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February 16, 2011

Sussex Community College
Academic & Athletics Building E

Local Government Energy Program
Energy Audit Report FINAL

One College Hill Rd
Newton, NJ 07860

Project Number: LGEA79

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EXECUTIVE SUMMARY

The Academic & Athletics building is a two story building with an additional partial basement level comprising a total conditioned floor area of 31,432 square feet. The original structure was built in 1967 with additions/renovations in 1997, 2007, and 2009. The following chart provides an overview of current energy usage in the building based on the analysis period of August 2009 through July 2010:

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	Joint Energy Consumption, MMBtu/yr
Current	357,363	21,916	$86,931	109.0	3,411
Proposed	274,623	15,247	$61,930	64.5	2,019
Savings	82,740	6,669	$25,001*	44.5	1,392
% Savings	23.2%	30.4%	28.8%	40.8%	40.8%
• Includes operation and maintenance savings					

There may be energy procurement opportunities for the Academic & Athletics building to reduce annual electric utility costs, which are $5,003 higher, when compared to the average estimated NJ commercial utility rates.

SWA has also entered energy information about the Public Academic & Athletics building in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager Energy benchmarking system. The resulting Site Energy Use Intensity is 109.0 kBtu/sq ft yr, while the average energy use intensity for campus type buildings is 120.0 kBtu/sq ft yr.

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

Table 2: Energy Conservation Measure Recommendations

ECMs	First Year Savings ($)	Simple Payback Period (years)	Initial Investment, $	CO2 Savings, lbs/yr
0-5 Year	$11,942	1.2	$14,637	112,958
5-10 Year	$4,259	6.9	$29,561	42,895
>10 year	$8,800	26.7	$235,480	65,803
Total	$25,001	11.1	$279,678	221,656

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 9 cars from the roads each year or the equivalent of planting 275 trees to offset the annual CO_2 emissions generated.

Further Recommendations: Other recommendations to increase building efficiency pertaining to capital improvements and operations and maintenance are (with additional information in the Proposed Further Recommendations section):

Capital Improvements

- Replace exhaust fans
- Replace window air conditioners
- Install NEMA premium motors when replacements are required
- Install waterless urinals

Operations and Maintenance

- Maintain roofs
- Maintain downspouts and cap flashing
- Provide weather-stripping/air-sealing
- Repair/seal wall cracks and penetrations
- Provide water-efficient fixtures and controls
- Use smart power electric strips

The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for Sussex Community College. Based on the requirements of the LGEA program, Sussex Community College must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The minimum amount to be spent, net of other NJCEP incentives, is $2,048 (or 25% of $8,192).

Financial Incentives and Other Program Opportunities

The table below summarizes the recommended next steps that the Sussex Community College can take to achieve greater energy efficiency and reduce operating expenses.

Table 3: Next Steps for the Academic & Athletics building

Recommended ECMs	Incentive Program (Please refer to Appendix F for details)
Upgrade (6) Thermostats to Programmable Thermostats	Direct Install
Install (43) New CFL fixtures	Direct Install
Install (1) Motion Sensor	Smart Start, Direct Install
Install (1) Beverage Vending Machine Miser	Direct Install
Replace (1) Refrigerator with an 18 cu ft ENERGY STAR® Model	N/A

There are various incentive programs that the Sussex Community College could apply for that could help lower the cost of installing the ECMs. For the Academic & Athletics building, and contingent upon available funding, SWA recommends the following incentive programs:

- **Direct Install 2010 Program**: Commercial buildings with peak electric demand below 200kW can receive up to 60% of installed cost of energy saving upgrades.
- **Smart Start**: Most of energy savings equipment and design measures have moderate incentives under this program.
- **Utility Sponsored Programs**: See available programs with JCP&L https://www.firstenergycorp.com/JCP_L/index.html and Elizabethtown Gas http://www.elizabethtowngas.com/Business/EnergySavings.aspx

Please refer to Appendix F for further details.

INTRODUCTION

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

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

SWA performed an energy audit and assessment for the Academic & Athletics building at One College Hill Rd, Sussex Community College, 07901. The process of the audit included facility visits on August 24, 27, and September 17, 2010, benchmarking and energy bills analysis, assessment of existing conditions, energy modeling, energy conservation measures and other recommendations for improvements. The scope of work includes providing a summary of current building conditions, current operating costs, potential savings, and investment costs to achieve these savings. The facility description includes energy usage, occupancy profiles and current building systems along with a detailed inventory of building energy systems, recommendations for improvement and recommendations for energy purchasing and procurement strategies.

The goal of this Local Government Energy Audit is to provide sufficient information to the Sussex Community College to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Academic & Athletics building.

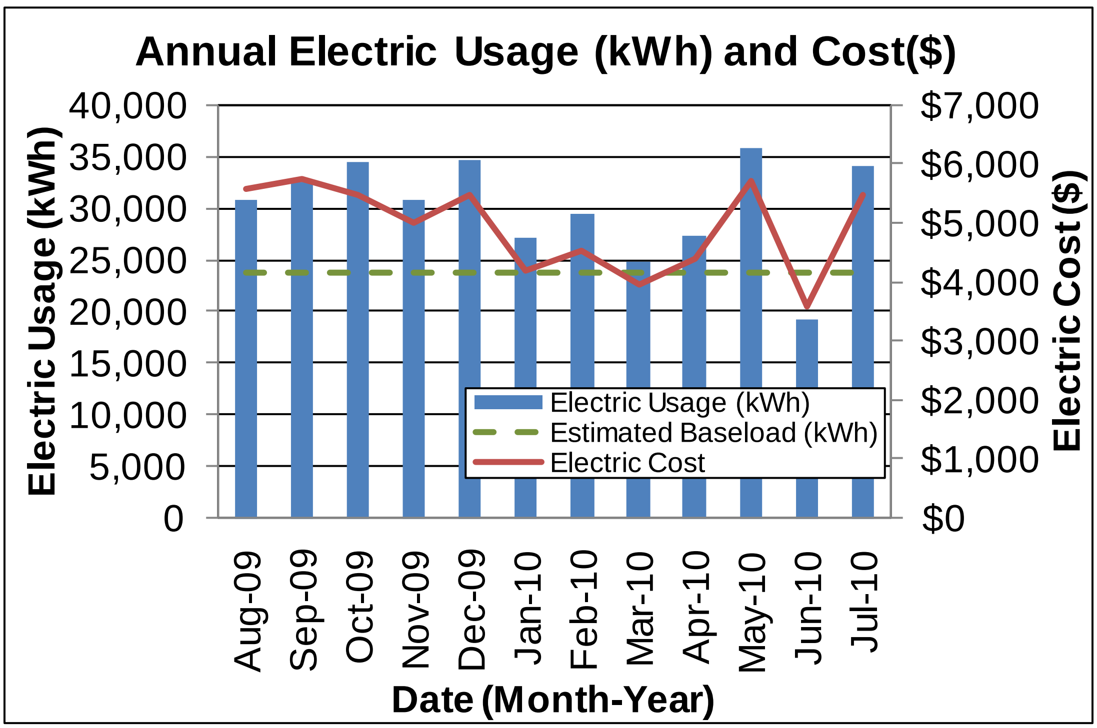
HISTORICAL ENERGY CONSUMPTION

Energy usage, load profile and cost analysis

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

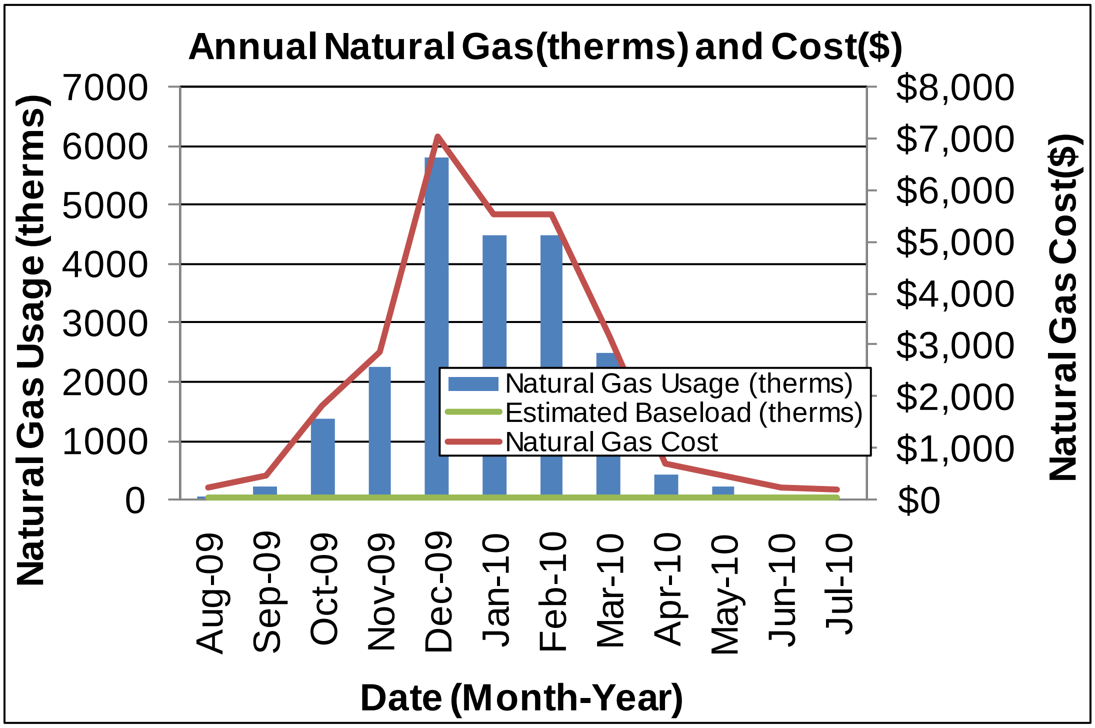
Electricity - The Academic & Athletics building is currently served by one electric meter. The Academic & Athletics building currently buys electricity from JCP&L at **an average aggregated rate of $0.164/kWh**. The Academic & Athletics building purchased **approximately 357,363 kWh, or $58,559 worth of electricity,** in the previous year. The average monthly demand was 100.0 kW and the annual peak demand was 112.1 kW.

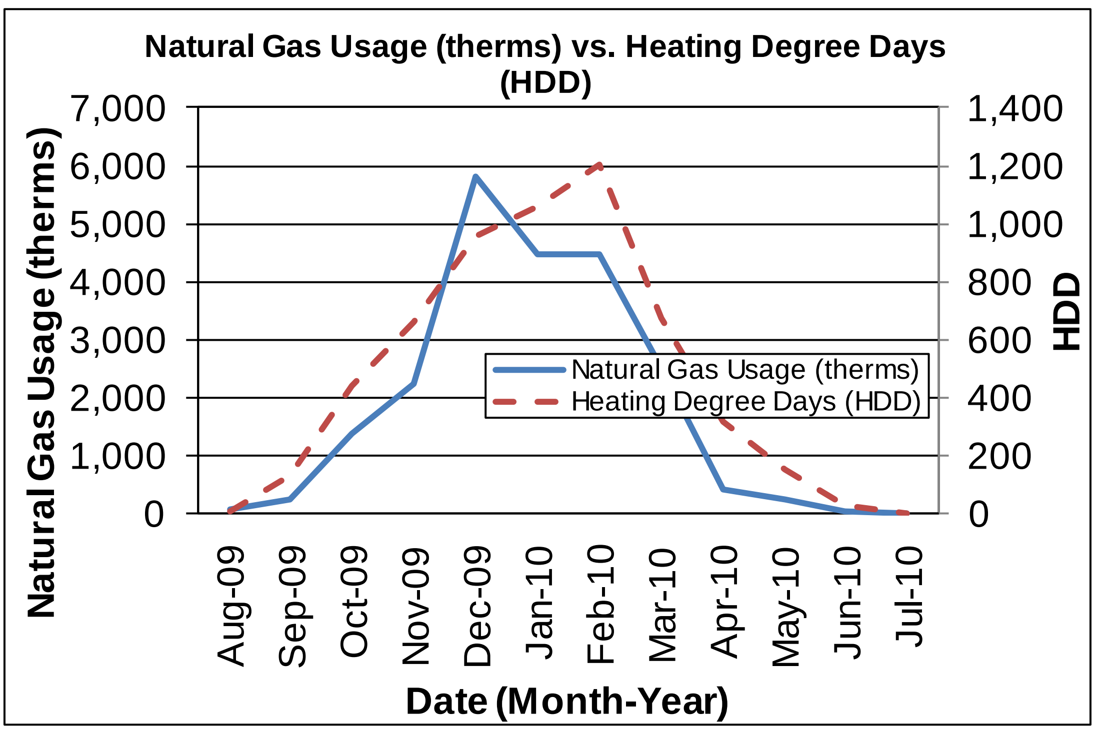
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate base-load or minimum electric usage required to operate the Academic & Athletics building. Please note the abnormally low kWh usage in June – SWA reckons this to be a utility issue and recommends the Sussex Community College to investigate with JCP&L. SWA also recommends the Sussex Community College to investigate why the December kWh is unusually high – it may due to utility metering issues as well.



Natural gas - The Academic & Athletics building is currently served by one meter for natural gas. The Academic & Athletics building currently buys natural gas from Elizabethtown Gas at **an average aggregated rate of $1.295/therm**. The Academic & Athletics building purchased **approximately 21,916 therms, or $28,372 worth of natural gas,** in the previous year.

The following chart shows the monthly natural gas usage and costs. The green line represents the approximate base-load or minimum natural gas usage required to operate the Academic & Athletics building.

