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June 14, 2013

Local Government Energy Program
Energy Audit Report

Lower School
Dwight-Englewood School
315 East Palisade Avenue
Englewood, NJ 07631

Project Number: LGEA106

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EXECUTIVE SUMMARY

The Dwight-Englewood School's Lower School is a three story, 40,000 ft^2 Pre-K - 5^{th} grade school. The building, built in 1995, currently houses several classrooms, a cafeteria, kitchen, and boiler room located in the basement. The building is mechanically cooled during the summer months and is provided heating hot water (HHW) via a hot water boiler, located in the mechanical room, during the heating season. Table 1 below provides a comparison of the current building energy usage based on the period from December 2011 through November 2012 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	340,840	14,216	$81,212	64.0	134	2,584
Proposed	291,478	12,734	$67,598	56.1	116	2,267
Savings	49,362	1,482	$13,614*	7.9	18	317
% Savings	14.5%	10.4%	16.8%	12.4%	13.4%	12.3%
*Includes operation and maintenance savings						

SWA has entered energy information about the Dwight-Englewood School facility into the U.S. Environmental Protection Agency's (EPA) Energy Star Portfolio Manager Energy Benchmarking system. The ENERGY STAR Energy Performance Rating was calculated to be 66. The building has a Site Energy Utilization Intensity of 65 kBtu/sqft/yr compared to the National Median of 75 kBtu/sqft/yr, for similar schools.

Recommendations

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

Recommended ECMs	Incentive Program (APPENDIX G for details)
Upgrade 54 Halogen Lamps with compact fluorescent lamps (CFLs)	Direct Install, Smart Start
Retrofit 140 T12 fixtures with electronic ballasts and T8 lamps	Direct Install, Smart Start
Upgrade 40 lighting controls with occupancy sensors	Direct Install, Smart Start
Replace 1 old Drapkin Hall Refrigerator with 18 cu ft energy star model	N/A
Retro-commissioning	N/A
Replace Boiler Controller	N/A
Retrofit 10 T12 U-Shaped fixtures with electronic ballasts and T8 U-Shaped lamps	Direct Install, Smart Start

Appendix H contains an Energy Conservation Measures table

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.

- Install a building management system (BMS)
- Increase envelope thermal resistance
- Replace exterior doors

In addition to these ECMs, SWA recommends the following Operation and Maintenance (O&M) measures that would contribute to reducing energy usage at low or no cost:

- Replace old motors with NEMA premium efficiency models
- Install 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 new purchases are made
- Use smart electric power strips
- Create an energy educational program

There may be energy procurement opportunities for the Dwight-Englewood School to reduce annual utility costs. The School currently pays a competitive utility rate for electric and gas, but may be able to further reduce utility costs. SWA recommends further evaluation with energy suppliers, listed in Appendix D.

Energy Conservation Measure Implementation

SWA recommends that Dwight-Englewood School implement the following Energy Conservation Measures using an appropriate Incentive Program for reduced capital cost:

Table 2: Energy Conservation Measure Recommendations

Measures	First Year Savings ($)	Simple Payback Period (Years)	Initial Investment	CO2 Savings (lbs/yr)
0-5 Year	$5,204	2.2	$11,516	42,409
5-10 Year	$8,410	6.4	$53,942	62,309
Total	$13,614	4.8	$65,458	104,718

Environmental Benefits

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 9 cars from the roads each year or is equivalent of planting 255 trees to absorb CO_2 from the atmosphere.

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 40-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 Dwight-Englewood School at 315 East Palisade Ave, Englewood, NJ. The process of the audit included a facility visits in December 10th, 11th 2012 and January 2nd, 3rd 2013, 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 Dwight-Englewood Schools to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures.

HISTORICAL ENERGY CONSUMPTION

Energy usage, load profile and cost analysis per building

SWA reviewed electric and gas utility bills from December 2010 through November 2012 that were received from the Dwight-Englewood School. A 12 month period of analysis from December 2011 through November 2012 was used for all calculations and for purposes of benchmarking the building.

Electricity – The Lower School is currently served by one electric meter, supplied and delivered by Public Service Electric & Gas (PSE&G). Electricity is used in process loads such as fans, motors, as well as plug loads such as computers, refrigerators and copying machines. Electricity is also used to operate the chiller. Electricity was purchased at an average aggregated rate of $0.197/kWh and the school consumed 340,840 kWh, or $67,272 of electricity, for the analyzed billing period. The monthly peak demand was 150.4 kW for the month of August, while the average monthly demand was 115 kW.

Figure 1 below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate the school. The baseline usage for the facility is approximately 12,000 kWh. As shown in the chart, an increase in electric consumption during the summer months is typical of this building type, which uses electricity for cooling.

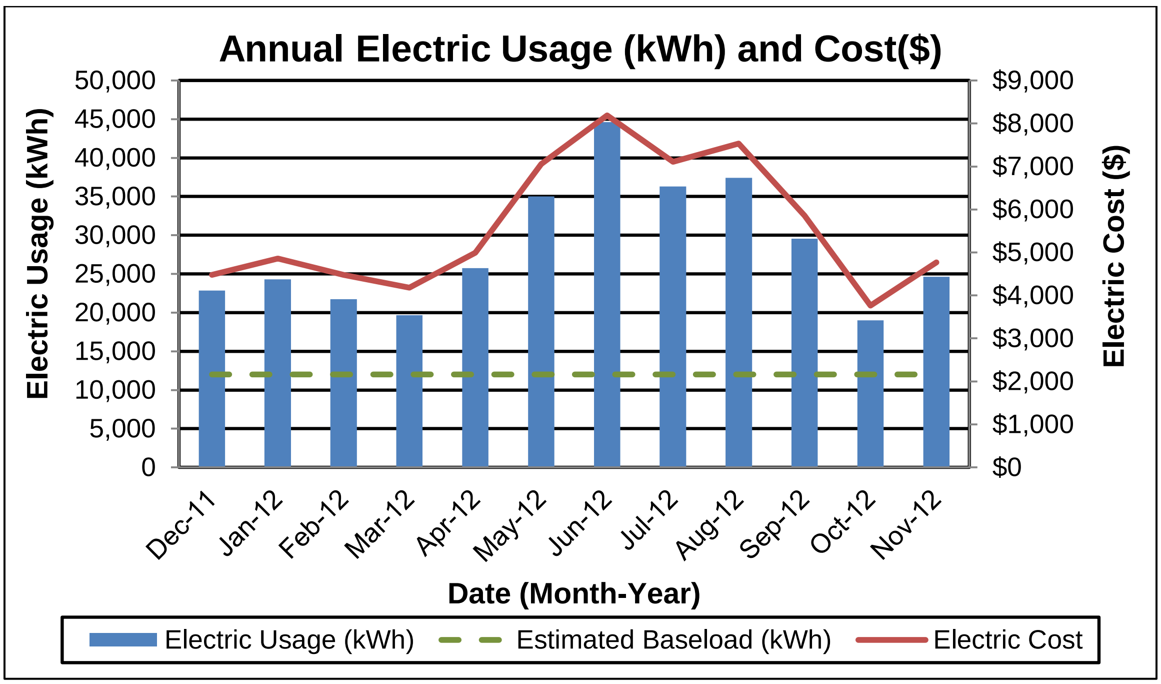


Figure 1: Annual electric usage (kWh) and cost ($)

Natural gas – The school is served by one natural gas meter which is supplied by HESS and deliver by PSE&G. Natural gas was purchased at an average aggregated rate of $0.981/therm and the school consumed 14,216 therms, or $13,940 of natural gas, for the analyzed billing period. Figure 2 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 school. The non-heating gas baseload for the school is approximately 71 therms. As expected, usage peaks in the winter months in conjunction with the operation of the gas-fired hot water heating boiler. The monthly natural gas costs also peak in the winter months in correlation with the increased natural gas usage.

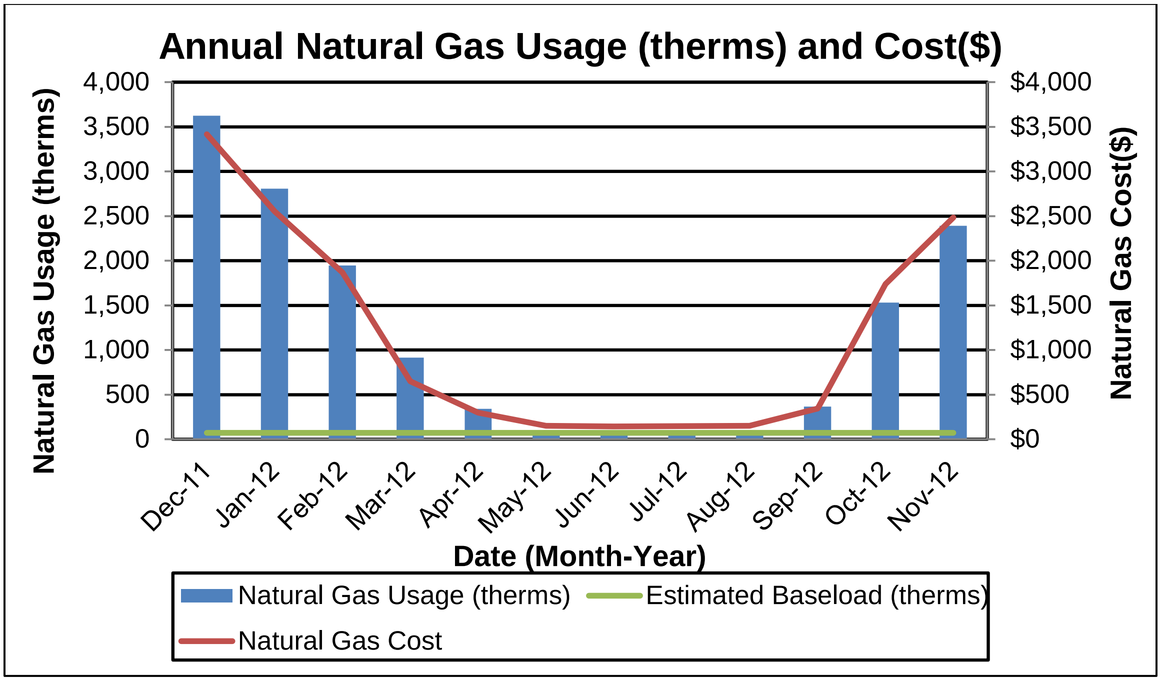


Figure 2: Annual natural gas usage (therms) and Cost ($)

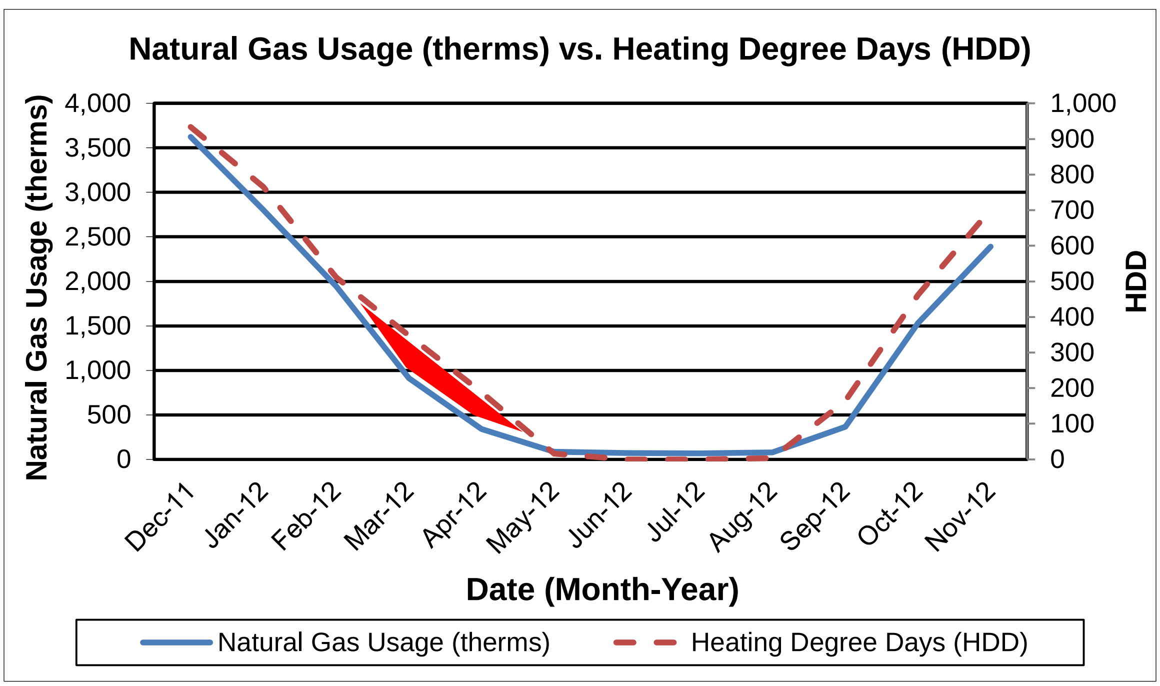


Figure 3: Natural gas usage (therms) vs. Heating degree days (HDD)

Figure 3 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 of 65°F, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the base temperature. Figure 3 shows that the natural gas curve follows closely the HDD curve. However, there are months where the natural gas curve deviates from the HDD curve. Such deviation may lead to inefficient heating by the heating system and usage of supplemental heating by the air source heat pumps. In the char above, gas usage exceeds the HDD curve between May and August; however, this is attributed to a non-weather dependent domestic hot water heating.

