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June 14, 2013

Local Government Energy Program
Energy Audit Report

Pope Science Hall
Dwight Englewood School
315 East Palisade Avenue
Englewood, NJ 07631

Project Number: LGEA106

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EXECUTIVE SUMMARY

The Dwight Englewood School's Pope Science Hall is a three story, 20,400 ft^2 building. The building, built in 1965, currently houses several classrooms, and science labs, a communications room, boiler room, and mechanical room. The science labs are equipped with sinks and, in some cases, window exhaust fans. 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 the 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	573,225	9,171	$90,998	141	367	2,873
Proposed	500,550	8,470	$74,320	125.4	323	2,555
Savings	72,674	701	$16,678*	15.6	44	318
% Savings	12.7%	7.6%	18.3%	11.1%	12.0%	11.1%
*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 1. The building has a Site Energy Utilization Intensity of 141 kBtu/sqft/yr compared to the National Median of 46 kBtu/sqft/yr, for similar schools. Pope Science Hall's energy performance rating is low primarily due to its high annual electric usage which exceeds the maximum for a building of its type.

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)
Install 2 daylight sensors	Direct Install, Smart Start
Replace 11 Halogen and Incandescent lamps with CFL	Direct Install, Smart Start
Retro-commissioning	N/A
Upgrade 17 lighting controls with occupancy sensors	Direct Install, Smart Start
Replace 9 High Pressure Sodium fixtures with LED fixtures	N/A

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.

- Replace original boilers and steam distribution system
- Replace original unit ventilators
- Replace windows with Energy Star rated windows

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:

- Winterize window AC units
- Service steam traps
- 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	$16,678	2.3	$37,665	137,855
Total	$16,678	2.3	$37,665	137,855

Environmental Benefits

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 11 cars from the roads each year or is equivalent of planting 336 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 Palisades Avenue, Englewood, NJ. The process of the audit included a facility visits on December 10^{th}, 11^{th} 2012, and January 2^{nd}, 3^{rd}, 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 utility bills from November 2010 through October 2012 that were received from the utility companies supplying the School with electricity and natural gas. A 12 month period of analysis from November 2011 through October 2012 was used for all calculations and for purposes of benchmarking the building.

Pope Science Hall

Electricity – Pope Science Hall is currently served by one electric meter. Electricity is delivered and supplied by the Public Service Electricity and Gas (PSE&G) Company. Electricity was purchased at an average aggregated rate of $0.144/kWh and the school consumed 573,225 kWh, or $82,600 of electricity, for the analyzed billing period. The monthly peak demand was 183 kW for the month of May, while the average monthly demand was 157 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 8,300 kWh. Figure 1 also shows that electric usage is higher during the winter months, November through March and then is reduced in April. The maximum monthly electric usage was 54,516 kWh and occurred during November 2011. The lowest monthly electric usage was 39,645 kWh and occurred during July 2012. The average electric usage during the analysis period was 47,769 kWh. SWA calculated the annual electric usage per square foot as 28.10 kWh/ft2; this result was approximately 30% higher than buildings of the same type.

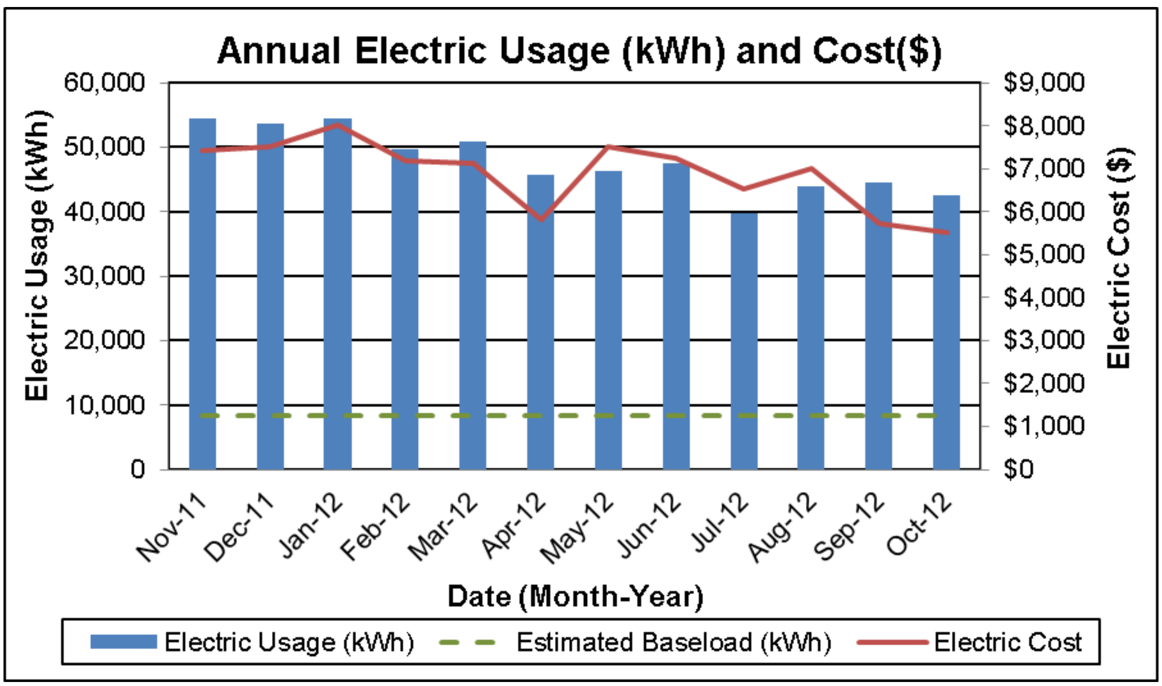


Figure 1: Annual electric usage (kWh) and Cost ($)

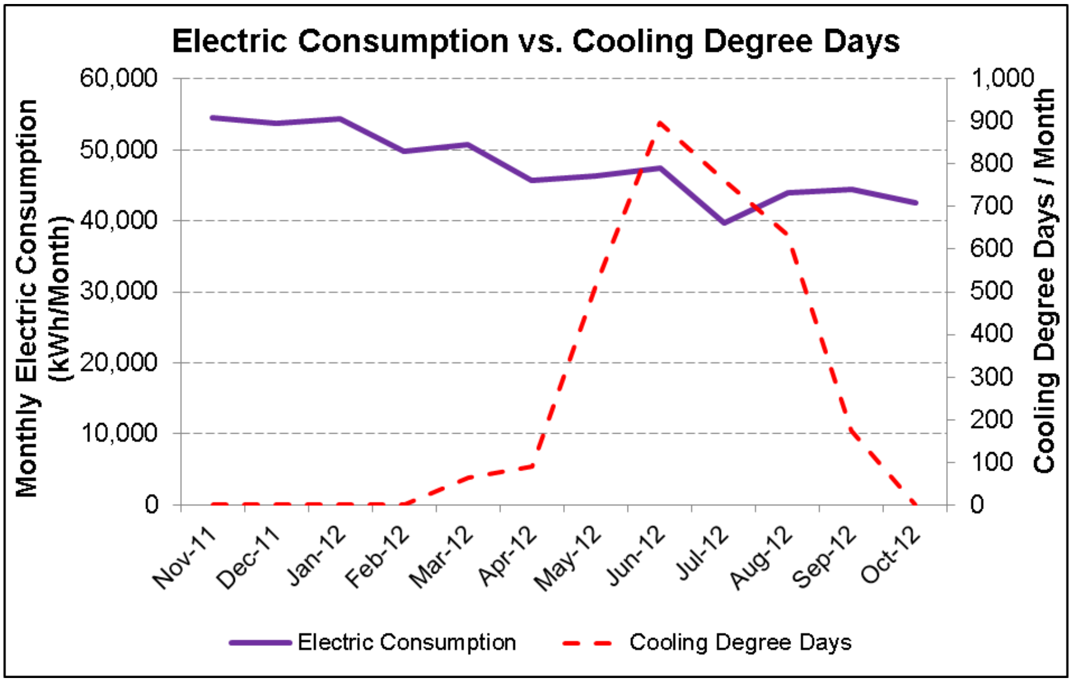


Figure 2: Electric consumption vs. Cooling degree days (CDD)

Figure 2 above shows the monthly electric usage along with the cooling degree days or CDD. Cooling degree days is the difference of the average daily temperature and a base temperature of 50°F, on a particular day. The cooling degree days are zero for the days when the average temperature exceeds the base temperature. Figure 2 shows that the electric usage curve differs largely from the CDD curve. For a building that uses natural gas boilers for space heating, such high electric consumption during the winter months is unusual. During the audit SWA observed that heat coming from the basement due to boiler operation was affecting the classrooms in the first floor raising the space temperature.

