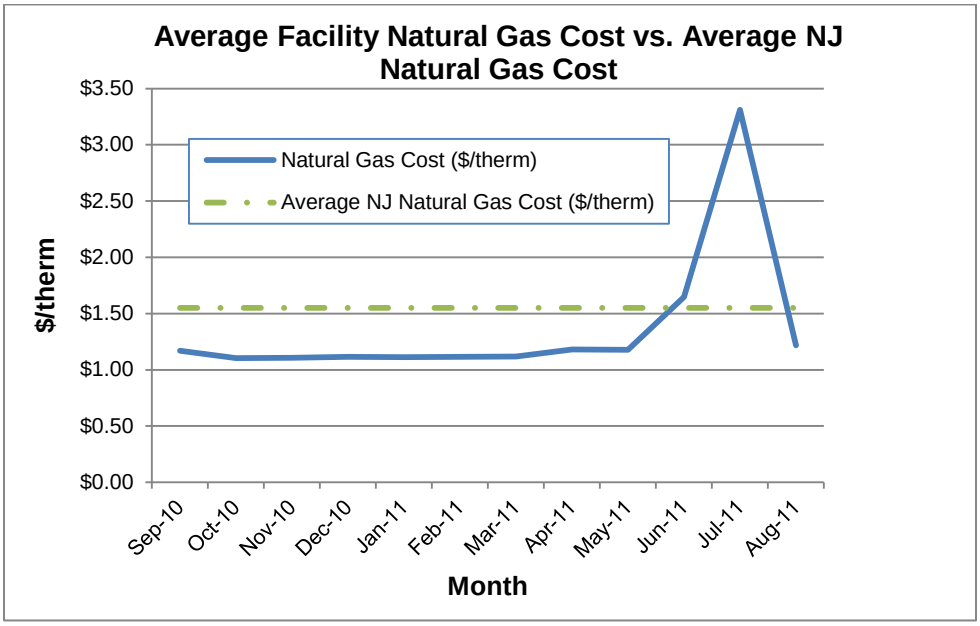
Billing analysis was conducted using an average aggregated rate which is estimated based on the total cost divided by the total energy usage for each utility over a 12 month period. Average aggregated rates do not separate demand charges from usage, and instead provide a metric of inclusive cost per 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 Wedgwood Elementary School pays a rate of $0.161/kWh. Wedgwood Elementary School annual electric utility costs are $606 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 58% 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 Wedgwood Elementary School pays a rate of $1.118/therm. Natural gas bill analysis shows fluctuations up to 7% 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 Wedgwood 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 Wedgwood Elementary School. Appendix H 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 Monday, January 10, 2012, the following data was collected and analyzed.

Building Characteristics

The single-story slab on grade 64,956 square feet Washington Township Wedgwood Elementary School was built in 1970. It is a square shaped building with an open courtyard in the center. The building is made up of two sections built at separate times. The front section is known as the old section, while the rear portion of the building is known at the new section which was built in 1996. This building houses elementary grade classrooms, faculty offices, a gymnasium and library.

North Façade

East Façade

South Façade

West Façade

Building Occupancy Profiles

The school's occupancy is approximately 520 students from 9:30 AM to 3:30 PM Monday through Friday, 55 teachers, and 32 faculty and 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.

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 an unconfirmed level of detectable insulation. The interior is predominantly painted CMU (Concrete Masonry Units). Other interior walls are finished painted gypsum wallboard.

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 age appropriate condition with some 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 beneath window sill indicates moisture in the wall and uncontrolled roof run-off due to defective/clogged gutters and downspouts

Roof

The building's roof is predominantly a flat and parapet type over steel decking, with a dark-colored EPDM single membrane from Simplast and Carlisle. It is unknown when the roof above the old section was installed; however the warranty has expired in 2000. The roof above the new section is scheduled to be replaced in 2012.

Note: Roof insulation levels for the old building could not be visually 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 fair condition, with a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues on any roof areas.

The following specific roof problem spots were identified:

Pooling/standing water and roof debris

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 building contains several different types of windows:

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

2. Glass blocks type windows with no interior or exterior shading devices. The windows are located in the gymnasium.

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 fair age appropriate 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 single-hung type window with a non-insulated frame(L) and broken glass block windows in gymnasium(R)

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. Insulated vinyl exterior doors with single-pane windows. 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:

Single-pane glass panels on doors have poor insulating properties and deteriorating weather-stripping allows warm air to escape in the winter and warm air to enter in the summer

Building air-tightness

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

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

Mechanical Systems

Heating Ventilation Air Conditioning

All spaces in Wedgwood Elementary School are mechanically ventilated, heated and cooled. The school contains two separate hot water loops in the building for heating that are fed from two separate systems. The school contains two distinct zones for heating in the building; the Older section (front) and the Newer section (Back). The Front and Back portions of the school are served by individual heating plants. 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 – Wedgwood Elementary School is heated by two independent heating plants that provide heating hot water to unit ventilators, baseboard heaters and heating coils located in rooftop packaged units throughout the building. The older section of the building is served by a 1970 American Standard - Kewanee scotch marine boiler with a total heating output of 5,231 MBH and a nameplate thermal efficiency of 80%. The newer section of the building is served by 3 Weil McLain (Model #PFG-8-PIN) atmospheric boilers piped in parallel. Each Weil-McLain boiler was installed at the time of the addition in 1996. Each boiler has a heating output of 346 MBH for a combined heating plant capacity of 1,038 MBH and a nameplate thermal efficiency of 81%.

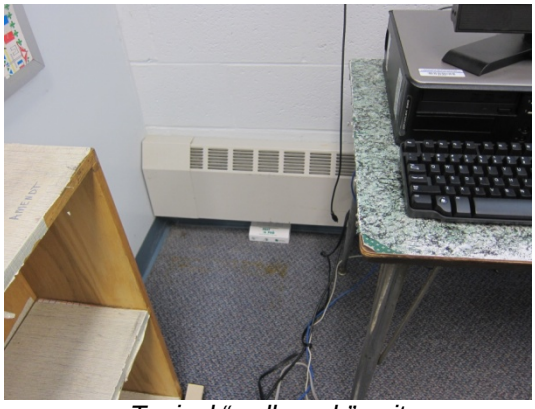
American Standard - Kewanee boiler – old section (L); 3 Weil-McLain boilers – new section (R)

Hot water is circulated through the building via two separate hot water loops; one for each heating plant. Both hot water loops are constant flow. The newer section contains two 3 HP motors (Emerson) to circulate heating hot water through the back section of the building. The first 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.

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 as gravity relief ventilators located on the roof directly above corridors.

Typical rooftop unit (L); View of typical rooftop condensers for unit ventilators (R)

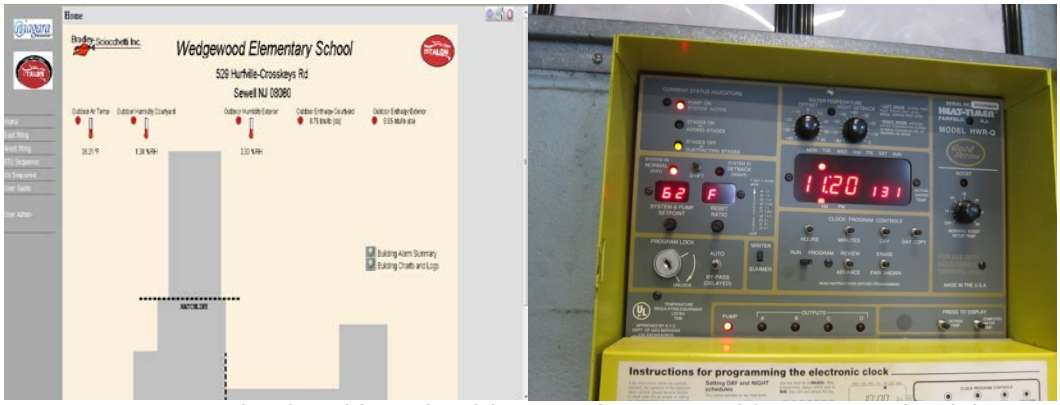
All perimeter classrooms have either unit ventilators or baseboard “wall wash” units. Classrooms and special rooms that do not contain unit ventilators are heated using baseboard heating as well as rooftop units.



Typical “wall wash” unit

Controls

Building equipment including the American Standard - Kewanee boiler, rooftop units and exhaust fans in the older section of the building are controlled centrally via the Niagara Talon BMS system. The newer section of the building was built and not tied into the central control system. Instead, the newer section was built with pneumatic actuators and tied to a central compressor and controlled primarily by a Heat-Timer controller. The Heat-Timer also controls hot water supply temperature via control logic based on outside air temperature and hot water return temperature. Both heating systems have an outside air temperature cutoff of 60°F to ensure heating does not occur above this outside air temperature.



BMS Screenshot for Old Section (L); Heat-Timer Control for New Section (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.

Unit ventilators and packaged units connected to the Niagara BMS system are equipped with more rigorous controls. These units contain additional controls that allow for economizer mode based on outside air temperature and enthalpy. The building has one temperature and humidity sensor mounted outside the boiler room as well as a humidity sensor mounted in the courtyard. The humidity sensors allow the building to read enthalpy at the perimeter of the building as well as the courtyard.

All BMS-connected units are equipped with both a warm-up and cool-down mode to pre-condition the spaced using return air while the building is not occupied. The BMS ensures that minimum ventilation requirements are met during occupied mode and closes outside air dampers and disables interconnected exhaust fans when the building is in unoccupied mode. In unoccupied mode, teachers and staff can press a manual override switch to allow units to turn on for a maximum of 2 hours if required.

Rooftop units monitor return air humidity and control humidity in the space via reheat coils. Valves located in the units allow both hot water reheated as well as refrigerant to flow in the

reheat coils to dehumidify. Rooftop units have an unoccupied setback of 85°F during the cooling season and 55°F during the heating season, with night cycling.

The All-Purpose room is served by four rooftop packaged units that are manually operated and not tied into either control system. These units are operated during school hours only and provide heating, cooling and ventilation to the All-Purpose room.

Domestic Hot Water

Wedgwood Elementary 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.

Lochinvar Condensing DHW heater

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 Wedgwood Elementary School is electronically ballasted T8 lamped fixtures. The hallways currently have T8 u-shaped lamps, while the classrooms have suspended linear T8 fixtures. Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas.

Typical interior linear and u-shaped T8 fixtures

Exit Lights - Exit signs were found to be LED types, however many were found to be an older LED type.

Typical old LED exit sign

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a combination of high pressure sodium, and CFL and incandescent lamped fixtures. Exterior lighting is controlled by both photocells and timers.

Typical recessed CFL and high pressure sodium wall pack fixtures. Note: The fixture on the left is operating during daytime hours due to incorrect time clocks

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.

Installed at Wedgwood Elementary School are two refrigerators, a beverage vending machine, several compact refrigerators and a walk-in freezer.

Typical refrigerators and beverage vending machine

Small walk-in freezer

Elevators

Wedgwood 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 Wedgwood Elementary School other than a 25 kW natural gas Onan Emergency Generator located in the boiler room. This Onan emergency generator is operated once per week as a functional test for 30 minutes.

25 kW natural gas generator

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 Wedgwood Elementary facility is a good candidate for a 22.5 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

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

Geothermal

Wedgwood 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

Wedgwood 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 5 incandescent lamps with CFLs
ECM 2	Replace existing high bay metal halide lighting fixtures with 15 new LED fixtures
ECM 3	Replace 19 old LED Exit Signs with Newer LED Exit Signs
ECM 4	Install 26 new occupancy sensors
	Capital Improvement Measures
CI 1	Install 22.5 kW Solar Photovoltaic system
CI 2	Replace existing roof on both Newer and Older building sections
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
CI 6	Replace End-Of-Life American Standard - Kewanee Boiler
CI 7	Replace broken glass block windows
CI 8	Replace existing windows with Energy Star certified windows

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 5 incandescent lamps with CFLs

On the day of the site visit, SWA completed a lighting inventory of the Wedgwood Elementary School (see Appendix C). The existing lighting inventory contained a total of five 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: $57 (includes $20 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
$57	540	0.0	0	0.0	$0	$87	5	$435	0.7	664%	133%	151%	$27	967

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 K for more information on Incentive Programs.