Table 3 and figure 4 show energy use for Drapkin Hall (Lower School) based on utility bills for the analyzed billing period. Note: electrical cost at $58/MMBtu of energy is over 4 times as expensive as natural gas at $10/MMBtu

Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Misc	182	7%	$10,550	13%	58
Electric For Cooling	460	18%	$26,604	33%	58
Electric For Heating	212	8%	$12,247	15%	58
Lighting	309	12%	$17,872	22%	58
Domestic Hot Water (Gas)	235	9%	$2,301.16	3%	10
Building Space Heating (Gas)	1,187	46%	$11,638.59	14%	10
Totals	2,585	100%	$81,212	100%	31
Total Electric Usage	1,163	45%	$67,272	83%	58
Total Gas Usage	1,422	55%	$13,940	17%	10
Totals	2,585	100%	$81,212	100%	31

Table 3: Annual energy consumption / Costs.

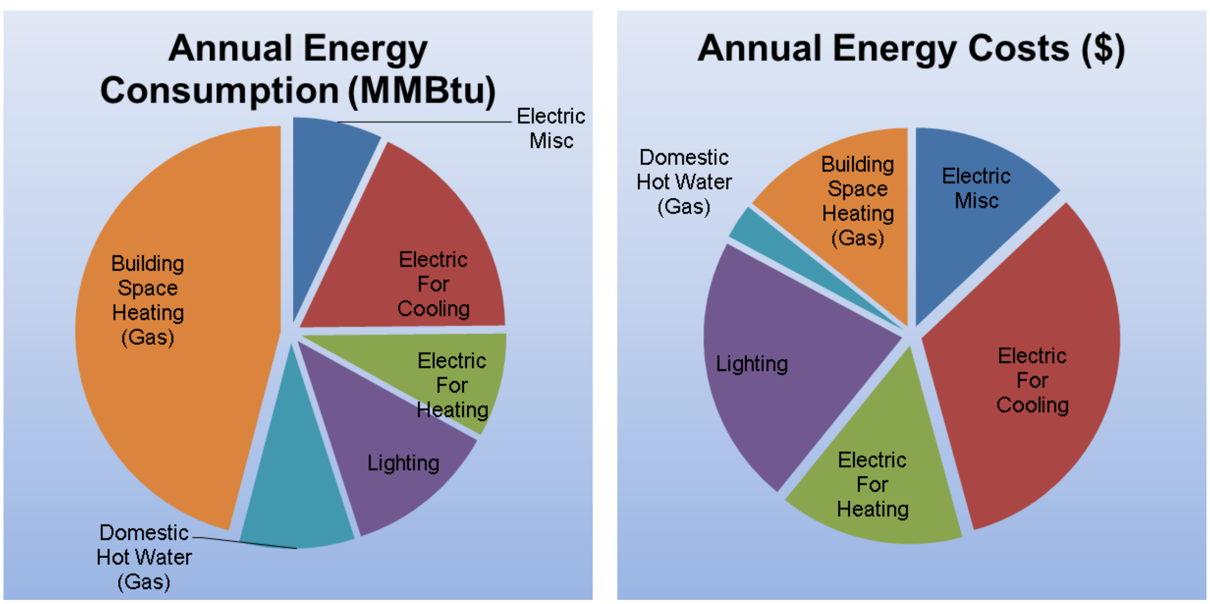


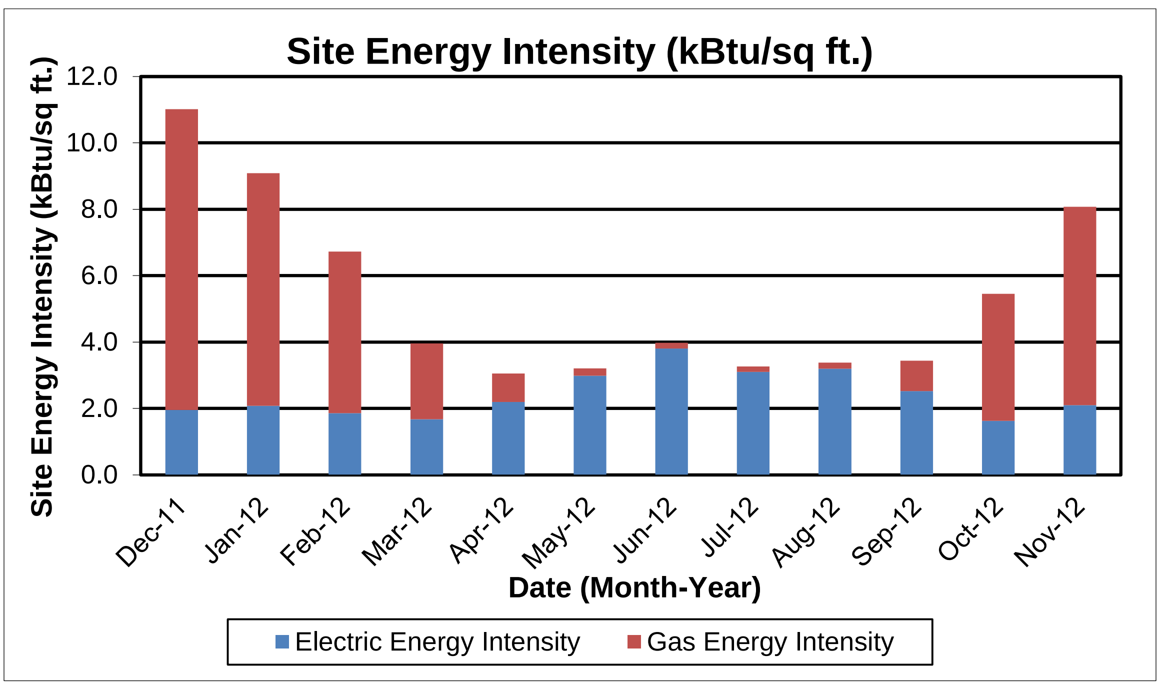
Figure 4: Annual energy consumption (MMBTU) and costs ($) by end use

Energy Benchmarking

SWA has entered energy information about the Lower 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. The ENERGY STAR® Portfolio Manager calculated the Energy Performance Rating to be 66. For reference, a score of 69 is required for LEED for Existing Buildings certification, and a score of 75 is required for ENERGY STAR® certification.

The ENERGY STAR® Portfolio Manager uses a national survey conducted by the U.S. Energy Information Administration (EIA). This national survey, known as the Commercial Building Energy Consumption Survey (CBECS), is conducted every four years, and gathers data on building characteristics and energy use from thousands of buildings across the United States. As of 2012, Portfolio Manager continues to use CBECS data from 2003 due to insufficient data from the 2007 survey. 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 school 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.

The Site Energy Use Intensity (SEUI) is 65 kBtu/sqft/yr compared to the national median SEUI of a "K-12 School" building consuming 75 kBtu/sqft/yr. This is a 14% difference between the buildings intensity and the national median. 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 Dwight-Englewood School in creating an ENERGY STAR® Portfolio Manager account and sharing the 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 Dwight-Englewood School (user name of [redacted]" with a password of "[redacted]).

Tariff analysis

Tariff analysis can help determine if the school 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 Dwight-Englewood School. The electric use for the building is direct-metered and purchased under the Large Power and Lighting-Secondary service rate schedule, which includes demand and societal benefits charges. The Large Power and Lighting rate schedule 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. The school is also paying for natural gas under the Large Volume Gas rate schedule, which includes fixed costs such as meter reading charges.

Energy Procurement strategies

Utility 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 $0.137/kWh, while the school pays a rate of $0.197/kWh. The school's annual electric utility costs are $20,577 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 12% over the analyzed billing period. Electric rate fluctuations in the winter and spring can be attributed to a combination of demand charges, market rate changes and actual and estimated meter readings. The Dwight-Englewood School can benefit from switching to a third-party supplier, which would bring the supply costs and overall electric costs down.

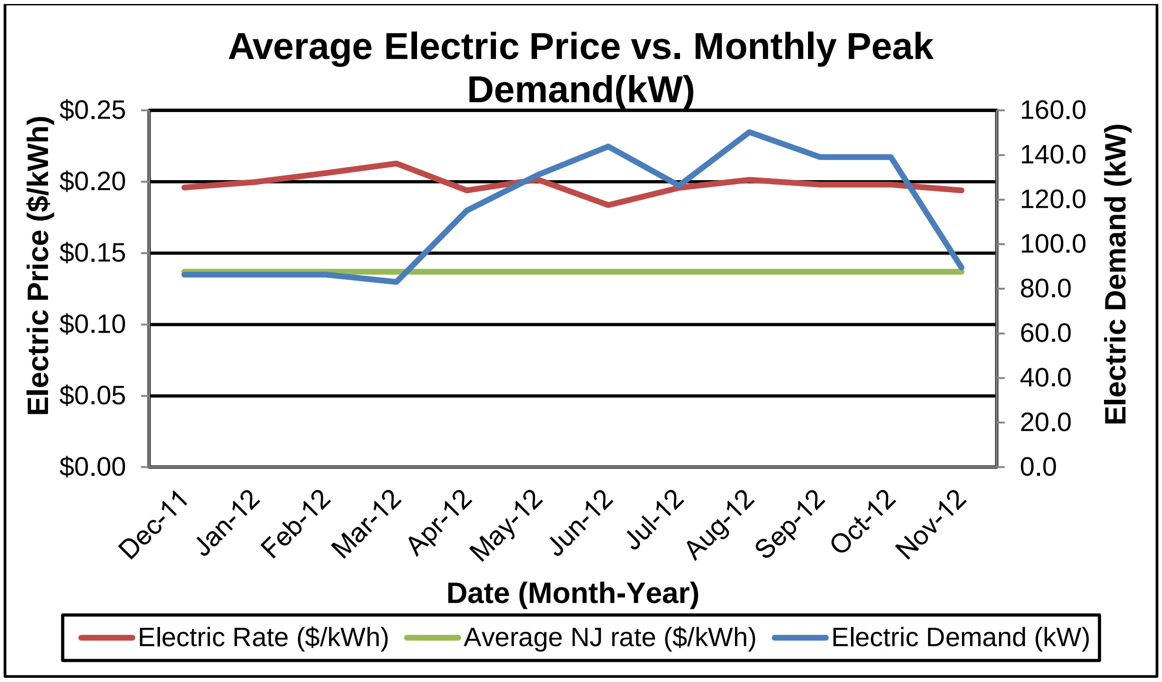


Figure 5: Average electric price vs. Monthly peak demand (kW)

The average estimated NJ commercial utility rates for gas are $0.811/therm, while the school pays a rate of $0.981/therm. The school's annual natural gas costs are $2,410 higher, when compared to the average estimated NJ commercial utility rates. Natural gas bill analysis shows fluctuations over the analyzed billing period. Utility rate fluctuations in the spring and summer months are caused by a combination of low usage and the assessment of fixed fees and costs.