The facilities manager indicated that some spaces on the Pope Science Hall require use of mechanical cooling during the winter months in order to reduce the space temperature as a result of uncontrolled heat gain from boiler operation.

Natural gas – Pope Science Hall is served by one natural gas meter and currently purchases natural gas from PSE&G which is responsible for transmission and distribution and from Hess which acts as a third party energy supplier. The gas fired boilers located on the basement of the Pope Science Hall currently provide heating to three (3) buildings; Pope Science Hall, Schenk Auditorium and Klein Center. For analysis purposes SWA has divided the natural gas consumption on a per square foot basis. For Pope Science Hall natural gas was purchased at an average aggregated rate of $0.916/therm and the school consumed 9,171 therms, or $8,398 of natural gas, for the analyzed billing period.

Figure 3 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. 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.

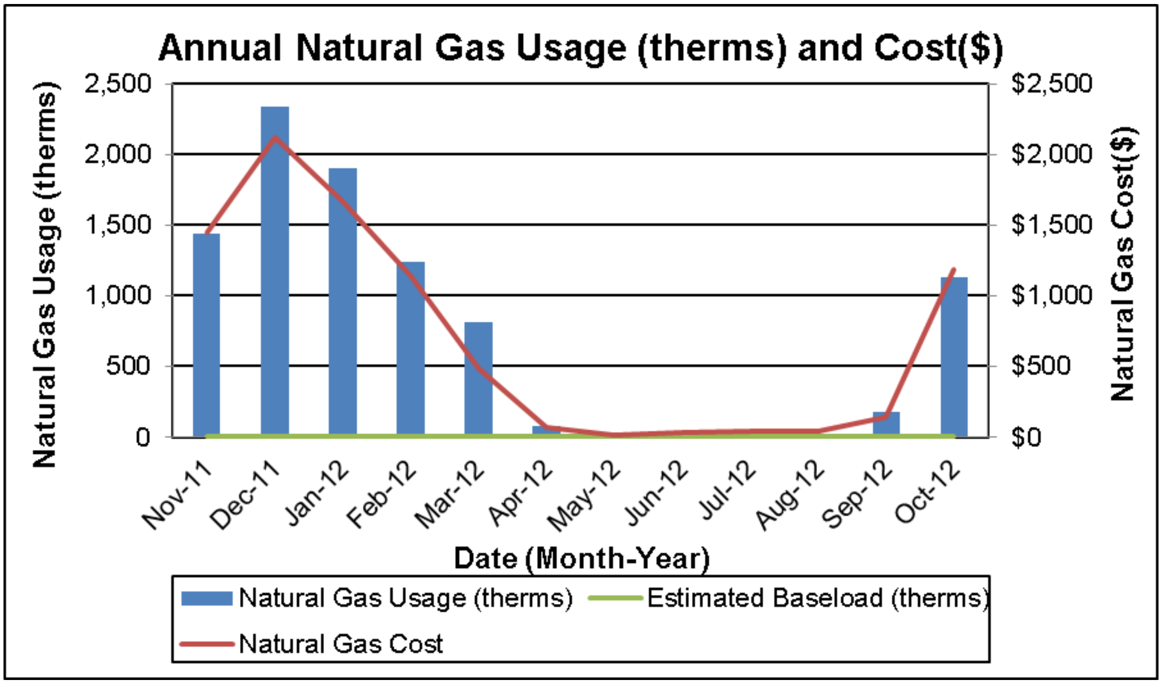


Figure 3: Annual natural gas usage (therms) and Cost ($)

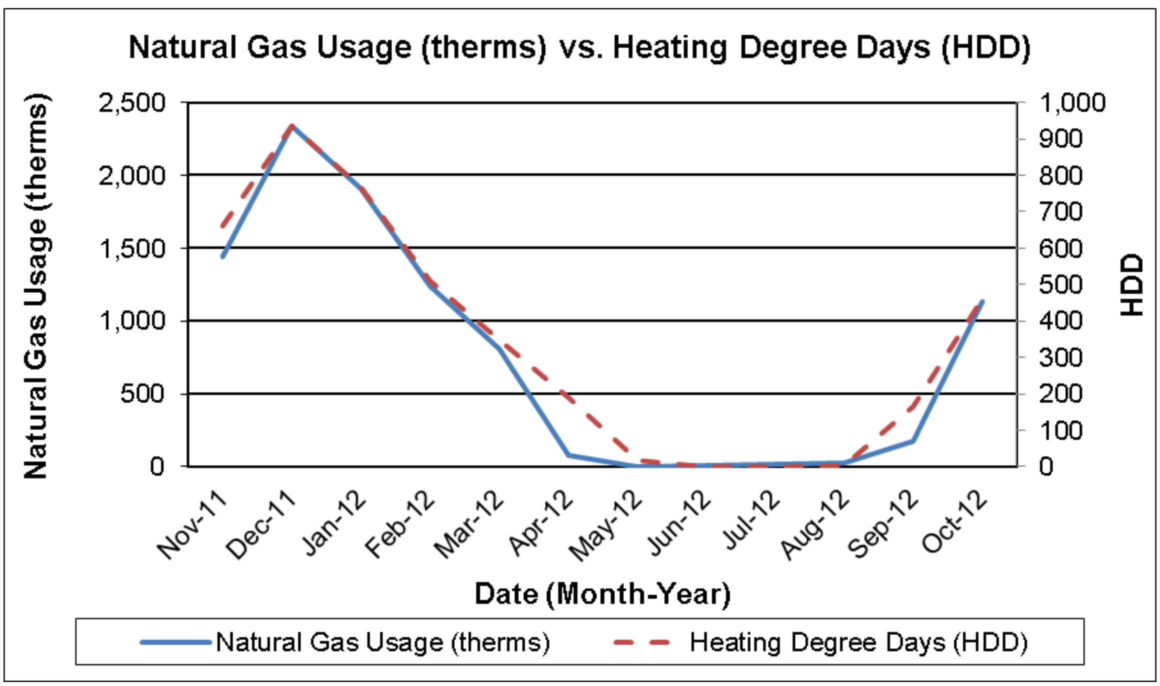


Figure 4: Natural gas usage (therms) vs Heating degree days (HDD)

Figure 4 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. The natural gas usage curve follows closely the HDD curve; however during the month of April the natural gas usage curve drops lower than the HDD curve possibly as a result that the boilers are turned off in April for the spring season.

Table 3 and figure 5 show the energy use for the Pope Science Hall by end use based on utility bills for the analyzed billing period. Note: electrical cost at $42/MMBtu of energy is almost 5 times as expensive as natural gas at $9/MMBtu

Annual Energy Consumption / Costs					
	MMBtu	**% MMBtu**	**$**	**% $**	**$/MMBtu**
Electric Misc	109	4%	$4,611	5%	42
Electric For Cooling	1,116	39%	$47,114	52%	42
Electric For Heating	500	17%	$21,134	23%	42
Lighting	231	8%	$9,741	11%	42
Domestic Hot Water (Gas)	216	8%	$1,976	2%	9
Building Space Heating (Gas)	701	24%	$6,422	7%	9
Totals	2,873	100%	$90,998	100%	32
Total Electric Usage	1,956	68%	$82,600	91%	42
Total Gas Usage	917	32%	$8,398	9%	9
Totals	2,873	100%	$90,998	100%	32