ECM #2: Replace existing high bay metal halide lighting fixtures with fifteen new LED fixtures

On the day of the site visit, SWA completed a lighting inventory of Wedgwood Elementary School (see Appendix C). The gymnasium 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. Additionally, because of the higher light output the gymnasium may require less fixtures, thus reducing the initial cost and improving the simple payback compared to the numbers below. The labor for the recommended installations is assumed to be performed by in-house electricians.

*It is important to note that further savings maybe achieved if the number of fixtures can be reduced based on the light quality of the LED fixtures. Washington Township Board of Education removed 15 MH light fixtures in a similar-sized gym at Hurffville Elementary School and were able to install only 9 LED fixtures and achieve the same light quality.

Installation cost:

Estimated installed cost: $7,875
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
$7,875	4,916	1.0	0	0.3	$375	$1,167	15	$17,512	6.7	122%	8%	8%	$365	8,802

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 K for more information on Incentive Programs.

ECM #3: Replace 19 old LED Exit Signs with Newer LED Exit Signs

During the field audit, SWA completed a building lighting inventory (see Appendix C). SWA observed that the building contains a number of old LED Exit signs. SWA recommends replacing these with newer low wattage LED types. Replacing existing Exit signs with newer LED Exit signs can result in lower kilowatt-hour consumption, as well as lower maintenance costs. Since Exit signs operate 24 hours per day, they can consume large amounts of energy. In addition, older Exit signs require frequent maintenance due to the short life span of the lamps that light them. LED Exit signs last at least 5 years. In addition, LED Exit signs offer better fire code compliance because they are maintenance free in excess of 10 years. LED Exit signs are usually brighter than comparable incandescent or fluorescent signs, and have a greater contrast with their background due to the monochromatic nature of the light that LEDs emit. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $2,670 (includes $880 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
$2,670	3,662	1.0	0	0.2	$53	$643	15	$9,650	4.2	261%	17%	23%	$201	6,557

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 – Smart Start - $20 per fixture
- NJ Clean Energy – Direct Install (Up to 70% of installed cost)

Please see APPENDIX K for more information on Incentive Programs.

ECM #4: Install 26 new occupancy sensors

On the days of the site visits, SWA completed a lighting inventory of Wedgwood 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: $4,940 (includes $1,640 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
$4,940	3,211	0.0	0	0.2	$0	$518	10	$5,176	9.5	5%	0%	1%	$162	5,749

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: $520.
- NJ Clean Energy – Direct Install (Up to 70% of installed costs)

Please see APPENDIX K for more information on Incentive Programs.

CI #1: Install 22.5 kW Solar Photovoltaic system

Currently, Wedgwood 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 22.5 kW system needs approximately 98 panels which would take up 1,715 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.

A Solar PV system, while providing revenue from the generation of electricity, would not be justified by energy savings alone. Extensive capital planning is required to implement a successful Solar PV system. Revenue generated from the sale of SRECs is not guaranteed and the value of SRECs is determined by a high fluctuating and unpredictable SREC market.

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

Installation cost:
Net estimated installed cost: $135,000 (includes $101,250 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
$135,000	27,404	18.0	0	1.4	-$500	$7,670	25	$154,177	17.6	14%	1%	1%	-$24,147	49,067

Annual Solar PV Financial Breakdown						
Rated Capacity (kW)		22.54	SRECs are earned for the first 15 years of Solar PV lifetime only			
Rated Capacity (kWh)		27,404.00				
Annual Capacity Loss		0%				
Electric Cost ($/kWh)		$0.161				
SRECs Value ($/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	27,404	$4,412	27	$3,758	($500)	$7,670
2	27,404	$4,412	27	$3,758	($500)	$7,670
3	27,404	$4,412	27	$3,758	($500)	$7,670
4	27,404	$4,412	27	$3,758	($500)	$7,670
5	27,404	$4,412	27	$3,758	($500)	$7,670
6	27,404	$4,412	27	$3,758	($500)	$7,670
7	27,404	$4,412	27	$3,758	($500)	$7,670
8	27,404	$4,412	27	$3,758	($500)	$7,670
9	27,404	$4,412	27	$3,758	($500)	$7,670
10	27,404	$4,412	27	$3,758	($500)	$7,670
11	27,404	$4,412	27	$3,758	($500)	$7,670
12	27,404	$4,412	27	$3,758	($500)	$7,670
13	27,404	$4,412	27	$3,758	($500)	$7,670
14	27,404	$4,412	27	$3,758	($500)	$7,670
15	27,404	$4,412	27	$3,758	($500)	$7,670
16	27,404	$4,412	0	$0	($500)	$3,912
17	27,404	$4,412	0	$0	($500)	$3,912
18	27,404	$4,412	0	$0	($500)	$3,912
19	27,404	$4,412	0	$0	($500)	$3,912
20	27,404	$4,412	0	$0	($500)	$3,912
21	27,404	$4,412	0	$0	($500)	$3,912
22	27,404	$4,412	0	$0	($500)	$3,912
23	27,404	$4,412	0	$0	($500)	$3,912
24	27,404	$4,412	0	$0	($500)	$3,912
25	27,404	$4,412	0	$0	($500)	$3,912
TOTAL	**685,100**	**110,301**	**405**	**$56,376**	**-$192,500**	**-$25,823**

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. SRECs are currently evaluated 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 22.5 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 $3,758/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 K for more information on Incentive Programs.

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

Both the newer and older sections of the school roof contain an EPDM rubber type roof surface. Based on maintenance records, this roof surface is beyond the manufacturer's warranty 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 cost this measure will not be justified based on energy savings alone. SWA estimates the roof replacements to cost $181,844 based on the total footprint of 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 by energy savings alone at this time. The project is estimated to cost $44,545 to replace the existing wall pack, wall-mounted and parking lot pole-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 36 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 as part of the addition in 1996 or replaced at the same time as the addition. 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. The units recommended for replacement are currently operating beyond their useful lifetime and although they are operating beyond their useful lifetime, the units have not failed and are still operable. Due to the current state of operation and the high capital cost, this measure is not justified based on energy savings alone. Implementation costs and units to be replaced are presented below:

Replacement Component	Installed Cost
Replacement of two 3 ton RTUs	$16,738
Replacement of nine 4 ton RTUs	$65,350
Replacement of two 5 ton RTUs	$16,526
Replacement of three 7.5 ton RTUs	$34,754
Replacement of two 10 ton RTUs	$42,677
Replacement of three 3 ton condensing units	$8,255
Replacement of fifteen 3.5 ton condensing units	$48,148
Total Replacement Costs	**$232,448**

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 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. This measure has the potential to provide a framework for future energy savings; however, more planning is needed and the savings are not quantifiable at this point in time. 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. Implementation costs are presented below:

Replacement Component	Installed Cost
Installation of Controller MUX panel with 128 point input	$8,262
Installation of 34 space temperature sensors	$25,757
Installation of 15 duct temperature sensors	$7,069
Installation of 15 duct static pressure sensors	$9,663
Total Replacement Costs	**$50,751**

CI #6: Replace End-Of-Life American Standard - Kewanee Boiler

The original section of the school is heated by the original 1970 Kewanee boiler with 5,231 MBH. Although this boiler has been well maintained, it is operating well beyond its useful lifetime and is recommended to be replaced. The Kewanee boiler has a nameplate thermal efficiency of 80%. SWA recommends replacing this boiler with two smaller cast iron boilers in order to allow for more modulation. Installing two boilers piped in parallel will provide energy savings by having the capability to meet the demand of the building during a large amount of operational hours by a single boiler. On design heating days when the temperature is extreme, both boilers will work in tandem to meet the heating load of the building. In addition to energy savings, there may be an opportunity to meet the heating load of the building. In addition to energy savings, there may be an opportunity to reduce maintenance costs based on code requirements for the building to maintain an operating engineer based on the size of the original boiler. Two boilers in parallel will also provide redundancy for the system in case partial heating is required at the same time as maintenance on one of the boilers. This measure is recommended as a capital improvement due to the high installation costs and the recommendation of a heating plant with similar thermal efficiency. SWA reviewed the option of installing a condensing boiler; however, additional energy savings are not substantial based on the amount of actual time that the unit would spend in condensing mode. The estimated installed costs to install 2 new boilers with a total capacity the same or similar to the existing American Standard - Kewanee boiler is $91,237.

CI #7: Replace broken glass block windows

The windows in the gymnasium are made up of glass block masonry. During the site visit, SWA found a set of glass blocks that were broken. The broken glass blocks compromise the thermal properties of that wall section, thus allowing some heat to escape in the winter and allowing heat to transfer during the summer. SWA recommends replacing these glass blocks. This measure will result in energy savings that are not quantifiable. The project is estimated to cost $928.

CI #8: Replace existing windows with Energy Star certified windows

The entire building is currently outfitted with windows that have double glazing and a low-E coating. Although these characteristics provide good thermal insulation and solar radiation performance, the windows still have non-insulated aluminum frames, which permit heat loss in the winter and heat gain in the summer. SWA recommends replacing the windows with double or triple glazing, low-E coating and an insulated frame, which may reduce the heating and cooling load. The replacement of these windows will have a substantial impact on energy savings; however, savings cannot be quantified at this time. Replacing the windows has a high installation cost and requires intensive

capital planning. Ideally the windows should be Energy Star certified, which meets strict requirements for energy saving performance. The project is estimated to cost $123,247.

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.

- Calibrate humidity sensors twice per year – There are two humidity sensors installed for the building; one on the exterior near the boiler room and one in the courtyard. The current Niagara Talon control system uses these sensors to calculated enthalpy that drives several parts of the control logic for rooftop units and unit ventilators. SWA recommends calibrating these sensors to ensure the accuracy of the control system. Humidity sensors are sensitive and are susceptible to changes in the way that they measure relative humidity. Small changes in humidity readings can result in a significant impact on energy use when control logic is based on enthalpy.

- Check and adjust timers and time clocks monthly – During the site visit, several exterior lights were observed to be left on during the day due to incorrect timer settings. In addition to exterior lights, several time clocks that control HVAC equipment were also 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-4; American Standard - Kewanee Boiler, 5,231 MBH input, 80% nameplate thermal efficiency	American Standard-Kewanee, NJ #000003448H, Serial #71-2839-H	Natural Gas	Boiler Room	Older Section (Front)	1970	25	0%
Heating	PowerFlame burner attached to B-4, 5,231 MBH max input	PowerFlame, Model #C4-G-25, Serial #079990470	Natural Gas	Boiler Room	Older Section (Front)	1970	25	0%
Heating	B-1; Weil-McLain boiler, 427,000 Btuh input, 346,000 Btuh output, 81% thermal efficiency	Weil-McLain, Model #PFG-8-PIN	Natural Gas	Boiler Room	Newer Section (Back)	1996	25	36%
Heating	B-2; Weil-McLain boiler, 427,000 Btuh input, 346,000 Btuh output, 81% thermal efficiency	Weil-McLain, Model #PFG-8-PIN	Natural Gas	Boiler Room	Newer Section (Back)	1996	25	36%
Heating	B-3; Weil-McLain boiler, 427,000 Btuh input, 346,000 Btuh output, 81% thermal efficiency	Weil-McLain, Model #PFG-8-PIN	Natural Gas	Boiler Room	Newer Section (Back)	1996	25	36%
Domestic Hot Water	Lochinvar condensing domestic hot water heater, 199,999 btuh input, 96% thermal efficiency, 93 gallons, 232 gallosn recovery	Lochinvar Shield, Model #SNR200-100, Serial #K10C20022557, Control #M-9	Natural Gas	Boiler Room	All Sections	2010	10	80%
Generator	Onan generator, 25 kW	Onan, Model #45.OEM/15R/91440, Serial #0670217659	Natural Gas	Boiler Room	All Sections	1970	30	0%
Heating	Heat-Timer Controller	Heat-Timer, Model #HWR-Q Gold Series	Electricity	Boiler Room	Newer Section (Back)	1996	25	36%
Refrigeration	Howard walk-in freezer	Howard, Model #T-280	Electricity	Kitchen	Kitchen	2004	15	47%
HVAC	AHU-14; Trane rooftop packaged rooftop unit, larger model, nameplate covered	Trane, Model #N/A	HW/ Electricity	Rooftop	Room #45	1996	15	0%
HVAC	AHU-13; Trane packaged rooftop unit, 10 tons, 2 compressors, R-22	Trane, Model #TCD120C30AAA, Serial #L43101581D	HW/ Electricity	Rooftop	Room #43	1996	15	0%
HVAC	AHU-12; Trane packaged rooftop unit, 5 tons, 1 compressor, R-22	Trane, Model #TC060C30AAA, Serial #L43101481D	HW/ Electricity	Rooftop	Room #41	1996	15	0%