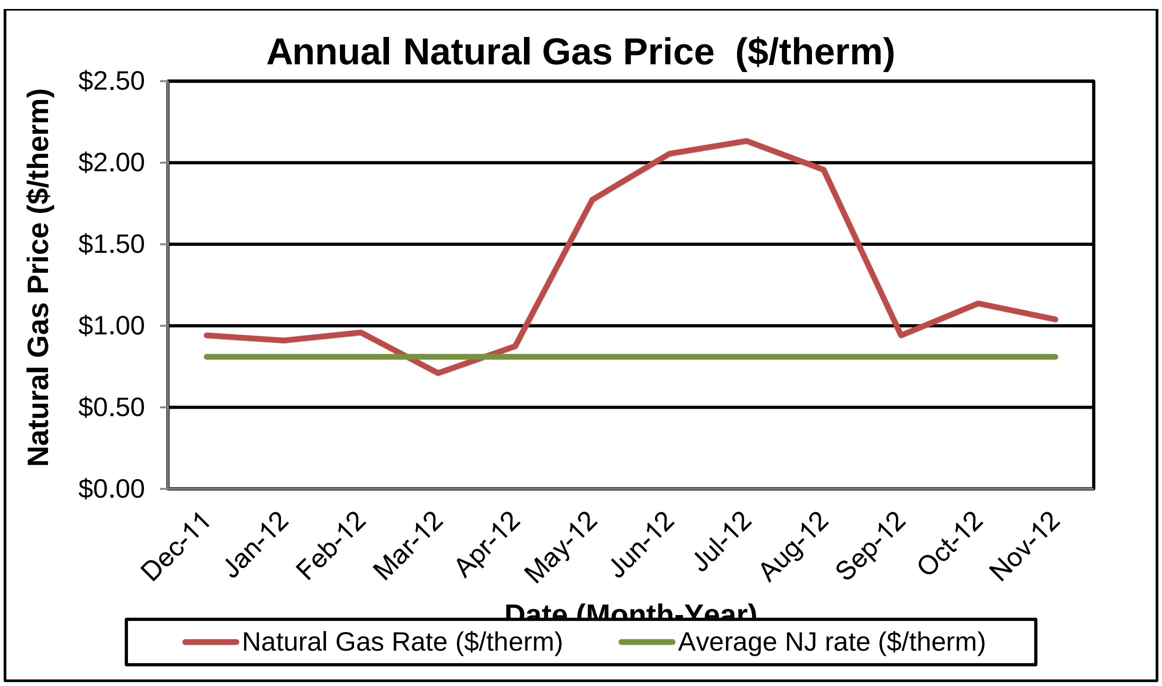


Figure 6: Annual natural gas price ($/therm)

Preceding the expiration of any third-party supplier contract, SWA recommends that the school further explore opportunities of purchasing electricity and natural gas from other third-party suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for Dwight-Englewood Schools. Appendix D contains a complete list of third-party energy suppliers for the Dwight-Englewood 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 December 10, 2012, the following data was collected and analyzed.

Building Characteristics

The Dwight-Englewood School's Drapkin Hall also known as the Lower School is a three story, 40,000 ft^2 grammar school. The Lower School was built in 1995 to relocate the Pre-K through 5th grade students after the merger with the Bede School in 1993. The building, currently houses 15 classrooms, dining area, kitchen, and mechanical room located in the second level.

Image 1 Main entrance

Image 2 exterior façade and bridge

Image 3 Playground area

Image 4 Playground area

Building Occupancy Profiles

Occupancy is approximately 243 students and 44 faculty members from 7:30 AM to 7:00 PM Monday through Friday. Kitchen staff typically arrives at 6:30 AM and cleaning crews are in the building from 8:00 PM to 11:00 PM.

Building Envelope

On January 3rd, 2013, SWA performed a building envelope analysis. At this time, the average outside dry bulb temperature was approximately 34°F with an average wind speed of 8 mph. These conditions are considered favorable for infrared imagery. Infrared imagery requires a minimum temperature difference of 18°F, between indoor and outdoor spaces. Infrared images below exhibit specific building envelope deficiencies, such as unwanted heat transfer and air infiltration. Additional building envelope characteristics are detailed below. The building envelope consists of the outer shell of the building including the walls, windows, doors, and roof. This section will examine the overall condition of the envelope and note any deficiencies discovered during the audit.

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 detailed visual analysis, as far as accessibility and weather conditions allowed at the time of the field audit.

Exterior Walls

The exterior construction of the building is mainly of a steel frame and a combination of brick masonry and cast stone veneer cavity wall with CMU backup, glass curtain wall, and red-face brick cavity walls. There is a glass curtain wall with 1" insulated glazing supported by an un-insulated aluminum frame. The estimated insulation inside the wall structure is 2 inch of fiber glass insulation. The building walls were found to be in good condition with no observed defects.

Image 8: Exterior of School

Image 9: Rear Entrance

Roof

The building has a roof of asphalt shingles and aluminum-coated smooth faced modified bitumen on polyisocyanurate insulation. The estimated insulation below the roof deck is 2 inches of rigid insulation. The roof has sections of steep sloping along with flat areas. The roof was inspected during a light shower and was found to have no leaks or areas of observable pooling. The roof looks to be in good condition, overall.

Roofs, related flashing, gutters and downspouts were inspected during the field audit with limited access. They were reported to be in overall fair condition. The following is a photo of the roof from the time of the audit:

Image 10 Toilet exhaust fans and DX Units

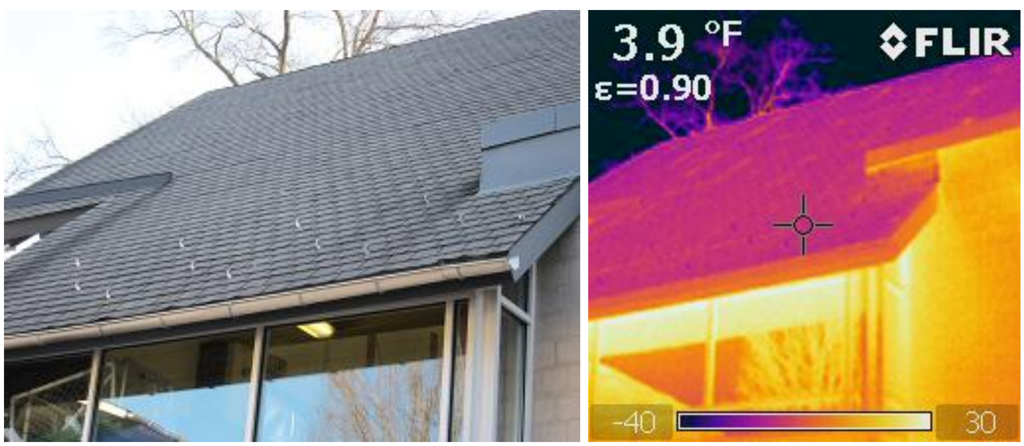


Image 11 Heat escaping near flashing

The photos above detail an infrared image of the building. The number in the top left corner represents the temperature of the area within the crosshairs in the center of the photo. The numbers on the bottom of the photo represent the scale of the color gradient shown.

Image 11 shows signs of heat leakage around the flashing between walls and roof; this is a typical area of infiltration. We also see heat emanating from the non-insulated aluminum window frames, though there are no abnormal areas of heat outflow. The operational and maintenance section covers recommendations associated with leakage through joints and partitions that can help reduce the heat loss through a wall joint.

Base

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 fair condition with a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues neither visible on the interior nor exterior. Slab and perimeter insulation levels could not be verified in the field.

Windows

The building contains several different types of windows.

1. A large glass curtain wall with 1" insulated glazing on a non-insulated aluminum frame
    a. This can be found at the main entrance of the building

2. Double-glazed fixed windows with a non-insulated aluminum frame.
    a. These windows are located throughout the classrooms and hallways.

Windows, shading devices, sill, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage, and other energy compromising issues. Overall, the windows were found to be in good condition with few signs of energy compromising issues.

The following specific window problems were identified:

Window frames are non-insulated and allow heat to easily escape. Image 12, below, shows a thermal imaging photograph of windows, taken from the exterior. The bright yellow indicates higher temperatures, showing the heat from the interior escaping through the window panes.

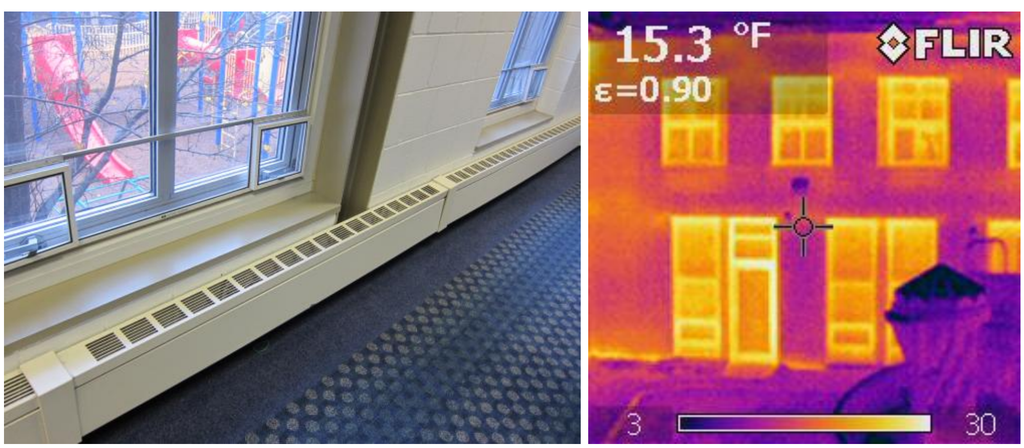


Image 12 Non-insulated metal frame provides poor insulation to the building

Exterior Doors

The building contains aluminum type doors with double glazing and a non-insulated aluminum door frame. This door is located all the entrances and emergency classroom exits.

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 fair condition with no noticeable air-leakage or moisture related issues. Weather-stripping on doors should be re-stripped every 3-5 years, depending on wear.

Image 13, below, shows heat emanating from around the door frame due to the frame being non-insulated. Heat is not significantly permeating from the gap on the bottom of the doors, which suggests proper weather-stripping.

The following photo is typical of exterior doors:

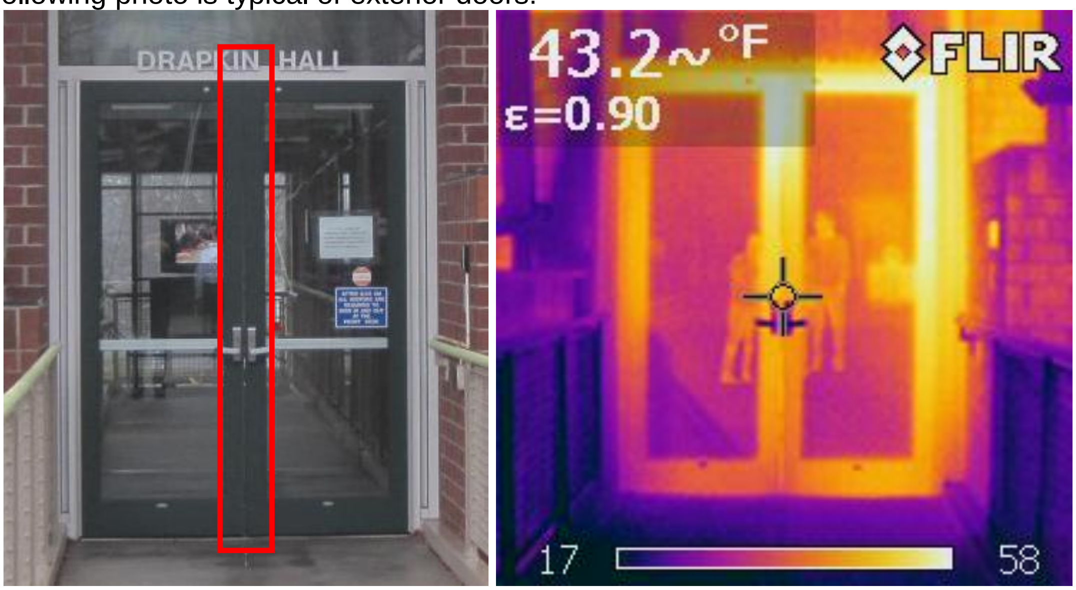


Image 13 There is no noticeable gap between doors; this suggests that weather-stripping is in good condition and is being maintained properly.