Table 3: Annual Energy Consumption / Costs

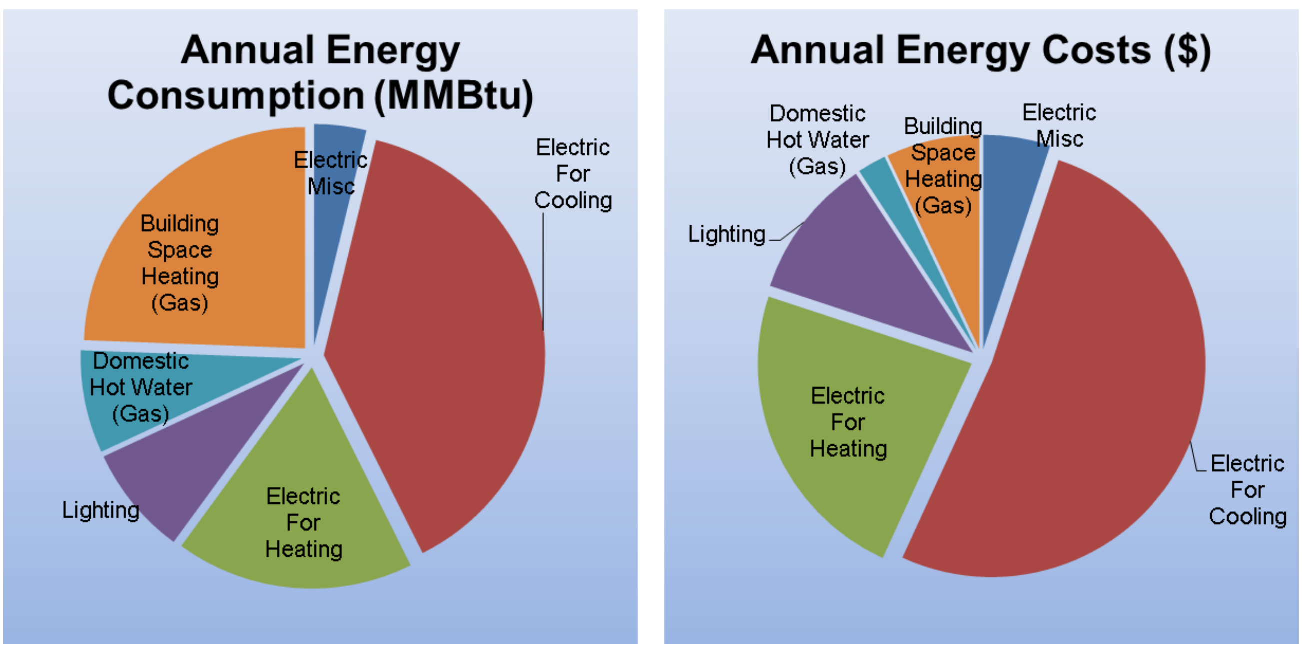


Figure 5: Annual energy consumption (MMBtu) and Costs ($)

Energy Benchmarking

SWA has entered energy information about the Pope Science Hall 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 1. 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 Site Energy Utilization Intensity (Site EUI) was calculated to be 141 kBtu/sqft/yr compared to the National Median of 46 kBtu/sqft/yr. See the ECM section for guidance on how to further reduce the building's energy intensity.

The ENERGY STAR® Portfolio Manager uses a national survey conducted by the U.S. Energy Information Administration (EIA). This national survey, known as the Commercial Building Energy Consumption Survey (CBECS), is conducted every four years, and gathers data on building characteristics and energy use from thousands of buildings across the United States. The Portfolio Manager software uses this data to create a database by building type. By entering the building parameters and utility data into the software, Portfolio Manager is able to generate a performance scale from 1-100 by comparing it to similar 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 141 kBtu/sqft/yr compared to the national median SEUI of a "K-12 School" building consuming 46 kBtu/sqft/yr. This is a 203% 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.

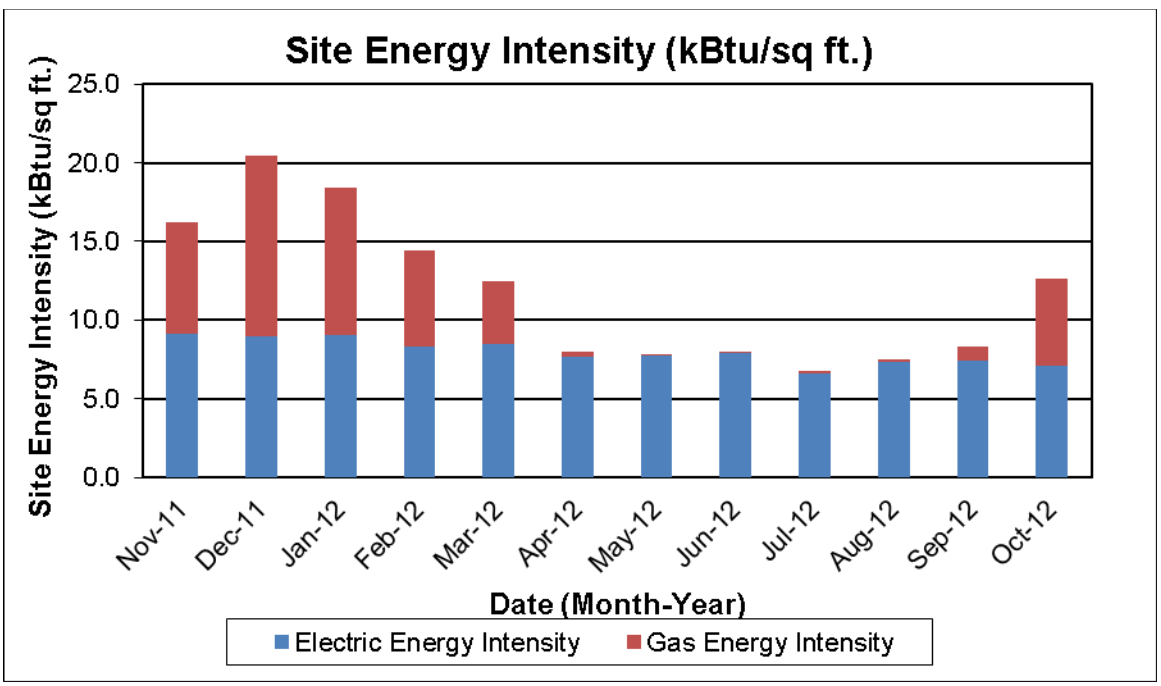


Figure 6: Site energy intensity (kbtu/sq ft.)

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]) and TRC Energy Services (user name 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 School is currently paying a general service rate for natural gas including fixed costs such as meter reading charges. The electric use for the building is direct-metered and purchased at a general service rate with an additional charge for electrical demand factored into each monthly bill. The general service rate is a market-rate based on electric usage and electric demand. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year.

Energy Procurement strategies

Billing analysis was conducted using an average aggregated rate which is estimated based on the total cost divided by the total energy usage for each utility over a 12 month period. Average aggregated rates do not separate demand charges from usage, and instead provide a metric of inclusive cost per unit of energy. Average aggregated rates are used in order to equitably compare building utility rates to average utility rates throughout the state of New Jersey.

The average estimated NJ commercial utility rates for electric are $0.137/kWh, while the School pays a competitive rate of $0.144/kWh. The School annual electric utility costs are $4,068 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.