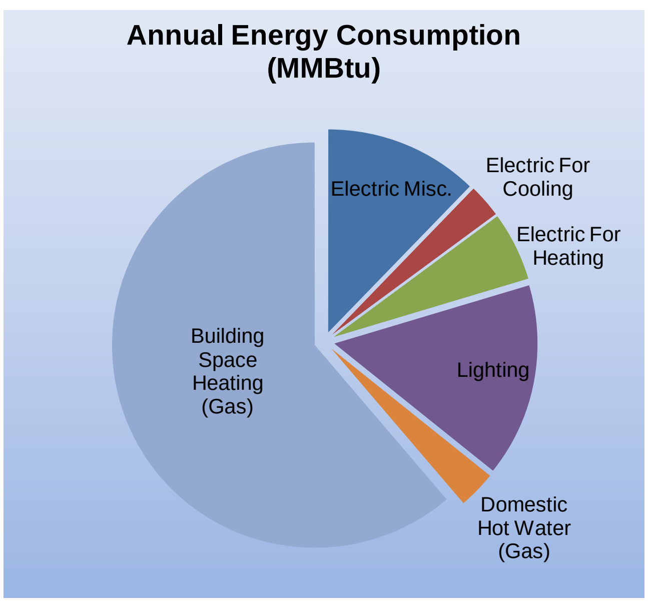


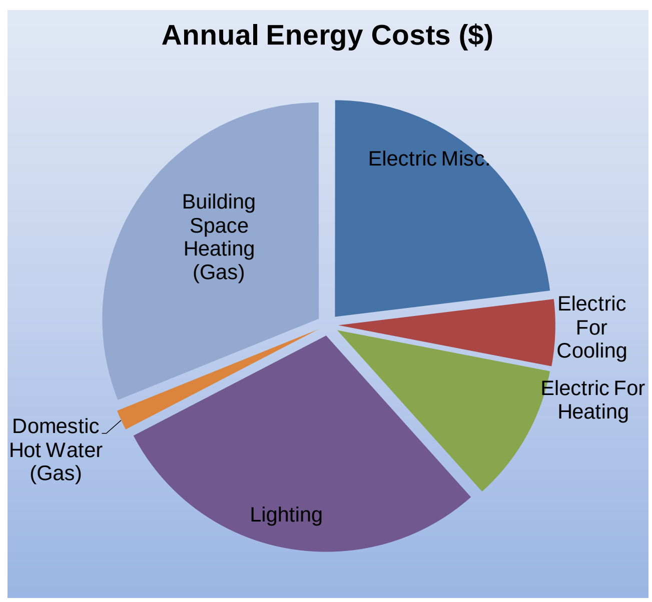


The previous chart shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the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

The following graphs, pie charts, and table show energy use for the Public Academic & Athletics building based on utility bills for the 12 month period. Note that electrical cost at $48/MMBtu of energy is 3.7 times as expensive as natural gas at $13/MMBtu.

Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Misc.	418	12%	$20,050	23%	48
Electric For Cooling	90	3%	$4,326	5%	48
Electric For Heating	187	5%	$8,980	10%	48
Lighting	525	15%	$25,204	29%	48
Domestic Hot Water (Gas)	102	3%	$1,323	2%	13
Building Space Heating	2,089	61%	$27,049	31%	13
Totals	3,411	100%	$86,931	100%	
Total Electric Usage	1,219	36%	$58,559	67%	48
Total Gas Usage	2,192	64%	$28,372	33%	13
Totals	3,411	100%	$86,931	100%	



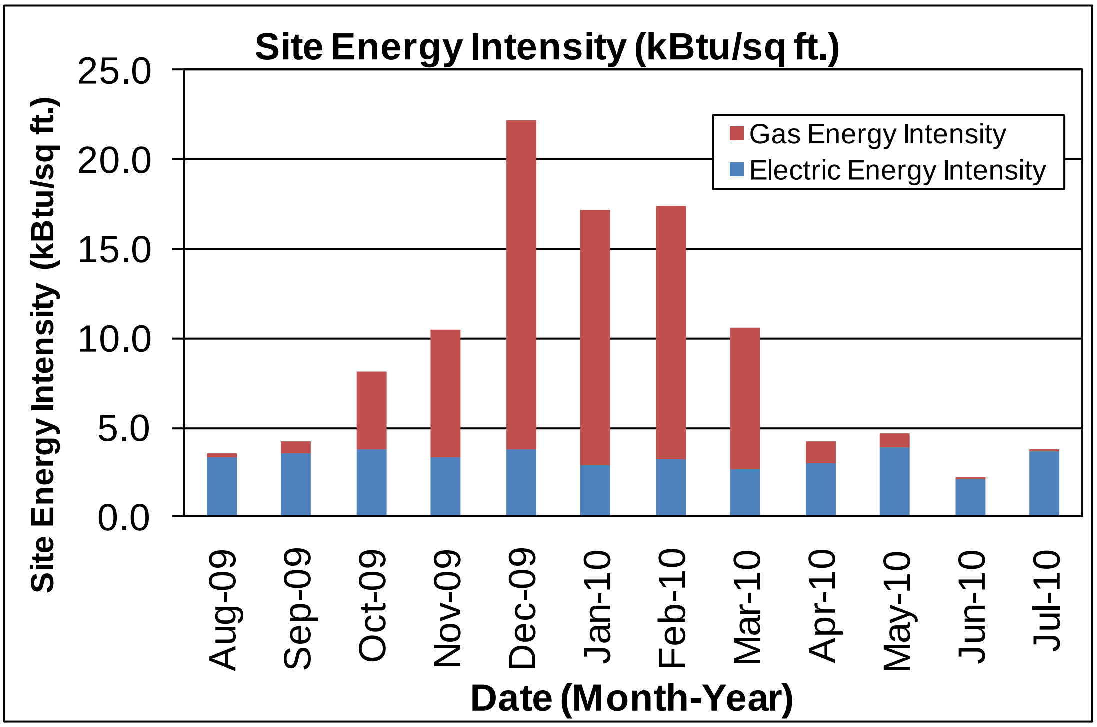


Energy benchmarking

SWA has entered energy information about the Academic & Athletics building in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager Energy benchmarking system. This Academic & Athletics building facility is categorized as a non-eligible ("Other") space type. Because it is an "Other" space type, there is no rating available.

Consequently, the Academic & Athletics building is not eligible to receive a national energy performance rating at this time. The Site Energy Use Intensity is 109.0 kBtu/sq ft yr compared to the national average of College/University buildings consuming 120.0 kBtu/sq ft yr. See ECM section for guidance on how to improve the building's rating.

Due to the nature of its calculation based upon a survey of existing buildings of varying usage, the national average for "Other" space types is very subjective, and is not an absolute bellwether for gauging performance. Additionally, should the Sussex Community College desire to improve the building energy use intensity there are other large scale and financially less advantageous improvements that can be made, such as envelope, door, and insulation upgrades that would help to improve the building.



Per the LGEA program requirements, SWA has assisted the Sussex Community College to create an ENERGY STAR® Portfolio Manager account and share the Academic & Athletics building facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager Account information with the Sussex Community College [redacted]

Tariff analysis

As part of the utility bill analysis, SWA evaluated the current utility rates and tariffs. Tariffs are typically assigned to buildings based on size and building type.

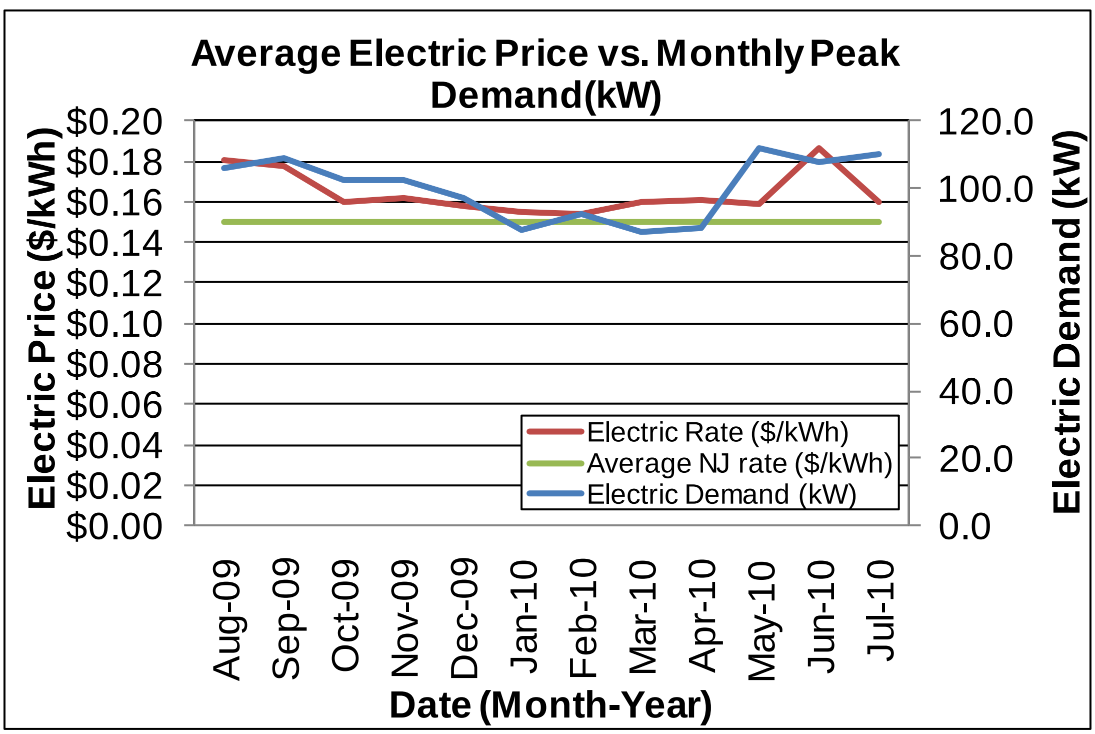
Tariff analysis is performed to determine if the rate that a building is contracted to pay with each utility provider is the best rate possible resulting in the lowest costs for electric and gas provision. Typically, the natural gas prices increase during the heating months when natural gas is used for heating. Some high gas price per therm fluctuations in the summer may be due to high energy costs that recently occurred and low use caps for the non-heating months. Typically, electricity prices also increase during the cooling months when electricity is used for cooling.

The supplier charges a market-rate price based on use, and the billing does not break down demand costs for all periods because usage and demand are included in the rate. Currently, the building is paying a general service rate for natural gas. Demand charges are not broken out in the bill. Thus the building pays for fixed costs such as meter reading charges during the summer months. The building is direct metered and currently purchases electricity at a general service rate for usage with an additional charge for electrical demand factored into each monthly bill. The general service rate for electric charges is market-rate based on usage and demand. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year.

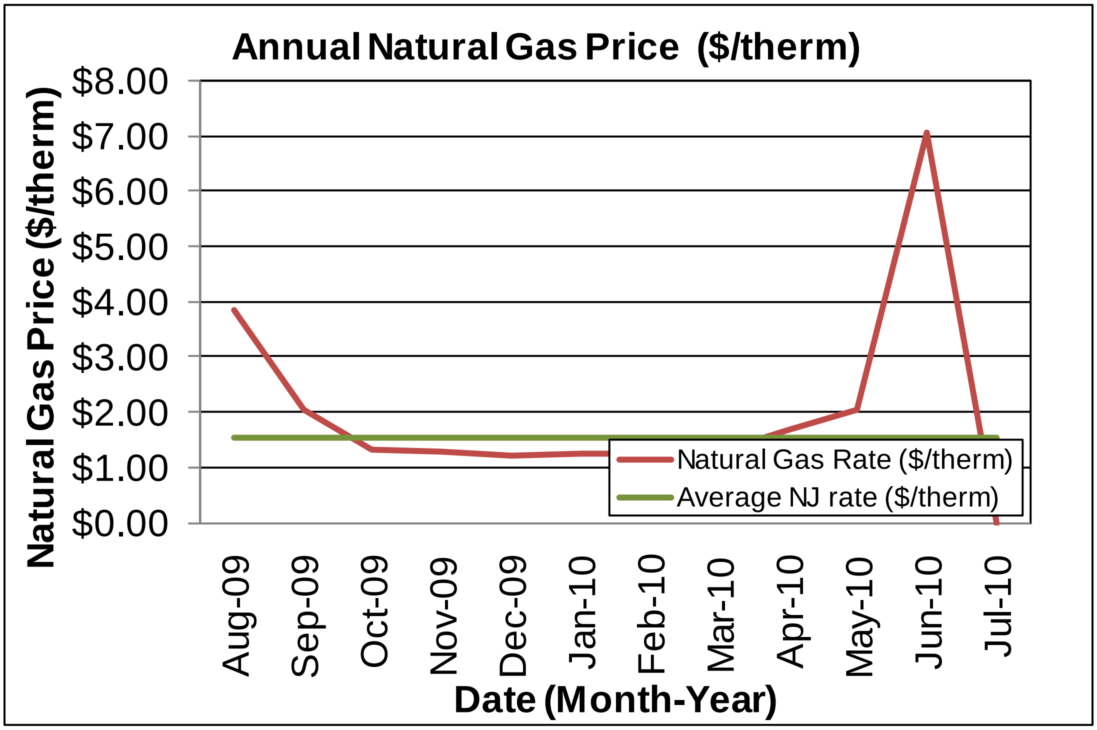
Energy Procurement strategies

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

The average estimated NJ commercial utility rates for electric are $0.150/kWh, while Academic & Athletics building pays a rate of $0.165/kWh. The Academic & Athletics building annual electric utility costs are $5,003 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 17% over the most recent 12 month period.



The average estimated NJ commercial utility rates for gas are $1.550/therm, while Academic & Athletics building pays a competitive rate of $1.295/therm. Natural gas bill analysis shows fluctuations up to 83% over the most recent 12 month period.



Utility rate fluctuations may have been caused by adjustments between estimated and actual meter readings; others may be due to unusual high and recent escalating energy costs.

SWA recommends that the Academic & Athletics building further explore opportunities of purchasing both natural gas and electricity from third-party suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Academic & Athletics building. Appendix C contains a complete list of third-party energy suppliers for the Newton 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 the visit from SWA on August 24, 27, and September 17, 2010, the following data was collected and analyzed.

Building Characteristics

The Academic & Athletics building is a two story building with an additional partial basement level comprising 31,432 square foot. It was originally built in 1967 with additions/renovations in 1997, 2007, and 2009. The Academic & Athletics building houses classrooms, office areas, meeting rooms, a gymnasium, storage spaces, mechanical rooms, and bathrooms.


North West Façade and Main Entrance


South West Façade


South East Façade


North West Facing Façade from roof of L Bldg

Building Occupancy Profiles

There are approximately 100-140 people in the building at any given time; approximately 100 employees and 1000 students when the Academic & Athletics building is in use weekdays from 8am through 10pm (approximately 80 hours/week on average). The Academic & Athletics building has 40 employees.

