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

293 Route 18, Suite 330
East Brunswick, NJ 08816

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

September 3, 2010

Local Government Energy Program
Energy Audit Final Report

Cumberland County College

Student Services Gymnasium
3322 College Drive
Vineland, NJ 08360

Project Number: LGEA66

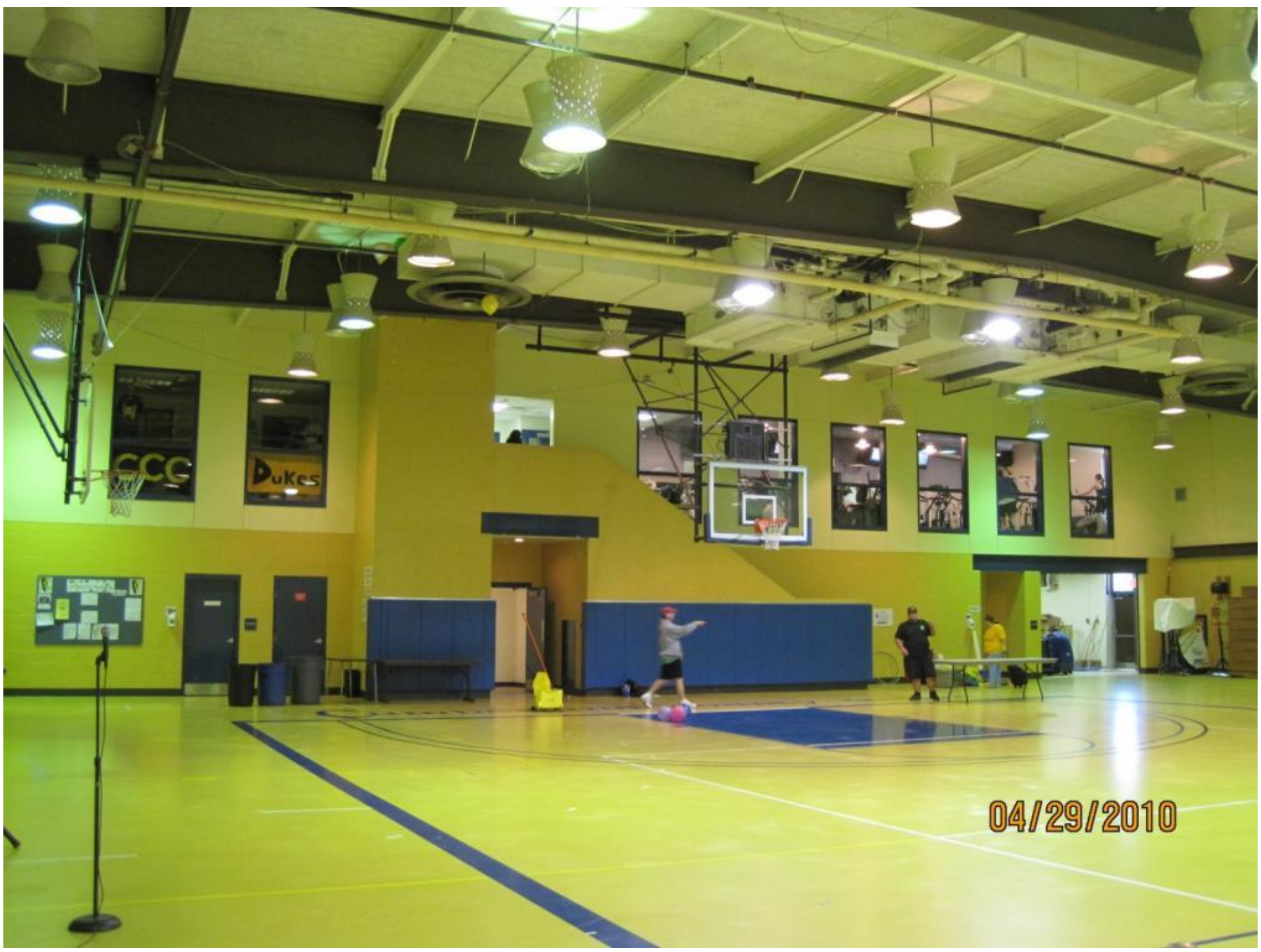


TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Cumberland County College Student Services Gymnasium is a partial two-story building comprising a total conditioned floor area of 18,666 square feet. The original structure was built in 1965, with major renovations or additions in 2000. The following chart provides an overview of current energy usage in the building based on the analysis period of April 2009 through March 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	448,769	20,025	$85,829	189.3	3,534
Proposed	342,306	17,451	$63,643	156.1	2,913
Savings	106,463	2,574	$22,187	33.3	621
% Savings	24%	13%	26%	18%	18%
Renewable Savings (Includes SRECs)	*35,400*	*Includes SRECs*	*$25,628*	*6.5*	*63*