Building air-tightness

Overall the field auditors found the building to be adequately air-tight.

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

Most spaces in the Dwight-Englewood School are mechanically ventilated, heated and cooled. The building has a mechanical room in the 2nd floor housing boilers, pumps, motors and controls. One 110-ton McQuay air cooled chiller is located on the roof. The heating, ventilating and air conditioning (HVAC) equipment is described below.

Heating System

Heating hot water (HHW) is generated by two 1,300 MBH low-pressure Weil-Mclain gas-fired boilers located in the 2nd floor mechanical room. The boilers are controlled by a Tekmar controller which operates the boilers whenever outside air temperature falls below 52°F. According to the building superintendent, the boilers operate on a lead-lag mode and are set to maintain a HHW leaving water temperature of 140°F with a 10°F temperature drop on the return side. Heating hot water is distributed throughout the building by two (2) 3HP pumps with constant volume flow. HHW is distributed serves perimeter fin tube radiators in hallways, thru-the-wall unit ventilators in classrooms and offices and hot water coils in air handling units.

Typically, the building operates on heating mode from the second week of October until the second week of April, depending on weather. During the walkthrough SWA was informed that classrooms 211, 213, 214, 217, and some rooms in the first floor has ductless mini split air conditioning units that cool down the rooms through the heating season. The rooms previously mentioned have a southern exposure.

Image 16 (above) Weil-Mclain boiler

Image 17 (Right) Missing insulation on HHW Piping

Image 18 HHW Pumps

Cooling Plant

The building has a 110 ton McQuay air cooled chiller located in the flat roof. The chiller has two (2) compressors at 35-HP each and two (2) compressors at 30HP each, for a total of four (4) compressors. The condenser section for each chiller consists of eight (8) condenser fans at 1-HP each and two (2) condenser fans at 10-HP each, for a total of 10 condenser fans. The chiller is original to the building and was installed in 1995. The air cooled chiller provides chilled water (CHW) at approximately 45°F leaving water temperature, according to the building superintendent.

Image 19 CHW Pumps

Image 20 Air cooled chiller

Chilled water is distributed throughout the building by two (2) 5 HP pumps with constant flow control, the CHW is recirculated in the dual temperature loop which delivers chilled water to perimeter fin tube radiators in the hallways, thru-the-wall unit ventilators located in the classrooms and cooling coils in air handling unit serving the gymnasium and cafeteria. Fan coil units contain dual temperature coils for heating and cooling.

Image 21 Thru-Wall Unit Ventilator *Image 22 Hallway Fin-Tube Radiators*

Classrooms 211, 213, 214, 217 and some first-floor offices have supplemental ductless DX units to provide additional cooling when needed. These rooms all have southern exposures.

Image 23 Split DX Units

Ventilation

Ventilation for the gymnasium and cafeteria is provided by modular air handling units located in the mezzanine mechanical room. The air-handling unit was manufactured by McQuay and has an outside air intake for fresh air, return and supply ductwork. Fan belts are notched and the fan motor is 5HP, with an overall efficiency of 84%. Honeywell room thermostats located in the cafeteria provide temperature feed and control the AHU. It was noted during the walkthrough that the cafeteria supply fans were operating during unoccupied mode, overriding the manual timer.

Image 24 Cafeteria/Gym AHU

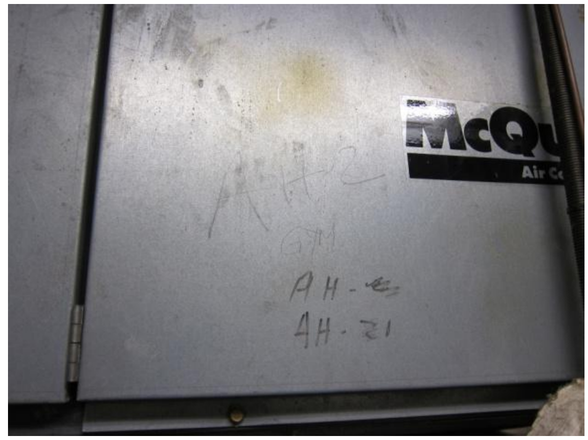


Image 25 Cafeteria/Gym AHU

Classrooms receive outside air for ventilation from the thru-the-wall unit ventilators. The ventilators have a fixed outside air louver that provides minimum fresh air.

Roof-mounted exhaust fans provide general ventilation in the building.

Domestic Hot Water

The building is provided domestic hot water (DHW) by one gas-fired 89-gallon A.O Smith Commercial Lime Tamer #BTC-154-920 hot water heater with input capacity of 154 MBH. Domestic hot water is distributed throughout the building by a fractional horsepower pump located next to the water heater, the leaving water temperature was observed to 130°F. The water heater, pump and expansion tank are located in the 2nd floor Mechanical room.

Image 26 A.O. Smith gas-fired DHW boiler

Controls

Boilers are controlled by a Tekmar Boiler control panel, which modulates based on outside air temperature. The thru-the-wall unit ventilators are controlled by integrated equipment controls. Gym and Cafeteria AHUs have Honeywell room thermostats and are typically set to maintain 70° - 72° F. The dual temperature loop control valves and isolation valves are manually controlled. Exhaust fans are controlled by timers and typically operate from 6:30 a.m. until 3 p.m.

Image 27 Tekmar Boiler Controller

Image 28 DHW Timer Controller

Electrical systems

Lighting

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

Interior lighting – Hallways consist mainly of efficient T-8 and CFL lighting while exit signs are of the LED variety. The lighting in the classrooms of the lower school is predominantly electronically ballasted T-12 fluorescent lamped fixtures. T-12 lamps are less efficient than T-8 lamps and should be replaced. Metal Halide and Halogen lamps were also noted in several areas of the school; there exist energy-efficient replacements for these.

Image 29 Typical Corridor T8 lighting

Exit Lights - Exit signs were found to be LED types.

Image 30 & 31 Typical LED exit signs

Exterior Lighting - The playground lighting surveyed during the building audit was found to be of halogen lighting. There exist energy-efficient replacements for these.

Image 32 & 33 Typical wall mounted and ceiling mounted halogen fixtures

Appliances and Process

The Lower School Facility contains a kitchen area adjacent to the cafeteria. This area contains commercial kitchen equipment including: an industrial dishwasher, dual oven, stove top, freezer, and walk in refrigerator. All the commercial kitchen equipment is energy star qualified and approximately 6 years old. In addition to the kitchen and prep area, there is a teacher's lounge containing a standard size refrigerator and microwave oven. The refrigerator in the teacher's lounge is not energy star rated and it is approximately over 10 years old.


Images 34, 35, & 36 Ovens (L), Dishwasher (C), and Refrigerator (R)

Elevators

The building contains two hydraulic Schindler elevators. Elevator-1 is 2-stop, 2500 lb., 125 fpm, and microprocessor controlled. Elevator-2 is 3-stop, front-and-rear-opening, 2500 lb, 100 fpm, and microprocessor controlled.

Other electrical systems

There are currently no other significant energy-impacting electrical systems installed at the Dwight-Englewood Lower School.

RENEWABLE AND DISTRIBUTED ENERGY MEASURES

Renewable energy is defined as any power source generated from sources which are naturally replenished, such as sunlight, wind and geothermal. Technology for renewable energy is improving and the cost of installation is decreasing due to both demand and the availability of government-sponsored funding. Renewable energy reduces the need for using either electricity or fossil fuel, therefore lowering costs by reducing the amount of energy purchased from the utility company. Solar photovoltaic panels and wind turbines use natural resources to generate electricity. Geothermal systems offset the thermal loads in a building by using water stored in the ground as either a heat sink or heat source. Cogeneration or Combined Heat and Power (CHP) allows for heat recovery during electricity generation.

Existing systems

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

Evaluated Systems

Solar Photovoltaic

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

Installation of solar photovoltaic panels in Drapkin Hall is not recommended based on the roof construction and orientation. Approximately 70% of the roof area is sloped, the remaining 30% of the roof is flat and it is already occupied with other mechanical equipment. The available area for installation is not sufficient to support a solar panel array with good potential for energy and cost savings.

Solar Thermal Collectors

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

Wind

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

Geothermal

The Drapkin Hall building 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

The Drapkin Hall 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 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	**Upgrade 54 Halogen Lamps to CFLs**
ECM 2	**Retrofit 140 T12 fixtures with T8 lamps and electronic ballasts**
ECM 3	**Install 40 occupancy sensors**
ECM 4	**Replace 1 old Drapkin Hall refrigerator with 18 cu ft Energy star model**
ECM 5	**Retro-commissioning**
ECM 6	**Replace Boiler Controller**
ECM 7	**Retrofit 10 T12 U-Shape fixtures with T8 U-Shaped lamps and electronic ballasts**

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: Upgrade 54 Halogen Lamps with Compact Fluorescent Lamps (CFLs)

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

Installation cost:

Estimated installed cost: $537.75 (includes $216 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
$538	7,870	2	0	0.7	$18	$1,356	5	$6,778	0.4	1,161%	232%	252%	$5,461	14,092

Assumptions: SWA calculated the savings for this measure using measurements taken on the day of the field visit and using the billing analysis. SWA also assumed 2 hours/day to replace aging burnt out lamps.

Rebates/financial incentives:

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

Please see APPENDIX G for more information on Incentive Programs.

ECM #2: Retrofit 140 T12 fixtures with electronic ballasts and T8 lamps

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

Installation cost:

Estimated installed cost: $2,978 (includes $2,084 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
$2,978	3,905	1	0	0.3	$867	$1,531	15	$22,961	2	671%	45%	51%	$14,568	6,991

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

Rebates/financial incentives:

- NJ Clean Energy – Direct Install program (Up to 70% of installed costs)
- NJ Clean Energy – SmartStart program – T8 fixtures with electronic ballasts ($10 per fixture – Maximum incentive amount is $580

Please see APPENDIX G for more information on Incentive Programs.

ECM #3: Upgrade 40 Lighting Controls with Occupancy Sensors

The building contains several areas that could benefit from the installation of occupancy sensors. These areas consisted of various classrooms, 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 ultrasonic lighting sensors include sound detection as a means to controlling lighting operation.

Installation cost:

Estimated installed cost: $8,000 (includes $2,400 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
$8,000	11,500	2	0	1.0	$0	$1,955	15	$29,325	4	267%	18%	23%	$14,540	20,591

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

Rebates/financial incentives:

- NJ Clean Energy – SmartStart – Wall-mounted occupancy sensors ($20 per occupancy sensor) – Maximum incentive amount is $740

Please see APPENDIX G for more information on Incentive Programs.

ECM #4: Replace 1 old Drapkin Hall refrigerator with 18 cu ft Energy Star model

During the field audit, SWA inspected old refrigerator(s) which were not Energy Star rated (using approximately 775 kWh/yr). Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. SWA recommends the replacement of existing old refrigerators with 18 cu. ft. top freezer refrigerators ENERGY STAR®, using approximately 425 kWh/yr, or equivalent. Besides saving energy, the replacement will also keep the surrounding area cooler. When compared to the average electrical consumption of older equipment, Energy Star equipment results in large savings. Look for the Energy Star label when replacing appliances and equipment, including: window air conditioners, refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

On April 28, 2008, the ENERGY STAR criteria changed for all full-size refrigerators. All refrigerators greater than 7.75 cubic feet must be at least 20% more efficient than the federal standard. Before April 28, 2008, refrigerators needed to be at least 15% more efficient than the federal standard. The criteria for freezers and compact refrigerators and freezers did not change.