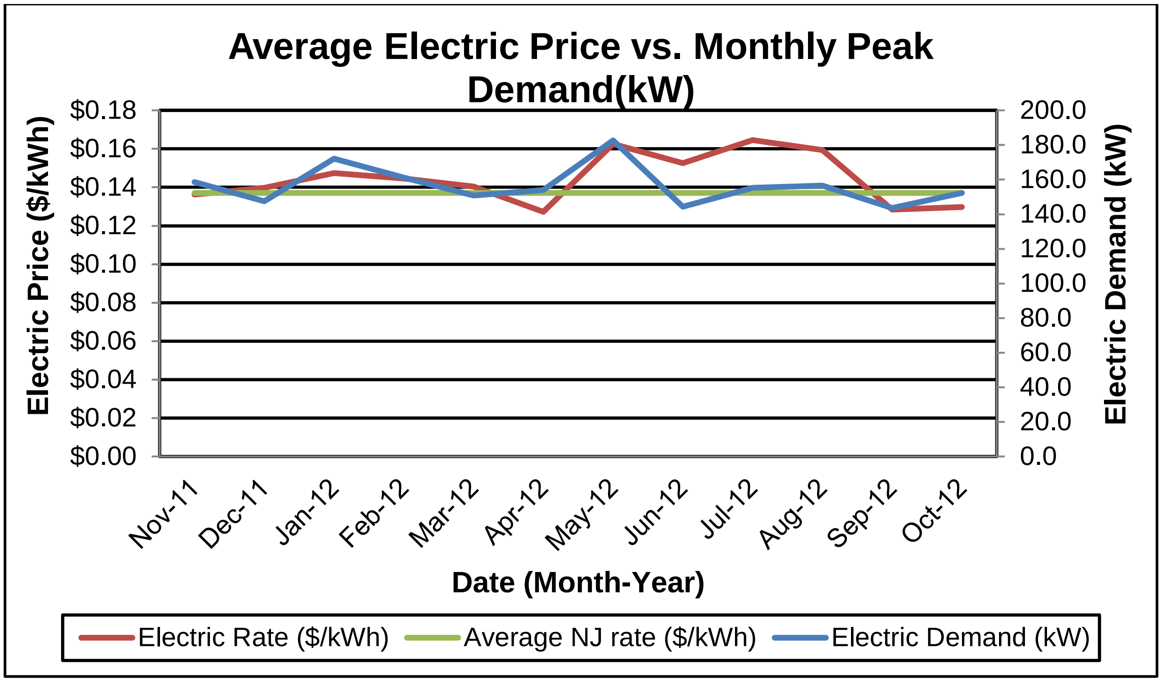


Figure 7: Average electric price vs. monthly peak demand

The average estimated NJ commercial utility rates for gas are $0.811/therm, while the School pays a rate of $0.916/therm. The School annual natural gas costs are $960 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 may have been caused by a combination of low usage and the assessment of fixed fees and costs.

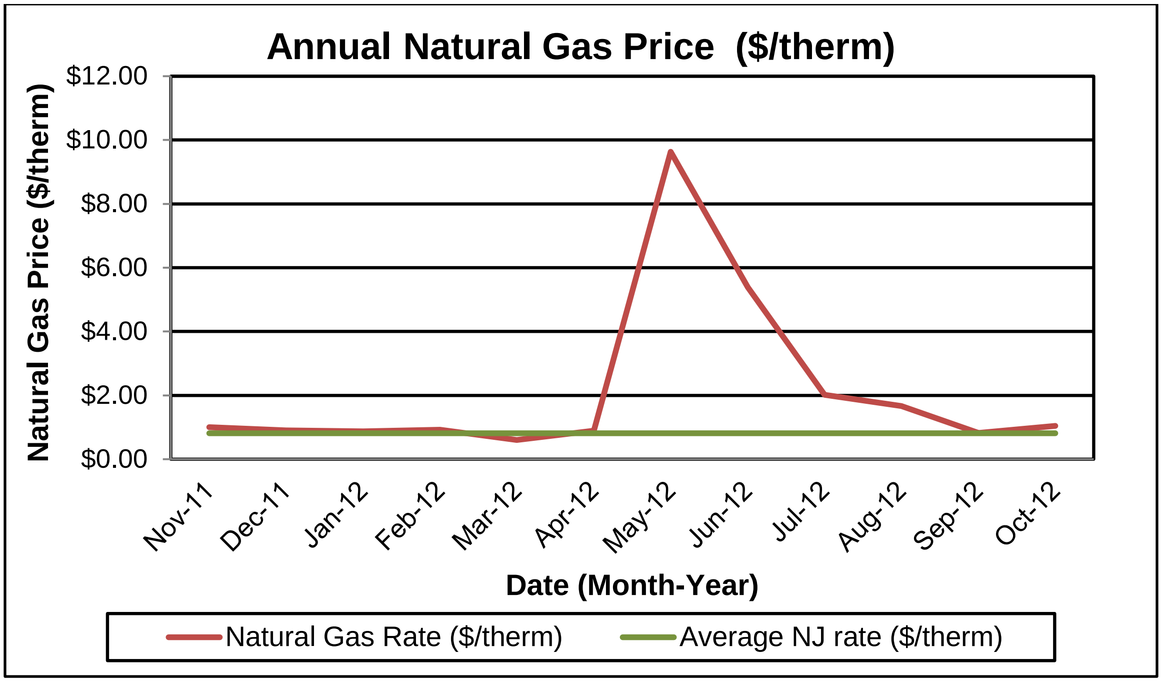


Figure 8: Annual natural gas price ($/therm)

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 in December of 2012 and January of 2013 the following data was collected and analyzed.

Building Characteristics

The Dwight Englewood School's Pope Science Hall is a three story, 20,400 ft^2 high school. The building, built in 1965, currently houses several classrooms, and science labs, a communications room, boiler room, and mechanical room. The science labs are equipped with sinks and, in some cases, window exhaust fans.

Image 1 Main entryway

Image 2 Main entryway and typical wall profile

Building Occupancy Profiles

The facility has a maximum occupancy of 129 students and 12 adults and is open on weekdays only from 7:30 a.m. until custodians leave at 8 p.m. The building is in use year-round.

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 steel frame with red-brick masonry units and limestone copings. The estimated insulation within the cavity wall is approximately 1 inch. There is a small rooftop greenhouse on the south side of the building.

Image 3 Exterior of School

Image 4 Main Entrance

Image 5 Greenhouse

The photo below details 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. The highest temperatures are shown in yellow and the coldest in deep purple.

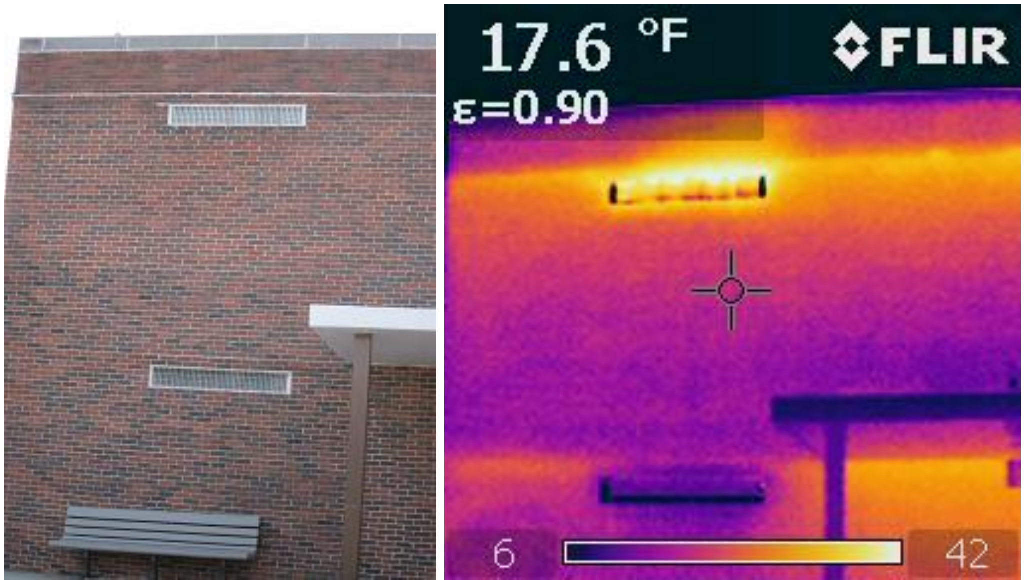


Image 6 Unit ventilator

Image 6 shows a unit ventilator on the second floor allowing heat to escape through the wall while a unit ventilator on the 1st floor does not. It is possible that a damper has been left open allowing heat to escape.

Roof

The building has a built-up asphalt rooftop, a portion of which has recovery granulated modified bitumen cap sheet. Drainage is processed via four roof-drains on the outer roof and four roof drains within the “patio” area. The roof was inspected one day after a light shower and was found to be poorly pitched with areas of excessive pooling. 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 estimated insulation below the roof deck is approximately 2 inches.

There is an area of the roof in which photovoltaic panels have been installed (image 8). No significant deficiencies were found around the area.

Note: Roof insulation levels could not be visually verified in the field and are based on notes from previous audits of this facility.