Building Envelope

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

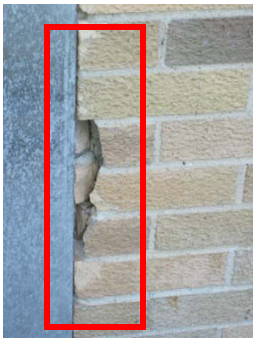
Exterior Walls

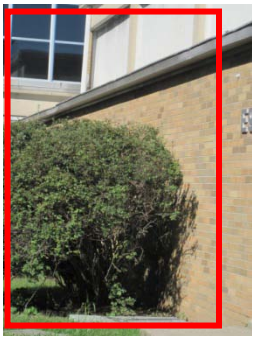
There are various types of exterior wall sections including the original building section with 6" CMU or 8" CMU (Concrete Masonry Unit) with no insulation. The exterior façade of this section consists of brick veneer with precast concrete sills. The interior walls are 5/8" gypsum board or painted CMU interiors.

Note: Wall insulation levels could not be verified in the field and are based on available construction plans or building management provided information.

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

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

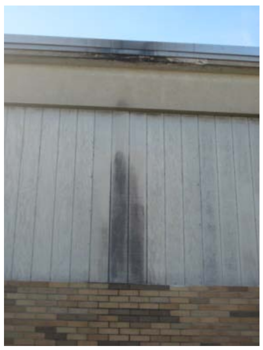

Cracked/deteriorated bricks and mortar joints


Overgrown ground vegetation touching/blocking exterior wall surfaces


Uncontrolled roof water run-off due to missing/ineffective downspout deflector


Insect nest on exterior wall


Overgrown ground vegetation touching/blocking exterior wall surfaces, missing brick veneer


Uncontrolled roof water run-off due to defective/clogged gutters and downspouts, leading to potential water damage in wall cavity

Roof

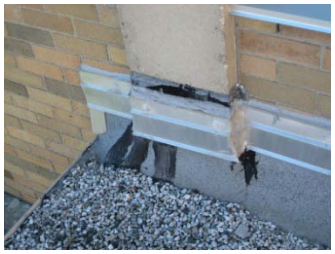
The building's roof is predominantly a flat, no parapet type over steel decking, with a dark-colored EPDM single membrane finish with gravel. There are also roof sections with dark-colored EPDM single ply membrane and sections with light-colored EPDM single membrane finishes. Two to three inches of rigid insulation on plywood and steel decking of rigid roof insulation was recorded. The roof surface above the gymnasium is in poor condition with reported soft spots and leaks.

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

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


EPDM membrane, minimal standing water due to pitch


Pooling on roof


Effective sealing around roof flashing


Roof tar melting around perimeter of roof


Different roofing materials – gravel built up, light colored EPDM and dark colored EPDM

Base

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

Note: Slab/perimeter insulation levels could not be verified in the field and are based on available construction plans.

The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall the base was reported to be in good condition with no signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues neither visible on the interior nor exterior.

Windows

The building contains fixed and awning style storefront windows with an aluminum clad frames, low-E coated/gas-filled, double glazing and interior mini blinds, that were installed in 2009.

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in very good condition with no signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues.


Typical aluminum frame low-e window


South East typical window


Interior shading in classroom

Exterior doors

The building contains two different types of exterior doors:

- There with aluminum/steel frame type exterior doors with glass panels. They are located at many building entrances and were replaced during the renovations.
- There are metal doors located at the back of the gymnasium.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in acceptable/age appropriate condition with only a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

Gymnasium back doors in need of either replacement of weather-stripping and exterior caulking around perimeter of door framing

Building air-tightness

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

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

Daylight seen around perimeter of window AC unit

Mechanical Systems

Heating Ventilation Air Conditioning

The Academic & Athletics building is divided into East and West wings – the former contains window air conditioners for cooling while the latter is served by four gas fired heating and direct expansion cooling rooftop packaged units. Both wings are heated by hot water baseboards served with hot water from two boilers. The West wing was renovated in 1998 when the existing HVAC system was put into place, except for the boilers and baseboards. There are two rooftop cooling only packaged units serving the coach'es office and student lounge in the east wing.

Equipment

The E building contains six rooftop packaged units, two hot water boilers, hot water pumps, and ventilation fans. A comprehensive Equipment List can be found in Appendix A.

There are 4 rooftop packaged units (RTU-1 through 4) providing heating, cooling, and ventilation that were installed in 1998 and serve the West wing. There are three Trane and one Aaon units with associated distributive ducts. Each of the package units contains an evaporator with direct expansion (DX) coil for cooling and a gas fired furnace for heating. The RTUs are in satisfactory condition and have about 20% remaining estimated service lives. RTU-1 is Trane with 250MBH input and 25 tons of nominal cooling and serves the West wing classrooms. RTU-2 is Trane with 250MBH input and 17 tons of nominal cooling and serves the West wing corridors on 1st and 2nd floors. RTU-4 is Trane with 90MBH input and 4 tons of nominal cooling and serves the West wing gymnasium corridor.

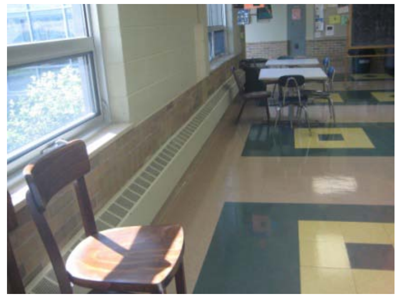
RTU-3 is Aaon that provides gas-fired heating with 75MBH input and has 5 tons of nominal cooling capacity. It serves the Gymnasium locker rooms and is a 100% outside air unit. The supply air quantity of this unit matches the total exhaust air quantity from the gymnasium exhaust fans. The two systems seem to be interlocked together to balance the air pressure within the building.

There are two Lennox RTUs providing only cooling, with 3.5 tons nominal capacity, to the East wing coach offices and student lounge areas respectively. They were installed in 1986 and are operating beyond their expected service lives of 15 years. The cabinet looks rusted the units are in generally bad shape.


Typical Trane Roof Top Unit


Lennox units installed in 1986: bad shape

There are two HB Smith natural gas-fired, 10 sections each for heating, hot water heating boilers original to the building installed in 1967. The boilers are rated for 1559MBH input capacity each and are operating beyond their expected service lives of 23 years as published in the 2007 ASHRAE HVAC Applications Handbook. Estimated efficiency of the boilers is about 70%. The boilers serve hot water to hot water baseboards located throughout the building. East wing baseboard heaters are original from 1967 and in bad condition; however, the West wing baseboard heaters were upgraded in 1998 and are in good condition.



HB Smith Boilers West wing baseboard – good condition East Wing baseboard – bad condition

There are 26 window air conditioner units of varying ages found throughout the east wing of the building. These units range in size from 1 to 2 tons providing cooling to offices and classrooms. There is one Lennox 2 ton condensing unit, 10 SEER, providing cooling to Athletics office that was, installed in 1994. It is operating beyond its expected service life of 15 years. SWA found a portable air conditioning unit serving an office space in the East wing, which could have been installed because the window air conditioner was not sufficient to meet the cooling load.

The building is provided ventilation by outside air intake louvers on the rooftop units and by many exhaust fans. The outside air louvers are motorized to allow economizer operation when the outside air conditions are favorable.

Bathrooms in the west wing are ventilated by a roof mounted mushroom type exhaust fan that was installed in 1996. East wing is naturally ventilation by roof mounted gravity ventilators. The A/V room has general exhaust provided by one ½ HP roof mounted mushroom type exhaust fan installed around 1996. The Gymnasium general exhaust is provided by two ½ HP roof mounted mushroom type exhaust fans installed in 1998. All of the buildings fans are over ten years old which is the established average service life for a ventilation fan.

Distribution Systems

A typical rooftop unit arrangement draws in fresh air and brings it into a mixing box, where it is combined with return air from the building. A small portion of the return air is purged and vented outside prior to entering the mixing box. The mixed air inside the air handler is sent through a filter before passing through the evaporator or direct expansion (DX) coil. The air handler fan then pushes the air through the furnace section before the conditioned air is distributed into the building spaces. The DX system is only active in the cooling season. In between seasons only the blower will be active to provide fresh air to the building.

There are six hot water pumps to provide hot water to the various heating coils and baseboards in six heating zones. All the pumps are equipped with small fractional horse power motors. The oldest pump and motor combination is from 1997 and has about 30% more of its service life remaining. SWA found the pumps and motors to be in reasonably good condition.

Hot water pumps

Controls

There is a Trane Tracker building automation system (BAS) to monitor and control the HVAC equipment within the building. Reportedly, the BAS does not function as intended and is not programmed accurately to reflect the occupied and unoccupied modes.

The baseboards are operated through the BAS and have local temperature sensor for zone controls. There are six heating zones in the whole building. Further, the baseboard heaters have individual, manual, heating control valves mounted on the radiators themselves. In the West wing, there is no winter night setback for the hot water baseboard heaters while the summer setback is maintained at 80 deg F. In the East wing, the winter night setback for the hot water baseboard heaters is maintained at 62 deg F while there is no summer setback. The boiler remains off during the summer – there are no reheat coils in the building.

The rooftop packaged units are not shut down during unoccupied modes in the summer and shoulder season; consequently, they run 8760 hours annually. RTU-3 serving the classrooms in the West wing is equipped with variable air volume (VAV) boxes; however, there is no variable speed drive on RTU-3 to modulate the supply air quantity.

Window air conditioners are manually operated and meant to be turned off by the last person leaving. Gymnasium general exhaust fans are controlled from individual reverse acting thermostats with a temperature set point which can be manually adjusted using a turn dial.

Zone control thermostat

Gymnasium fans controls

Domestic Hot Water

The domestic hot water (DHW) for the building is provided by a natural gas-fired A O Smith, 40 MBH input domestic hot water heater with an estimated 100 gal storage tank. It has an estimated efficiency of 75%. This DHW heater was installed in 2000 and is in acceptable condition.

Gas fired AO Smith 100 gal DHW

Electrical systems

Lighting

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

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

Interior Lighting - The Academic & Athletics building currently contains T12 lamps with magnetic ballasts, T8 lamps with electronic ballasts, and a few incandescent lamps. Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas.

Light fixture directly over window; Hallway with sufficient daylighting without need for artificial lighting

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

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a mix of Metal Halide and compact fluorescent fixtures. Exterior lights are on automatic mechanical time clock.

Automatic time clock set 7pm to 7am

Appliances and process

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

Personal refrigerators, TVs, microwaves, and air purifiers contribute to plug loads

Elevators

The Academic & Athletics building is a two story building comprising one (two level) OTIS hydraulic elevator equipped with a 20hp motor. The elevator model number is ABA21241K1 and is rated for 480/3/60, and it was installed in 1998. The elevator appears in satisfactory condition and no action is required at this time besides routine maintenance.

Other electrical systems

The incoming power main transformer is owned/maintained by JCP&L and it appears in satisfactory condition. The building has photovoltaic panels located on the building roof to generate electricity. Please refer to the next section for details.

RENEWABLE AND DISTRIBUTED ENERGY MEASURES

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

Existing systems

Currently, there is a renewable system installed at the Academic & Athletics building.

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. Excess electricity generated from photovoltaic panels is 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, the Sussex Community College is availing 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.

The Academic & Athletics building has approximately 301 solar panels generating a maximum of 100 kW installed on the roof.

Solar PV panels on the building roof

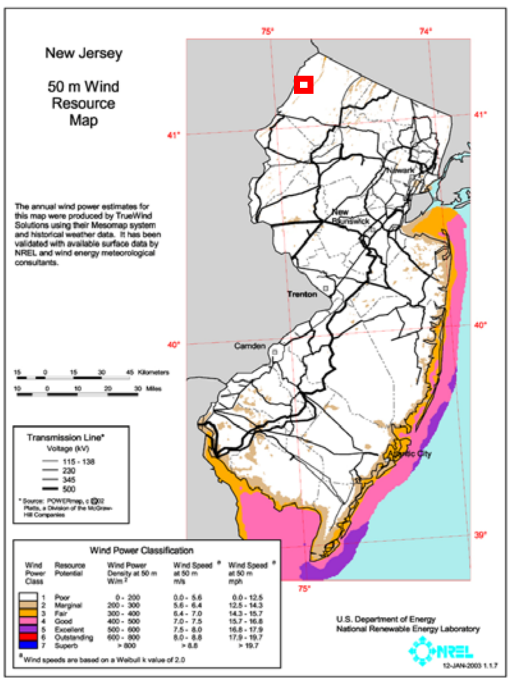
Evaluated Systems

Solar Thermal Collectors

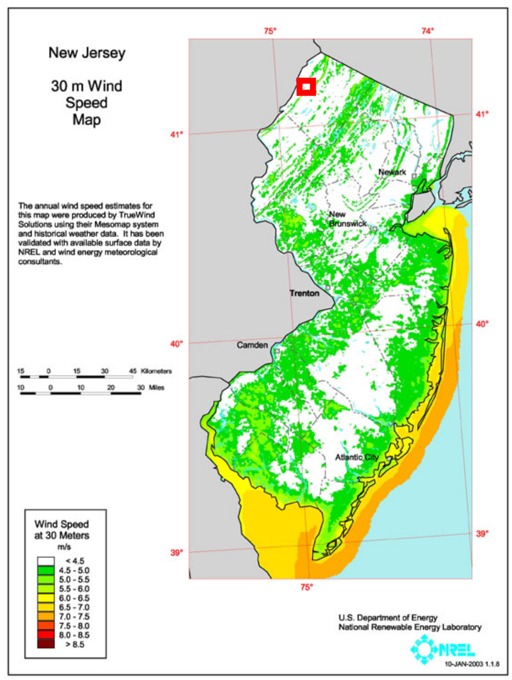
Solar thermal collectors are not cost-effective for this building and would not be recommended due to the insufficient and intermittent use of domestic hot water throughout the building to justify the expenditure.

Wind

The Academic & Athletics building is not a good candidate for wind power generation due to unfavorable wind conditions in this area of New Jersey, according to the following wind map by “Wind Powering America”, a US DOE analysis. Average wind speeds in Sussex County are less than 12mph, and most wind turbines tend to be efficient at speeds greater than this. Shown below are two wind maps for New Jersey with the location of Sussex Community College marked as a square.



New Jersey 50-Meter Wind Resource Maps



New Jersey 30-Meter Wind Resource Maps

The first map shows the annual wind power estimates at 50 meters using NREL's standard classification system for utility-scale applications in relation to transmission lines and major cities. The second shows the annual wind speed estimates at 30 meters, which is useful for identifying areas that hold promise for small wind turbine applications. Wind speeds in Sussex County for both these type of applications are less than 12mph (5.3mph) and do not justify wind power systems. Please see the following for more details:

http://www.windpoweringamerica.gov/where_is_wind_new_jersey.asp

Geothermal

The Academic & Athletics building is not a good candidate for a geothermal installation since it would require replacement of the entire existing HVAC system, of which major components still have 20% to 80% remaining useful lives. Estimated capital cost for installing a 100 ton geothermal heat pump system for this building is in the ball park of $1.1M, and estimated simple payback would be in excess of 20 years; however, for a new building, the simple payback for incremental cost and benefits over a conventional system is generally in the range of 4-6 years.