Installation cost:

Estimated installed cost: $750 (includes $100 of labor)
Source of cost estimate: Energy star website, www.energystar.com

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
$750	350	0	0	0.0	$50	$119	12	$1,429	6.3	91%	8%	12%	$408	627

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

Rebates/financial incentives:

- Currently there are not any incentives for this measure.

Please see APPENDIX G for more information on Incentive Programs.

ECM #5: Retro-commissioning

Retro-commissioning is a process that seeks to improve how building equipment and systems function together. Depending on the age of the building, retro-commissioning can often resolve problems that occurred during design or construction and/or address problems that have developed throughout the building's life. Owners often undertake retro-commissioning to optimize building systems, reduce operating costs, and address comfort complaints from building occupants.

Since the systems in the building have undergone some renovations in recent years, and the occupants continue to have concerns with thermal comfort control, SWA recommends undertaking retro-commissioning to optimize system operation as a follow-up to completion of the upgrades. The retro-commissioning process should include a review of existing operational parameters for both newer and older installed equipment. During retro-commissioning, the individual loop temperatures and (setback) schedules should also be reviewed to identify opportunities for optimizing system performance, besides air balancing and damper proper operation.

Installation cost:

Estimated installed cost: $50,000 (includes $42,500 of labor)
Source of cost estimate: Similar Projects

Economics:

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
$50,000	24,797	1	1,187	5.1	$1,820	$7,878	12	$94,536	6.3	89%	7%	11%	$26,637	57,482

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

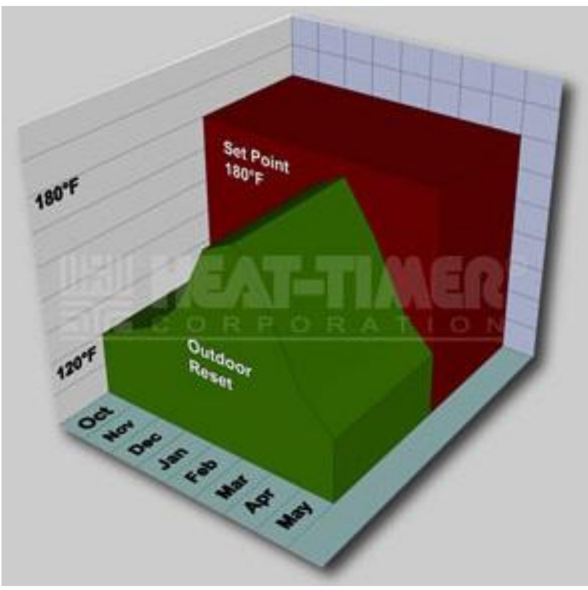
Rebates/financial incentives:

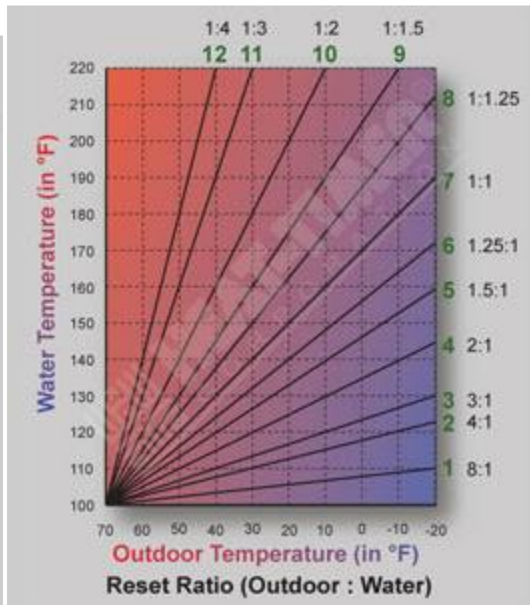
- Currently there are not any incentives for this measure.

Please see APPENDIX G for more information on Incentive Programs.

ECM #6: Replace Boiler Controller

During the energy audit, SWA observed that the existing *tekmar* controller operates the boilers whenever outside air temperature drops below 52°F. During heating mode, the boilers are programmed to deliver a constant 140°F leaving water temperature throughout the heating season. The heating hot water distribution loop is a constant volume system and therefore circulates heating hot water through the building constantly independent of actual building load. The current boiler operating parameters make space temperatures to be higher than required when outside air temperatures are milder in months such as April, May, October and November. SWA recommends replacing the boiler controller for a newer model capable of performing heating hot water reset. The controller will set the leaving water temperature based on outside air temperatures, by adjusting the heating hot water temperature there is a 1% energy savings for every 4°F of temperature drop. The graphs below show how companies such as heat-timer implement heating hot water reset, for more information visit: www.heat-timer.com.





Installation cost:

Estimated installed cost: $2000 (including labor)
Source of cost estimate: Heat-timer Corporation

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
$2,000	0	0	295	0.7	$0	$290	10	$2,900	6.9	45%	5%	7%	$435	3,252

Assumptions: SWA calculated the savings for this measure using Weather BIN Data to estimate the percentage of hours when outside air temperature at which heating hot water reset would be possible during the year. Using published values by Heat-Timer Corporation of 1% energy saving for every 4°F of heating hot water reduction were applied to the calculation.

Outside Air Temp DB (°F)	Hrs/yr at O.A Temp	% hrs Vs. Total hrs	Current HHWT (°F)	Proposed HHWT (°F)	HHWT (°F) Reduced	% Energy Savings	% Actual Savings
~~55~~	~~100~~						
~~53~~	~~146~~						
51	**166**	**5%**	**140**	**120**	**20**	**5%**	**0.2%**
49	**399**	**11%**	**140**	**120**	**20**	**5%**	**0.5%**
47	**219**	**6%**	**140**	**120**	**20**	**5%**	**0.3%**
45	**211**	**6%**	**140**	**120**	**20**	**5%**	**0.3%**
43	**219**	**6%**	**140**	**130**	**10**	**3%**	**0.2%**
41	**159**	**4%**	**140**	**130**	**10**	**3%**	**0.1%**
39	**229**	**6%**	**140**	**130**	**10**	**3%**	**0.2%**
37	**208**	**6%**	**140**	**130**	**10**	**3%**	**0.1%**
35	**212**	**6%**	**140**	**130**	**10**	**3%**	**0.1%**
33	195	5%	140	140	0	0%	0.0%
31	348	10%	140	140	0	0%	0.0%
29	162	4%	140	140	0	0%	0.0%
27	200	6%	140	140	0	0%	0.0%
25	198	5%	140	140	0	0%	0.0%
23	91	3%	140	140	0	0%	0.0%
21	98	3%	140	140	0	0%	0.0%
19	83	2%	140	140	0	0%	0.0%
17	64	2%	140	140	0	0%	0.0%
15	36	1%	140	140	0	0%	0.0%
13	52	1%	140	140	0	0%	0.0%
11	81	2%	140	140	0	0%	0.0%
Totals	**3630**	**100%**					**2.1%**

Current NG Usage (therms/yr)	% Actual Savings	NG Savings (therms/yr)	NG cost ($/therm)	Annual Savings
14,216	2.1%	295.4	$0.98	$290

Rebates/financial incentives:

Currently there are no incentive programs for boiler controls replacement.

ECM #7: Upgrade 10 T12 U-Shaped fixtures with electronic ballasts and T8 U-Shaped lamps

During the field audit, SWA completed a building lighting inventory (see Appendix C). The existing lighting contains inefficient T12 U-Shaped fluorescent fixtures with magnetic ballasts. SWA recommends replacing each existing fixture with more efficient, T8 U-Shaped fluorescent fixtures with electronic ballasts. T8 fixtures with electronic ballasts provide equivalent or better light output while reducing energy consumption by 30% when compared to T12 fixtures with magnetic ballasts. T8 fixtures also provide better lumens for less wattage when compared to incandescent, halogen and Metal Halide fixtures. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $1,192 (includes $834 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
$1,192	530	0	0	0.0	$19	$123	15	$1,847	9.7	55%	4%	6%	$249	949

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

Rebates/financial incentives:

- NJ Clean Energy – Direct Install program (Up to 70% of installed costs)
- NJ Clean Energy – SmartStart program – T8 fixtures with electronic ballasts ($10 per fixture – Maximum incentive amount is $580

Please see APPENDIX G for more information on Incentive Programs.

Proposed Further Recommendations

Capital Improvements

Capital improvements are recommendations for the building that may not be cost-effective at the current time, but that could yield a significant long-term payback. These recommendations should typically be considered as part of a long-term capital improvement plan. Capital improvements should be considered if additional funds are made available. SWA recommends the following capital improvements for the Dwight-Englewood School.

- Install a building management system (BMS) – SWA considers that based on the size of the building and amount of mechanical equipment that provides space conditioning to the Drapkin Hall the building can benefit from installing a centralized building management system. The BMS provides the facility manager the ability to control all the equipment connected to the BMS and adjust setpoint and operating parameters based on daily activities. Further, it allows the user to track energy usage and operating alarms in order to avoid equipment problems. The cost associated with installing a BMS is proportional to the amount of equipment connected to the system. For a dynamic control system that provides optimum start/stop daylight modulating controls and optimized HVAC operation with reduced human interaction the average cost per control point is $1,000. Typical installation costs for small to medium buildings can range from $0.60 per ft^2 to $1.00 per ft^2 with typical energy savings in the first year between 30% to 50%. For a building like Drapkin Hall the cost of installing a BMS would be $40,000 and the estimated first year savings are approximately $21,000. Further study is recommended in order to estimate approximate number of control points and the level of control desired by the maintenance staff. The study is recommended to properly assess the potential cost of installation and energy savings.

- Increase envelope thermal resistance. During the energy audit, SWA took infrared images of the building envelope. The images showed that heat loss through the wall due to low R-values. SWA estimates that the current R-value for the wall insulation is below the minimum recommended by ASHRAE 90.1 1999 which is R-13. The current overall wall U-value is estimated to be 0.129 Btu/hr*ft^2*°F. ASHRAE 90.1 2010 recommends a minimum R-value of 13 plus a continuous insulation thermal resistance value of R-7.5, to achieve an overall U-value of 0.062Btu/hr*ft^2*°F. SWA recommends that Dwight Englewood considers increasing the R-value of the wall by injecting Closed Cell spray foam insulation in the cavity walls. The National Research Council Canada (NRCC) estimates that spray foam insulation can perform up to 30% better than conventional insulation due to the additional benefit of air leakage reduction. Based on the values published by the NRCC SWA estimates that the existing insulation can be improved by 30%, therefore achieving and overall U-value of 0.0954Btu/hr*ft^2*°F. Assuming the overall U-factor will be improved by 30% SWA estimates that the heat loss through the wall is approximately 3.35kBtu/ft^2 during the heating season and 2.57kBtu/ft^2 during the cooling season. With an approximate wall area of 4200ft^2 the energy savings associated with improving the overall U-factor is 29,619 kBtu/yr or $866/yr. the estimated cost of installing closed cell spray foam insulation is approximately $1.68/ft^2 or $7,056. The estimated payback time is 8 years. Further study is recommended in order to determine feasibility of installation and to calculate actual wall area and additional installation details.

- Replace exterior doors. As seen in the Building Description section of this report, the main entrance door lack adequate thermal insulation, allowing heat to escape the building. The heat loss increases the building's heat load which requires additional heat generation and energy consumption. SWA recommends replacing the doors and frames with similar insulated models. SWA estimates the cost of doors with installation of approximately $1,500 per door. The associated savings by replacing the doors are 1,451kBtu/yr or $44.35 per year. The simple payback for this recommendation would be 33 years. Further study is recommended.

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.

- Replace motors with NEMA premium efficiency models – SWA observed several motors 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. This measure can be conducted by in-house maintenance staff.

- Install water-efficient fixtures and controls – 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. This measure can be conducted by in-house maintenance staff with little investment, and yield a short payback.