The following are photos of the roof from the time of the audit:


Image 7 Pooling on roof


Image 8 Pooling near exhaust fans


Image 9 Photovoltaic System

Base

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

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

The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall the base was reported to be in fair condition with a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues neither visible on the interior nor exterior.

Windows

The building contains both fixed and operable double-hung windows which were installed approximately 10 years ago (Image 10). The main entrance is comprised of fixed, single pane windows.

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, however, during a 28° F winter day, all window AC units remained in windows allowing heat to escape between the unit and window frame, as seen in the infrared image (Image 12). Window ACs should be removed in the winter to minimize heat loss through the windows.

Image 10

The following specific window problems were identified:

Image 11 Heat escaping through the non-insulated window frames and between AC unit and frame.

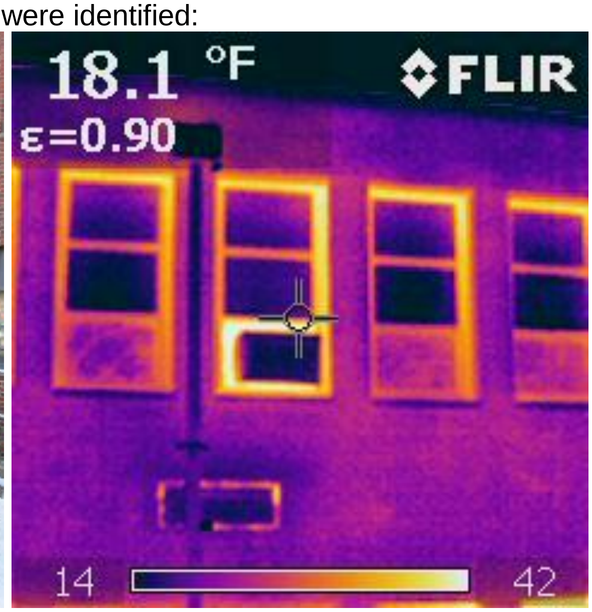


Image 12 Window ACs installed

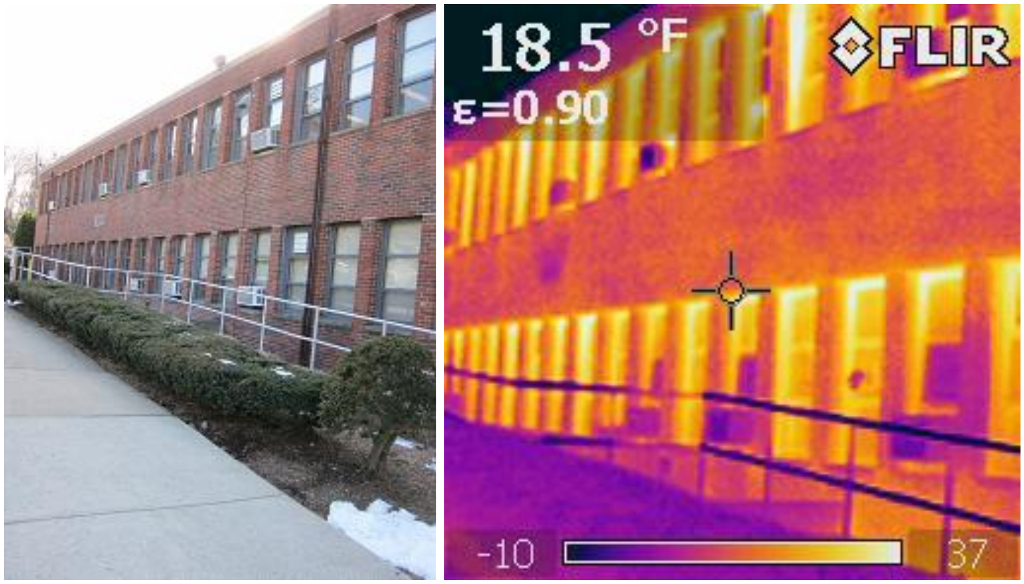


Image 13 Windows

Image 13 shows the non-insulated aluminum window frames excreting heat along with window ac units allowing heat to escape from between the unit and frame.

Exterior doors

The building contains aluminum type doors with single glazing and a non-insulated aluminum door frame. This door is located all the main entrances. There is a basement door that has no windows. All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. The doors were found to show significant air leakage and heat transfer due to a combination of single paned windows and poor weather stripping.

The photos below 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. The highest temperatures are shown in yellow and the coldest in deep purple.

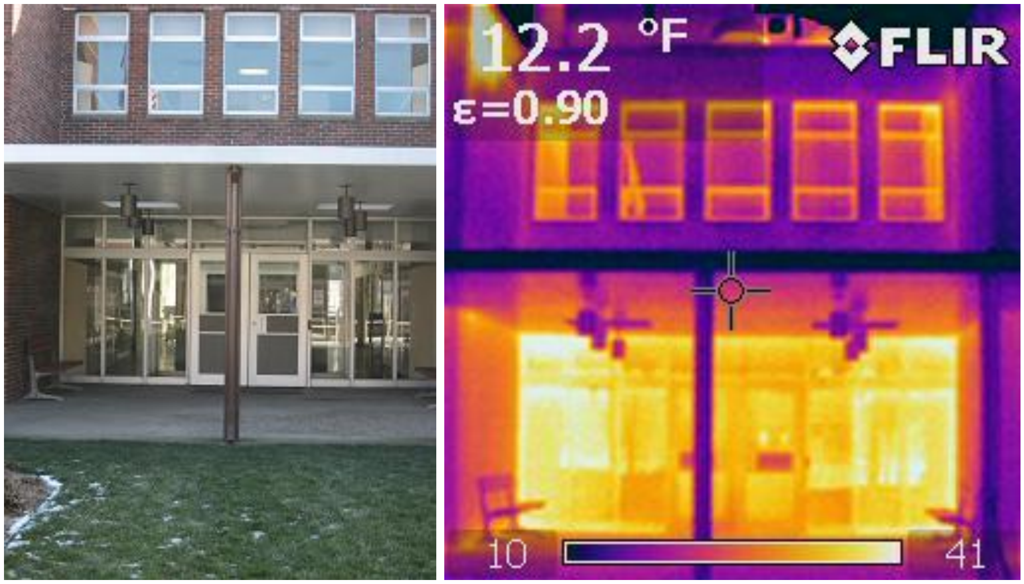


Image 14 Main Entrance

Image 14 shows the single paned glass, which makes up the building's main entry way, allowing heat to easily escape from the building. The main entryway is a bright yellow, showing the heat escaping from the building. Single paned glass has very little insulation and should be replaced with double paned glass. When comparing the lower level windows with the upper level's double paned glass, the difference in insulation can be easily seen.

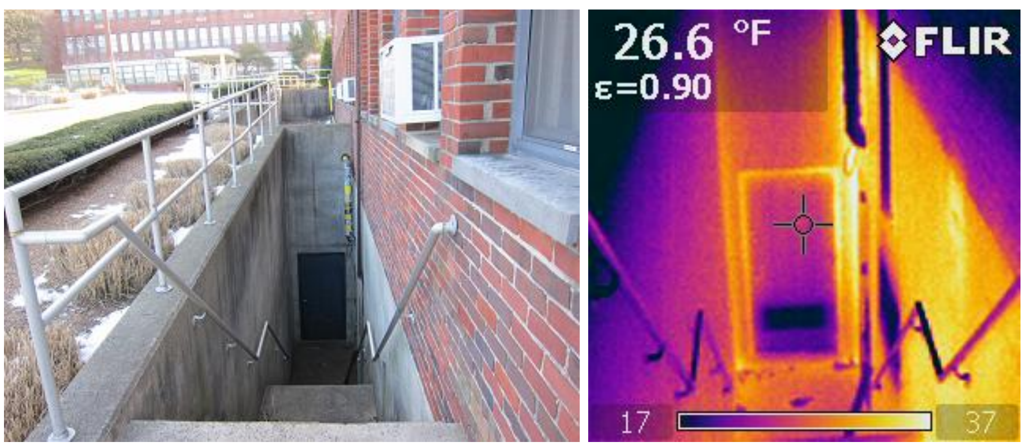


Image 15 Cellar Door

Image 15 reveals poor weather-stripping along the basement level door.