Combined Heat and Power

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

PROPOSED ENERGY CONSERVATION MEASURES

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

Recommendations: Energy Conservation Measures

ECM #	Description	net est. ECM cost with incentives, $	kWh, 1st yr savings	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	total 1st yr savings, $	life of measure, yrs	simple payback, yrs	annual return on investment, %	net present value, $	CO_2 reduced, lbs/yr
1	Install 2 new Daylight sensors with incentives	390	4,181	0	0.5	686	15	0.6	169	7,678	7,486
2	Retrofit 6 existing refrigerated vending machine with VendingMiser™ device	1,194	9,672	0.0648	1.1	1,586	10	0.8	123	12,200	17,318
3	Install 15 new T5 fixtures with incentives	2,910	8,197	1095.8	4.4	3,603	15	0.8	146	39,491	26,756
4	Retrofit 3 existing vending machine with SnackMiser™ device	297	1,161	1044.7	3.4	1,543	10	0.2	510	12,734	13,594
5	Install 16 new Motion sensors with incentives	3,200	10,508	51.1	1.3	1,789	15	1.8	49	17,857	19,378
6	Install 5 new Photocell sensors with incentives	1,000	2,878	5	0.3	478	15	2.1	41	4,630	5,208
7	Install 1 new CFL fixture	9	28	0	0.0	4	5	2.3	24	9	50
8	Install 10 new Pulse start metal halide fixtures with incentives	8,125	6,190	0.0648	0.7	1,165	15	7.0	10	5,586	11,084
9	Install 7 new Bi-level fixtures with incentives	980	835	0.0648	0.1	137	15	7.2	7	632	1,496
10	Install 62 new Occupancy sensors with incentives	12,400	10,165	0.0648	1.1	1,667	15	7.4	7	7,217	18,201
11	Install 220 new T8 fixtures with incentives	39,230	14,572	0	1.6	3,435	15	11.4	5	1,188	26,091
12	Install Programmable thermostats on 5 RTUs	4,200	7,050	453	2.2	1,743	15	2.4	35	16,308	17,616
13	Install VFD on West wing classroom unit	1,437	3,100	0	0.3	508	15	2.8	29	4,545	5,551
14	Install demand controlled ventilation with CO2 sensors	6,140	1,550	632	2.2	1,073	15	5.7	11	6,482	9,742
15	Replace 1 existing 10SEER condensing units	1,916	1,325	0	0.1	217	15	8.8	5	641	2,372
16	Install Heat Recovery Unit for Gymnasium	11,000	1,328	587	2.0	978	15	11.2	2	508	8,848
17	Replace existing hot water boilers (2)	60,250	-	2800	9.3	4,387	30	13.7	6	23,556	30,864
18	Install new Building Management System	125,000	11,699	3762	13.9	6,231	12	20.1	-3	-63,709	62,416
	TOTALS	279,678	94,439	10,431	44.5	31,232		9.0	-	-	284,072

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 new Daylight sensors

During the field audit, SWA completed a building lighting inventory (see Appendix B). SWA observed that the existing lighting has minimal to no control via day lighting sensors. SWA identified areas that could benefit from the installation of a day lighting sensor. SWA recommends installing one day lighting sensor where lighting fixtures are mounted above windows and where the payback on savings is justified. Ceiling mounted day light sensors measure the ambient light reflected from surfaces ranging from 0 to 6,500 foot candles. 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: $390 (Includes $154 of labor)
Source of cost estimate: Manufacturers information

Economics:

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	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Install 2 new Daylight sensors with incentives	440	50	390	4,181	0.1	0	0.5	0	686	15	10,285	0.6	169	176	7,678	7,486

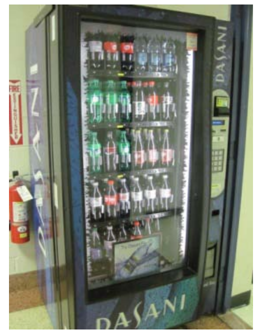
Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis.

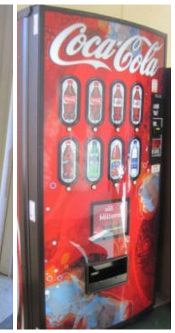
Rebates/financial incentives:
NJ Clean Energy - Occupancy sensors, wall mounted ($25 per control) - Maximum incentive amount is $50.

Please see Appendix F for more information on Incentive Programs.

ECM#2: Retrofit 6 Existing Refrigerated Vending Machines with VendingMiser™ devices

Energy vending miser devices are now available for conserving energy used by beverage vending machines and coolers. There is not a need to purchase new machines to reduce operating costs and greenhouse gas emissions. When equipped with the vending miser devices, refrigerated beverage vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR® qualified machines. Vending miser devices incorporate innovative energy-saving technology into small plug-and-play devices that installs in minutes, either on the wall or on the vending machine. Vending miser devices use a Passive Infrared Sensor (PIR) to: Power down the machine when the surrounding area is vacant; Monitor the room's temperature; Automatically repower the cooling system at one- to three-hour intervals, independent of sales; Ensure the product stays cold.



Installation cost:

Estimated installed cost: $1,194 (Includes $120 of labor)
Source of cost estimate: Manufacturers information

Economics:

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	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Retrofit 6 existing refrigerated vending machine with VendingMiser™ device	1,194	0	1,194	9,672	0.2	0	1.1	0	1,586	10	15,862	0.8	123	133	12,200	17,318

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA assumes energy savings based on modeling calculator found at www.usatech.com or http://www.usatech.com/energy_management/energy_calculator.php .

Rebates/financial incentives:
NJ Clean Energy – Direct Install program (up to 60% of installed cost)

Please see Appendix F for more information on Incentive Programs and Appendix H for calculations.

ECM#3: Install 15 new T5 fixtures

During the field audit, SWA completed a building interior as well as exterior lighting inventory (see Appendix B). The existing lighting consists of standard probe start Metal Halide (MH) lamps. SWA recommends replacing the interior higher wattage MH fixtures with T5 lamps and electronic ballasts which offer the advantages of standard probe start MH lamps, but minimize the disadvantages. They produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. Due to these characteristics, energy savings can be realized via one-to-one substitution of lower-wattage systems, or by taking advantage of higher light output and reducing the number of fixtures required in the space. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $2,910 (Includes $945 of labor)
Source of cost estimate: Manufacturers information

Economics:

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	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Install 15 new T5 fixtures with incentives	3,150	240	2,910	8,197	0.2	0	0.9	840	2,184	15	32,765	1.3	97	75	22,793	14,677

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA also assumed an aggregated 10 hrs/yr to replace aging burnt out lamps/ballasts vs. newly installed.

Rebates/financial incentives:

NJ Clean Energy - Retrofit MH with T5 fixtures with electronic ballasts ($16 per fixture) - Maximum incentive amount is $240.

Please see Appendix F for more information on Incentive Programs.

ECM#4: Install (3) Snack Vending Machine Energy Misers

Energy vending miser devices are now available for conserving energy used by beverage vending machines and coolers. There is not a need to purchase new machines to reduce operating costs and greenhouse gas emissions. Snack vending miser devices can be used on snack vending machines to achieve maximum energy savings that result in reduced operating costs and decreased greenhouse gas emissions with existing machines. Snack vending miser devices also use a Passive Infrared Sensor (PIR) to determine if there is anyone within 25 feet of the machine. It waits for 15 minutes of vacancy, then powers down the machine. If a customer approaches the machine while powered down, the snacks vending miser will sense the presence and immediately power up.

Installation cost:

Estimated installed cost: $297 (Includes $60 of labor)
Source of cost estimate: Manufacturers information

Economics:

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	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Retrofit 3 existing vending machine with SnackMiser™ device	297	0	297	1,161	0.0	0	0.1	0	190	10	1,904	1.6	54	64	1,311	2,079

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA assumes energy savings based on modeling calculator found at www.usatech.com or http://www.usatech.com/energy_management/energy_calculator.php .

Rebates/financial incentives:
NJ Clean Energy – Direct Install program (up to 60% of installed cost)

Please see Appendix F for more information on Incentive Programs and Appendix H for calculations.

ECM#5: Install 16 New Motion Sensors

SWA recommends installing motion sensors in areas that are occupied only part of the day, and where payback on savings is justified. Typically, motion sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advance micro-phonic lighting sensors include sound detection as a means to control lighting operation. Please see Appendix B for a detailed lighting inventory.

Installation cost:

Estimated installed cost: $3,200 (includes $1,056 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program, ENERGY STAR®*

Economics:

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	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Install 16 new Motion sensors with incentives	3,520	320	3,200	10,508	0.3	0	1.1	0	1,723	15	25,850	1.9	47	54	17,078	18,815

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

Rebates/financial incentives:

NJ Clean Energy – Smart Start – Ceiling-mounted motion sensors ($20 per sensor). Maximum incentive amount is $320.

Please see Appendix F for more information on Incentive Programs.

ECM#6: Install 5 New Photocell Sensors

On the day of the site visit, SWA completed a lighting inventory of the Academic & Athletics building (see Appendix B). The exterior lighting fixtures are currently operated by timers. SWA recommends installing photocell sensors in replacement of timers. Photocell sensors will help to reduce operating costs of lights left on during daytime hours.

Installation cost:

Estimated installed cost: $1,000 (includes $300 of labor)

Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Economics:

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	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Install 5 new Photocell sensors with incentives	1,100	100	1,000	2,878	0.1	0	0.3	0	472	15	7,080	2.1	41	47	4,554	5,153

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

Rebates/financial incentives:

NJ Clean Energy – Smart Start – Photocell sensors in existing facilities ($20 per fixture). Maximum incentive amount is $100.

Please see Appendix F for more information on Incentive Programs.

ECM#7: Install 1 New CFL Fixture

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

Installation cost:

Estimated installed cost: $9 (Includes $5 of labor)
Source of cost estimate: Manufacturers information

Economics:

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	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Install 1 new CFL fixture	9	0	9	28	0.0	0	0.0	0	4	5	20	2.3	24	34	9	50

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis.

Rebates/financial incentives:

There is no incentive available for this measure at this time.

Please see Appendix F for more information on Incentive Programs.

ECM#8: Install 10 New Pulse Start Metal Halide Fixtures

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

Installation cost:
Estimated installed cost: $8,125 (Includes $2,512 of labor)
Source of cost estimate: Manufacturers information

Economics:

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	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Install 10 new Pulse start metal halide fixtures with incentives	8,375	250	8,125	6,190	0.2	0	0.7	150	1,165	15	17,477	7.0	10	10	5,586	11,083

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA also assumed an aggregated 3.75 hrs/yr to replace aging burnt out lamps/ballasts vs. newly installed.

Rebates/financial incentives:
NJ Clean Energy - Pulse Start Metal Halide ($25 per fixture) - Maximum incentive amount is $250.

Please see Appendix F for more information on Incentive Programs.

ECM#9: Install 7 New Bi-level T8 Fixtures in Stairwells

On the day of the site visit, SWA completed a lighting inventory of Academic & Athletics building (see Appendix B). The building currently contains T12 and T8 fluorescent lighting fixtures that are operated 16 hours per day in stairwells. New technology called bi-level lighting, combines fluorescent lighting fixtures with an occupancy sensor. These efficient light fixtures operate at a minimal light level in order to meet code and safety requirements and power up to a higher level when any motion is detected in the stairwells. This building would be an appropriate application for these fixtures since there are large periods of time when the stairwells should be unoccupied.

Installation cost:

Estimated installed cost: $980 (includes $346 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Economics:

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	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Install 7 new Bi-level fixtures with incentives	1,155	175	980	835	0.0	0	0.1	0	137	15	2,054	7.2	7	9	631	1,495

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

Rebates/financial incentives:

NJ Clean Energy – SmartStart – bi-level T8 fluorescent fixtures ($25 per fixture). Maximum incentive amount is $175.

Please see Appendix F for more information on Incentive Programs

ECM#10: Install 62 Lighting Occupancy Sensors

During the field audit, SWA completed a building lighting inventory (see Appendix B). SWA observed that the existing lighting has minimal to no control via occupancy sensors. SWA identified a number of areas that could benefit from the installation of occupancy sensors. SWA recommends installing occupancy sensors in areas that are occupied only part of the day and the payback on savings is justified. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advance micro-phonic lighting sensors include sound detection as a means to control lighting operation. 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: $12,400 (Includes $4,092 of labor)
Source of cost estimate: Manufacturers information

Economics:

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	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Install 62 new Occupancy sensors with incentives	13,640	1,240	12,400	10,165	0.3	0	1.1	0	1,667	15	25,006	7.4	7	8	7,216	18,200

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis.

Rebates/financial incentives:

NJ Clean Energy - Occupancy sensors, wall mounted ($20 per control) - Maximum incentive amount is $1,240.

Please see Appendix F for more information on Incentive Programs.

ECM#11: Install 220 New T8 Fixtures

During the field audit, SWA completed a building lighting inventory (see Appendix B). 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: $39,230 (Includes $12,759 of labor)
Source of cost estimate: Manufacturers information

Economics:

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	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Install 220 new T8 fixtures with incentives	42,530	3,300	39,230	14,572	0.4	1044.7	4.9	2,272	6,015	15	90,220	6.5	14	11	31,545	37,607

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA also assumed an aggregated 45 hrs/yr to replace aging burnt out lamps/ballasts vs. newly installed.

Rebates/financial incentives:

NJ Clean Energy - Retrofit T12 with T8 fixtures with electronic ballasts ($15 per fixture) - Maximum incentive amount is $3,300.

Please see Appendix F for more information on Incentive Programs.