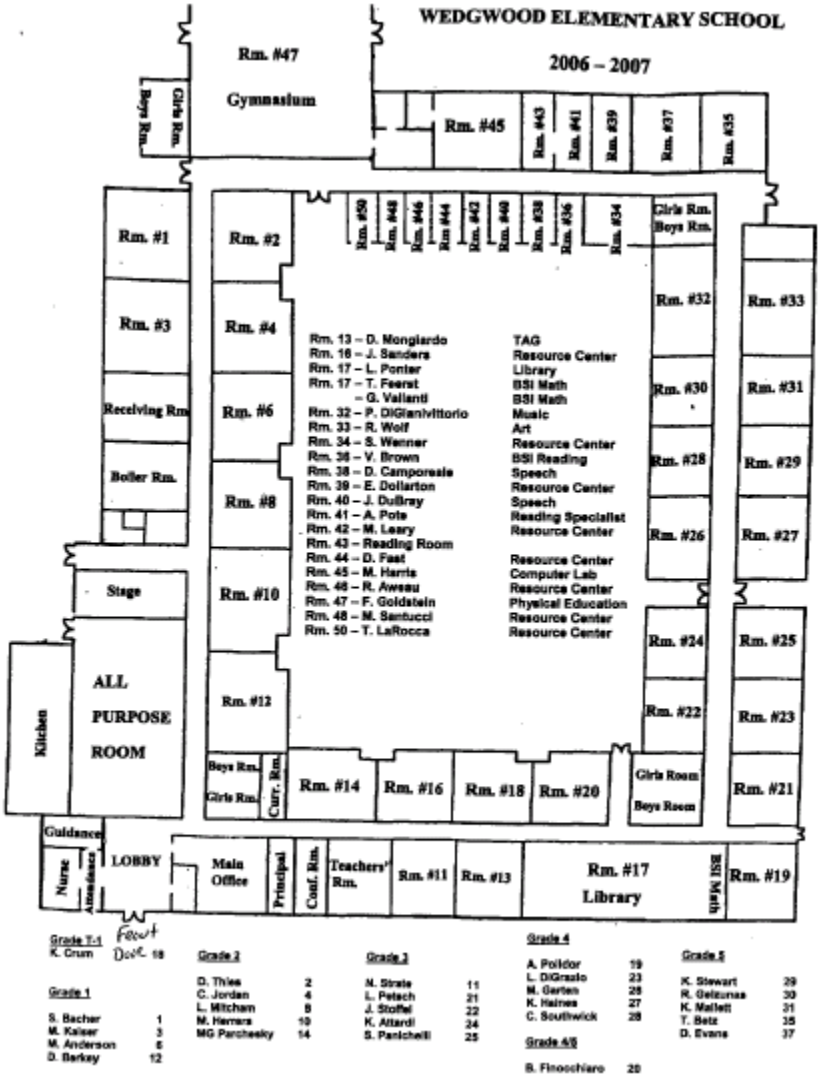
HVAC	AHU-11; Trane packaged rooftop unit, 3 tons, 1 compressor, R-22	Trane, Model #TCD036C30AAA, Serial #L43101431D	HW/ Electricity	Rooftop	Room #39	1996	15	0%
HVAC	AHU-10; Trane packaged rooftop unit, 4 tons, 1 compressor, R-22	Trane, Model #TCD048C30AAA, Serial #L43101434D	HW/ Electricity	Rooftop	Room #37	1996	15	0%
HVAC	AHU-9; Trane package rooftop unit, 4 tons, 1 compressor, R-22	Trane, Model #TCD048C30AAA, Serial #L431043XXX	HW/ Electricity	Rooftop	Room #35	1996	15	0%
HVAC	AHU-8; Trane packaged rooftop unit, 5 tons, 1 compressor, R-22	Trane, Model #TCD060C30AAA, Serial #L431XXXX	HW/ Electricity	Rooftop	Room #32	1996	15	0%
HVAC	AHU-7; Trane packaged rooftop unit, 4 tons, 1 compressor, R-22	Trane, Model #TCD048C30AA, Serial #L43101XXX	HW/ Electricity	Rooftop	Room #33	1996	15	0%
HVAC	AHU-6; Trane packaged rooftop unit, 4 tons, 1 compressor, R-22	Trane, Model #TCD048C30AA, Serial #L43101XXX	HW/ Electricity	Rooftop	Room #30	1996	15	0%
HVAC	AHU-5; Trane packaged rooftop unit, 4 tons, 1 compressor, R-22	Trane, Model #TCD048C30AA, Serial #L43101437D	HW/ Electricity	Rooftop	Room #31	1996	15	0%
HVAC	AHU-4; Trane packaged rooftop unit, 4 tons, 1 compressor, R-22	Trane, Model #TCD048C30AA, Serial #L43101435D	HW/ Electricity	Rooftop	Room #28	1996	15	0%
HVAC	AHU-3; Trane packaged rooftop unit, 4 tons, 1 compressor, R-22	Trane, Model #TCD048C30AA, Serial #L4310143XX	HW/ Electricity	Rooftop	Room #29	1996	15	0%
HVAC	AHU-2; Trane packaged rooftop unit, 4 tons, 1 compressor, R-22	Trane, Model #TCD048C30ABC, Serial #L43101438D	HW/ Electricity	Rooftop	Room #26	1996	15	0%
HVAC	AHU-1; Trane packaged rooftop unit, 4 tons, 1 compressor, R-22	Trane, Model #TCD048C30AA, Serial #L4310144XX	HW/ Electricity	Rooftop	Room #27	1996	15	0%
HVAC	RTU-2; York packaged rooftop unit, 5 tons, 1 compressor, R-22	York, Model #DR060C00P4TZZ20001A, Serial #N0F6541530	HW/ Electricity	Rooftop	All Purpose Room	2006	15	60%
HVAC	York packaged rooftop unit, older, 7.5 tons, 2 compressors, R-22	York, Model #D2CE090A25B, Serial #NHAM147417	HW/ Electricity	Rooftop	All Purpose Room	1973	15	0%
HVAC	York packaged rooftop unit, older, 7.5 tons, 2 compressors, R-22	York, Model #D2CE090A25B, Serial #NHAM147428	HW/ Electricity	Rooftop	All Purpose Room	1973	15	0%
HVAC	AHU-17; York packaged rooftop unit, 7.5 tons, 2 compressors, R-22	York, Model #D2CE090A25B, Serial #NA	HW/ Electricity	Rooftop	All Purpose Room	1973	15	0%
HVAC	Carrier packaged rooftop unit, 3 tons, 1 compressor, R-22	Carrier, Model #50TJ-004---501GA, Serial #2894G20214	HW/ Electricity	Rooftop	All Purpose Room	1994	15	0%
Cooling	CU-3; York condensing unit, 1 compressor, R-22, 3.5 tons	York, Model #H1RA042S46G, Serial #W0C6087796	Electricity	Rooftop	Stage	1996	15	0%

HVAC	RTU-3; York packaged rooftop unit, 5 tons, 1 compressor, R-22	York, Model #DR060C00P4TZZ20001A, Serial #N0F6541529	HW/ Electricity	Rooftop	Stage	2006	15	60%
Cooling	CU-4; York condensing unit, 3.5 tons, R-22, 1 compressor	York, Model #H1RA042S46G, Serial #W0C6087795	Electricity	Rooftop	Room #12	1995	15	0%
HVAC	RTU-4; York packaged rooftop unit, 5 tons, 1 compressor, R-22	York, Model #DR060C00P4TZZ20001A, Serial #N0F6541528	HW/ Electricity	Rooftop	Kitchen	2006	15	60%
Cooling	CU-17; York condensing unit, 3.5 tons, 1 compressor, R-22	York, Model #H1RA042S46G, Serial #W0C6087802	Electricity	Rooftop	Main Office	1996	15	0%
Cooling	CU-13; York condensing unit, 3 tons, 1 compressor, R-22	York, Model #H1RA036S46G, Serial #W0F6421400	Electricity	Rooftop	Teacher's Room	1996	15	0%
Cooling	CU-16; York condensing unit, 3.5 tons, 1 compressor, R-22	York, Model #H1RA042S46G, Serial #W0C6087800	Electricity	Rooftop	Room #14	1996	15	0%
Cooling	CU-14; York condensing unit, 3 tons, 1 compressor, R-22	York, Model #H1RA036S46G, Serial #W0F6421401	Electricity	Rooftop	Room #16	1996	15	0%
Cooling	CU-15; York condensing unit, 3.5 tons, 1 compressor, R-22	York, Model #H1RA042S46G, Serial #W0C6087797	Electricity	Rooftop	Room #18	1996	15	0%
Cooling	York condensing unit, 3.5 tons, 1 compressor, R-22	York, Model #H1RA042S46G, Serial #W0C6087794	Electricity	Rooftop	Library	1996	15	0%
Cooling	EMI split condensing unit, 1 ton, 1 compressor, R-22	EMI, Model #S1HA9000010, Serial #1-06-2690-15	Electricity	Rooftop	Library	2006	15	60%
Cooling	CU-9; York condensing unit, 3 tons, 1 compressor, R-22	York, Model #H1RA036S46G, Serial #W0F6421402	Electricity	Rooftop	Library	1996	15	0%
HVAC	RTU-1; York packaged rooftop unit, 5 tons, 1 compressor, R-22	York, Model #DR060C00P4TZZ20001A, Serial #N0F6494132	HW/ Electricity	Rooftop	Corridors	2006	15	60%
Cooling	CU-10; York condensing unit, 3.5 tons, 1 compressor, R-22	York, Model #H1RA042S46G, Serial #W0C6087806	Electricity	Rooftop	Room #21	1996	15	0%
Cooling	CU-11; York condensing unit, 3.5 tons, R-22, 1 compressor	York, Model #H1RA042S46G, Serial #W0C6087791	Electricity	Rooftop	Room #23	1996	15	0%
Cooling	CU-12; York condensing unit, 3.5 tons, R-22, 1 compressor	York, Model #H1RA042S46G, Serial #W0C6087780	Electricity	Rooftop	Room #25	1996	15	0%
Cooling	CU-2; York condensing unit, 3.5 tons, R-22, 1 compressor	York, Model #H1RA042S46G, Serial #W0C6087798	Electricity	Rooftop	Room #8	1996	15	0%

Cooling	CU-1; York condensing unit, 3.5 tons, R-22, 1 compressor	York, Model #H1RA042S46G, Serial #W0C6087793	Electricity	Rooftop	Room #6	1996	15	0%
Cooling	CU-8; York condensing unit, 3.5 tons, R-22, 1 compressor	York, Model #H1RA042S46G, Serial #W0C6087801	Electricity	Rooftop	Room #3	1996	15	0%
Cooling	CU-6; York condensing unit, 3.5 tons, R-22, 1 compressor	York, Model #H1RA042S46G, Serial #W0C6087781	Electricity	Rooftop	Room #4	1996	15	0%
Cooling	CU-7; York condensing unit, 3.5 tons, R-22, 1 compressor	York, Model #H1RA042S46G, Serial #W0F6421429	Electricity	Rooftop	Room #1	1996	15	0%
Cooling	CU-5; York condensing unit, 3.5 tons, R-22, 1 compressor	York, Model #H1RA042S46G, Serial #W0F6501931	Electricity	Rooftop	Room #2	1996	15	0%