Building air-tightness

Overall the field auditors found the building to not be adequately air-tight with numerous areas if suggested improvements, as described in more detail earlier in this section.

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 Pope Science Hall are mechanically ventilated, heated and cooled. Cooling is provided by window air conditioners.

Equipment

Heating System

The two low-pressure Cleaver-Brooks gas-fired boilers, built in 1965, are located in the basement mechanical room and have design pressures of 15 psi. The boilers have an input of 6,275 MBH and an estimated output of 5,020 MBH, based on a 70% efficiency rating. The boilers operate on a Lead/Lag mode and are set to maintain a 15 psi pressure setpoint. The steam main has two branches, one that serves the Pope building's unit ventilators and cabinet unit heaters, while the other serves a steam-to-hot-water heat exchanger (HX). The heat exchanger supplies heating hot water (HHW) to the Schenck Auditorium and the Klein Campus Center.

Image 16 Cleaver Brooks boilers

Image 17 Boiler tag info

Steam passes through a shell-and-tube heat exchanger to produce heating hot water (HHW) for the Shenck Auditorium and the Klein Campus Center. The HHW is delivered to the building VIA two 10HP pumps.

Image 18 Heat Exchanger

Image 19 HHW Pumps

As mentioned earlier, steam is distributed to Wall Unit Ventilators which also provide a minimum amount of outside air for ventilation
.

Image 20 Wall Unit Ventilator

Cooling Systems

Cooling for spaces is provided by the wall unit ventilators which have a direct expansion coil and window AC units. Window AC units are installed to provide supplemental cooling; also wall propeller exhaust fans are present in rooms for use when necessary during science labs. Window AC units remain in windows during the winter season and are not covered in order to reduce cold air infiltration.

Controls

Heating in the classrooms are provided by wall cabinet heaters and are controlled by room wall-mounted thermostats. Window AC units are controlled by the teachers in each classroom. Exhaust fans and outdoor lighting are controlled by a timer.

Image 21 Exhaust Fan Timer

Domestic Hot Water

The building is provided domestic hot water (DHW) by one gas-fired 69-gallon Rheem-Ruud hot water heater installed in 2005. The DHW tank has a rated capacity of 250 MBH and provides domestic hot water to Umpleby Hall and Schenk Auditorium also.

Image 22 Rheem gas-fired DHW boiler

Electrical systems

Lighting

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

Interior lighting – The interior lighting is almost entirely electronically ballasted T8 fluorescent lamped fixtures controlled by wall switches. There was only one instance of an incandescent light in use in one of the staircases.

Image 23 Typical Light Fixtures

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

Exterior Lighting - The exterior lighting surveyed during the building audit was found to consist of halogen lamps of 75 watts each.

Image 24 Exterior *Image 25 Exterior Lighting*

Elevators

There are no elevators in this building.

Other electrical systems

There are currently no other significant energy-impacting electrical systems installed at the Dwight Englewood Pope Science Hall.

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

There is currently a 3 kW Photovoltaic system installed on the roof of the Pope Science Hall.

Image 26 Photovoltaic System

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.

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

Geothermal

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

Combined Heat and Power

The School is not a good candidate for CHP installation and would not be cost-effective due to the size and operations of the building. Typically, CHP is best suited for buildings with a constant electrical baseload to accommodate the electricity generated, as well as a means for using waste heat generated. Additionally, the seasonal occupancy schedule of the 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	**Install 2 Daylight Sensors**
ECM 2	**Upgrade 11 Incandescent/Halogen fixtures with Compact Fluorescent Lamps (CFLs)**
ECM 3	**Retro-commissioning**
ECM 4	**Upgrade 17 Lighting Controls with Occupancy Sensors**
ECM 5	**Retrofit 9 High Pressure Sodium (HPS) Street Lights with LED lamps**

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

ECM #1: Install 2 Daylight Sensors

At the time of the visit SWA observed that exterior lights in front of Pope Science Hall were on while plenty of daylight was available. Daylight sensors are a type of lighting control that automatically maintain a specified light level based on the amount of daylight coming into the building. As daylight increases, the light fixtures are dimmed thus reducing electric consumption. The use of daylight controls help maintain a minimum required light level, without over lighting a space or area. SWA recommends installing daylight sensors in areas that use light fixtures and building openings (i.e. windows) to illuminate the space.

Installation cost:

Estimated installed cost: $390 (includes $120 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
$390	274	0	0	0.0	$1,869	$1,909	15	$28,631	0.2	7,241%	483%	489%	$21,386	490

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. Existing light fixtures are assumed to have dimming capabilities.

Rebates/financial incentives:

- NJ Clean Energy – Smart Start - $25 per fixture – Maximum incentive amount is $50.

Please see APPENDIX I for more information on Incentive Programs.

ECM #2: Upgrade 11 Halogen and Incandescent fixtures with Compact Fluorescent Lamps (CFLs)

The building is equipped with fixtures containing inefficient incandescent lamps. SWA recommends that each halogen and incandescent 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: $107 (includes $44 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
$107	3,060	1	0	0.5	$15	$455	5	$2,277	0.2	2,038%	408%	427%	$1,906	5,479

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 I for more information on Incentive Programs.

ECM #3: 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.

The goals of RCx include:

- Finding opportunities to reduce energy costs through readily implemented changes to the operation of the building.
- Evaluating set points of equipment and systems with the intent of bringing them to a proper operational state.
- Improving indoor environmental quality (IEQ) thereby reducing occupant complaints and reducing staff time spent on complaint calls.
- Improving equipment reliability through enhanced operation and maintenance procedures.

Installation cost:

Estimated installed cost: $25,500 (includes $21,675 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
$25,500	55,961	1	701	12.8	$1,820	$10,526	12	$126,312	2.4	395%	33%	41%	$75,616	107,929

Assumptions: SWA calculated the estimated the ECM cost at $1.25/ft^2$, which is typical of buildings of this size and type.

Rebates/financial incentives:

- Currently there are not any incentives for this measure.

Please see APPENDIX I for more information on Incentive Programs.

ECM #4: Upgrade 17 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: $3,400 (includes $1,020 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
$3,400	9,536	2	0	1.6	$0	$1,373	15	$20,599	2.5	506%	34%	40%	$12,364	17,075

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 I for more information on Incentive Programs.

ECM#5: Replace 9 High Pressure Sodium (HPS) Street lights with LEDs fixtures

During the field audit, SWA completed a building interior as well as exterior lighting inventory (see Appendix B). The existing exterior lighting contains standard High Pressure Sodium (HPS) lamps. SWA recommends replacing the higher wattage HPS fixtures with LED lamps which offer the advantages of standard HPS lamps, but minimize the disadvantages. They produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. Due to these characteristics, energy savings can be realized via one-to-one substitution of lower-wattage systems, or by taking advantage of higher light output and reducing the number of fixtures required in the space. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $8,268 (includes $4,547 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
$8,268	3,843	1	0	0.6	$1,861	$2,414	5	$12,071	3.4	46%	9%	14%	$2,641	6,882

Assumptions: SWA calculated the savings for this measure using measurements taken on the day of the field visit and using the billing analysis. Replace the existing 15 watt fluorescent sign with a 5 watt LED equivalent.

Rebates/financial incentives:

- Currently there are no incentives for this measure

Please see APPENDIX I 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.

- Replace the original boilers with newer efficient models and steam distribution system. The existing boilers operate in a lead/lag mode to meet the heating demand of three (3) buildings during the winter season. The lack of zone control and advance outdoor reset controls along with the advance age of the boilers make the existing heating system highly inefficient. Currently the boilers operate on or off independent of actual building heating demand; the result of such operation mode is higher gas usage and excessive space heating in Pope Science Hall. SWA recommends replacing the existing steam boilers with heating hot water boilers, dedicated to serving Pope Science Hall exclusively. SWA also recommends replacing the existing steam distribution system to a hydronic heating hot water loop and installing zone control valves. SWA estimates a replacement cost of approximately $150,000 including removing the old boilers, and replacing them with smaller sized boilers with higher efficiencies. SWA estimates that the total annual energy savings are approximately 10% or $843/yr. Further savings can be achieved by implementing advance boiler control techniques such as heating hot water temperature reset. Further study is recommended in order to determine actual project requirements and costs.