- Inspect and replace cracked/ineffective caulk. This measure can be conducted by in-house maintenance staff with little investment, and yield a short payback.

- Inspect and maintain sealants at all windows for airtight performance. This measure can be conducted by in-house maintenance staff with little investment, and yield a short payback.

- Inspect and maintain weather-stripping around all exterior doors and roof hatches. This measure can be conducted by in-house maintenance staff with little investment, and yield a short payback.

- SWA recommends that the building considers purchasing the most energy-efficient equipment, including ENERGY STAR® labeled appliances, when equipment is installed or replaced. ENERGY STAR® appliances meet stricter standards compared to standard appliances. Stricter standards include exceeding Federal minimum efficiencies and reduced environmental impact. More information can be found in the "Products" section of the ENERGY STAR® website at: http://www.energystar.gov.

- Consider the use of 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 students and professionals how to minimize energy use. An educational program may be incorporated into school curricula to increase students' environmental awareness. 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

Building System	Description	Model #	Fuel	Location	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	Weil-McLain Boiler Fuel -Natural Gas Input BTU/hr - 1300000 Output BTU/hr - 1053000 Steam PSI - 15	Weil-McLain Boiler Model # - LGB-11 Serial # LGB-11-1	Natural Gas	Boiler Room	Lower School	1995	15%
Heating	Weil-McLain Boiler Fuel -Natural Gas Input BTU/hr - 1300000 Output BTU/hr - 1053000 Steam PSI - 15	Weil-McLain Boiler Model # - LGB-11 Serial # LGB-11 - 2	Natural Gas	Boiler Room	Lower School	1995	15%
Heating (HHWP)	Marathon Motor HP - 3 Volt - 208-230 / 460 FLA - 9.4 - 9 / 4.5	Marathon Model # - 2VJ162TTDR735GAT L	Electric	Boiler Room	Lower School	1995	15%
Heating (HHWP)	Marathon Motor HP - 3 Volt - 208-230 / 460 FLA - 9.4 - 9 / 4.5	Marathon Model # - 2VJ162TTDR735GAT L	Electric	Boiler Room	Lower School	1995	15%
DHW	Gal - 89 Fuel - Natural Gas Input BTU/hr - 154000 Max working press. - 160 psi. Rec. RTG - 140 Gal/Hr, 80% efficiency	A.O. Smith Model # - BTC 154 920	Natural Gas	Boiler Room	Lower School	1995	15%
Cooling (Chiller)	Compressors [Qty,HP] - (2) 35 HP, (2) 30 HP Cond. Fan[Qty,HP] - (8) 1 HP, (2) 10HP Refrigerant - R22	McQuay Model #: ALR110D Serial #: 55L8133401	Electric	Rooftop	Lower School	1995	32%
Cooling (Split DX)	Compressor RLA - 13.5 Volts - 208 / 230 Outdoor fan motor FLA -1.3	RUUD Model #: UAMC-030JAZ Serial #: 6973 M1704 05981	Electric	Rooftop	Lower School	2004	47%
Cooling (Split DX) Quantity - 4	Compressor RLA - 14.0 Volts - 208 / 230 Outdoor fan motor FLA -2	Samsung Model #: AQV36JAX	Electric	Rooftop	Lower School	2012	100%
Cooling (Split DX)	Unknown	Unknown	Electric	Rooftop	Lower School	2000	20%
Condensing unit for walk-in refrigerator	Volt - 208 / 230 Compressor RLA - 4.2 Cond. Fan motor FLA - 0.5	Heatcraft Inc. Model # 8901243 Serial# T96F 01614	Electric	Rooftop	Lower School Cafeteria	2004	47%
Cooling (Split DX) Quantity - 4	Compressor RLA - 16.0 Volts - 230 Outdoor motor HP - 1/4	Mitsubishi Model #: PUGH36BKB	Electric	Rooftop	Lower School	2010	87%
Exhaust	RF-1 ARRG 9 Part # 614757 120	Barry Blower Model # I82 AFV Serial# 45L 00332	Electric	MER	Lower School	1995	15%
Air Handling	AH-1	McQuay Model #: LSL114DH Serial #: 35K01363-04	Electric	MER	Lower School	1995	15%
Chilled Water	CHWP-1	N/A	Electric	MER	Lower School	1995	15%
Chilled Water	CHWP-2	N/A	Electric	MER	Lower School	1995	15%

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

Appendix B: Lighting Study

Location			Existing Fixture Information												Retrofit Information													Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	2	Classroom (220)	Ceiling Mounted	E	4'T12	15	1	34	Sw	9	230	10	663	1,372	T8 Kit	Ceiling Mounted	4'T8	E	OS	15	1	32	7	230	5	555	862	224	287	511
2	2	Classroom (220)	Track	E	Hal	18	1	75	Sw	9	230	17	1,647	3,409	CFL	Track	CFL	E	Sw	18	1	25	7	230	0	450	725	2478	207	2685
3	2	Bathroom	Ceiling Mounted	E	Circline - T12	1	1	40	Sw	9	230	12	52	108	C	Ceiling Mounted	Circline - T8	E	OS	1	1	40	7	230	6	46	72	12	24	36
4	2	Janitor's Closet	Ceiling Mounted	E	4'T12	1	1	34	Sw	2	230	10	44	20	T8 Kit	Ceiling Mounted	4'T8	E	Sw	1	1	32	2	230	5	37	17	3	0	3
5	2	Classroom (217)	Ceiling Mounted	E	4'T12	8	1	34	Sw	9	230	10	354	732	T8 Kit	Ceiling Mounted	4'T8	E	OS	8	1	32	7	230	5	296	460	119	153	272
6	2	Classroom (217)	Ceiling Mounted	E	4'T12	10	2	34	Sw	9	230	20	884	1,830	T8 Kit	Ceiling Mounted	4'T8	E	OS	10	2	32	7	230	10	740	1149	298	383	681
7	2	Classroom (217)	Track	E	Hal	20	1	75	Sw	9	230	17	1,830	3,788	CFL	Track	CFL	E	Sw	20	1	25	7	230	0	500	805	2753	230	2983
8	2	Hallway	Ceiling Suspended	E	4'T8	9	2	32	Sw	16	230	10	666	2,451	N/A	Ceiling Suspended	4'T8	E	Sw	9	2	32	16	230	10	666	2451	0	0	0
9	2	Classroom (216)	Ceiling Suspended	E	4'T8	4	2	32	Sw	9	230	10	296	613	C	Ceiling Suspended	4'T8	E	OS	4	2	32	7	230	10	296	460	0	153	153
10	2	Bathroom (215 Br)	Ceiling Mounted	E	Circline - T12	1	1	40	Sw	9	230	12	52	108	C	Ceiling Mounted	Circline - T8	E	OS	1	1	40	7	230	6	46	72	12	24	36
11	2	Hallway	Wall Mounted	S	CFL	2	1	13	Sw	16	230	0	26	96	N/A	Wall Mounted	CFL	S	Sw	2	1	13	16	230	0	26	96	0	0	0
12	2	Classroom (214)	Ceiling Mounted	E	4'T12	8	1	34	Sw	9	230	10	354	732	T8 Kit	Ceiling Mounted	4'T8	E	OS	8	1	32	7	230	5	296	460	119	153	272
13	2	Classroom (214)	Ceiling Mounted	E	4'T12	10	2	34	Sw	9	230	20	884	1,830	T8 Kit	Ceiling Mounted	4'T8	E	OS	10	2	32	7	230	10	740	1149	298	383	681
14	2	Classroom (214)	Recessed Parabolic	S	CFL	2	1	32	Sw	9	230	0	64	132	N/A	Recessed Parabolic	CFL	S	Sw	2	1	32	9	230	0	64	132	0	0	0
15	2	Classroom (213)	Ceiling Mounted	E	4'T12	8	1	34	Sw	9	230	10	354	732	T8 Kit	Ceiling Mounted	4'T8	E	OS	8	1	32	7	230	5	296	460	119	153	272
16	2	Classroom (213)	Ceiling Mounted	E	4'T12	10	2	34	Sw	9	230	20	884	1,830	T8 Kit	Ceiling Mounted	4'T8	E	OS	10	2	32	7	230	10	740	1149	298	383	681
17	2	Classroom (212)	Ceiling Mounted	M	Circline - T12	1	1	40	Sw	9	230	12	52	108	C	Ceiling Mounted	Circline - T8	M	OS	1	1	40	7	230	6	46	72	12	24	36
18	2	Classroom (210)	Ceiling Mounted	E	4'T8 U-Shaped	1	2	32	Sw	9	230	10	74	153	C	Ceiling Mounted	4'T8 U-Shaped	E	OS	1	2	32	7	230	10	74	115	0	38	38
19	2	Classroom (211)	Ceiling Mounted	E	4'T12	8	1	34	Sw	9	230	10	354	732	T8 Kit	Ceiling Mounted	4'T8	E	OS	8	1	32	7	230	5	296	460	119	153	272
20	2	Classroom (211)	Ceiling Mounted	E	4'T12	10	2	34	Sw	9	230	20	884	1,830	T8 Kit	Ceiling Mounted	4'T8	E	OS	10	2	32	7	230	10	740	1149	298	383	681
21	2	Hallway	Ceiling Suspended	S	CFL	9	2	32	Sw	16	230	0	576	2,120	N/A	Ceiling Suspended	CFL	S	Sw	9	2	32	16	230	0	576	2120	0	0	0
22	2	Classroom (209)	Ceiling Suspended	E	4'T8	6	2	32	Sw	9	230	10	444	919	C	Ceiling Suspended	4'T8	E	OS	6	2	32	7	230	10	444	689	0	230	230
23	2	Hallway	Ceiling Suspended	E	Hal	2	1	75	Sw	16	230	17	183	673	CFL	Ceiling Suspended	CFL	E	Sw	2	1	25	16	230	0	50	184	489	0	489
24	2	Office (208)	Recessed Parabolic	E	4'T8	9	2	32	Sw	9	230	10	666	1,379	C	Recessed Parabolic	4'T8	E	OS	9	2	32	7	230	10	666	1034	0	345	345
25	2	Office (208)	Recessed Parabolic	S	CFL	4	1	18	Sw	9	230	0	72	149	C	Recessed Parabolic	CFL	S	OS	4	1	18	7	230	0	72	112	0	37	37
26	2	Hallway	Wall Mounted	S	CFL	4	1	13	Sw	16	230	0	52	191	N/A	Wall Mounted	CFL	S	Sw	4	1	13	16	230	0	52	191	0	0	0
27	2	Hallway	Ceiling Suspended	E	4'T8	8	2	32	Sw	16	230	10	592	2,179	N/A	Ceiling Suspended	4'T8	E	Sw	8	2	32	16	230	10	592	2179	0	0	0
28	2	Classroom (207)	Ceiling Suspended	E	4'T12	8	1	40	Sw	9	230	12	416	861	T8 Kit	Ceiling Suspended	4'T8	E	OS	8	1	32	7	230	5	296	460	248	153	402
29	2	Classroom (207)	Ceiling Suspended	E	4'T12	10	2	40	Sw	9	230	24	1,040	2,153	T8 Kit	Ceiling Suspended	4'T8	E	OS	10	2	32	7	230	10	740	1149	621	383	1004
30	2	Classroom (207)	Recessed Parabolic	S	CFL	2	2	32	Sw	9	230	0	128	265	N/A	Recessed Parabolic	CFL	S	Sw	2	2	32	9	230	0	128	265	0	0	0
31	2	Classroom (206)	Ceiling Mounted	E	4'T12	8	1	34	Sw	9	230	10	354	732	T8 Kit	Ceiling Mounted	4'T8	E	OS	8	1	32	7	230	5	296	460	119	153	272
32	2	Classroom (206)	Ceiling Mounted	E	4'T12	10	2	34	Sw	9	230	20	884	1,830	T8 Kit	Ceiling Mounted	4'T8	E	OS	10	2	32	7	230	10	740	1149	298	383	681
33	2	Classroom (206)	Recessed Parabolic	S	CFL	2	2	32	Sw	9	230	0	128	265	N/A	Recessed Parabolic	CFL	S	Sw	2	2	32	9	230	0	128	265	0	0	0
34	2	Hallway	Ceiling Suspended	E	4'T8	4	2	32	Sw	16	230	10	296	1,089	N/A	Ceiling Suspended	4'T8	E	Sw	4	2	32	16	230	10	296	1089	0	0	0
35	2	Classroom (205)	Ceiling Suspended	E	4'T8	5	2	32	Sw	9	230	10	370	766	C	Ceiling Suspended	4'T8	E	OS	5	2	32	7	230	10	370	574	0	191	191
36	2	Library	Spotlight	S	Hal	8	1	75	Sw	9	230	17	732	1,515	CFL	Spotlight	CFL	S	OS	8	1	25	7	230	0	200	311	1101	104	1205
37	2	Library	Spotlight	S	CFL	6	1	26	Sw	9	230	0	156	323	C	Spotlight	CFL	S	OS	6	1	26	7	230	0	156	242	0	81	81
38	2	Office	Recessed Parabolic	S	CFL	6	1	26	Sw	9	230	0	156	323	C	Recessed Parabolic	CFL	S	OS	6	1	26	7	230	0	156	242	0	81	81
39	2	Office	Ceiling Suspended	E	4'T8	3	2	32	Sw	9	230	10	222	460	C	Ceiling Suspended	4'T8	E	OS	3	2	32	7	230	10	222	345	0	115	115
40	2	Office	Parabolic Ceiling Suspended	S	CFL	2	1	26	Sw	9	230	0	52	108	N/A	Parabolic Ceiling Suspended	CFL	S	Sw	2	1	26	9	230	0	52	108	0	0	0
41	2	Classroom (204)	Parabolic Ceiling Suspended	E	4'T12	15	2	40	Sw	9	230	24	1,560	3,229	T8 Kit	Parabolic Ceiling Suspended	4'T8	E	OS	15	2	32	7	230	10	1110	1723	932	574	1506
42	2	Classroom (204)	Parabolic Ceiling Suspended	E	4'T12	1	4	40	Sw	9	230	48	208	431	T8 Kit	Parabolic Ceiling Suspended	4'T8	E	OS	1	3	32	7	230	15	111	172	201	57	258
43	2	Bathroom Women	Ceiling Mounted	E	4'T8	2	1	32	Sw	9	230	5	74	153	C	Ceiling Mounted	4'T8	E	OS	2	1	32	7	230	5	74	115	0	38	38
44	2	Bathroom Women	Ceiling Mounted	E	4'T8	2	2	32	Sw	9	230	10	148	306	C	Ceiling Mounted	4'T8	E	OS	2	2	32	7	230	10	148	230	0	77	77
45	2	Bathroom Women	Recessed Parabolic	S	CFL	1	1	18	Sw	9	230	0	18	37	C	Recessed Parabolic	CFL	S	OS	1	1	18	7	230	0	18	28	0	9	9
46	2	Bathroom Men	Recessed Parabolic	S	CFL	1	1	18	Sw	9	230	0	18	37	C	Recessed Parabolic	CFL	S	OS	1	1	18	7	230	0	18	28	0	9	9
47	2	Bathroom Men	Ceiling Mounted	E	4'T8	2	1	32	Sw	9	230	5	74	153	C	Ceiling Mounted	4'T8	E	OS	2	1	32	7	230	5	74	115	0	38	38
48	2	Bathroom Men	Ceiling Mounted	E	4'T8	2	2	32	Sw	9	230	10	148	306	C	Ceiling Mounted	4'T8	E	OS	2	2	32	7	230	10	148	230	0	77	77
49	1	Storage Closet (Café closet)	Ceiling Mounted	E	4'T8	1	2	32	Sw	2	230	10	74	34	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	2	230	10	74	34	0	0	0
50	1	Gymnasium	Ceiling Mounted	E	4'T5	5	2	54	Sw	9	230	15	617	1,277	C	Ceiling Mounted	4'T5	E	OS	5	2	54	7	230	15	617	958	0	319	319
51	1	Gymnasium	Ceiling Mounted	E	4'T5	13	3	54	Sw	9	230	23	2,407	4,982	C	Ceiling Mounted	4'T5	E	OS	13	3	54	7	230	23	2407	3736	0	1245	1245