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

Appendix B: Wedgwood 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	Cafeteria	Recessed Parabolic	E	4'T8	44	4	32	Sw	8	241	20	6,512	12,555	N/A	Recessed Parabolic	4'T8	E	Sw	44	4	32	8	241	20	6512	12555	0	0	0
2	1	Cafeteria	Exit Sign	S	LED	3	1	25	N	24	365	3	83	723	LEDex	Exit Sign	LED	S	N	3	1	5	24	365	1	17	145	578	0	578
3	1	Cafeteria	Recessed	S	CFL	6	1	13	Sw	8	241	0	78	150	N/A	Recessed	CFL	S	Sw	6	1	13	8	241	0	78	150	0	0	0
4	1	Cafeteria	Track	S	Inc	2	3	60	Sw	8	241	0	360	694	CFL	Track	CFL	S	Sw	2	3	20	8	241	0	120	231	463	0	463
5	1	Storage Room	Ceiling Mounted	S	Inc	1	1	60	Sw	2	241	0	60	29	CFL	Ceiling Mounted	CFL	S	Sw	1	1	20	2	241	0	20	10	19	0	19
6	1	Kitchen	Recessed	S	CFL	16	1	13	Sw	8	241	0	208	401	N/A	Recessed	CFL	S	Sw	16	1	13	8	241	0	208	401	0	0	0
7	1	Storage Room	Recessed	E	4'T8	1	4	32	Sw	2	241	20	148	71	N/A	Recessed	4'T8	E	Sw	1	4	32	2	241	20	148	71	0	0	0
8	1	Storage Room	Ceiling Mounted	S	CFL	3	1	13	Sw	2	241	0	39	19	N/A	Ceiling Mounted	CFL	S	Sw	3	1	13	2	241	0	39	19	0	0	0
9	1	Storage Room	Ceiling Mounted	S	Inc	1	1	60	Sw	2	241	0	60	29	CFL	Ceiling Mounted	CFL	S	Sw	1	1	20	2	241	0	20	10	19	0	19
10	1	Kitchen	Ceiling Mounted	E	4'T8	11	2	32	Sw	8	241	10	814	1,569	N/A	Ceiling Mounted	4'T8	E	Sw	11	2	32	8	241	10	814	1569	0	0	0
11	1	Locker Room	Ceiling Mounted	E	4'T8	1	2	32	Sw	8	241	10	74	143	C	Ceiling Mounted	4'T8	E	OS	1	2	32	6	241	10	74	107	0	36	36
12	1	Kitchen	Ceiling Mounted	E	4'T8	6	2	32	Sw	8	241	10	444	856	N/A	Ceiling Mounted	4'T8	E	Sw	6	2	32	8	241	10	444	856	0	0	0
13	1	Boiler Room	Ceiling Mounted	E	4'T8	10	2	32	Sw	2	241	10	740	357	C	Ceiling Mounted	4'T8	E	OS	10	2	32	2	241	10	740	268	0	89	89
14	1	Boiler Room	Exit Sign	S	LED	2	1	25	N	24	365	3	55	482	LEDex	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	385	0	385
15	1	Storage Room	Ceiling Mounted	E	4'T8	1	2	32	Sw	2	241	10	74	36	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	2	241	10	74	36	0	0	0
16	1	Lobby	Recessed	E	4'T8	6	8	32	Sw	8	241	40	1,776	3,424	N/A	Recessed	4'T8	E	Sw	6	8	32	8	241	40	1776	3424	0	0	0
17	1	Lobby	Exit Sign	S	LED	3	1	25	N	24	365	3	83	723	LEDex	Exit Sign	LED	S	N	3	1	5	24	365	1	17	145	578	0	578
18	1	Office Area-Attendance	Ceiling Mounted	E	4'T8	2	2	32	Sw	8	241	10	148	285	C	Ceiling Mounted	4'T8	E	OS	2	2	32	6	241	10	148	214	0	71	71
19	1	Nurse's Station	Ceiling Suspended	E	4'T8	10	2	32	Sw	8	241	10	740	1,427	N/A	Ceiling Suspended	4'T8	E	Sw	10	2	32	8	241	10	740	1427	0	0	0
20	1	Bathroom	Recessed	S	CFL	1	1	13	Sw	8	241	0	13	25	N/A	Recessed	CFL	S	Sw	1	1	13	8	241	0	13	25	0	0	0
21	1	Copy Room	Recessed	E	4'T8	2	2	32	Sw	2	241	10	148	71	N/A	Recessed	4'T8	E	Sw	2	2	32	2	241	10	148	71	0	0	0
22	1	Classroom-Guidance	Recessed	E	4'T8	6	4	32	Sw	8	241	20	888	1,712	N/A	Recessed	4'T8	E	Sw	6	4	32	8	241	20	888	1712	0	0	0
23	1	Office	Recessed	E	4'T8	17	2	32	Sw	8	241	10	1,258	2,425	C	Recessed	4'T8	E	OS	17	2	32	6	241	10	1258	1819	0	606	606
24	1	Office	Recessed	E	4'T8 U-Shaped	1	2	32	Sw	8	241	10	74	143	N/A	Recessed	4'T8 U-Shaped	E	Sw	1	2	32	8	241	10	74	143	0	0	0
25	1	Storage Room	Ceiling Mounted	E	4'T8	1	2	32	Sw	2	241	10	74	36	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	2	241	10	74	36	0	0	0
26	1	Principal Office	Recessed	E	4'T8	5	2	32	Sw	8	241	10	370	713	C	Recessed	4'T8	E	OS	5	2	32	6	241	10	370	535	0	178	178
27	1	Principal Office	Track	S	CFL	1	3	13	Sw	8	241	0	39	75	C	Track	CFL	S	OS	1	3	13	6	241	0	39	56	0	19	19
28	1	Principal Office	Recessed	S	CFL	1	1	13	Sw	8	241	0	13	25	N/A	Recessed	CFL	S	Sw	1	1	13	8	241	0	13	25	0	0	0
29	1	Principals Office Bathroom	Recessed	S	CFL	1	1	13	Sw	4	241	0	13	13	N/A	Recessed	CFL	S	Sw	1	1	13	4	241	0	13	13	0	0	0
30	1	Principals Office Bathroom	Wall Mounted	E	2'T8	1	1	17	Sw	4	241	2	19	18	N/A	Wall Mounted	2'T8	E	Sw	1	1	17	4	241	2	19	18	0	0	0
31	1	Office Area	Ceiling Suspended	E	4'T8	2	2	32	Sw	8	241	10	148	285	N/A	Ceiling Suspended	4'T8	E	Sw	2	2	32	8	241	10	148	285	0	0	0
32	1	Hallway	Exit Sign	S	LED	1	1	25	N	24	365	3	28	241	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	193	0	193
33	1	Hallway	Recessed	E	2'T8	2	2	17	Sw	12	241	4	76	220	N/A	Recessed	2'T8	E	Sw	2	2	17	12	241	4	76	220	0	0	0
34	1	Electrical Room	Ceiling Suspended	S	CFL	2	1	13	Sw	2	241	0	26	13	N/A	Ceiling Suspended	CFL	S	Sw	2	1	13	2	241	0	26	13	0	0	0
35	1	Hallway	Exit Sign	S	LED	1	1	25	N	24	365	3	28	241	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	193	0	193
36	1	Bathroom Men	Recessed	E	4'T8	1	2	32	Sw	8	241	10	74	143	C	Recessed	4'T8	E	OS	1	2	32	6	241	10	74	107	0	36	36
37	1	Bathroom Women	Recessed	E	4'T8	1	2	32	Sw	8	241	10	74	143	C	Recessed	4'T8	E	OS	1	2	32	6	241	10	74	107	0	36	36
38	1	Bathroom Women	Recessed	S	CFL	2	1	13	Sw	8	241	0	26	50	N/A	Recessed	CFL	S	Sw	2	1	13	8	241	0	26	50	0	0	0
39	1	Bathroom Men	Recessed	S	CFL	2	1	13	Sw	8	241	0	26	50	N/A	Recessed	CFL	S	Sw	2	1	13	8	241	0	26	50	0	0	0
40	1	Hallway	Recessed	E	2'T8	8	2	17	Sw	9	241	4	304	659	N/A	Recessed	2'T8	E	Sw	8	2	17	9	241	4	304	659	0	0	0
41	1	Hallway	Exit Sign	S	LED	1	1	25	N	24	365	3	28	241	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	193	0	193
42	1	Classroom (12)	Ceiling Suspended	E	4'T8	21	2	32	Sw	8	241	10	1,554	2,996	N/A	Ceiling Suspended	4'T8	E	Sw	21	2	32	8	241	10	1554	2996	0	0	0
43	1	Bathroom (12)	Recessed	S	CFL	1	1	13	Sw	4	241	0	13	13	N/A	Recessed	CFL	S	Sw	1	1	13	4	241	0	13	13	0	0	0
44	1	Storage Room (12)	Recessed	E	2'T8	1	2	17	Sw	2	241	4	38	18	N/A	Recessed	2'T8	E	Sw	1	2	17	2	241	4	38	18	0	0	0
45	1	Storage Room (12)	Recessed	S	CFL	1	1	13	Sw	2	241	0	13	6	N/A	Recessed	CFL	S	Sw	1	1	13	2	241	0	13	6	0	0	0
46	1	Classroom (12)	Recessed	S	CFL	1	1	13	Sw	8	241	0	13	25	N/A	Recessed	CFL	S	Sw	1	1	13	8	241	0	13	25	0	0	0
47	1	Backstage Area	Ceiling Suspended	S	CFL	7	1	13	Sw	4	241	0	91	88	N/A	Ceiling Suspended	CFL	S	Sw	7	1	13	4	241	0	91	88	0	0	0
48	1	Backstage Area	Ceiling Suspended	S	Inc	1	1	60	Sw	4	241	0	60	58	CFL	Ceiling Suspended	CFL	S	Sw	1	1	20	4	241	0	20	19	39	0	39
49	1	Backstage Area	Ceiling Suspended	E	4'T8	10	4	32	Sw	4	241	20	1,480	1,427	N/A	Ceiling Suspended	4'T8	E	Sw	10	4	32	4	241	20	1480	1427	0	0	0
50	1	Backstage Area	Exit Sign	S	LED	1	1	25	N	24	365	3	28	241	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	193	0	193
51	1	Backstage Area	Exit Sign	S	LED	1	1	25	N	24	365	3	28	241	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	193	0	193
52	1	Classroom (10)	Ceiling Suspended	E	4'T8	21	2	32	Sw	8	241	10	1,554	2,996	N/A	Ceiling Suspended	4'T8	E	Sw	21	2	32	8	241	10	1554	2996	0	0	0
53	1	Bathroom (10)	Recessed	S	CFL	1	1	13	Sw	4	241	0	13	13	N/A	Recessed	CFL	S	Sw	1	1	13	4	241	0	13	13	0	0	0
54	1	Classroom (10)	Recessed	S	CFL	1	1	13	Sw	8	241	0	13	25	N/A	Recessed	CFL	S	Sw	1	1	13	8	241	0	13	25	0	0	0
55	1	Hallway	Recessed	E	2'T8	4	2	17	Sw	9	241	4	152	330	N/A	Recessed	2'T8	E	Sw	4	2	17	9	241	4	152	330	0	0	0
56	1	Hallway	Exit Sign	S	LED	1	1	25	N	24	365	3	28	241	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	193	0	193
57	1	Janitor's Closet	Ceiling Suspended	S	CFL	2	1	13	Sw	2	241	0	26	13	N/A	Ceiling Suspended	CFL	S	Sw	2	1	13	2	241	0	26	13	0	0	0
58	1	Hallway	Recessed	E	2'T8	7	2	17	Sw	9	241	4	266	577	N/A	Recessed	2'T8	E	Sw	7	2	17	9	241	4	266	577	0	0	0
59	1	Classroom (8)	Ceiling Suspended	E	4'T8	15	2	32	Sw	8	241	10	1,110	2,140	N/A	Ceiling Suspended	4'T8	E	Sw	15	2	32	8	241	10	1110	2140	0	0	0
60	1	Bathroom (8)	Recessed	S	CFL	1	1	13	Sw	4	241	0	13	13	N/A	Recessed	CFL	S	Sw	1	1	13	4	241	0	13	13	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)
61	1	Storage Room (8)	Recessed	E	2'T8	1	2	17	Sw	2	241	4	38	18	N/A	Recessed	2'T8	E	Sw	1	2	17	2	241	4	38	18	0	0	0