ECM#12: Install Programmable Thermostats

There are four gas fired heating and DX cooling rooftop package units serving the West wing, and two DX cooling only rooftop packaged units serving the East wing. Currently, they are controlled from manual thermostats and remain on 24/7. They also provide a constant amount of fresh air to these areas at all times. SWA recommends that the Sussex Community College install six (6) new programmable thermostats and a new central controller to program schedules from a computer. In the new proposed settings, most equipment would operate at minimum settings and remain off during unoccupied hours in summer and shoulder seasons. The proposed temperature settings may be as follows:

	Summer		Winter		Shoulder	
	Occupied	**Unoccupied**	**Occupied**	**Unoccupied**	**Occupied**	**Unoccupied**
Proposed settings	78F	Off	62F	62F	Off	Off

This schedule cannot be achieved with the existing thermostats as they have limited programming capability and would require intervention at the onset of a new season. The intention is to turn down the set point temperature during unoccupied modes in winter, and to shut down the units completely during unoccupied modes of other seasons. Savings will be realized as a result of ventilation heating savings, fan energy savings, and cooling energy savings.

Installation cost:

Estimated installed cost: $4,200 (includes $2,000 of labor)

Source of cost estimate: Manufacturer's data and similar projects

Economics:

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	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Install Programmable thermostats on 5 RTUs	4,200	0	4,200	7,050	2.1	453	2.2	0	1,743	15	26,143	2.4	35	41	16,308	17,616

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. SWA used the bin analysis to estimate the savings. SWA assumed the winter night setback temperature would be reduced to 62 deg F and the units will be shut down during unoccupied modes of other seasons. SWA assumed a loading factor of 70% to calculate the fan savings. SWA assumed a total of 3,200 off peak hours for the unit from which savings are realized.

Rebates/financial incentives:
There is no incentive available for this measure at this time.

Please see Appendix F for more information on Incentive Programs.

ECM#13: Install Variable Frequency Drives on Motors

Variable Frequency Drive or Variable Speed Drive allows users to gain advantage in both productivity improvements and reduced energy. A variable frequency drive is an electronic controller that adjusts the speed of an electric motor by regulating the power being delivered. Variable-frequency drives provide continuous control, matching motor speed to the specific demands of the work being performed.

The rooftop packaged unit (RTU-1) serving the West wing classrooms has variable air volume boxes in the distribution ducts to the classrooms. There is no variable speed drives on the unit. As a result, when the dampers close, the excess air is bypassed into the ceiling plenum and then returned to the unit. SWA recommends replacing the bypass system with VFDs operated from pressure signal in the duct. This measure would require installation a pressure sensor and a variable frequency drive along with minor controls upgrades.

Installation cost:

Estimated installed cost: $1,437 (labor cost estimated, $1,300)
Source of cost estimate: RS Means Cost Data and client input

Economics (with no incentives):

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	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Install VFD on West wing classroom unit	2,600	1,163	1,437	3,100	0.9	0	0.3	0	508	15	7,626	2.8	29	34	4,545	5,551

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. Further, since most equipment did not have a means to control the VFD and hence speed, a conservative 10% savings was estimated. Existing kWh was obtained using the DOE Motor Master International selection and calculator using 8,760 hours of operation.

Rebates/financial incentives:

There is no incentive available for this measure at this time.

Please see Appendix F for more information on Incentive Programs.

ECM#14: Provide Demand Control Ventilation using Carbon Dioxide Sensors

The rooftop units serving the corridors on West wing (RTU-2, and RTU-4) provide a fixed amount of outside air during operational hours. Conditioning outside air can be a significant portion of the heating or cooling load. Demand control ventilation involves providing carbon dioxide (CO2) sensors in the occupied spaces or return ducts which can partially or totally shut down the outside air intake dampers in the air handling unit when the space is underutilized or unoccupied. The spaces served are used frequently but may also remain vacant for long periods during the day. By keeping the CO2 level less than 1000ppm within the conditioned space, the outside air is reduced to the minimum allowable in compliance with ASHRAE requirements. This control method can greatly reduce the heating or cooling load seen by the rooftop unit and therefore save energy. Along with the two carbon dioxide sensors on each floor, necessary motorized air intake dampers and a controller will also have to be installed.

Installation cost:

Estimated installed cost: $6,140 (includes $2,800 labor)
Source of cost estimate: RS Means Cost Data & Similar Projects

Economics:

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	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Install demand controlled ventilation with CO2 sensors	6,180	40	6,140	1,550	0.5	632	2.2	0	1,073	15	16,090	5.7	11	14	6,482	9,742

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. SWA estimated the savings using bin data and assumed 50% outside air savings, for a total of 8,760 hours annually.

Rebates/financial incentives:

NJ Clean Energy - Occupancy sensors, wall mounted ($20 per control) - Maximum incentive amount is $40.

Please see Appendix F for more information on Incentive Programs.

ECM#15: Replace one 10SEER Condensing Unit

SWA recommends replacing the existing 2 ton condensing units serving the Athletics office with ENERGY STAR® rated condensing units with higher operating efficiencies. A split-system central air conditioner consists of an outdoor metal cabinet called the condensing unit which contains the condenser coil and compressor, and an indoor cabinet contains the evaporator coil and supply air fan. Central air conditioners are rated according to their seasonal energy efficiency ratio (SEER - Btu/Watt-hr), which indicates the relative amount of energy needed to provide a specific cooling output. Each existing condensing unit has an estimated SEER rating of 10; the minimum SEER allowed today is 13. ENERGY STAR® label central air conditioners with SEER ratings of 13 or greater, and up to 16 SEER condensing units are now available. More information can be found in the "Products" section of the ENERGY STAR® website at: http://www.energystar.gov. SWA recommends 14 SEER units or greater.

Installation cost:

Estimated installed cost: $1,916 (includes $280 of labor)
Source of cost estimate: Manufacturer's data and similar projects

Economics:

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	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Replace 1 existing 10SEER condensing units	2,100	184	1,916	1,325	0.4	0	0.1	0	217	15	3,260	8.8	5	5	641	2,372

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. SWA estimated annual electric savings calculated from ENERGY STAR® online calculator.

Rebates/financial incentives:

NJ Clean Energy – Unitary HVAC/Split Systems, 14 SEER minimum, $73- $92/ton; maximum incentive available is $184.

Please see Appendix F for more information on Incentive Programs.

ECM#16: Install Heat Recovery Units

RTU-3 provides ventilation to the Gymnasium area in conjunction with two roof mounted mushroom type exhaust fans. The packaged unit is gas fired and DX cooled and is 100% outside air unit. The supply air quantity of this unit matches the total exhaust air quantity from the gymnasium exhaust fans. The two systems are interlocked together to balance the air pressure within the building. Currently, the exhaust fans exhaust the conditioned air. SWA recommends replacing both these systems with one, new, Heat Recovery Unit (HRU) system. Generally, heat recovery is intended to extract heat from exhaust air prior to being exhausted. It can be recovered in a variety of ways – one, by installing small fan powered four ducts air to air heat exchanger boxes generally called Energy Recovery Ventilators (ERVs), two, by a fan powered heat recovery unit with a rotating sensible heat recovery wheel, and three, by installing simple air to air heat exchanger with no moving parts. SWA recommends using a rotating sensible heat recovery wheel. SWA estimated the cost and benefit of installing the HRU based on the air volume of the existing equipment.

Installation cost:
Estimated installed cost: $11,000 (estimated labor cost $3,500)
Source of cost estimate: RS Means and other projects

Economics (with no incentives):

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	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Install Heat Recovery Unit for Gymnasium	11,000	0	11,000	1,328	0.4	587	2.0	0	978	15	14,669	11.2	2	1	508	8,848

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis. SWA estimated the savings arising during 8,760 use hours. SWA assumed the heat exchanger efficiency of 65% to calculate the savings using bin analysis.

Rebates/financial incentives:
There is no incentive available for this measure at this time.

Please see Appendix F for more information on Incentive Programs.

ECM #17: Replace (2) Existing Hot Water Boilers

The existing HB Smith boilers were installed in 1960s and have passed the end of their useful life. SWA recommends replacing both boilers under this measure. The initial efficiency of the existing boiler was approximately 80%, which is now estimated to be only around 70% due to performance degradation over time. SWA analyzed the economics of replacing and upgrading the boilers with new condensing technology. Condensing boilers allow condensation of moisture in flue gases resulting in lower flue gas temperatures with increased efficiencies up to 95%. The new high efficiency condensing boilers should have a guaranteed minimum thermal efficiency of 85% and efficiencies of up to 95% achievable during condensing mode at lower return water temperatures. Suggested new boiler capacity is about 500 MBH each, as the existing boilers were recognized to be way oversized for the therms used by the building.

Installation cost

Estimated installed cost: $60,250 (estimated labor cost of $18,500)
Source of cost estimate: RS Means and similar projects

Economics:

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	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Replace existing hot water boilers (2)	62,000	1,750	60,250	-	0.0	2800	9.3	1,125	4,387	30	131,610	13.7	6	-2	23,556	30,864

Assumptions: SWA assumed the efficiency of the new condensing boilers as 90% for calculating the therms saved, and that of the existing boiler as 70%. Further, SWA estimated the current boilers' contribution of total heat to the building in the proportion of installed capacity of the boilers and the rooftop units.

Rebates/financial incentives:

NJ Clean Energy - Gas-fired boilers ≤ 1500 MBH and 90% ($1.75 per MBH) – Maximum incentive amount is $1,750 for both boilers.

Please see Appendix F for more information on Incentive Programs.

ECM#18: Install new Building Management System

There is an existing Trane Tracker building management system. The existing system is not programmed correctly and many sensors and actuators don't report data into this system. The current system is inadequate to handle the building needs of a tight HVAC controls, and has limited capability for setting occupied/unoccupied mode settings. SWA recommends the Sussex Community College to install a new Direct Digital Control (DDC) Building Automation System (BAS). The new BAS should be open source and be compatible with the existing state of art Automated Logic BMS at the A building. The BAS should be programmable with occupied/unoccupied modes settings and with night-setback schedules for building HVAC system. Space temperature sensors individually and collectively should report to the BAS, which in turn would control the heating and cooling valves on HVAC equipment. The new system would operate the HVAC system tightly and reduce wasteful energy. Savings in therms and kWh will be realized mainly from reducing the hours of operation of the rooftop unit, resulting in ventilation load savings and fan savings. Please note that savings below are duplicative in the sense that the savings may already have been accounted for in some of the earlier ECMs.

Installation cost:

Estimated installed cost: $125,000 (estimated labor cost $60,000)
Source of cost estimate: Similar projects

Economics:

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	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Install new Building Management System	125,000	0	125,000	11,699	0.2	3762	13.9	0	6,231	12	74,774	20.1	-3	-7	-63,709	62,416

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. SWA estimated the savings using bin data calculations. It is assumed that the new BMS would completely shut down the unit and the fans during summer and shoulder seasons during unoccupied modes. Approximately 2,000 hours of unit run time is estimated to be saved thus. The BMS for this building is assumed to be a part of the larger campus wide BMS, which incorporates lighting controls too; the lighting cost component of the BMS was excluded for calculations in this ECM.

Rebates/financial incentives:

There is no incentive available for this measure at this time.

Please see Appendix F for more information on Incentive Programs.

PROPOSED FURTHER RECOMMENDATIONS

Capital Improvements

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

- Replace exhaust fans- There are seven rooftop mushroom type exhaust fans which serve the bathrooms, mechanical room, and general building. Two of these fans are not in use anymore. The two disconnected units should be removed and roof penetrations should be thermally sealed. SWA recommends replacing the remaining five exhaust fans which are operating past their estimated service lives of ten years. The resulting energy savings will be marginal and hence this measure is categorized as capital improvement. The estimated installed cost of five new fans is $2,400.

- Replace window air conditioners - There are approximately 30 window air conditioners (WAC) serving the third floor. The WACs all have various capacities ranging from 1 ton through 2 tons of cooling, and were manufactured by various manufacturers, and installed at various times in the past. These are manually controlled and there is a good likelihood that the last person leaving may not turn off the unit. SWA recommends replacing all WACs with a central air system comprising a gas fired rooftop packaged unit and variable air volume boxes serving each classroom, similar to the system already existing serving lower floors. The new system would cost approximately $225,000 and has an estimated simply pay back of 40 years or more.

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

- Install waterless urinals campus-wide. Typical paybacks range from 1-3 years based on typical water and sewer savings, depending on use.

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.

- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly and drains are cleaned.

- Maintain downspouts and cap flashing - Repair/install missing downspouts and cap flashing as needed to prevent water/moisture infiltration and insulation damage. SWA recommends round downspout elbows to minimize clogging.

- Provide weather-stripping/air-sealing - SWA observed that exterior door weather-stripping was beginning to deteriorate in places. Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. The perimeter of all window frames should also be regularly inspected, and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.

- Repair/seal wall cracks and penetrations - SWA recommends as part of the maintenance program installing proper flashing and correct masonry efflorescence, and sealing wall cracks and penetrations wherever necessary in order to keep insulation dry and effective.

- Provide water-efficient fixtures and controls - Adding controlled on/off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and/or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. SWA recommends replacing the 2.2 gpm aerators in the bathrooms with 0.5 gpm faucets in bathrooms. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consumption fixtures/appliances will reduce energy consumption for water heating, while also decreasing water/sewer bills.

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

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

Computer left on when classroom unoccupied

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

- Change filters on air handling and rooftop package units monthly to ensure efficient operation of the blowers and ensure adequate air delivery to the spaces.

- Tighten belts on exhaust fans and blowers every three to six months - Tightening belts on belt-driven fans/blowers can maximize the overall efficiency of the equipment.

- Inspect air handling and rooftop package units' coils for dirt buildup three to six months. These conditions should be rectified if found because they will cause inefficient operation and possibly damage to the equipment.

The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for Sussex Community College. Based on the requirements of the LGEA program, Sussex Community College must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The minimum amount to be spent, net of other NJCEP incentives, is $2,048 (or 25% of $8,192).