52	1	Hallway	Ceiling Mounted	E	4'T8	8	2	32	Sw	16	230	10	592	2,179	N/A	Ceiling Mounted	4'T8	E	Sw	8	2	32	16	230	10	592	2179	0	0	0
53	1	Boiler Rm	Ceiling Mounted	E	4'T8	3	2	32	Sw	2	230	10	222	102	N/A	Ceiling Mounted	4'T8	E	Sw	3	2	32	2	230	10	222	102	0	0	0
54	1	Boiler Rm	Wall Mounted	S	CFL	1	1	13	Sw	2	230	0	13	6	N/A	Wall Mounted	CFL	S	Sw	1	1	13	2	230	0	13	6	0	0	0
55	1	Elevator (Main elevator)	Wall Mounted	E	4'T8	1	1	32	Sw	8	230	5	37	68	N/A	Wall Mounted	4'T8	E	Sw	1	1	32	8	230	5	37	68	0	0	0
56	1	Elevator (Secondary)	Wall Mounted	E	4'T8	1	1	32	Sw	8	230	5	37	68	N/A	Wall Mounted	4'T8	E	Sw	1	1	32	8	230	5	37	68	0	0	0
57	1	Kitchen	Ceiling Mounted	E	4'T8	4	4	32	Sw	9	230	20	592	1,225	C	Ceiling Mounted	4'T8	E	OS	4	4	32	7	230	20	592	919	0	306	306
58	1	Cafeteria	Ceiling Mounted	E	4'T8 U-Shaped	4	2	32	Sw	8	230	10	296	545	C	Ceiling Mounted	4'T8 U-Shaped	E	OS	4	2	32	6	230	10	296	408	0	136	136
59	1	Cafeteria	Recessed Parabolic	S	CFL	4	1	18	Sw	8	230	0	72	132	C	Recessed Parabolic	CFL	S	OS	4	1	18	6	230	0	72	99	0	33	33
60	1	Cafeteria	Ceiling Suspended	E	4'T8	26	2	32	Sw	8	230	10	1,924	3,540	C	Ceiling Suspended	4'T8	E	OS	26	2	32	6	230	10	1924	2655	0	885	885
61	1	Bathroom Men (103)	Ceiling Mounted	E	4'T8	2	1	32	Sw	9	230	5	74	153	C	Ceiling Mounted	4'T8	E	OS	2	1	32	7	230	5	74	115	0	38	38
62	1	Bathroom Men (103)	Ceiling Mounted	E	4'T8	2	2	32	Sw	9	230	10	148	306	C	Ceiling Mounted	4'T8	E	OS	2	2	32	7	230	10	148	230	0	77	77
63	1	Bathroom Men (103)	Recessed Parabolic	S	CFL	1	1	18	Sw	9	230	0	18	37	C	Recessed Parabolic	CFL	S	OS	1	1	18	7	230	0	18	28	0	9	9
64	1	Bathroom Women (104)	Recessed Parabolic	S	CFL	1	1	18	Sw	9	230	0	18	37	C	Recessed Parabolic	CFL	S	OS	1	1	18	7	230	0	18	28	0	9	9
65	1	Bathroom Women (104)	Ceiling Mounted	E	4'T8	2	1	32	Sw	9	230	5	74	153	C	Ceiling Mounted	4'T8	E	OS	2	1	32	7	230	5	74	115	0	38	38
66	1	Bathroom Women (104)	Ceiling Mounted	E	4'T8	2	2	32	Sw	9	230	10	148	306	C	Ceiling Mounted	4'T8	E	OS	2	2	32	7	230	10	148	230	0	77	77
67	1	Hallway	Ceiling Suspended	E	4'T8	6	2	32	Sw	16	230	10	444	1,634	N/A	Ceiling Suspended	4'T8	E	Sw	6	2	32	16	230	10	444	1634	0	0	0
68	1	Hallway	Ceiling Suspended	S	CFL	2	2	26	Sw	16	230	0	104	383	N/A	Ceiling Suspended	CFL	S	Sw	2	2	26	16	230	0	104	383	0	0	0
69	1	Classroom (105)	Ceiling Suspended	E	4'T8	8	2	32	Sw	9	230	10	592	1,225	C	Ceiling Suspended	4'T8	E	OS	8	2	32	7	230	10	592	919	0	306	306
70	1	Classroom (105)	Recessed Parabolic	S	CFL	3	2	26	Sw	9	230	0	156	323	N/A	Recessed Parabolic	CFL	S	Sw	3	2	26	9	230	0	156	323	0	0	0
71	1	Classroom (106)	Ceiling Suspended	E	4'T8	8	2	32	Sw	9	230	10	592	1,225	C	Ceiling Suspended	4'T8	E	OS	8	2	32	7	230	10	592	919	0	306	306
72	1	Classroom (106)	Recessed Parabolic	S	CFL	3	2	26	Sw	9	230	0	156	323	N/A	Recessed Parabolic	CFL	S	Sw	3	2	26	9	230	0	156	323	0	0	0
73	1	Classroom (107)	Ceiling Suspended	E	4'T8	2	2	32	Sw	9	230	10	148	306	C	Ceiling Suspended	4'T8	E	OS	2	2	32	7	230	10	148	230	0	77	77
74	1	Classroom (108)	Ceiling Suspended	E	4'T8	12	2	32	Sw	9	230	10	888	1,838	C	Ceiling Suspended	4'T8	E	OS	12	2	32	7	230	10	888	1379	0	460	460
75	1	Classroom (109)	Ceiling Suspended	E	4'T8	11	2	32	Sw	9	230	10	814	1,685	C	Ceiling Suspended	4'T8	E	OS	11	2	32	7	230	10	814	1264	0	421	421
76	1	Bathroom	Ceiling Mounted	E	Circline - T8	2	1	40	Sw	9	230	6	93	191	C	Ceiling Mounted	Circline - T8	E	OS	2	1	40	7	230	6	93	144	0	48	48
77	1	Hallway (110)	Ceiling Suspended	E	4'T8	7	2	32	Sw	16	230	10	518	1,906	N/A	Ceiling Suspended	4'T8	E	Sw	7	2	32	16	230	10	518	1906	0	0	0
78	1	Classroom (110)	Recessed Parabolic	S	CFL	3	2	26	Sw	9	230	0	156	323	C	Recessed Parabolic	CFL	S	OS	3	2	26	7	230	0	156	242	0	81	81
79	1	Classroom (111)	Recessed Parabolic	E	4'T8	8	2	32	Sw	9	230	10	592	1,225	C	Recessed Parabolic	4'T8	E	OS	8	2	32	7	230	10	592	919	0	306	306
80	1	Classroom (111)	Recessed Parabolic	E	4'T8	8	2	32	Sw	9	230	10	592	1,225	C	Recessed Parabolic	4'T8	E	OS	8	2	32	7	230	10	592	919	0	306	306
81	1	Hallway	Recessed Parabolic	S	CFL	3	2	26	Sw	16	230	0	156	574	N/A	Recessed Parabolic	CFL	S	Sw	3	2	26	16	230	0	156	574	0	0	0
82	1	Hallway	Ceiling Suspended	S	Hal	3	1	150	Sw	16	230	33	549	2,020	CFL	Ceiling Suspended	CFL	S	Sw	3	1	50	16	230	0	150	552	1468	0	1468
83	1	Hallway	Recessed Parabolic	S	CFL	8	2	26	Sw	16	230	0	416	1,531	N/A	Recessed Parabolic	CFL	S	Sw	8	2	26	16	230	0	416	1531	0	0	0
84	1	Classroom (centro espanol)	Recessed Parabolic	E	4'T8	2	4	32	Sw	9	230	20	296	613	C	Recessed Parabolic	4'T8	E	OS	2	4	32	7	230	20	296	460	0	153	153
85	1	Classroom (120)	Recessed Parabolic	E	4'T8	2	2	32	Sw	9	230	10	148	306	C	Recessed Parabolic	4'T8	E	OS	2	2	32	7	230	10	148	230	0	77	77
86	1	Classroom (120)	Ceiling Mounted	E	Circline - T12	1	1	40	Sw	9	230	12	52	108	N/A	Ceiling Mounted	Circline - T8	E	Sw	1	1	40	9	230	6	46	96	12	0	12
87	1	Hallway	Recessed Parabolic	E	4'T12 U-Shaped	5	2	34	Sw	16	230	20	442	1,627	T8	Recessed Parabolic	4'T8 U-Shaped	E	Sw	5	2	32	16	230	10	370	1362	265	0	265
88	1	Hallway	Recessed Parabolic	E	4'T12 U-Shaped	5	2	34	Sw	16	230	20	442	1,627	T8	Recessed Parabolic	4'T8 U-Shaped	E	Sw	5	2	32	16	230	10	370	1362	265	0	265
89	1	Kitchen	Ceiling Mounted	E	4'T8	2	2	32	Sw	9	230	10	148	306	N/A	Ceiling Mounted	4'T8	E	Sw	2	2	32	9	230	10	148	306	0	0	0
90	1	Classroom (Preschool)	Ceiling Suspended	E	4'T8	20	2	32	Sw	9	230	10	1,480	3,064	C	Ceiling Suspended	4'T8	E	OS	20	2	32	7	230	10	1480	2298	0	766	766
91	1	Classroom (Preschool)	Ceiling Suspended	E	4'T8 U-Shaped	4	2	32	Sw	9	230	10	296	613	N/A	Ceiling Suspended	4'T8 U-Shaped	E	Sw	4	2	32	9	230	10	296	613	0	0	0
92	1	Classroom (Preschool)	Wall Mounted	E	4'T8	1	1	32	Sw	9	230	5	37	77	N/A	Wall Mounted	4'T8	E	Sw	1	1	32	9	230	5	37	77	0	0	0
93	1	Storage Closet	Ceiling Mounted	E	Circline - T8	1	1	32	Sw	2	230	5	37	17	N/A	Ceiling Mounted	Circline - T8	E	Sw	1	1	32	2	230	5	37	17	0	0	0
94	1	Classroom (centro espanol)	Ceiling Suspended	E	4'T8	12	2	32	Sw	9	230	10	888	1,838	C	Ceiling Suspended	4'T8	E	OS	12	2	32	7	230	10	888	1379	0	460	460
95	1	Classroom (centro espanol)	Track	E	Hal	3	1	75	Sw	9	230	17	275	568	CFL	Track	CFL	E	Sw	3	1	25	9	230	0	75	155	413	0	413
96	1	Classroom (centro espanol)	Recessed Parabolic	E	4'T8 U-Shaped	2	2	32	Sw	9	230	10	148	306	N/A	Recessed Parabolic	4'T8 U-Shaped	E	Sw	2	2	32	9	230	10	148	306	0	0	0
97	1	Bathroom	Ceiling Mounted	E	Circline - T8	2	1	32	Sw	9	230	5	74	153	N/A	Ceiling Mounted	Circline - T8	E	Sw	2	1	32	9	230	5	74	153	0	0	0
98	1	Classroom (Preschool)	Recessed Parabolic	E	4'T8 U-Shaped	18	2	32	Sw	9	230	10	1,332	2,757	C	Recessed Parabolic	4'T8 U-Shaped	E	OS	18	2	32	7	230	10	1332	2068	0	689	689
99	1	Classroom (Preschool)	Recessed Parabolic	S	CFL	45	1	18	Sw	9	230	0	810	1,677	N/A	Recessed Parabolic	CFL	S	Sw	45	1	18	9	230	0	810	1677	0	0	0
100	1	Storage Closet	Recessed Parabolic	E	4'T8	2	2	32	Sw	2	230	10	148	68	N/A	Recessed Parabolic	4'T8	E	Sw	2	2	32	2	230	10	148	68	0	0	0
101	Bsmt	Storage Rm	Recessed Parabolic	E	4'T8	2	2	32	Sw	2	230	10	148	68	N/A	Recessed Parabolic	4'T8	E	Sw	2	2	32	2	230	10	148	68	0	0	0
102	Bsmt	Storage Rm (Workshop)	Ceiling Suspended	E	4'T8	38	2	32	Sw	2	230	10	2,812	1,294	N/A	Ceiling Suspended	4'T8	E	Sw	38	2	32	2	230	10	2812	1294	0	0	0
103	Bsmt	Storage Closet	Ceiling Suspended	E	4'T8	2	2	32	Sw	2	230	10	148	68	N/A	Ceiling Suspended	4'T8	E	Sw	2	2	32	2	230	10	148	68	0	0	0
104	1	Staircase	Wall Mounted	E	Circline - T8	7	1	32	Sw	16	230	5	259	953	N/A	Wall Mounted	Circline - T8	E	Sw	7	1	32	16	230	5	259	953	0	0	0
105	All	All	Exit Sign	S	LED	21	3	5	N	24	365	2	347	3,035	N/A	Exit Sign	LED	S	N	21	3	5	24	365	2	347	3035	0	0	0
106	Ext	Exterior	Wall Mounted	S	MH	6	1	70	Sw	12	230	20	538	1,484	PSMH	Wall Mounted	PSMH	S	DLSw	6	1	50	8	230	10	360	662	490	331	821
Totals:						670	176	3,671				1,022	45,815	101,275						670	175	3,241			696	39,590	72,961	14,086	14,228	28,314