62	1	Storage Room (8)	Recessed	S	CFL	1	1	13	Sw	2	241	0	13	6	N/A	Recessed	CFL	S	Sw	1	1	13	2	241	0	13	6	0	0	0
63	1	Classroom (8)	Recessed	S	CFL	1	1	13	Sw	8	241	0	13	25	N/A	Recessed	CFL	S	Sw	1	1	13	8	241	0	13	25	0	0	0
64	1	Classroom (6)	Ceiling Suspended	E	4'T8	15	2	32	Sw	8	241	10	1,110	2,140	N/A	Ceiling Suspended	4'T8	E	Sw	15	2	32	8	241	10	1110	2140	0	0	0
65	1	Bathroom (6)	Recessed	S	CFL	1	1	13	Sw	4	241	0	13	13	N/A	Recessed	CFL	S	Sw	1	1	13	4	241	0	13	13	0	0	0
66	1	Classroom (6)	Recessed	S	CFL	1	1	13	Sw	8	241	0	13	25	N/A	Recessed	CFL	S	Sw	1	1	13	8	241	0	13	25	0	0	0
67	1	Receiving Room	Ceiling Suspended	E	4'T8	5	2	32	Sw	2	241	10	370	178	N/A	Ceiling Suspended	4'T8	E	Sw	5	2	32	2	241	10	370	178	0	0	0
68	1	Hallway	Recessed	E	2'T8	4	2	17	Sw	9	241	4	152	330	N/A	Recessed	2'T8	E	Sw	4	2	17	9	241	4	152	330	0	0	0
69	1	Hallway	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
70	1	Hallway	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
71	1	Hallway	Recessed	E	4'T8 U-Shaped	12	2	32	Sw	9	241	10	888	1,926	N/A	Recessed	4'T8 U-Shaped	E	Sw	12	2	32	9	241	10	888	1926	0	0	0
72	1	Copy room	Recessed	E	4'T8 U-Shaped	2	2	32	Sw	8	241	10	148	285	N/A	Recessed	4'T8 U-Shaped	E	Sw	2	2	32	8	241	10	148	285	0	0	0
73	1	Gymnasium (47)	High Bay	S	MH	15	1	250	Sw	8	241	70	4,800	9,254	LED	High Bay	LED	S	Sw	15	1	150	8	241	0	2250	4338	4916	0	4916
74	1	Gymnasium (47)	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
75	1	Bathroom Men (47)	Recessed	E	4'T8	4	2	32	Sw	8	241	10	296	571	C	Recessed	4'T8	E	OS	4	2	32	6	241	10	296	428	0	143	143
76	1	Bathroom Men (47)	Recessed	E	4'T8 U-Shaped	1	2	32	Sw	8	241	10	74	143	C	Recessed	4'T8 U-Shaped	E	OS	1	2	32	6	241	10	74	107	0	36	36
77	1	Bathroom Women (47)	Recessed	E	4'T8 U-Shaped	1	2	32	Sw	8	241	10	74	143	C	Recessed	4'T8 U-Shaped	E	OS	1	2	32	6	241	10	74	107	0	36	36
78	1	Bathroom Women (47)	Recessed	E	4'T8	4	2	32	Sw	8	241	10	296	571	C	Recessed	4'T8	E	OS	4	2	32	6	241	10	296	428	0	143	143
79	1	Janitor's Closet (47)	Ceiling Suspended	E	4'T8	1	2	32	Sw	2	241	10	74	36	N/A	Ceiling Suspended	4'T8	E	Sw	1	2	32	2	241	10	74	36	0	0	0
80	1	Storage Room (47)	Recessed	E	4'T8	4	4	32	Sw	2	241	20	592	285	N/A	Recessed	4'T8	E	Sw	4	4	32	2	241	20	592	285	0	0	0
81	1	Office (47)	Recessed	E	4'T8	2	4	32	Sw	8	241	20	296	571	C	Recessed	4'T8	E	OS	2	4	32	6	241	20	296	428	0	143	143
82	1	Hallway	Recessed	E	4'T8 U-Shaped	12	2	32	Sw	9	241	10	888	1,926	N/A	Recessed	4'T8 U-Shaped	E	Sw	12	2	32	9	241	10	888	1926	0	0	0
83	1	Hallway	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
84	1	Computer Lab (45)	Recessed	E	4'T8	15	4	32	Sw	8	241	20	2,220	4,280	N/A	Recessed	4'T8	E	Sw	15	4	32	8	241	20	2220	4280	0	0	0
85	1	Office (45)	Recessed	E	4'T8	2	4	32	Sw	8	241	20	296	571	C	Recessed	4'T8	E	OS	2	4	32	6	241	20	296	428	0	143	143
86	1	Classroom (43)	Recessed	E	4'T8	3	4	32	Sw	8	241	20	444	856	N/A	Recessed	4'T8	E	Sw	3	4	32	8	241	20	444	856	0	0	0
87	1	Classroom (41)	Recessed	E	4'T8	6	4	32	Sw	8	241	20	888	1,712	N/A	Recessed	4'T8	E	Sw	6	4	32	8	241	20	888	1712	0	0	0
88	1	Classroom (39)	Recessed	E	4'T8	6	4	32	Sw	8	241	20	888	1,712	N/A	Recessed	4'T8	E	Sw	6	4	32	8	241	20	888	1712	0	0	0
89	1	Classroom (34)	Recessed	E	4'T8 U-Shaped	1	2	32	Sw	8	241	10	74	143	N/A	Recessed	4'T8 U-Shaped	E	Sw	1	2	32	8	241	10	74	143	0	0	0
90	1	Classroom (34)	Recessed	E	4'T8	5	4	32	Sw	8	241	20	740	1,427	N/A	Recessed	4'T8	E	Sw	5	4	32	8	241	20	740	1427	0	0	0
91	1	Janitor's Closet	Ceiling Suspended	E	4'T8	1	2	32	Sw	2	241	10	74	36	N/A	Ceiling Suspended	4'T8	E	Sw	1	2	32	2	241	10	74	36	0	0	0
92	1	Bathroom Men	Recessed	E	4'T8 U-Shaped	1	2	32	Sw	4	241	10	74	71	C	Recessed	4'T8 U-Shaped	E	OS	1	2	32	3	241	10	74	54	0	18	18
93	1	Bathroom Women	Recessed	E	4'T8 U-Shaped	1	2	32	Sw	4	241	10	74	71	C	Recessed	4'T8 U-Shaped	E	OS	1	2	32	3	241	10	74	54	0	18	18
94	1	Bathroom Boy	Recessed	E	4'T8 U-Shaped	1	2	32	Sw	8	241	10	74	143	N/A	Recessed	4'T8 U-Shaped	E	Sw	1	2	32	8	241	10	74	143	0	0	0
95	1	Bathroom Girl	Recessed	E	4'T8 U-Shaped	1	2	32	Sw	8	241	10	74	143	N/A	Recessed	4'T8 U-Shaped	E	Sw	1	2	32	8	241	10	74	143	0	0	0
96	1	Bathroom Girl	Recessed	E	4'T8	3	4	32	Sw	8	241	20	444	856	C	Recessed	4'T8	E	OS	3	4	32	6	241	20	444	642	0	214	214
97	1	Bathroom Boy	Recessed	E	4'T8	3	4	32	Sw	8	241	20	444	856	C	Recessed	4'T8	E	OS	3	4	32	6	241	20	444	642	0	214	214
98	1	Classroom (35)	Recessed	E	4'T8	12	4	32	Sw	8	241	20	1,776	3,424	N/A	Recessed	4'T8	E	Sw	12	4	32	8	241	20	1776	3424	0	0	0
99	1	Classroom (37)	Recessed	E	4'T8	12	4	32	Sw	8	241	20	1,776	3,424	N/A	Recessed	4'T8	E	Sw	12	4	32	8	241	20	1776	3424	0	0	0
100	1	Hallway	Recessed	E	4'T8 U-Shaped	5	2	32	Sw	9	241	10	370	803	N/A	Recessed	4'T8 U-Shaped	E	Sw	5	2	32	9	241	10	370	803	0	0	0
101	1	Hallway	Exit Sign	S	LED	3	1	5	N	24	365	1	17	145	N/A	Exit Sign	LED	S	N	3	1	5	24	365	1	17	145	0	0	0
102	1	Hallway	Recessed	E	4'T8 U-Shaped	2	2	32	Sw	9	241	10	148	321	N/A	Recessed	4'T8 U-Shaped	E	Sw	2	2	32	9	241	10	148	321	0	0	0
103	1	Hallway	Recessed	E	4'T8 U-Shaped	5	2	32	Sw	9	241	10	370	803	N/A	Recessed	4'T8 U-Shaped	E	Sw	5	2	32	9	241	10	370	803	0	0	0
104	1	Classroom (33)	Recessed	E	4'T8	16	4	32	Sw	8	241	20	2,368	4,566	N/A	Recessed	4'T8	E	Sw	16	4	32	8	241	20	2368	4566	0	0	0
105	1	Classroom (33)	Recessed	E	4'T8 U-Shaped	4	2	32	Sw	8	241	10	296	571	N/A	Recessed	4'T8 U-Shaped	E	Sw	4	2	32	8	241	10	296	571	0	0	0
106	1	Storage Room (33)	Recessed	E	4'T8	4	4	32	Sw	2	241	20	592	285	N/A	Recessed	4'T8	E	Sw	4	4	32	2	241	20	592	285	0	0	0
107	1	Hallway	Recessed	E	4'T8 U-Shaped	10	2	32	Sw	12	241	10	740	2,140	N/A	Recessed	4'T8 U-Shaped	E	Sw	10	2	32	12	241	10	740	2140	0	0	0
108	1	Hallway	Exit Sign	S	LED	1	1	5	N	24	241	1	6	32	N/A	Exit Sign	LED	S	N	1	1	5	24	241	1	6	32	0	0	0
109	1	Classroom (32)	Recessed	E	4'T8	12	4	32	Sw	8	241	20	1,776	3,424	N/A	Recessed	4'T8	E	Sw	12	4	32	8	241	20	1776	3424	0	0	0
110	1	Classroom (30)	Recessed	E	4'T8	12	4	32	Sw	8	241	20	1,776	3,424	N/A	Recessed	4'T8	E	Sw	12	4	32	8	241	20	1776	3424	0	0	0
111	1	Classroom (31)	Recessed	E	4'T8	12	4	32	Sw	8	241	20	1,776	3,424	N/A	Recessed	4'T8	E	Sw	12	4	32	8	241	20	1776	3424	0	0	0
112	1	Classroom (28)	Recessed	E	4'T8	12	4	32	Sw	8	241	20	1,776	3,424	N/A	Recessed	4'T8	E	Sw	12	4	32	8	241	20	1776	3424	0	0	0
113	1	Classroom (29)	Recessed	E	4'T8	12	4	32	Sw	8	241	20	1,776	3,424	N/A	Recessed	4'T8	E	Sw	12	4	32	8	241	20	1776	3424	0	0	0
114	1	Classroom (26)	Recessed	E	4'T8	12	4	32	Sw	8	241	20	1,776	3,424	N/A	Recessed	4'T8	E	Sw	12	4	32	8	241	20	1776	3424	0	0	0
115	1	Classroom (27)	Recessed	E	4'T8	12	4	32	Sw	8	241	20	1,776	3,424	N/A	Recessed	4'T8	E	Sw	12	4	32	8	241	20	1776	3424	0	0	0
116	1	Hallway	Recessed	E	4'T8 U-Shaped	2	2	32	Sw	9	241	10	148	321	N/A	Recessed	4'T8 U-Shaped	E	Sw	2	2	32	9	241	10	148	321	0	0	0
117	1	Hallway	Exit Sign	S	LED	1	1	25	N	24	365	3	28	241	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	193	0	193
118	1	Hallway	Exit Sign	S	LED	2	1	25	N	24	365	3	55	482	LEDex	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	385	0	385
119	1	Hallway	Recessed	E	2'T8	7	2	17	Sw	9	241	4	266	577	N/A	Recessed	2'T8	E	Sw	7	2	17	9	241	4	266	577	0	0	0
120	1	Classroom (24)	Ceiling Suspended	E	4'T8	15	1	32	Sw	8	241	5	555	1,070	N/A	Ceiling Suspended	4'T8	E	Sw	15	1	32	8	241	5	555	1070	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)
121	1	Classroom (22)	Ceiling Suspended	E	4'T8	15	1	32	Sw	8	241	5	555	1,070	N/A	Ceiling Suspended	4'T8	E	Sw	15	1	32	8	241	5	555	1070	0	0	0
122	1	Classroom (23)	Ceiling Suspended	E	4'T8	15	1	32	Sw	8	241	5	555	1,070	N/A	Ceiling Suspended	4'T8	E	Sw	15	1	32	8	241	5	555	1070	0	0	0
123	1	Classroom (25)	Ceiling Suspended	E	4'T8	15	1	32	Sw	8	241	5	555	1,070	N/A	Ceiling Suspended	4'T8	E	Sw	15	1	32	8	241	5	555	1070	0	0	0