APPENDIX A: EQUIPMENT LIST

Inventory

Building System	Description	Location	Model#	Fuel	Space served	Year Equip Installed	Remaining useful life %
DHW	Domestic water heater, 40MBH in, est. 100 gallon tank, est. 75% eff.	Boiler room	AO Smith, model FSG 50 216	Gas	whole building	est. 2000	23%
Heating	Boiler, 10 sections heating, 1559MBH in, c/w Power Flame Burner, model WCR2-G-20B	Boiler room	HB Smith, 450 Mills, S/N 04982	Gas	Whole building	1967	0%
Heating	Boiler, 10 sections heating, 1559MBH in, c/w Power Flame Burner, model WCR2-G-20B	Boiler room	HB Smith, 450 Mills, S/N 04982	Gas	Whole building	1967	0%
Heating	#6 Heating pump, c/w GE motor, 1/4hp, 1725 rpm, 115/1/60	Boiler room	Pump nameplate N/A; motor model 5KH39QN5512AT	Elec.	Lower offices	est. 2005	75%
Heating	#5 Heating pump, c/w Emerson motor, 1/4hp, 1725 rpm, 115/1/60	Boiler room	Taco, model 121A3N1	Elec.	Lower level	1997	35%
Heating	#4 Heating pump, c/w Emerson motor, 1/4hp, 1725 rpm, 115/1/60	Boiler room	Taco, model 121A3N1	Elec.	Gymnasium	2001	55%
Heating	#3 Heating pump, c/w 1.5hp, 1725 rpm, 208/3/60	Boiler room	Thermatic, model 116-336	Elec.	2nd/3rd floor W wing	2008	90%
Heating	#2 Heating pump, c/w Emerson motor, 1/4hp, 1725 rpm, 115/1/60	Boiler room	Taco, model 121A3N1	Elec.	Chapel	1999	45%
Heating	#1 Heating pump, c/w ITT motor, 1/4hp, 1725 rpm, 115/1/60	Boiler room	ITT Bell & Gossett, model M40	Elec.	East Hall	2008	90%
PV	Utility interactive 3 phase inverter	Electric room	Xantrex, model PV-100S-480-HE, S/N HE1019	Elec.	Whole building	2007	88%
Cooling	Roof top packaged unit, 3.5 tons nominal cooling, R-22, 230/1/60	Roof	Lennox, model CHA15-411-1P, S/N 5186B10539	Elec.	Coach office, east wing	1986	0%
Cooling	Roof top packaged unit, 3.5 tons nominal cooling, R-22, 230/1/60	Roof	Lennox, model CHA15-411-1P, S/N 5186A13225	Elec.	Student Lounge, east wing	1986	0%
HVAC	RTU4: Roof top packaged unit, 4 tons nominal cooling, R-22, 460/3/60, MCA 12.9, gas fired heating, 90/72 in/out MBH, est. 80% eff.; 1600cfm, 200 cfm OA	Roof	Trane, model YCD049C4LCBE, S/N N23102767D	Elec./ Gas	West wing gymnasium corridor	1998	20%
Ventilation	Roof mounted mushroom type exhaust fan, est. 1/2hp motor	Roof	nameplate N/A	Elec.	A/V room	est. 1996	0%

Building System	Description	Location	Model#	Fuel	Space served	Year Equip Installed	Remaining useful life %
HVAC	RTU2: Roof top packaged unit, 17 tons nominal cooling, R-22, 460/3/60, MCA 46, gas fired heating, 250/203 in/out MBH, est. 80% eff.; 7000cfm, 500 cfm OA	Roof	Trane, model YCH211C4LFAA, S/N N23102956D	Elec./ Gas	West wing corridor, 1st and 2nd floor	1998	20%
Ventilation	EF-3: Roof mounted mushroom type exhaust fan, est. 1/3hp motor	Roof	Loren Cook, model 120C41	Elec.	West wing toilets	est. 1996	0%
HVAC	RTU1: Roof top packaged unit, 25 tons nominal cooling, R-22, 460/3/60, MCA 56, gas fired heating, 250/203 in/out MBH, est. 80% eff.; 8000cfm, 1600 cfm OA	Roof	Trane, model YCH301C4LFAA, S/N N2310295D	Elec./ Gas	West wing classrooms	1998	20%
HVAC	RTU3: Roof top packaged unit, 5 tons nominal cooling, R-22, 460/3/60, gas fired heating, 75/60 in/out MBH, est. 80% eff.; 1000cfm, 100% OA	Roof	Aaon, nameplate bleached out	Elec./ Gas	Gymnasium locker rooms	1998	20%
Ventilation	EF-1: Roof mounted mushroom type exhaust fan, 5000cfm, est. 1/2hp motor, 460/3/60	Roof	Loren Cook, model 300C5B,	Elec.	Gymnasium	1998	0%
Ventilation	EF-2: Roof mounted mushroom type exhaust fan, 5000cfm, est. 1/2hp motor, 460/3/60	Roof	Loren Cook, model 300C5B,	Elec.	Gymnasium	1998	0%
Cooling	Condensing unit, 2 tons cooling, R-22, 208/3/60, MCA 26.6, 10 SEER	Outside, on grade	Lennox, model HS21-653-1Y, S/N 5894D36102	Elec.	Athletics Office	1994	0%

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

Appendix B: Lighting Study

Location			Existing Fixture Information												Retrofit Information													Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	2	Lobby / Hallway	Recessed Parabolic	E	4'T8	20	3	32	Sw	12	345	5	2,020	8,363	C	Recessed Parabolic	4'T8	E	DL	20	3	32	9	345	5	2020	6272	0	2091	2091
2	2	Lobby / Hallway	Exit Sign	S	LED	4	1	5	N	24	365	1	22	193	N/A	Exit Sign	LED	S	N	4	1	5	24	365	1	22	193	0	0	0
3	2	Classroom (D205)	Recessed Parabolic	E	4'T8	8	3	32	Sw	4	345	5	808	1,115	C	Recessed Parabolic	4'T8	E	OS	8	3	32	3	345	5	808	836	0	279	279
4	2	Bathroom Men	Recessed Parabolic	E	4'T8	2	3	32	Sw	4	345	5	202	279	C	Recessed Parabolic	4'T8	E	OS	2	3	32	3	345	5	202	209	0	70	70
5	2	Bathroom Women	Recessed Parabolic	E	4'T8	2	3	32	Sw	4	345	5	202	279	C	Recessed Parabolic	4'T8	E	OS	2	3	32	3	345	5	202	209	0	70	70
6	2	Bathroom Women	Wall Mounted	E	4'T8	3	2	32	Sw	4	345	5	207	286	C	Wall Mounted	4'T8	E	OS	3	2	32	3	345	5	207	214	0	71	71
7	2	Bathroom Men	Wall Mounted	E	4'T8	3	2	32	Sw	4	345	5	207	286	C	Wall Mounted	4'T8	E	OS	3	2	32	3	345	5	207	214	0	71	71
8	2	Hallway	Recessed Parabolic	E	4'T8	20	3	32	Sw	12	345	5	2,020	8,363	C	Recessed Parabolic	4'T8	E	DL	20	3	32	9	345	5	2020	6272	0	2091	2091
9	2	Hallway	Exit Sign	S	LED	4	1	5	N	24	365	1	22	193	N/A	Exit Sign	LED	S	N	4	1	5	24	365	1	22	193	0	0	0
10	2	Staircase	Wall Mounted	M	4'T12	7	2	40	Sw	12	345	12	644	2,666	T8-BL	Wall Mounted	4'T8	M	BL	7	2	32	0	345	5	483	1165	667	835	1501
11	2	Hallway	Recessed Parabolic	E	4'T8	24	3	32	Sw	12	345	5	2,424	10,035	C	Recessed Parabolic	4'T8	E	MS	24	3	32	9	345	5	2424	7527	0	2509	2509
12	2	Hallway	Exit Sign	S	LED	3	1	5	N	24	365	1	17	145	N/A	Exit Sign	LED	S	N	3	1	5	24	365	1	17	145	0	0	0
13	2	Hallway	Recessed Parabolic	M	4'T12	6	4	40	Sw	12	345	12	1,032	4,272	T8	Recessed Parabolic	4'T8	E	Sw	6	4	32	12	345	5	798	3304	969	0	969
14	2	Hallway	Recessed Parabolic	M	4'T12	6	3	40	Sw	12	345	12	792	3,279	T8	Recessed Parabolic	4'T8	E	MS	6	3	32	9	345	5	606	1882	770	627	1397
15	2	Staircase	Ceiling Mounted	M	4'T12	1	4	40	Sw	12	345	12	172	712	T8	Ceiling Mounted	4'T8	E	MS	1	4	32	9	345	5	133	413	161	138	299
16	2	Staircase	Wall Mounted	S	CFL	1	2	13	Sw	12	345	0	26	108	C	Wall Mounted	CFL	S	MS	1	2	13	9	345	0	26	81	0	27	27
17	2	Staircase	Wall Mounted	M	2'T12	1	1	20	Sw	12	345	6	26	108	T8	Wall Mounted	2'T8	E	MS	1	1	17	9	345	2	19	59	29	20	49
18	2	Classroom (D206)	Recessed Parabolic	E	4'T8	24	3	32	Sw	4	345	5	2,424	3,345	C	Recessed Parabolic	4'T8	E	OS	24	3	32	3	345	5	2424	2509	0	836	836
19	2	Office (D207)	Recessed Parabolic	E	4'T8	3	3	32	Sw	4	345	5	303	418	C	Recessed Parabolic	4'T8	E	OS	3	3	32	3	345	5	303	314	0	105	105
20	2	Gymnasium	High Bay	S	MH	15	1	400	Sw	4	345	112	7,680	10,598	T5	High Bay	4'T5	E	Sw	15	4	28	4	345	4	1740	2401	8197	0	8197
21	2	Gymnasium	Exit Sign	S	LED	4	1	5	N	24	365	1	22	193	N/A	Exit Sign	LED	S	N	4	1	5	24	365	1	22	193	0	0	0
22	2	Classroom (E220)	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
23	2	Classroom (E220)	Recessed Parabolic	E	4'T8	11	3	32	Sw	4	345	5	1,111	1,533	N/A	Recessed Parabolic	4'T8	E	Sw	11	3	32	4	345	5	1111	1533	0	0	0
24	2	Office (E240A)	Recessed Parabolic	M	4'T12	2	3	40	Sw	4	345	12	264	364	T8	Recessed Parabolic	4'T8	E	Sw	2	3	32	4	345	5	202	279	86	0	86
25	2	Office (E240G)	Recessed Parabolic	M	4'T12	2	3	40	Sw	4	345	12	264	364	T8	Recessed Parabolic	4'T8	E	Sw	2	3	32	4	345	5	202	279	86	0	86
26	2	Office (E240F)	Recessed Parabolic	M	4'T12	2	3	40	Sw	4	345	12	264	364	T8	Recessed Parabolic	4'T8	E	Sw	2	3	32	4	345	5	202	279	86	0	86
27	2	Storage (E240E)	Recessed Parabolic	M	4'T12	6	3	40	Sw	1	345	12	792	273	T8	Recessed Parabolic	4'T8	E	Sw	6	3	32	1	345	5	606	209	64	0	64
28	2	Office (E240B)	Recessed Parabolic	M	4'T12	2	3	40	Sw	4	345	12	264	364	T8	Recessed Parabolic	4'T8	E	Sw	2	3	32	4	345	5	202	279	86	0	86
29	2	Office (E240C)	Recessed Parabolic	M	4'T12	3	3	40	Sw	4	345	12	396	546	T8	Recessed Parabolic	4'T8	E	Sw	3	3	32	4	345	5	303	418	128	0	128
30	2	Office	Recessed Parabolic	M	4'T12	3	3	40	Sw	4	345	12	396	546	T8	Recessed Parabolic	4'T8	E	Sw	3	3	32	4	345	5	303	418	128	0	128
31	2	Hallway	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
32	2	Hallway	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
33	2	Hallway	Exit Sign	S	LED	3	1	5	N	24	365	1	17	145	N/A	Exit Sign	LED	S	N	3	1	5	24	365	1	17	145	0	0	0
34	2	Hallway	Recessed Parabolic	M	4'T12	2	3	40	Sw	12	345	12	264	1,093	T8	Recessed Parabolic	4'T8	E	MS	2	3	32	9	345	5	202	627	257	209	466
35	2	Hallway	Ceiling Mounted	M	4'T12	4	3	40	Sw	12	345	12	528	2,186	T8	Ceiling Mounted	4'T8	E	MS	4	3	32	9	345	5	404	1254	513	418	932
36	2	Fitness Center	Ceiling Mounted	E	4'T8	8	2	32	Sw	4	345	5	552	762	C	Ceiling Mounted	4'T8	E	OS	8	2	32	3	345	5	552	571	0	190	190
37	2	Fitness Center	Recessed Parabolic	E	4'T8	2	3	32	Sw	4	345	5	202	279	C	Recessed Parabolic	4'T8	E	OS	2	3	32	3	345	5	202	209	0	70	70
38	2	Janitor's Closet	Ceiling Mounted	M	4'T12	1	1	40	Sw	1	345	12	52	18	T8	Ceiling Mounted	4'T8	E	Sw	1	1	32	1	345	5	37	13	5	0	5
39	2	Bathroom Women	Recessed Parabolic	M	4'T12	4	4	40	Sw	4	345	12	688	949	T8	Recessed Parabolic	4'T8	E	OS	4	4	32	3	345	5	532	551	215	184	399
40	2	Bathroom Men	Recessed Parabolic	M	4'T12	4	4	40	Sw	4	345	12	688	949	T8	Recessed Parabolic	4'T8	E	OS	4	4	32	3	345	5	532	551	215	184	399
41	2	Hallway	Recessed Parabolic	M	4'T12	7	3	40	Sw	12	345	12	924	3,825	T8	Recessed Parabolic	4'T8	E	MS	7	3	32	9	345	5	707	2195	898	732	1630
42	2	Hallway	Recessed Parabolic	E	4'T8 U-Shaped	10	2	32	Sw	12	345	5	690	2,857	C	Recessed Parabolic	4'T8 U-Shaped	E	MS	10	2	32	9	345	5	690	2142	0	714	714
43	2	Hallway	Recessed	S	CFL	1	1	13	Sw	12	345	0	13	54	N/A	Recessed	CFL	S	Sw	1	1	13	12	345	0	13	54	0	0	0
44	2	Office (E245)	Recessed Parabolic	M	4'T12	4	2	40	Sw	4	345	12	368	508	T8	Recessed Parabolic	4'T8	E	OS	4	2	32	3	345	5	276	286	127	95	222
45	2	Office (E247)	Recessed Parabolic	M	4'T12	4	2	40	Sw	4	345	12	368	508	T8	Recessed Parabolic	4'T8	E	OS	4	2	32	3	345	5	276	286	127	95	222
46	2	Office (E246)	Recessed Parabolic	M	4'T12	4	4	40	Sw	4	345	12	688	949	T8	Recessed Parabolic	4'T8	E	OS	4	4	32	3	345	5	532	551	215	184	399
47	2	Classroom (E248)	Recessed Parabolic	M	4'T12	8	3	40	Sw	4	345	12	1,056	1,457	T8	Recessed Parabolic	4'T8	E	OS	8	3	32	3	345	5	808	836	342	279	621
48	2	Classroom (E249)	Recessed Parabolic	M	4'T12	8	3	40	Sw	4	345	12	1,056	1,457	T8	Recessed Parabolic	4'T8	E	OS	8	3	32	3	345	5	808	836	342	279	621
49	2	Office (E249A)	Recessed Parabolic	M	4'T12	3	3	40	Sw	4	345	12	396	546	T8	Recessed Parabolic	4'T8	E	OS	3	3	32	3	345	5	303	314	128	105	233
50	2	Classroom (E251)	Recessed Parabolic	M	4'T12	8	3	40	Sw	4	345	12	1,056	1,457	T8	Recessed Parabolic	4'T8	E	OS	8	3	32	3	345	5	808	836	342	279	621
51	2	Classroom (E250)	Recessed Parabolic	M	4'T12	6	3	40	Sw	4	345	12	792	1,093	T8	Recessed Parabolic	4'T8	E	OS	6	3	32	3	345	5	606	627	257	209	466
52	2	Classroom (E252)	Recessed Parabolic	M	4'T12	8	3	40	Sw	4	345	12	1,056	1,457	T8	Recessed Parabolic	4'T8	E	OS	8	3	32	3	345	5	808	836	342	279	621
53	2	Classroom (E254)	Recessed Parabolic	E	4'T8 U-Shaped	6	2	32	Sw	4	345	5	414	571	C	Recessed Parabolic	4'T8 U-Shaped	E	OS	6	2	32	3	345	5	414	428	0	143	143
54	2	Classroom (E255)	Ceiling Suspended	E	4'T8	6	2	32	Sw	4	345	5	414	571	C	Ceiling Suspended	4'T8	E	OS	6	2	32	3	345	5	414	428	0	143	143
55	2	Classroom (E255)	Recessed	S	CFL	10	1	13	Sw	4	345	0	130	179	C	Recessed	CFL	S	OS	10	1	13	3	345	0	130	135	0	45	45
56	2	Office (E254A)	Recessed Parabolic	E	4'T8 U-Shaped	4	2	32	Sw	4	345	5	276	381	C	Recessed Parabolic	4'T8 U-Shaped	E	OS	4	2	32	3	345	5	276	286	0	95	95
57	1	Hallway	Ceiling Mounted	M	4'T12	10	2	40	Sw	12	345	12	920	3,809	T8	Ceiling Mounted	4'T8	E	MS	10	2	32	9	345	5	690	2142	952	714	1666
58	1	Hallway	Recessed Parabolic	M	4'T12	1	4	40	Sw	12	345	12	172	712	T8	Recessed Parabolic	4'T8	E	MS	1	4	32	9	345	5	133	413	161	138	299
59	1	Hallway	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
60	1	Hallway	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
61	1	Hallway	Recessed Parabolic	M	4'T12	13	3	40	Sw	12	345	12	1,716	7,104	T8	Recessed Parabolic	4'T8	E	MS	13	3	32	9	345	5	1313	4077	1668	1359	3027
62	1	Bathroom Women	Recessed Parabolic	E	4'T8	1	2	32	Sw	4	345	5	69	95	N/A	Recessed Parabolic	4'T8	E	Sw	1	2	32	4	345	5	69	95	0	0	0
63	1	Unisex bathroom	Recessed Parabolic	M	4'T12 U-Shaped	1	2	40	Sw	2	345	12	92	63	T8	Recessed Parabolic	4'T8 U-Shaped	E	Sw	1	2	32	2	345	5	69	48	16	0	16
64	1	Unisex bathroom	Ceiling Mounted	S	Inc	1	1	60	Sw	2	345	0	60	41	CFL	Ceiling Mounted	CFL	S	Sw	1	1	20	2	345	0	20	14	28	0	28
65	1	Storage Closet (E121)	Recessed Parabolic	M	4'T12	5	4	40	Sw	1	345	12	860	297	T8	Recessed Parabolic	4'T8	E	Sw	5	4	32	1	345	5	665	229	67	0	67