- Replacing old unit ventilators – SWA recommends replacing the existing unit ventilators in each classroom. The unit ventilators are original to the building and are near the end of their useful life. New unit ventilators have higher energy efficiency ratios (EERs) and provide better controls which can help reduce the annual energy usage. SWA estimates a replacement cost of approximately $55,000 including removal of old ventilators. SWA estimated savings associated with this recommendation are approximately $1,700/yr. Further study is recommended in order to determine accurate amount of unit ventilators to replace, capacity and additional HVAC requirements.

- Replace all windows with ENERGY STAR certified windows. ENERGY STAR certified windows provide improved insulation and reduced thermal heat gain. SWA estimates $155,047 to replace all the single-hung, fixed and hopper type windows in the main building. SWA estimate that the total annual energy savings are approximately $4,500/yr. Further study is recommended an a detailed building energy model is recommended to accurately calculate energy and cost savings.

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.

- Winterize window AC unit during winter months – During the audit SWA observed that window AC units were in place during the winter season. Window AC units allow cold air infiltration and may increase the need for space heating. SWA recommends winterizing the window AC units by placing outdoor covers over the condensing section and covering the blower section on the inside. Further, it is recommended to also insulate the perimeter of the unit where it meets the window frame with weather-stripping in order to reduce air infiltration.

- Service steam traps – Assure that all steam traps are functioning as intended. Overtime steam traps fail, thus blocking flow and/or causing an imbalance in the steam system. Routine maintenance or servicing helps to identify faulty steam traps, or potential deficiencies in the system, and provides an opportunity to repair or replace the faulty traps. The steam trap servicing can be conducted by in-house maintenance with a short payback.

- 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	Cleaver-Brooks Boiler Fuel -Oil Input BTU/hr - 6275000 Pressure - 15 psi	Cleaver-Brooks Boiler Model # - CB810-150 Serial # - L-35431	Oil	Boiler Room	Pope / Shenck	1965	-135%
Heating	Cleaver-Brooks Boiler Fuel -Oil Input BTU/hr - 6275000 Pressure - 15 psi	Cleaver-Brooks Boiler Model # - CB810-150 Serial # - L-35432	Oil	Boiler Room	Pope / Shenck	1965	-135%
Fuel Oil Pump	HP- 7.5 Volt - 201 - 220/440 RPM - 2875 AMP- 20/ 10	Marathon Motors Model # - 2L 215TDR8CD W	Electric	Boiler Room	Pope		
DHW	Fuel - Natural Gas Standby Loss - 2.67% / Hr Capacity - 69 Gal Thermal Eff - 80%	Rheem - Rudd Boiler Model # - G72 - 250 A	Natural gas	Boiler Room	Pope	2005	30%
	HP - 1 RPM - 1450 / 1760 Amps - 3.4 Volts - 208-220	Peerless Electric Model # - P182 Serial # P3104GS	Electric	Boiler Room	Pope		
	Volts - 240 Amps - 15.0 ROM - 3450	Emerson Electric Model # - CNV	Natural Gas	Boiler Room	Pope	1997	25%
Heat Exchanger		Armstrong Model #:		Rooftop	Pope	2005	53%
	HP- 5 Volt - 208 - 220/440 RPM - 1735 AMP- 14 / 7	Marathon Motors Model # - 3C 215TDR26DD W	Electric	Boiler Room	Pope		
	HP- 5 Volt - 208 - 220/440 RPM - 1735 AMP- 14.8 - 14 / 7	Baldor Motors Model # - 53218 T	Electric	Boiler Room	Pope		
	HP- 5 Volt - 230/460 RPM - 1750 AMP- 13 / 6.5 Efficiency - 87.5	Lincoln Electric	Electric	Boiler Room	Pope		
Hot Water Pump #2	HP- 10 Volt - 208-230/460 RPM - 1740 AMP- 26.7-24.2 / 12.1 Efficiency - 89.5	Westinghouse Motors Cat No - ASGANE010-4-2/4	Electric	Boiler Room	Pope		
Hot Water Pump #4	HP- 10 Volt - 208-230/460 RPM - 1740 AMP- 26.7-24.2 / 12.1 Efficiency - 89.5	Westinghouse Motors Cat No - ASGANE010-4-2/4	Electric	Boiler Room	Pope		

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	Ext	Exterior	Ceiling Suspended	S	Hal	10	1	75	Sw	12	365	17	915	4,008	CFL	Ceiling Suspended	CFL	S	DL	10	1	25	9	365	0	250	821	2913	274	3186
2	1	Staircase	Ceiling Mounted	E	4'T8	2	2	32	Sw	16	230	10	148	545	C	Ceiling Mounted	4'T8	E	N	2	2	32	16	230	10	148	545	0	0	0
3	1	Staircase	Ceiling Mounted	E	4'T8	1	4	32	Sw	16	230	20	148	545	C	Ceiling Mounted	4'T8	E	N	1	4	32	16	230	20	148	545	0	0	0
4	1	Staircase	Ceiling Mounted	E	4'T8 U-Shaped	1	2	32	Sw	16	230	10	74	272	C	Ceiling Mounted	4'T8 U-Shaped	E	N	1	2	32	16	230	10	74	272	0	0	0
5	1	Staircase	Ceiling Suspended	S	Inc	1	1	60	Sw	16	230	0	60	221	CFL	Ceiling Suspended	CFL	S	N	1	1	20	16	230	0	20	74	147	0	147
6	2	Classroom (212)	Recessed Parabolic	E	4'T8	24	2	32	Sw	9	230	10	1,776	3,676	C	Recessed Parabolic	4'T8	E	OS	24	2	32	7	230	10	1776	2757	0	919	919
7	2	Classroom (212a)	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
8	2	Classroom (215)	Recessed Parabolic	E	4'T8	16	2	32	Sw	9	230	10	1,184	2,451	C	Recessed Parabolic	4'T8	E	OS	16	2	32	7	230	10	1184	1838	0	613	613
9	2	Classroom (218)	Recessed Parabolic	E	4'T8	18	2	32	Sw	9	230	10	1,332	2,757	C	Recessed Parabolic	4'T8	E	OS	18	2	32	7	230	10	1332	2068	0	689	689
10	2	Hallway (Upper Hallway)	Recessed Parabolic	E	4'T8	15	4	32	Sw	16	230	20	2,220	8,170	C	Recessed Parabolic	4'T8	E	N	15	4	32	16	230	20	2220	8170	0	0	0
11	2	Classroom (208)	Recessed Parabolic	E	4'T8	24	2	32	Sw	9	230	10	1,776	3,676	C	Recessed Parabolic	4'T8	E	OS	24	2	32	7	230	10	1776	2757	0	919	919
12	2	Classroom (208a)	Recessed Parabolic	E	4'T8	3	2	32	Sw	9	230	10	222	460	C	Recessed Parabolic	4'T8	E	OS	3	2	32	7	230	10	222	345	0	115	115
13	2	Classroom (208b)	Recessed Parabolic	E	4'T8	3	2	32	Sw	9	230	10	222	460	C	Recessed Parabolic	4'T8	E	OS	3	2	32	7	230	10	222	345	0	115	115
14	2	Classroom (200)	Recessed Parabolic	E	4'T8	24	2	32	Sw	9	230	10	1,776	3,676	C	Recessed Parabolic	4'T8	E	OS	24	2	32	7	230	10	1776	2757	0	919	919
15	2	Classroom (204)	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
16	2	Storage Closet	Recessed Parabolic	S	CFL	1	1	13	Sw	2	230	0	13	6	C	Recessed Parabolic	CFL	S	N	1	1	13	2	230	0	13	6	0	0	0
17	2	Bathroom Women	Recessed Parabolic	E	4'T8	1	2	32	Sw	9	230	10	74	153	C	Recessed Parabolic	4'T8	E	OS	1	2	32	7	230	10	74	115	0	38	38
18	2	Bathroom Women	Recessed Parabolic	E	2'T8	1	2	17	Sw	9	230	4	38	79	C	Recessed Parabolic	2'T8	E	OS	1	2	17	7	230	4	38	59	0	20	20
19	2	Bathroom Men	Recessed Parabolic	E	2'T8	1	2	17	Sw	9	230	4	38	79	C	Recessed Parabolic	2'T8	E	OS	1	2	17	7	230	4	38	59	0	20	20
20	2	Bathroom Men	Recessed Parabolic	E	4'T8	1	2	32	Sw	9	230	10	74	153	C	Recessed Parabolic	4'T8	E	OS	1	2	32	7	230	10	74	115	0	38	38
21	1	Classroom (107)	Recessed Parabolic	E	4'T8	24	2	32	Sw	9	230	10	1,776	3,676	C	Recessed Parabolic	4'T8	E	OS	24	2	32	7	230	10	1776	2757	0	919	919
22	1	Classroom (107a)	Recessed Parabolic	E	4'T8	6	2	32	Sw	9	230	10	444	919	C	Recessed Parabolic	4'T8	E	OS	6	2	32	7	230	10	444	689	0	230	230
23	1	Classroom (108)	Recessed Parabolic	E	4'T8	24	2	32	Sw	9	230	10	1,776	3,676	C	Recessed Parabolic	4'T8	E	OS	24	2	32	7	230	10	1776	2757	0	919	919
24	1	Storage Closet	Recessed Parabolic	E	4'T8	2	2	32	Sw	2	230	10	148	68	C	Recessed Parabolic	4'T8	E	N	2	2	32	2	230	10	148	68	0	0	0
25	1	Storage Closet	Recessed Parabolic	E	4'T8	2	1	32	Sw	2	230	5	74	34	C	Recessed Parabolic	4'T8	E	N	2	1	32	2	230	5	74	34	0	0	0
26	1	Classroom (111)	Recessed Parabolic	E	4'T8	24	2	32	Sw	9	230	10	1,776	3,676	C	Recessed Parabolic	4'T8	E	OS	24	2	32	7	230	10	1776	2757	0	919	919
27	1	Classroom (111a)	Recessed Parabolic	E	4'T8	10	2	32	Sw	9	230	10	740	1,532	C	Recessed Parabolic	4'T8	E	OS	10	2	32	7	230	10	740	1149	0	383	383
28	1	Classroom (116)	Recessed Parabolic	E	4'T8	36	2	32	Sw	9	230	10	2,664	5,514	C	Recessed Parabolic	4'T8	E	OS	36	2	32	7	230	10	2664	4136	0	1379	1379
29	1	Hallway	Recessed Parabolic	E	2'T8	24	4	17	Sw	16	230	8	1,824	6,712	C	Recessed Parabolic	2'T8	E	N	24	4	17	16	230	8	1824	6712	0	0	0
30	1	Hallway	Ceiling Suspended	S	CFL	3	1	13	Sw	16	230	0	39	144	C	Ceiling Suspended	CFL	S	N	3	1	13	16	230	0	39	144	0	0	0
31	1	Boiler Rm	Ceiling Suspended	E	4'T8	6	2	32	Sw	2	230	10	444	204	C	Ceiling Suspended	4'T8	E	N	6	2	32	2	230	10	444	204	0	0	0
32	1	Boiler Rm	Ceiling Suspended	E	4'T8	8	2	32	Sw	2	230	10	592	272	C	Ceiling Suspended	4'T8	E	N	8	2	32	2	230	10	592	272	0	0	0
33	#N/A	Throughout	Exit Sign	S	LED	8	3	5	Sw	24	365	2	132	1,156	C	Exit Sign	LED	S	N	8	3	5	24	365	2	132	1156	0	0	0
34	Ext	Exterior	ple Mounted Off Buildi	S	HPS	9	1	150	T	12	365	30	1,620	7,096	LED	ple Mounted Off Buildi	LED	S	DL	9	1	75	12	365	8	743	3252	3843	0	3843
		Totals:				343	69	1,167				329	26,879	67,598						343	69	1,002			290	25,297	50,884	6,903	9,810	16,714