124	1	Classroom (21)	Ceiling Suspended	E	4'T8	15	1	32	Sw	8	241	5	555	1,070	N/A	Ceiling Suspended	4'T8	E	Sw	15	1	32	8	241	5	555	1070	0	0	0
125	1	Janitor's Closet	Ceiling Suspended	S	CFL	1	1	13	Sw	2	241	0	13	6	N/A	Ceiling Suspended	CFL	S	Sw	1	1	13	2	241	0	13	6	0	0	0
126	1	Bathroom Men	Recessed	E	4'T8	2	4	32	Sw	8	241	20	296	571	C	Recessed	4'T8	E	OS	2	4	32	6	241	20	296	428	0	143	143
127	1	Bathroom Women	Recessed	E	4'T8	2	4	32	Sw	8	241	20	296	571	C	Recessed	4'T8	E	OS	2	4	32	6	241	20	296	428	0	143	143
128	1	Bathroom Women	Recessed	S	CFL	1	1	13	Sw	8	241	0	13	25	N/A	Recessed	CFL	S	Sw	1	1	13	8	241	0	13	25	0	0	0
129	1	Bathroom Men	Recessed	S	CFL	1	1	13	Sw	8	241	0	13	25	N/A	Recessed	CFL	S	Sw	1	1	13	8	241	0	13	25	0	0	0
130	1	Hallway	Recessed	E	2'T8	7	2	17	Sw	9	241	4	266	577	N/A	Recessed	2'T8	E	Sw	7	2	17	9	241	4	266	577	0	0	0
131	1	Hallway	Exit Sign	S	LED	1	1	25	N	24	365	3	28	241	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	193	0	193
132	1	Classroom (19)	Ceiling Suspended	E	4'T8	15	1	32	Sw	8	241	5	555	1,070	N/A	Ceiling Suspended	4'T8	E	Sw	15	1	32	8	241	5	555	1070	0	0	0
133	1	Library	Ceiling Mounted	E	4'T8	48	2	32	Sw	8	241	10	3,552	6,848	N/A	Ceiling Mounted	4'T8	E	Sw	48	2	32	8	241	10	3552	6848	0	0	0
134	1	Library	Exit Sign	S	LED	1	1	25	N	24	365	3	28	241	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	193	0	193
135	1	Office Area	Ceiling Mounted	E	4'T8	4	2	32	Sw	8	241	10	296	571	N/A	Ceiling Mounted	4'T8	E	Sw	4	2	32	8	241	10	296	571	0	0	0
136	1	Storage Room	Ceiling Suspended	S	CFL	2	1	13	Sw	2	241	0	26	13	N/A	Ceiling Suspended	CFL	S	Sw	2	1	13	2	241	0	26	13	0	0	0
137	1	Bathroom	Ceiling Mounted	S	CFL	1	1	13	Sw	4	241	0	13	13	N/A	Ceiling Mounted	CFL	S	Sw	1	1	13	4	241	0	13	13	0	0	0
138	1	Library	Ceiling Mounted	S	CFL	1	1	13	Sw	8	241	0	13	25	N/A	Ceiling Mounted	CFL	S	Sw	1	1	13	8	241	0	13	25	0	0	0
139	1	Hallway	Recessed	E	2'T8	2	2	17	Sw	9	241	4	76	165	N/A	Recessed	2'T8	E	Sw	2	2	17	9	241	4	76	165	0	0	0
140	1	Hallway	Recessed	E	2'T8	5	2	17	Sw	9	241	4	190	412	N/A	Recessed	2'T8	E	Sw	5	2	17	9	241	4	190	412	0	0	0
141	1	Classroom (15)	Ceiling Suspended	E	4'T8	15	2	32	Sw	8	241	10	1,110	2,140	N/A	Ceiling Suspended	4'T8	E	Sw	15	2	32	8	241	10	1110	2140	0	0	0
142	1	Classroom (14)	Ceiling Suspended	E	4'T8	15	2	32	Sw	8	241	10	1,110	2,140	N/A	Ceiling Suspended	4'T8	E	Sw	15	2	32	8	241	10	1110	2140	0	0	0
143	1	Bathroom (14)	Recessed	S	CFL	1	1	13	Sw	4	241	0	13	13	N/A	Recessed	CFL	S	Sw	1	1	13	4	241	0	13	13	0	0	0
144	1	Storage Room (14)	Recessed	E	2'T8	1	2	17	Sw	2	241	4	38	18	N/A	Recessed	2'T8	E	Sw	1	2	17	2	241	4	38	18	0	0	0
145	1	Storage Room (14)	Recessed	S	CFL	1	1	13	Sw	2	241	0	13	6	N/A	Recessed	CFL	S	Sw	1	1	13	2	241	0	13	6	0	0	0
146	1	Classroom (14)	Recessed	S	CFL	1	1	13	Sw	8	241	0	13	25	N/A	Recessed	CFL	S	Sw	1	1	13	8	241	0	13	25	0	0	0
147	1	Classroom (16)	Ceiling Suspended	E	4'T8	15	2	32	Sw	8	241	10	1,110	2,140	N/A	Ceiling Suspended	4'T8	E	Sw	15	2	32	8	241	10	1110	2140	0	0	0
148	1	Bathroom (16)	Recessed	S	CFL	1	1	13	Sw	4	241	0	13	13	N/A	Recessed	CFL	S	Sw	1	1	13	4	241	0	13	13	0	0	0
149	1	Storage Room (16)	Recessed	E	2'T8	1	2	17	Sw	2	241	4	38	18	N/A	Recessed	2'T8	E	Sw	1	2	17	2	241	4	38	18	0	0	0
150	1	Storage Room (16)	Recessed	S	CFL	1	1	13	Sw	2	241	0	13	6	N/A	Recessed	CFL	S	Sw	1	1	13	2	241	0	13	6	0	0	0
151	1	Classroom (16)	Recessed	S	CFL	1	1	13	Sw	8	241	0	13	25	N/A	Recessed	CFL	S	Sw	1	1	13	8	241	0	13	25	0	0	0
152	1	Classroom (18)	Ceiling Suspended	E	4'T8	15	2	32	Sw	8	241	10	1,110	2,140	N/A	Ceiling Suspended	4'T8	E	Sw	15	2	32	8	241	10	1110	2140	0	0	0
153	1	Bathroom (18)	Recessed	S	CFL	1	1	13	Sw	4	241	0	13	13	N/A	Recessed	CFL	S	Sw	1	1	13	4	241	0	13	13	0	0	0
154	1	Storage Room (18)	Recessed	E	2'T8	1	2	17	Sw	2	241	4	38	18	N/A	Recessed	2'T8	E	Sw	1	2	17	2	241	4	38	18	0	0	0
155	1	Storage Room (18)	Recessed	S	CFL	1	1	13	Sw	2	241	0	13	6	N/A	Recessed	CFL	S	Sw	1	1	13	2	241	0	13	6	0	0	0
156	1	Classroom (18)	Recessed	S	CFL	1	1	13	Sw	8	241	0	13	25	N/A	Recessed	CFL	S	Sw	1	1	13	8	241	0	13	25	0	0	0
157	1	Classroom (20)	Ceiling Suspended	E	4'T8	15	2	32	Sw	8	241	10	1,110	2,140	N/A	Ceiling Suspended	4'T8	E	Sw	15	2	32	8	241	10	1110	2140	0	0	0
158	1	Bathroom (20)	Recessed	S	CFL	1	1	13	Sw	4	241	0	13	13	N/A	Recessed	CFL	S	Sw	1	1	13	4	241	0	13	13	0	0	0
159	1	Storage Room (20)	Recessed	E	2'T8	1	2	17	Sw	2	241	4	38	18	N/A	Recessed	2'T8	E	Sw	1	2	17	2	241	4	38	18	0	0	0
160	1	Storage Room (20)	Recessed	S	CFL	1	1	13	Sw	2	241	0	13	6	N/A	Recessed	CFL	S	Sw	1	1	13	2	241	0	13	6	0	0	0
161	1	Classroom (20)	Recessed	S	CFL	1	1	13	Sw	8	241	0	13	25	N/A	Recessed	CFL	S	Sw	1	1	13	8	241	0	13	25	0	0	0
162	1	Classroom (13)	Ceiling Suspended	E	4'T8	15	2	32	Sw	8	241	10	1,110	2,140	N/A	Ceiling Suspended	4'T8	E	Sw	15	2	32	8	241	10	1110	2140	0	0	0
163	1	Classroom (11)	Ceiling Suspended	E	4'T8	15	2	32	Sw	8	241	10	1,110	2,140	N/A	Ceiling Suspended	4'T8	E	Sw	15	2	32	8	241	10	1110	2140	0	0	0
164	1	Janitor's Closet	Ceiling Suspended	E	4'T8	4	2	32	Sw	2	241	10	296	143	N/A	Ceiling Suspended	4'T8	E	Sw	4	2	32	2	241	10	296	143	0	0	0
165	1	Hallway	Recessed	E	2'T8	4	2	17	Sw	9	241	4	152	330	N/A	Recessed	2'T8	E	Sw	4	2	17	9	241	4	152	330	0	0	0
166	1	Conference Room	Ceiling Suspended	E	4'T8	6	2	32	Sw	8	241	10	444	856	C	Ceiling Suspended	4'T8	E	OS	6	2	32	6	241	10	444	642	0	214	214
167	1	Teachers Lounge	Ceiling Suspended	E	4'T8	10	2	32	Sw	8	241	10	740	1,427	C	Ceiling Suspended	4'T8	E	OS	10	2	32	6	241	10	740	1070	0	357	357
168	1	Bathroom	Vanity	E	CFL	1	1	13	Sw	4	241	0	13	13	N/A	Vanity	CFL	E	Sw	1	1	13	4	241	0	13	13	0	0	0
169	1	Bathroom	Vanity	E	CFL	1	1	13	Sw	4	241	0	13	13	N/A	Vanity	CFL	E	Sw	1	1	13	4	241	0	13	13	0	0	0
170	1	Vestibule	Recessed	E	CFL	1	1	13	Sw	9	241	0	13	28	N/A	Recessed	CFL	E	Sw	1	1	13	9	241	0	13	28	0	0	0
171	1	Vestibule	Recessed	E	CFL	1	1	13	Sw	9	241	0	13	28	N/A	Recessed	CFL	E	Sw	1	1	13	9	241	0	13	28	0	0	0
172	1	Classroom (50)	Recessed	E	4'T8	3	4	32	Sw	8	241	20	444	856	N/A	Recessed	4'T8	E	Sw	3	4	32	8	241	20	444	856	0	0	0
173	1	Classroom (48)	Recessed	E	4'T8	3	4	32	Sw	8	241	20	444	856	N/A	Recessed	4'T8	E	Sw	3	4	32	8	241	20	444	856	0	0	0
174	1	Classroom (46)	Recessed	E	4'T8	3	4	32	Sw	8	241	20	444	856	N/A	Recessed	4'T8	E	Sw	3	4	32	8	241	20	444	856	0	0	0
175	1	Office (44)	Ceiling Suspended	E	4'T8	1	2	32	Sw	8	241	10	74	143	C	Ceiling Suspended	4'T8	E	OS	1	2	32	6	241	10	74	107	0	36	36
176	1	Office (42)	Ceiling Suspended	E	4'T8	1	2	32	Sw	8	241	10	74	143	C	Ceiling Suspended	4'T8	E	OS	1	2	32	6	241	10	74	107	0	36	36
177	1	Office (40)	Ceiling Suspended	E	4'T8	1	2	32	Sw	8	241	10	74	143	C	Ceiling Suspended	4'T8	E	OS	1	2	32	6	241	10	74	107	0	36	36
178	1	Office (38)	Ceiling Suspended	E	4'T8	1	2	32	Sw	8	241	10	74	143	C	Ceiling Suspended	4'T8	E	OS	1	2	32	6	241	10	74	107	0	36	36
179	1	Office (36)	Ceiling Suspended	E	4'T8	1	2	32	Sw	8	241	10	74	143	C	Ceiling Suspended	4'T8	E	OS	1	2	32	6	241	10	74	107	0	36	36
180	Ext	Exterior	Recessed	S	CFL	2	1	13	Sw	12	241	0	26	75	N/A	Recessed	CFL	S	Sw	2	1	13	12	241	0	26	75	0	0	0
181	Ext	Exterior	Wallpack	S	HPS	24	1	250	T	12	365	50	7,200	31,536		Wallpack	LED	S	T	24	1	78	12	365	8	2059	9019	22517	0	22517
182	Ext	Exterior	Wallpack	S	HPS	10	1	150	T	12	365	30	1,800	7,884		Wallpack	LED	S	T	10	1	30	12	365	3	330	1445	6439	0	6439
183	Ext	Exterior	Pole Mounted	S	HPS	8	1	400	PC	12	365	80	3,840	16,819		Pole Mounted	LED	S	PC	8	1	176	12	365	18	1549	6784	10035	0	10035
Totals:						**975**	**357**	**5,527**				**1,572**	**93,886**	**211,070**						**975**	**357**	**4,491**			**1,344**	**81,656**	**159,751**	**48,109**	**3,211**	**51,320**