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

Proposed Lighting Summary Table			
Total Gross Floor Area (SF)	40,000		
Average Power Cost ($/kWh)	0.1970		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	1,484	662	**821**
Exterior Power (watts)	538	360	**178**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	99,791	72,299	**27,493**
Lighting Power (watts)	45,277	39,230	**6,048**
Lighting Power Density (watts/SF)	1.13	0.98	**0.15**
Estimated Cost of Fixture Replacement ($)	5,630		
Estimated Cost of Controls Improvements ($)	8,000		
Total Consumption Cost Savings ($)	**6,496**		

LEGEND

Lamp Type		Controls	
CFL	Compact Fluorescent	T	Autom. Timer
Inc	Incadescent	BL	Bi-Level
LED	Light Emitting Diode	Ct	Contact
MH	Metal Halide	M	Daylight & Motion
MV	Mercury Vapor	DLSw	Daylight & Switch
PSMH	Pulse Start Metal Halide	DL	Daylight Sensor
HPS	High Pressure Sodium	DSw	Delay Switch
LPS	Low Pressure Sodium	D	Dimmer
Fl	Fluorescent	MS	Motion Sensor
4'T8	4 Feet long T8 Linear Lamp	MSw	Motion& Switch
4'T8 U-shaped	4 Feet long T8 U-shaped Lamp	N	None
4'T5	4 Feet long T5 Linear Lamp	OS	Occupancy Sensor
Ballast Type		OSCM	Occupancy Sensor Ceiling Mounted
E	Electronic	PC	Photocell
M	Magnetic	Sw	Switch
S	Self		

APPENDIX C: UPCOMING EQUIPMENT PHASEOUTS

LIGHTING:

- As of **July 1, 2010** magnetic ballasts most commonly used for the operation of T12 lamps are no longer being produced for commercial and industrial applications.

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

- As of **July 2012** many non energy saver model T12 lamps have been phased out of production.

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

- Starting **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 (Hydro chlorofluorocarbons):

- 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 D: THIRD PARTY ENERGY SUPPLIERS

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

Third Party Electric Suppliers for JCPL Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.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
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

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 Elizabethtown Gas Co. 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
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.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 Edison, NJ 08837	(800) 375-1277 www.mxenergy.com
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	(800) 840-4427 www.natgasco.com

Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	(800) 557-1121 www.woodruffenergy.com

APPENDIX E: 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.

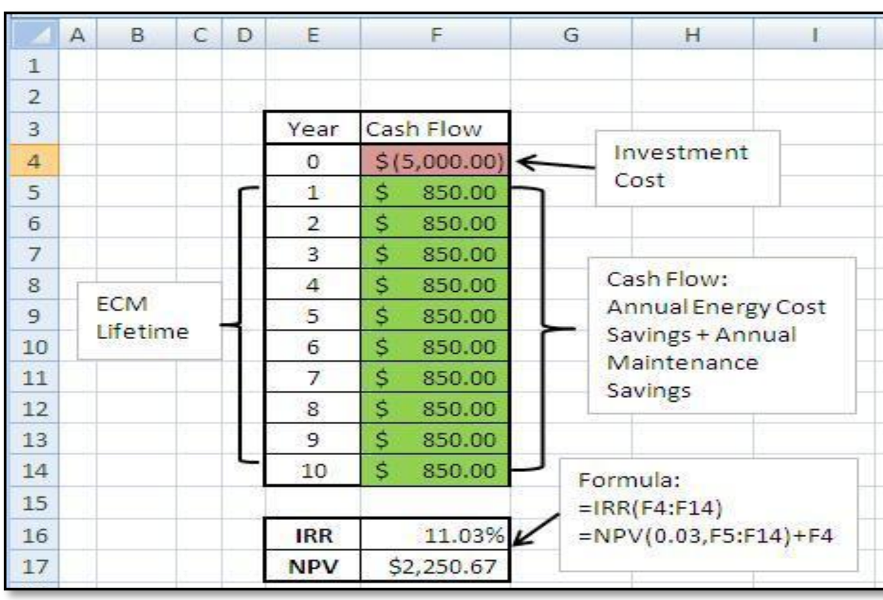
Calculation References

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 F: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Dwight-Englewood - Lower School

Building ID: 3425762
For 12-month Period Ending: November 30, 2012[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: January 29, 2013

Facility
Dwight-Englewood - Lower School
315 East Palisade Avenue
Englewood, NJ 07631

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1995
Gross Floor Area (ft²): 40,000

Energy Performance Rating[2] (1-100) 66

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	1,162,946
Natural Gas (kBtu)[4]	1,421,619
Total Energy (kBtu)	2,584,565
Energy Intensity[4]	
Site (kBtu/ft²/yr)	65
Source (kBtu/ft²/yr)	134
Emissions (based on site energy use)	
Greenhouse Gas Emissions (MtCO$_2$e/year)	240
Electric Distribution Utility	
Public Service Electric & Gas Co	
National Median Comparison	
National Median Site EUI	75
National Median Source EUI	157
% Difference from National Median Source EUI	-14%
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.

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

EPA Form 5900-16

APPENDIX G: 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 H: ENERGY CONSERVATION MEASURES

ECM #	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
1	Upgrade (54) Incandescent to CFL	538	0	538	7,870	2	0	0.7	18	1,356	5	6,778	0.4	1,161	232	252	5,461	14,092
2	Retrofit 140 T12 Fixtures with T8 Lamps	4,378	1,400	2,978	4,315	1	0	0.4	1,043	1,893	15	28,395	1.6	853	57	64	18,699	7,726
3	Install 40 occupancy sensors	8,800	800	8,000	11,500	2	0	1.0	0	1,955	15	29,325	4.1	267	18	23	14,540	20,591
4	Replace 1 old Drapkin Hall refrigerator with 18 cu ft Energy Star model	750	0	750	350	0	0	0.0	50	119	12	1,429	6.3	91	8	12	408	627
5	Retro-commissioning	50,000	none	50,000	24,797	1	1,187	5.1	1,820	7,878	12	94,536	6.3	89	7	11	26,637	57,482
6	Replace Boiler Controller	2,000	0	2,000	0	0	295	0.7	0	290	10	2,900	6.9	45	5	7	435	3,252
7	10 New T8 fixtures to be installed with incentives	1,292	100	1,192	530	0	0	0.0	19	123	15	1,847	9.7	55	4	6	249	949

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 I: METHOD OF ANALYSIS

Assumptions and tools

Cost estimates:	RS Means 2012 (Facilities Maintenance & Repair Cost Data) RS Means 2012 (Building Construction Cost Data) RS Means 2012 (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.