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)
66	1	Office (E125)	Recessed Parabolic	M	4'T12	5	4	40	Sw	4	345	12	860	1,187	T8	Recessed Parabolic	4'T8	E	OS	5	4	32	3	345	5	665	688	269	229	499
67	1	Office (E124)	Recessed Parabolic	M	4'T12	2	4	40	Sw	4	345	12	344	475	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	3	345	5	266	275	108	92	199
68	1	Office (E126)	Recessed Parabolic	M	4'T12	4	4	40	Sw	4	345	12	688	949	T8	Recessed Parabolic	4'T8	E	OS	4	4	32	3	345	5	532	551	215	184	399
69	1	Classroom (E127)	Recessed Parabolic	M	4'T12	6	4	40	Sw	4	345	12	1,032	1,424	T8	Recessed Parabolic	4'T8	E	OS	6	4	32	3	345	5	798	826	323	275	598
70	1	Classroom (E128)	Recessed Parabolic	M	4'T12	6	4	40	Sw	4	345	12	1,032	1,424	T8	Recessed Parabolic	4'T8	E	OS	6	4	32	3	345	5	798	826	323	275	598
71	1	Office (E127A)	Recessed Parabolic	M	4'T12	2	4	40	Sw	4	345	12	344	475	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	3	345	5	266	275	108	92	199
72	1	Classroom (E130)	Recessed Parabolic	M	4'T12	8	4	40	Sw	4	345	12	1,376	1,899	T8	Recessed Parabolic	4'T8	E	OS	8	4	32	3	345	5	1064	1101	431	367	798
73	1	Classroom (E129)	Recessed Parabolic	M	4'T12	8	4	40	Sw	4	345	12	1,376	1,899	T8	Recessed Parabolic	4'T8	E	OS	8	4	32	3	345	5	1064	1101	431	367	798
74	1	Office (E131)	Recessed Parabolic	M	4'T12	2	4	40	Sw	4	345	12	344	475	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	3	345	5	266	275	108	92	199
75	1	Office (E132)	Recessed Parabolic	M	4'T12	2	4	40	Sw	4	345	12	344	475	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	3	345	5	266	275	108	92	199
76	1	Office (E133A)	Recessed Parabolic	M	4'T12	2	4	40	Sw	4	345	12	344	475	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	3	345	5	266	275	108	92	199
77	1	Storage Closet (E133)	Ceiling Mounted	E	4'T8	2	2	32	Sw	1	345	5	138	48	C	Ceiling Mounted	4'T8	E	OS	2	2	32	1	345	5	138	36	0	12	12
78	1	Classroom (E101)	Recessed Parabolic	M	4'T12	6	4	40	Sw	4	345	12	1,032	1,424	T8	Recessed Parabolic	4'T8	E	OS	6	4	32	3	345	5	798	826	323	275	598
79	1	Classroom (E101)	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
80	1	Office (E108)	Recessed Parabolic	M	4'T12	2	4	40	Sw	4	345	12	344	475	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	3	345	5	266	275	108	92	199
81	1	Office (E107)	Recessed Parabolic	M	4'T12	2	4	40	Sw	4	345	12	344	475	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	3	345	5	266	275	108	92	199
82	1	Office (E106)	Recessed Parabolic	M	4'T12	2	4	40	Sw	4	345	12	344	475	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	3	345	5	266	275	108	92	199
83	1	Classroom (E105)	Recessed Parabolic	M	4'T12	6	4	40	Sw	4	345	12	1,032	1,424	T8	Recessed Parabolic	4'T8	E	OS	6	4	32	3	345	5	798	826	323	275	598
84	1	Hallway	Recessed Parabolic	M	4'T12	1	4	40	Sw	12	345	12	172	712	T8	Recessed Parabolic	4'T8	E	MS	1	4	32	9	345	5	133	413	161	138	299
85	1	Hallway	Recessed Parabolic	M	4'T12 U-Shaped	4	2	40	Sw	12	345	12	368	1,524	T8	Recessed Parabolic	4'T8 U-Shaped	E	MS	4	2	32	9	345	5	276	857	381	286	667
86	1	Men's locker room	Recessed Parabolic	E	4'T8	7	3	32	Sw	4	345	5	707	976	C	Recessed Parabolic	4'T8	E	OS	7	3	32	3	345	5	707	732	0	244	244
87	1	Women's locker room	Recessed Parabolic	E	4'T8	7	3	32	Sw	4	345	5	707	976	C	Recessed Parabolic	4'T8	E	OS	7	3	32	3	345	5	707	732	0	244	244
88	1	Women's locker room	Recessed	S	CFL	2	2	13	Sw	4	345	0	52	72	C	Recessed	CFL	S	OS	2	2	13	3	345	0	52	54	0	18	18
89	1	Men's locker room	Recessed	S	CFL	2	2	13	Sw	4	345	0	52	72	C	Recessed	CFL	S	OS	2	2	13	3	345	0	52	54	0	18	18
90	1	Office (E102)	Ceiling Mounted	M	4'T12	2	4	40	Sw	4	345	12	344	475	T8	Ceiling Mounted	4'T8	E	OS	2	4	32	3	345	5	266	275	108	92	199
91	1	Office (E104)	Recessed Parabolic	M	4'T12	2	4	40	Sw	4	345	12	344	475	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	3	345	5	266	275	108	92	199
92	1	Kitchen (E103)	Recessed Parabolic	M	4'T12	2	4	40	Sw	4	345	12	344	475	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	3	345	5	266	275	108	92	199
93	1	Trainer room	Recessed Parabolic	E	4'T8	2	3	32	Sw	4	345	5	202	279	C	Recessed Parabolic	4'T8	E	OS	2	3	32	3	345	5	202	209	0	70	70
94	1	Trainer room	Recessed Parabolic	E	4'T8 U-Shaped	2	2	32	Sw	4	345	5	138	190	C	Recessed Parabolic	4'T8 U-Shaped	E	OS	2	2	32	3	345	5	138	143	0	48	48
95	1	Trainer room	Recessed Parabolic	E	4'T8	1	1	32	Sw	4	345	5	37	51	C	Recessed Parabolic	4'T8	E	OS	1	1	32	3	345	5	37	38	0	13	13
96	1	Bathroom Men	Recessed Parabolic	E	4'T8	1	4	32	Sw	4	345	5	133	184	C	Recessed Parabolic	4'T8	E	OS	1	4	32	3	345	5	133	138	0	46	46
97	1	Bathroom Women	Recessed Parabolic	E	4'T8	1	4	32	Sw	4	345	5	133	184	C	Recessed Parabolic	4'T8	E	OS	1	4	32	3	345	5	133	138	0	46	46
98	1	Staircase	Wall Mounted	M	4'T12	4	2	40	Sw	12	345	12	368	1,524	T8	Wall Mounted	4'T8	E	MS	4	2	32	9	345	5	276	857	381	286	667
99	1	Hallway	Recessed Parabolic	E	4'T8	21	3	32	Sw	12	345	5	2,121	8,781	C	Recessed Parabolic	4'T8	E	MS	21	3	32	9	345	5	2121	6586	0	2195	2195
100	1	Hallway	Exit Sign	S	LED	3	1	5	N	24	365	1	17	145	N/A	Exit Sign	LED	S	N	3	1	5	24	365	1	17	145	0	0	0
101	1	Classroom (E307)	Recessed Parabolic	E	4'T8	8	3	32	Sw	4	345	5	808	1,115	C	Recessed Parabolic	4'T8	E	OS	8	3	32	3	345	5	808	836	0	279	279
102	1	Classroom (E306)	Recessed Parabolic	E	4'T8	12	3	32	Sw	4	345	5	1,212	1,673	C	Recessed Parabolic	4'T8	E	OS	12	3	32	3	345	5	1212	1254	0	418	418
103	1	Classroom (E305)	Recessed Parabolic	E	4'T8	2	3	32	Sw	4	345	5	202	279	C	Recessed Parabolic	4'T8	E	OS	2	3	32	3	345	5	202	209	0	70	70
104	1	Classroom (E305)	Recessed Parabolic	E	4'T8 U-Shaped	3	2	32	Sw	4	345	5	207	286	C	Recessed Parabolic	4'T8 U-Shaped	E	OS	3	2	32	3	345	5	207	214	0	71	71
105	1	Office (E304)	Ceiling Mounted	E	4'T8 U-Shaped	1	2	32	Sw	6	345	5	69	143	C	Ceiling Mounted	4'T8 U-Shaped	E	OS	1	2	32	5	345	5	69	107	0	36	36
106	1	Office (E303)	Recessed Parabolic	M	4'T12	1	3	40	Sw	4	345	12	132	182	T8	Recessed Parabolic	4'T8	E	OS	1	3	32	3	345	5	101	105	43	35	78
107	1	Office (E303)	Recessed Parabolic	E	4'T8 U-Shaped	2	2	32	Sw	4	345	5	138	190	C	Recessed Parabolic	4'T8 U-Shaped	E	OS	2	2	32	3	345	5	138	143	0	48	48
108	3	Classroom (E302)	Recessed Parabolic	E	4'T8	8	3	32	Sw	4	345	5	808	1,115	C	Recessed Parabolic	4'T8	E	OS	8	3	32	3	345	5	808	836	0	279	279
109	3	Classroom (E301)	Recessed Parabolic	E	4'T8	16	3	32	Sw	4	345	5	1,616	2,230	C	Recessed Parabolic	4'T8	E	OS	16	3	32	3	345	5	1616	1673	0	558	558
110	3	Closet (E300)	Ceiling Mounted	E	4'T8	1	2	32	Sw	1	345	5	69	24	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	1	345	5	69	24	0	0	0
111	Ext	Exterior	Ceiling Mounted	S	CFL	1	1	13	T	8	365	0	13	38	C	Ceiling Mounted	CFL	S	PC	1	1	13	6	365	0	13	28	0	9	9
112	Ext	Exterior	Wallpack	S	MH	10	1	400	T	8	365	112	5,120	14,950	PSMH	Wallpack	PSMH	S	PC	10	1	250	6	365	50	3000	6570	6190	2190	8380
113	Ext	Exterior	Wallpack	S	MH	2	1	150	T	8	365	42	384	1,121	MH	Wallpack	MH	S	PC	2	1	150	6	365	42	384	841	0	280	280
114	Ext	Exterior	Sconce	S	CFL	5	1	13	T	8	365	0	65	190	C	Sconce	CFL	S	PC	5	1	13	6	365	0	65	142	0	47	47
115	Ext	Exterior	Pole Mounted	S	MH	5	1	75	T	8	365	21	480	1,402	MH	Pole Mounted	MH	S	PC	5	1	75	6	365	21	480	1051	0	350	350
Totals:						564	302	4,568				1,127	70,517	153,807						564	305	3,571			575	54,916	95,586	29,654	28,567	58,221