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

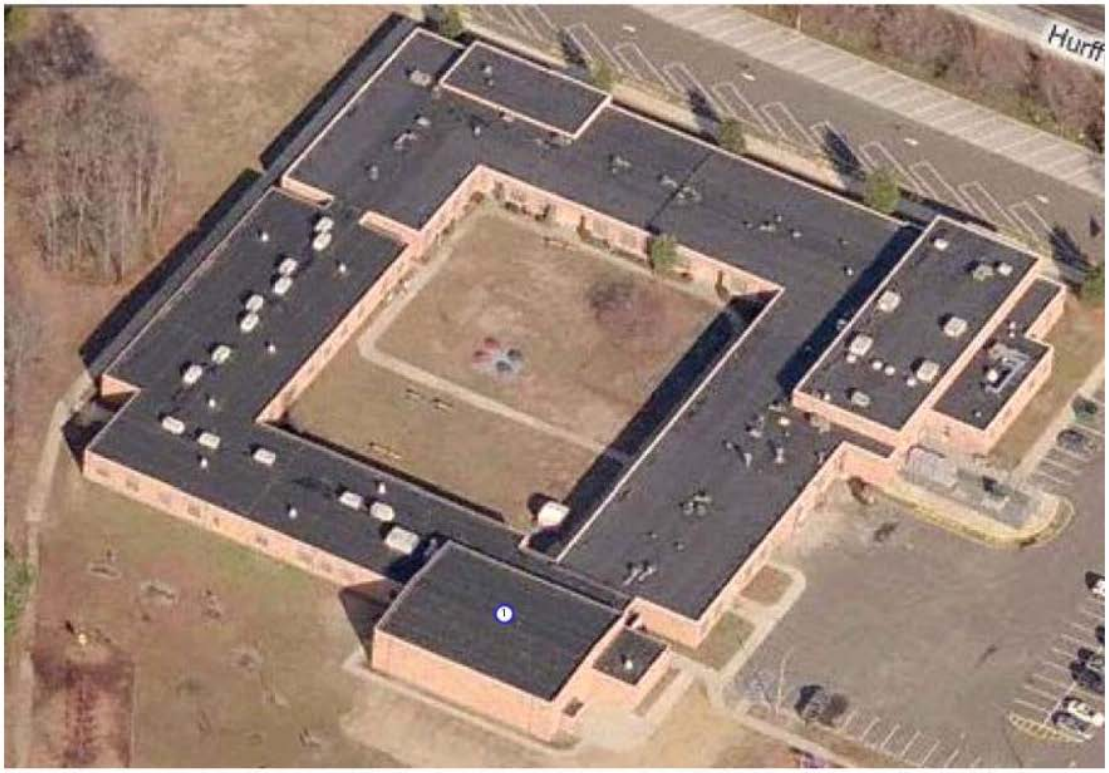
Site Report

Report Name	Washington Township - Wedgwood Elementary
Report Date	2/27/2012 9:52:17 AM
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	0.161 ($/KWH)
Panel Make	Sharp
Panel Model	ND-230UC1
Panel Count	98
DC Rate (per panel)	230.0 W
Total System Size	22,540.0 W
Inverter Make	Sharp
Inverter Model	JH-3500U
Inverter Count	2
Derate Method	Using Components
Derate Factor	0.761
Layout Configuration	SinglePicture
Layout Point Count	1

Notes: [None]

System Picture Layout

Layout Type Single Picture
Layout Point Count 1



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Solar Site Analysis Report

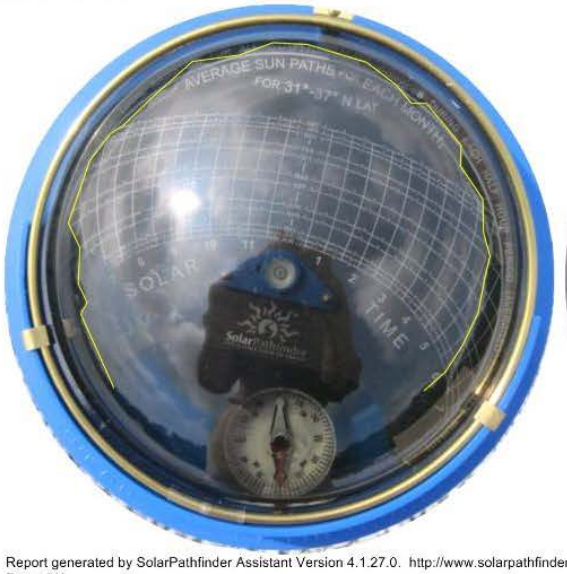
1

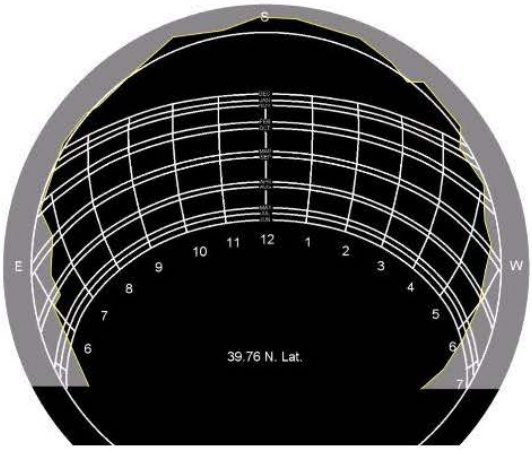
Image File IMG_6135.jpg

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 0.161 ($/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	1,941.00	1,941.00	1,941.00	$312.50	99.93 %	99.93 %	99.93 %
February	100.00%	4.04	1,943.00	1,943.00	1,943.00	$312.82	99.93 %	99.69 %	99.69 %
March	99.85%	4.71	2,435.00	2,435.00	2,435.00	$392.04	99.89 %	99.89 %	99.89 %
April	99.19%	5.05	2,463.55	2,466.00	2,466.00	$396.63	99.26 %	99.26 %	99.26 %
May	99.14%	5.38	2,627.14	2,628.00	2,628.00	$422.97	99.24 %	99.24 %	99.24 %
June	99.00%	5.60	2,594.31	2,595.00	2,595.00	$417.68	99.08 %	98.91 %	98.91 %
July	98.92%	5.23	2,469.22	2,470.00	2,470.00	$397.54	99.03 %	98.84 %	98.84 %
August	98.73%	5.69	2,716.47	2,719.00	2,719.00	$437.35	98.98 %	98.98 %	98.98 %
September	99.08%	5.08	2,371.75	2,374.00	2,374.00	$381.85	99.08 %	98.88 %	98.88 %
October	100.00%	4.56	2,337.00	2,338.00	2,338.00	$376.26	99.92 %	99.05 %	99.05 %
November	100.00%	3.58	1,837.00	1,837.00	1,837.00	$295.76	100.00 %	99.73 %	99.73 %
December	100.00%	3.17	1,683.00	1,683.00	1,683.00	$270.96	99.88 %	99.88 %	99.88 %
Totals	**99.49%**	**55.59**	**27,418.45**	**27,429.00**	**27,429.00**	**$4,414.37**	**99.52 %**	**99.36 %**	**99.36 %**
	Unweighted Yearly Avg	**Effect: 99.28% Sun Hrs: 4.63**					**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 0.161 ($/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	1,941.00	1,941.00	1,941.00	$312.50	99.93 %	99.93 %	99.93 %
February	100.00%	4.04	1,939.73	1,943.00	1,943.00	$312.30	99.69 %	99.45 %	99.45 %
March	99.85%	4.71	2,435.00	2,435.00	2,435.00	$392.04	99.91 %	99.91 %	99.91 %
April	99.19%	5.05	2,464.40	2,466.00	2,466.00	$396.77	99.43 %	99.43 %	99.43 %
May	99.14%	5.38	2,627.19	2,628.00	2,628.00	$422.98	99.29 %	99.29 %	99.29 %
June	99.00%	5.60	2,594.43	2,595.00	2,595.00	$417.70	99.19 %	99.01 %	99.01 %
July	98.92%	5.23	2,469.31	2,470.00	2,470.00	$397.56	99.11 %	98.92 %	98.92 %
August	98.73%	5.69	2,717.62	2,719.00	2,719.00	$437.54	99.21 %	99.21 %	99.21 %
September	99.08%	5.08	2,371.75	2,374.00	2,374.00	$381.85	99.08 %	98.88 %	98.88 %
October	100.00%	4.56	2,325.34	2,338.00	2,338.00	$374.38	99.40 %	98.53 %	98.53 %
November	100.00%	3.58	1,837.00	1,837.00	1,837.00	$295.76	100.00 %	99.73 %	99.73 %
December	100.00%	3.17	1,681.65	1,683.00	1,683.00	$270.75	99.63 %	99.63 %	99.63 %
Totals	**99.49%**	**55.59**	**27,404.42**	**27,429.00**	**27,429.00**	**$4,412.11**	**99.49 %**	**99.33 %**	**99.33 %**
	Unweighted	**Effect: 99.28%**					**Unweighted**	**Unweighted**	**Unweighted**
	Yearly Avg	**Sun Hrs: 4.63**					**Yearly Avg**	**Yearly Avg**	**Yearly Avg**

Notes: [None]

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APPENDIX E: EXISTING SEQUENCE OF OPERATIONS

SEQUENCE OF OPERATION – Rooftop Units (RTUs)

RTU – Mixed Air

Space sensor provided with local setpoint adjustment. Occupied pushbutton override will index the unit to occupied mode for a period of two hours when depressed. Optimum start program functions to ensure occupied conditions at the scheduled time.

The RTU motors are configured with random start delays that prevent all motors from starting at the same time after power failure or at the beginning of the occupied cycle.

WARM-UP MODE:

The outside air damper remains closed and the unit runs on 100% return air. The heating valve modulates to maintain maximum discharge air temperature setpoint to bring space up to occupied conditions.

COOL-DOWN MODE:

The outside air damper remains closed and the unit runs on 100% return air. DX cooling stages on in sequence to maintain discharge air temperature setpoint to bring space temperature down to occupied conditions.

OCCUPIED MODE:

The supply fan is energized and runs continuously and the outside air damper opens to minimum position. In heating mode, on a fall in space temperature below setpoint the hot water valve modulates to maintain setpoint of 72°F (adjustable). On a rise in space temperature above setpoint the outside air damper modulates open to introduce atmospheric cooling. In cooling mode, on a rise in space temperature above setpoint the economizer dampers modulate open to maintain setpoint of 74°F adjustable. If the packaged unit outside air enthalpy control indicates that free cooling is not available, the unit economizer dampers remain at minimum position and DX cooling is enabled in stages to maintain setpoint. Low limit sensor prevents discharge air from falling below 55°F by overriding the outside air damper closed.

On a rise in space humidity above setpoint, the dehumidification mode is initiated. Economizer dampers move to minimum outside air position and the dehumidification relay is enabled. The hot gas reheat solenoid valve and the first stage of cooling are energized and unit refrigerant moves from the compressor to the hot gas reheat coil to drop the mixed air sensible temperature and remove moisture. On a call for cooling the first stage of DX cooling is allowed to energize but on a continued call for cooling the dehumidification mode will be terminated to allow additional cooling. When zone humidity is reduced to 5% below the RH setpoint the dehumidification cycle is terminated.

Whenever the unit is de-energized the fan runs for a predetermined off cycle minimum time while heating and cooling are de-energized.

UNOCCUPIED MODE:

The unit fan is off, outside air damper is closed and the return air damper is open. The unit cycles with either heating or cooling to maintain 85°F cooling (adjustable) or 55°F heating (adjustable). If space humidity rises above the unoccupied humidity setpoint the unit cycles on in dehumidification mode as described above.