SWA has also entered energy information about the Student Services Gymnasium in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. This recreation facility is comprised of non-eligible ("Other") space type. The resulting site Energy Intensity is 186.0 kBtu/sq ft yr, which is more than the average comparable building of 65.0 kBtu/sq ft yr by 186%.

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	$10,243	1.5	$15,559	107323
5-10 Year	$11,944	5.2	$62,410	111672
>10 year	$0	NA	$0	0
Total	$22,187	3.5	$77,969	218,995
Renewable	$25,628	7.3	$187,500	63,384

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 26 cars from the roads each year or avoiding the need of 790 trees to absorb the annual CO_2 generated.

Further Recommendations:

SWA recommends that the Student Services Gymnasium further explore the following:

- Capital Improvements
  - Install NEMA premium motors when replacements are required
  - Replace 23 T12 fixtures with T8 as ballasts fail
  - Add all HVAC equipment and space conditions to campus Electronic Building Integrator (EBI) System
  - Once Carrier Air Cooled chiller reaches end of useful life, remove chiller and serve Fitness Center cooling from Central Plant (if there is ample capacity without major plant upgrades); also opportunity to correct AHU-1 freeze stat

- Operations and Maintenance
  - Install/replace and maintain weather-stripping around all exterior doors and roof hatches
  - Provide water-efficient fixtures and controls
  - SWA recommends procurement of ENERGY STAR® labeled appliances
  - Use smart power electric strips
  - Create an energy educational program

See more details on these measures in the Proposed Further Recommendations section of the report on page 36.

The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for Cumberland County College. Based on the requirements of the LGEA program, Cumberland County 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 $1,946.

Financial Incentives and Other Program Opportunities

The overall energy usage of the campus based on the two electric meters and one gas meter is 186.0 kBtu/sq ft yr. This is higher than typical buildings which perform between 90.0 and 130.0 kBtu/sq ft yr and therefore Cumberland County College is an excellent candidate for the NJ Clean Energy Pay for Performance (P4P) incentive program. The three-tiered incentive program requires at least 15% overall energy reduction for the campus buildings. Prior to acceptance in the program it is required that this building be separately metered for a period of 12 consecutive months.

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

Table 3: Next Steps for the Student Services Gymnasium

Recommended ECMs	Incentive Program (Please refer to Appendix F for details)
Programmable Thermostats, All Lighting Upgrades, Replace AC-1, 2, 3 and 4, Install 30 kW Solar and EBI Integration	P4P
Replace AC-1, 2, 3 and 4	Direct Install
All Lighting Upgrades	NJ Clean Energy

There are various incentive programs that the Cumberland County College could apply for that could help lower the cost of installing the ECMs and for feasibility studies to improve the efficiency of the campus overall. Below are the details of eligible incentive programs.

New Jersey Clean Energy Pay for Performance - Three phase incentive plan:

1. Develop plan to reduce current energy use by 15%: receive up to 50% of annual energy costs
2. Install measures as outlined in the plan: receive up to $0.13 per kWh saved and $1.45 per therm saved
3. After benchmarking energy savings for one year: receive up to $0.09 per kWh saved and $1.05 per therm.

Direct Install 2010 Program: Commercial buildings with peak electric demand below 200kW can receive up to 60% of installed cost of energy saving upgrades.

NJ Clean Energy: Smart Start: Majority of energy saving equipment and design measures have moderate incentives under this program.

Renewable Energy Incentive Program: Receive up to $0.75/Watt toward installation cost for PV panels upon available funding. For each 1,000 kWh generated by renewable energy, receive a credit between $475 and $600.