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

Proposed Lighting Summary Table			
Total Gross Floor Area (SF)	31,432		
Average Power Cost ($/kWh)	0.1640		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	17,701	8,633	**9,068**
Exterior Power (watts)	6,062	3,942	**2,120**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	136,106	86,953	**49,153**
Lighting Power (watts)	64,455	50,974	**13,481**
Lighting Power Density (watts/SF)	2.05	1.62	**0.43**
Estimated Cost of Fixture Replacement ($)	50,274		
Estimated Cost of Controls Improvements ($)	17,970		
Total Consumption Cost Savings ($)	**12,706**		

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

APPENDIX C: THIRD PARTY ENERGY SUPPLIERS

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

Third Party Electric Suppliers for 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 D: GLOSSARY AND METHOD OF CALCULATIONS

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

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

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

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

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

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

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

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

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

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

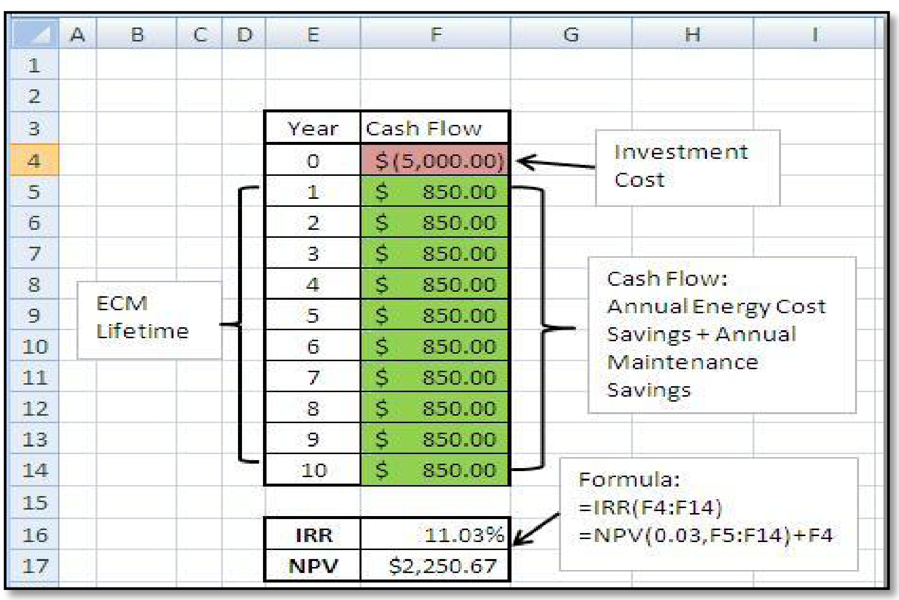
Calculation References

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

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

Excel NPV and IRR Calculation

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



Solar PV ECM Calculation

There are several components to the calculation:

Costs:	Material of PV system including panels, mounting and net-metering + Labor
Energy Savings:	Reduction of kWh electric cost for life of panel, 25 years
Incentive 1:	NJ Renewable Energy Incentive Program (REIP), for systems of size 30kW or less, $0.75/Watt incentive subtracted from installation cost
Incentive 2:	Solar Renewable Energy Credits (SRECs) – Market-rate incentive. Calculations assume $600/Megawatt hour consumed per year for a maximum of 15 years; added to annual energy cost savings for a period of 15 years. (Megawatt hour used is rounded to nearest 1,000 kWh)
Assumptions:	A Solar Pathfinder device is used to analyze site shading for the building and determine maximum amount of full load operation based on available sunlight. When the Solar Pathfinder device is not implemented, amount of full load operation based on available sunlight is assumed to be 1,180 hours in New Jersey.

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

ECM and Equipment Lifetimes

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

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

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

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

New Jersey Clean Energy Program Commercial & Industrial Lifetimes

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

APPENDIX E: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

ENERGY STAR

STATEMENT OF ENERGY PERFORMANCE
Sussex County Community College - Building E

Building ID: 2473780
For 12-month Period Ending: June 30, 2010[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: October 05, 2010

Facility
Sussex County Community College - Building E
One College Hill Road
Newton, NJ 07860

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1970
Gross Floor Area (ft²): 31,432

Energy Performance Rating[2] (1-100) N/A

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	1,219,431
Natural Gas (kBtu)[4]	2,191,592
Total Energy (kBtu)	3,411,023
Energy Intensity[5]	
Site (kBtu/ft²/yr)	109
Source (kBtu/ft²/yr)	203
Emissions (based on site energy use)	
Greenhouse Gas Emissions (MtCO_2e/year)	302
Electric Distribution Utility	
FirstEnergy - Jersey Central Power & Lt Co	
National Average Comparison	
National Average Site EUI	120
National Average Source EUI	280
% Difference from National Average Source EUI	-28%
Building Type	College/University (Campus-Level)

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Meets Industry Standards[6] for Indoor Environmental Conditions:

Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Certifying Professional
N/A

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

EPA Form 5900-16

APPENDIX F: INCENTIVE PROGRAMS

New Jersey Clean Energy Pay for Performance

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

The Energy Reduction Plan must define a comprehensive package of measures capable of reducing a building's energy consumption by 15+%. P4P incentives are awarded upon the satisfactory completion of three program milestones: submittal of an Energy Reduction Plan prepared by an approved Program Partner, installation of the recommended measures and completion of a Post-Construction Benchmarking Report. 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.

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

Direct Install 2010 Program*

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

Eligibility:

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

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

Smart Start

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

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

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

Renewable Energy Incentive Program*

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

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

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

Utility Sponsored Programs

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

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

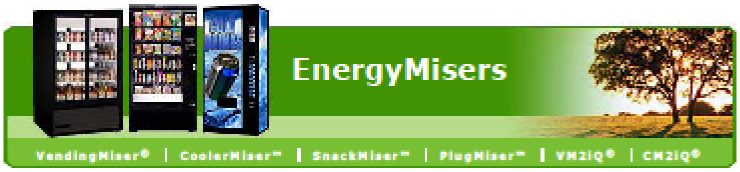
Other federal and state sponsored funding opportunities may be available, including BLOCK and R&D grant funding. For more information, please check http://www.dsireusa.org/.

*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 G: ENERGY CONSERVATION MEASURES

ECM Counter		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 year cost 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, $	CO2 reduced, lbs/yr
4	0 to 5 Year Payback ECM	Retrofit 3 existing vending machine with SnackMiser™ device	297	0	297	1,161	0.3	1,045	3.4	0	1,543	10	15,433	0.2	5,096	510	520	12,734	13,594
1		Install 2 new Daylight sensors with incentives	440	50	390	4,181	1.3	0	0.5	0	686	15	10,285	0.6	2,537	169	176	7,678	7,486
2		Retrofit 6 existing refrigerated vending machine with VendingMiser™ device	1,194	0	1,194	9,672	2.9	0	1.1	0	1,586	10	15,863	0.8	1,229	123	133	12,200	17,318
3		Install 15 new T5 fixtures with incentives	3,150	240	2,910	8,197	2.5	1,096	4.4	840	3,603	15	54,051	0.8	2,190	146	124	39,491	26,756
5		Install 16 new Motion sensors with incentives	3,520	320	3,200	10,508	3.2	51	1.3	0	1,789	15	26,842	1.8	739	49	56	17,857	19,378
6		Install 5 new Photocell sensors with incentives	1,100	100	1,000	2,878	0.9	5	0.3	0	478	15	7,177	2.1	618	41	47	4,630	5,208
7		Install 1 new CFL fixture	9	0	9	28	0.0	0	0.0	0	4	5	20	2.3	122	24	34	9	50
12		Install Programmable thermostats on 5 RTUs	4,200	0	4,200	7,050	2.1	453	2.2	0	1,743	15	26,143	2.4	522	35	41	16,308	17,616
13		Install VFD on West wing classroom unit	2,600	1,163	1,437	3,100	0.9	0	0.3	0	508	15	7,626	2.8	431	29	34	4,545	5,551
		TOTALS	**16,510**	**1,873**	**14,637**	**46,775**	**14**	**2,650**	**13.5**	**840**	**11,942**	-	**163,439**	**1.2**	-	-	-	**115,454**	**112,958**
14	5 to 10 Year Payback	Install demand controlled ventilation with CO2 sensors	6,180	40	6,140	1,550	0.5	632	2.2	0	1,073	15	16,090	5.7	162	11	14	6,482	9,742
8		Install 10 new Pulse start metal halide fixtures with incentives	8,375	250	8,125	6,190	1.9	0	0.7	150	1,165	15	17,479	7.0	143	10	10	5,586	11,084
9		Install 7 new Bi-level fixtures with incentives	1,155	175	980	835	0.3	0	0.1	0	137	15	2,055	7.2	110	7	9	632	1,496
10		Install 62 new Occupancy sensors with incentives	13,640	1,240	12,400	10,165	3.0	0	1.1	0	1,667	15	25,007	7.4	102	7	8	7,217	18,201
15		Replace 1 existing 10SEER condensing units	2,100	184	1,916	1,325	0.4	0	0.1	0	217	15	3,260	8.8	70	5	5	641	2,372
		TOTALS	**31,450**	**1,889**	**29,561**	**20,065**	**6.1**	**632**	**4.2**	**150**	**4,259**		**63,890**	**6.9**	-	-	-	**20,559**	**42,895**
16	> 10 Year Paybakc (End of Life ECM)	Install Heat Recovery Unit for Gymnasium	11,000	0	11,000	1,328	0.4	587	2.0	0	978	15	14,669	11.2	33	2	1	508	8,848
11		Install 220 new T8 fixtures with incentives	42,530	3,300	39,230	14,572	4.4	0	1.6	1,045	3,435	15	51,522	11.4	71	5	1	1,188	26,091
17		Replace existing hot water boilers (2)	62,000	1,750	60,250	0	0.0	2,800	9.3	1,125	4,387	30	131,610	13.7	174	6	-2	23,556	30,864
18		Install new Building Management System	125,000	0	125,000	11,699	0.2	3,762	13.9	0	6,231	12	74,774	20.1	-40	-3	-7	-63,709	62,416
		TOTALS	**240,530**	**5,050**	**235,480**	**27,599**	**5**	**7,149**	**27**	**2,170**	**15,031**	-	**272,576**	**15.7**	-	-	-	**-38,458**	**128,219**

APPENDIX H: VendingMiser™ and SnackMiser™ Energy Savings



Savings Calculator

Please replace the default values in the table below with your location's unique information and then click on the "calculate savings" button.
Note: To calculate for CoolerMiser, use the equivalent VendingMiser results. To calculate for PlugMiser, use the equivalent SnackMiser results.

Energy Costs ($0.000 per kWh)
Facility Occupied Hours per Week
Number of Cold Drink Vending Machines
Number of Non-refrigerated Snack Machines
Power Requirements of Cold Drink Machine (Watts; 400 typical)
Power Requirements of Snack Machine (Watts; 80 typical)
VendingMiser® Sale Price (for cold drink machines)
SnackMiser™ Sale Price (for snack machines)

Results of your location's projected savings with VendingMiser® installed:

COLD DRINK MACHINES	Current	Projected	Total Savings	% Savings
kWh	20966	11294	9672	46%
Cost of Operation	$3,438.49	$1,852.28	$1,586.21	46%

SNACK MACHINES	Current	Projected	Total Savings	% Savings
kWh	2097	936	1161	55%
Cost of Operation	$343.85	$153.50	$190.34	55%

Location's Total Annual Savings

	Current	Projected	Total Savings	% Savings
kWh	23063	12230	10833	47%
Cost of Operation	$3,782.34	$2,005.79	$1,776.55	47%

Total Project Cost	Break Even (Months)
$1,491	10.07

Estimated Five Year Savings on ALL Machines = $8,882.76

Estimated Five Year Return on Investment = 496%

Service and Support

The Help Desk is available around the clock to answer account, service, installation and reporting questions.

HOW TO BUY — Purchase from our online store or contact us to start saving.

Programs

$$$ Over 40 utilities nationwide are offering rebates for EnergyMiser products.

Use the Savings Calculator to learn how much you can save.

Testimonials

Paul Lustig
Energy Program Manager
Austin Energy

Written Testimonials

Bottlers' Perspectives

Vending Machine Distributors' Perspectives

Customer Lists

- Universities and Colleges
- Schools and School Districts
- Energy Service Companies (ESCOs)
- Federal Government Facilities
- Local Government Facilities

Downloads

- Product Sheets
- Installation Guides
- Articles and Technical Papers

Still have a question? Read the FAQs.

APPENDIX I: METHOD OF ANALYSIS

Assumptions and tools

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

Disclaimer

This engineering audit was prepared using the most current and accurate fuel consumption data available for the site. The estimates that it projects are intended to help guide the owner toward best energy choices. The costs and savings are subject to fluctuations in weather, variations in quality of maintenance, changes in prices of fuel, materials, and labor, and other factors. Although we cannot guarantee savings or costs, we suggest that you use this report for economic analysis of the building and as a means to estimate future cash flow.

THE RECOMMENDATIONS PRESENTED IN THIS REPORT ARE BASED ON THE RESULTS OF ANALYSIS, INSPECTION, AND PERFORMANCE TESTING OF A SAMPLE OF COMPONENTS OF THE BUILDING SITE. ALTHOUGH CODE-RELATED ISSUES MAY BE NOTED, SWA STAFF HAVE NOT COMPLETED A COMPREHENSIVE EVALUATION FOR CODE-COMPLIANCE OR HEALTH AND SAFETY ISSUES. THE OWNER(S) AND MANAGER(S) OF THE BUILDING(S) CONTAINED IN THIS REPORT ARE REMINDED THAT ANY IMPROVEMENTS SUGGESTED IN THIS SCOPE OF WORK MUST BE PERFORMED IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS THAT APPLY TO SAID WORK. PARTICULAR ATTENTION MUST BE PAID TO ANY WORK WHICH INVOLVES HEATING AND AIR MOVEMENT SYSTEMS, AND ANY WORK WHICH WILL INVOLVE THE DISTURBANCE OF PRODUCTS CONTAINING MOLD, ASBESTOS, OR LEAD.