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

Proposed Lighting Summary Table			
Total Gross Floor Area (SF)	20,400		
Average Power Cost ($/kWh)	0.1440		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	11,103	4,073	**7,030**
Exterior Power (watts)	2,535	993	**1,543**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	56,495	46,811	**9,684**
Lighting Power (watts)	24,344	24,304	**40**
Lighting Power Density (watts/SF)	1.19	1.19	**0.00**
Estimated Cost of Fixture Replacement ($)	8,375		
Estimated Cost of Controls Improvements ($)	3,790		
Total Consumption Cost Savings ($)	**6,152**		

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

<u>LIGHTING:</u>

- 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.

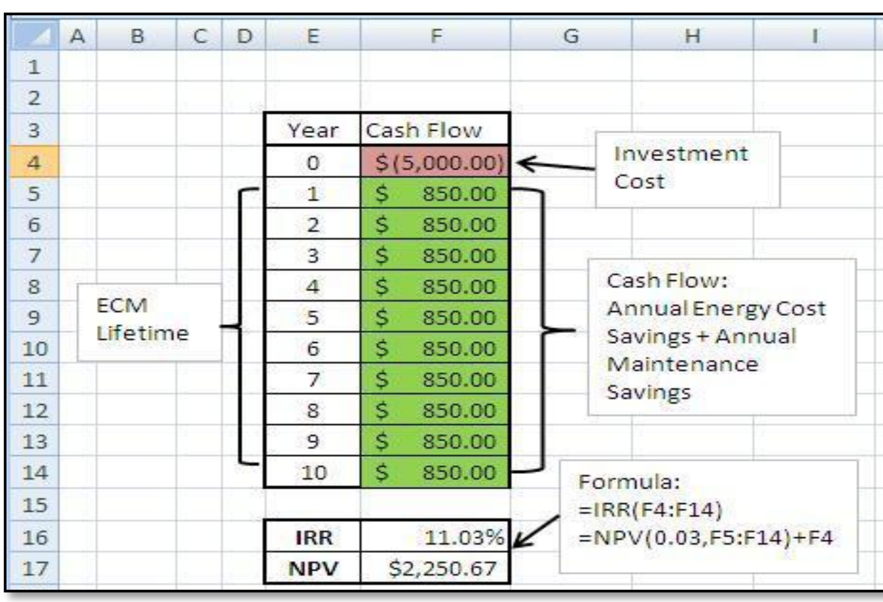
Calculation References

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 - Pope Science Hall

Building ID: 3419576
For 12-month Period Ending: October 31, 2012[1]
Date SEP becomes Ineligible: N/A

Date SEP Generated: February 01, 2013

Facility
Dwight-Englewood - Pope Science Hall
315 East Palisade Avenue
Englewood, NJ 07631

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1965
Gross Floor Area (ft²): 20,400

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	1,955,843
Natural Gas (kBtu)[4]	917,142
Total Energy (kBtu)	2,872,985
Energy Intensity[4]	
Site (kBtu/ft²/yr)	141
Source (kBtu/ft²/yr)	367
Emissions (based on site energy use)	
Greenhouse Gas Emissions (MtCO₂e/year)	326
Electric Distribution Utility	
Public Service Electric & Gas Co	
National Median Comparison	
National Median Site EUI	46
National Median Source EUI	121
% Difference from National Median Source EUI	203%
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

<u>New Jersey Clean Energy Pay for Performance</u>

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 .

<u>Direct Install 2011 Program*</u>

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	Install 2 Daylight sensors	440	50	390	274	0	0	0.0	1,869	1,909	15	28,631	0.2	7,241	483	489	21,386	490
2	Upgrade (11) Halogen and Incandescent to CFL	107	0	107	3,060	1	0	0.5	15	455	5	2,277	0.2	2,038	408	427	1,906	5,479
3	Retro-commissioning	25,500	none at this time	25,500	55,961	1	701	12.8	1,820	10,526	12	126,312	2.4	395	33	41	75,616	107,929
4	Install 17 occupancy sensors	3,740	340	3,400	9,536	2	0	1.6	0	1,373	15	20,599	2.5	506	34	40	12,364	17,075
5	Upgrade (9) High Pressure Sodium fixtures to LED	8,268	0	8,268	3,843	1	0	0.6	1,861	2,414	5	12,071	3.4	46	9	14	2,641	6,882

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.