SYSTEM SAFETIES:

Smoke detector SD-1 located in the return air signals an alarm, stops the fan upon sensing products of combustion.

The unit auto reset freezestat signals an alarm, stops the fans and closes the outside air damper upon a drop in temperature below 38°F (adjustable). The operator will be required to reset the alarm from the workstation.

If the fan is commanded on but does not prove status after a time delay, a system alarm is generated and all unit control is disabled.

Compressor operation is disabled below a 50°F outside air temperature. Minimum run time is set to 2 minutes.

The rooftop unit will initiate a fail-safe mode on a freezestat trip, a fire/smoke signal from the BAS or if the space sensor or discharge air sensor fail. The fail-safe mode will close the outside air damper, open the hot water valve, de-energize the condensing unit and de-energize the supply fan.

SEQUENCE OF OPERATION – Unit Ventilators (UVs)

Unit Ventilators

Space sensor provided with local setpoint adjustment. Occupied pushbutton override will index the unit to occupied mode for a period of two hours when depressed. Optimum start program functions to ensure occupied conditions at the scheduled time.

WARM-UP MODE:

Prior to occupancy of the space, the unit runs on full heat with the outside air damper closed to bring temperature up to occupied setpoint. When warm-up is achieved the outside air damper moves to minimum position.

OCCUPIED MODE:

The supply fan and any interlocked exhaust fans are energized and run continuously and the dampers open to minimum position. On a fall in space temperature below setpoint the unit hot water valve modulates open to maintain setpoint. On a rise in space temperature above setpoint the dampers modulate open to outside air to introduce atmospheric cooling. If outside air enthalpy is not suitable for free cooling as determined by comparison to zone enthalpy, the dampers remain at minimum outside air position and mechanical cooling is energized to maintain setpoint. Discharge air sensor works as a low limit to prevent discharge air from falling below 55°F by first opening heating valve and then overriding the outside air damper closed.

UNOCCUPIED MODE:

The unit fan is off, exhaust fans are off, the outside damper is closed, the return air damper is open and the heating valve is open. In heating mode, the unit cycles with full heat to maintain unoccupied heating space temperature setpoint of 65°F (adjustable).

SYSTEM SAFETIES:

The unit auto reset freezestat signals an alarm, stops the fans and closes the outside air damper upon a drop in temperature below 38°F (adjustable). The operator will be required to reset the alarm from the workstation.

If the fan is commanded on but does not prove status after a time delay, a system alarm is generated and all unit control is disabled.

The unit vent will initiate a fail-safe mode on a freezestat trip, a fire/smoke signal from the BAS or if the space sensor or discharge air sensor fail. The fail-safe mode will close the outside air damper, open the hot water valve, de-energized the condensing unit and de-energize the supply fan.

EXHAUST FANS:

Interlocked exhaust fan runs continuously during occupied mode only (where applicable).

APPENDIX F: COST WORKS COST ESTIMATES

Washington Township BOE
236 Hurffville Road
Sewell,
NJ, 08080
Year 2011 Quarter 4

Date: 27-Feb-12

Unit Detail Report

Wedgwood 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 02 Existing Conditions							
024210200740			Deconstruction of building doors and windows, deconstruciton of door & wrap, interior or exterior, double, solid core, up to 2 stories, excludes handling, packaging or disposal costs, no closers	109.00	Ea.	$196.55	$21,423.95
Division 02 Subtotal							**$21,423.95**
Division 04 Masonry							
040513302700			Mortar, for glass block	1.00	C.F.	$16.52	$16.52
042313100100			Glass block, plain, under 1000 S.F., 4" thick, 6" x 6", includes mortar, excludes scaffolding	10.00	S.F.	$54.92	$549.20
042313100100	A		Glass block, 4" thick, 6" x 6", for solar reflective, add	1.00		$27.16	$271.60
Division 04 Subtotal							**$837.32**
Division 07 Thermal and Moisture Protection							
070150101600			Roof Coatings, reflective, white, elastomeric, 50 sf/gallon	1,300.00	Gal.	$17.89	$23,257.00
075323204800			Ethylene-propylene-diene-monomer roofing, (EPDM), 0.40 P.S.F., fully adhered with adhesive, 60 mils	650.00	Sq.	$243.98	$158,587.00
Division 07 Subtotal							**$181,844.00**
Division 08 Openings							
085113203800			Windows, aluminum, commercial grade, stock units, single hung, enameled, insulating glass, 3'-4" x 5'-0" opening, incl. frame and glazing	109.00	Ea.	$590.51	$64,365.59
088713102050			Reflective Glass, solar film on glass, excl. glass, maximum	1,635.00	S.F.	$22.91	$37,457.85
Division 08 Subtotal							**$101,823.44**
Division 09 Finishes							
090505301600			Walls and partitions demolition, glass block	10.00	S.F.	$9.11	$91.10
Division 09 Subtotal							**$91.10**
Division 23 Heating, Ventilating, and Air Conditioning (HVAC)							
230923100120			Control Components/DDC Systems, subcontractor's quote incl. material & labor, analog inputs, sensors (avg. 50' run in 1/2" EMT), duct temperature	15.00	Ea.	$471.24	$7,068.60
230923100130			Control Components/DDC Systems, analog inputs, sensors (avg. 50' run in 1/2" EMT), space temperature	34.00	Ea.	$757.56	$25,757.04
230923100160			Control Components/DDC Systems, subcontractor's quote incl. material & labor, analog inputs, sensors (avg. 50' run in 1/2" EMT), duct static pressure	15.00	Ea.	$644.22	$9,663.30

LineNumber			Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
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
235223202360			Boiler, gas fired, natural or propane, cast iron, steam, gross output, 2675 MBH, includes standard controls and insulated jacket, packaged	2.00	Ea.	$45,618.60	$91,237.20
236213100300			Condensing unit, air cooled, compressor, 3 ton, includes standard controls	3.00	Ea.	$2,751.75	$8,255.25
236213100350			Condensing unit, air cooled, compressor, 3.5 ton, includes standard controls	15.00	Ea.	$3,209.85	$48,147.75
237433101112			Rooftop air conditioner, single zone, electric cool, gas heat SEER 13, 3 ton cooling, 60 MBH heating, includes, standard controls, curb and economizer	2.00	Ea.	$8,368.80	$16,737.60
237433101120			Rooftop air conditioner, single zone, electric cool, gas heat, 4 ton cooling, 95 MBH heating, includes, standard controls, curb and economizer	9.00	Ea.	$7,261.11	$65,349.99
237433101140			Rooftop air conditioner, single zone, electric cool, gas heat, 5 ton cooling, 112 MBH heating, includes, standard controls, curb and economizer	2.00	Ea.	$8,263.06	$16,526.12
237433101150			Rooftop air conditioner, single zone, electric cool, gas heat, 7.5 ton cooling, 170 MBH heating, includes, standard controls, curb and economizer	3.00	Ea.	$11,584.78	$34,754.34
237433101162			Rooftop air conditioner, single zone, electric cool, gas heat SEER 13, 10 ton cooling, 200 MBH heating, includes, standard controls, curb and economizer	2.00	Ea.	$21,338.40	$42,676.80
Division 23 Subtotal							**$374,435.52**
Division 26 Electrical							
260150813200			Lighting fixture, maintenance, remove and replace (reinstall), incl. remove, disconnect wire terminations, store, reinstall and reconnect wire terminations	42.00	Ea.	$222.76	$9,355.92
265619209220			Roadway area luminaire, LED fixture, high power, replaces high pressure sodium 150 watt, incl lamp	10.00	Ea.	$1,523.90	$15,239.00
265619209250			Roadway area luminaire, LED fixture, high power, replaces high pressure sodium 250 watt, incl lamp	24.00	Ea.	$2,303.90	$55,293.60
265619209260			Roadway area luminaire, LED fixture, high power, replaces high pressure sodium 320 watt, incl lamp	8.00	Ea.	$2,493.78	$19,950.24
Division 26 Subtotal							**$99,838.76**

APPENDIX G: 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 H: 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 I: 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.

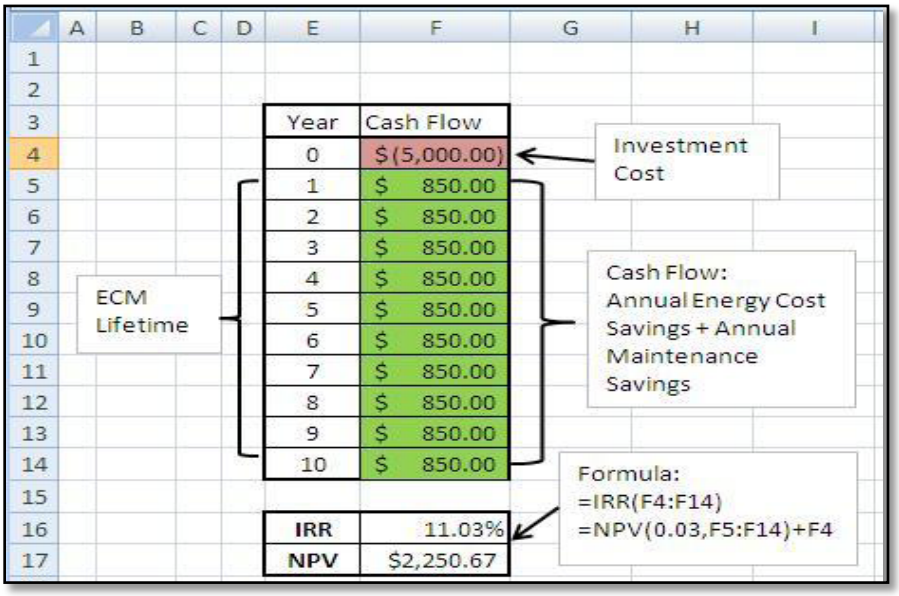
Calculation References

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 J: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Wedgwood Elementary School

Building ID: 3050410
For 12-month Period Ending: August 31, 2011[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: February 24, 2012

Facility
Wedgwood Elementary School
236 Hurffville Road
Sewell, NJ 08080

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1970
Gross Floor Area (ft²): 64,956

Energy Performance Rating[2] (1-100) 61

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	1,860,953
Natural Gas (kBtu)[4]	2,314,267
Total Energy (kBtu)	4,175,220

Energy Intensity[4]

Site (kBtu/ft²/yr)	64
Source (kBtu/ft²/yr)	133

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	387

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

National Median Comparison

National Median Site EUI	71
National Median Source EUI	148
% Difference from National Median Source EUI	-10%
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 K: 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 L: 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 5 incandescent lamps with CFLs	$57	$0	$57	540	0.0	0	0.0	$0	$87	5	$435	0.7	664%	133%	151%	$27	967
ECM 2	Replace 15 high bay MH fixtures with LEDs	$7,875	$0	$7,875	4,916	1.0	0	0.3	$375	$1,167	15	$17,512	6.7	122%	8%	8%	$365	8,802
ECM 3	Replace 19 old LED exit signs with newer LED exit signs	$3,050	$380	$2,670	3,662	1.0	0	0.2	$53	$643	15	$9,650	4.2	261%	17%	23%	$201	6,557
ECM 4	Install 26 new occupancy sensors	$5,460	$520	$4,940	3,211	0.0	0	0.2	$0	$518	10	$5,176	9.5	5%	0%	1%	$162	5,749
CI 1	Install 22.5 kW Solar Photovoltaic System	$135,000	$0	$135,000	27,404	18.0	0	1.4	-$500	$7,670	25	$154,227	17.6	14%	1%	1%	($24,147)	49,068
CI 2	Replace existing roof on both Newer and Older building sections	$181,844	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CI 3	Replace existing exterior light fixtures	$44,545	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CI 4	Replace End-of-Life RTUs and Condensing Units	$242,448	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CI 5	Upgrade Heat Timer Control and pneumatic system to DDC Control System	$50,751	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CI 6	Replace existing American Standard - Kewanee boiler	$91,237	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CI 7	Replace broken glass block windows	$928	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CI 8	Replace existing windows with Energy Star certified windows	$123,247	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals:		**$886,442**	**$900**	**$885,542**	**39,733**	**20.0**	**0**	**2.1**	**-$72**	**$10,085**	**-**	**$187,000**	**38.7**	**-**	**-**	**-**	**-**	**71,143**

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 M: 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.