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, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize up to 100% of the cost of the audit. The Board of Public Utilities (BPUs) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

Steven Winter Associates, Inc. (SWA) is a 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 Student Services Gymnasium at 3322 College Drive, Vineland, NJ. The process of the audit included facility visits on April 29, 2010 and June 3, 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 Cumberland County College to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Student Services Gymnasium.

HISTORICAL ENERGY CONSUMPTION

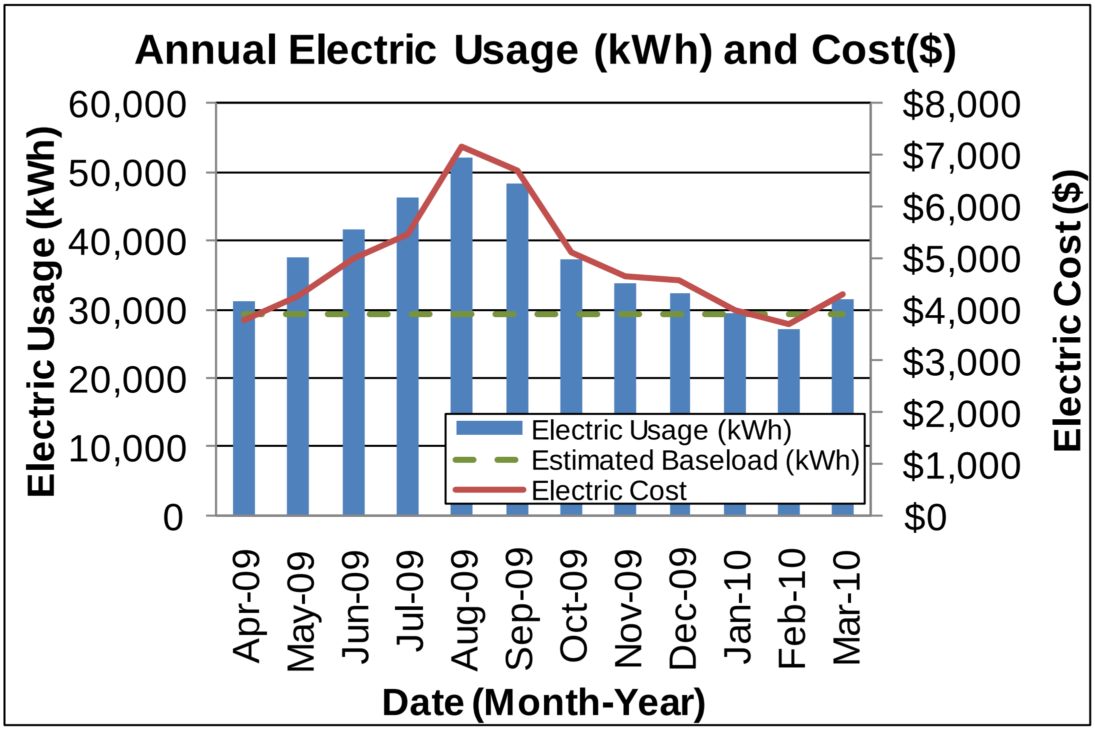
Energy usage, load profile and cost analysis

SWA reviewed utility bills from April 2008 through March 2010 that were received from the utility companies supplying the Student Services Gymnasium with electric and natural gas. A 12 month period of analysis from April 2009 through March 2010 was used for all calculations and for purposes of benchmarking the building.

In order to analyze the energy usage of each campus building, since there are no building sub-meters, it was agreed upon with campus management that the energy usage would be proportioned based on the square footage of each building compared to the entire campus building square footage. For gas usage, the entire campus is served by one main meter. The minor gas meters used for the kitchens, lab equipment and small DHW contribute negligible gas usage. There are two electric meters, one serving the Vineland coverage area and one serving the AC Electric coverage area. It is difficult to separate the actual electric usage per building since the Central Plant serves most of the campus heating and cooling. Therefore, the electric consumption of both meters was combined and using the entire campus of 274,527 sqft, the electric usage was proportioned for each building. The billing rate used in the analysis is based on the weighted average of the Vineland Electric and AC Electric utility rates. Both electric suppliers contribute to the campus and in order to reasonably compare Energy Saving Measures, the same rate was used for all buildings. After installation of sub meters for each building, the rates for each utility supplier will be more relevant.

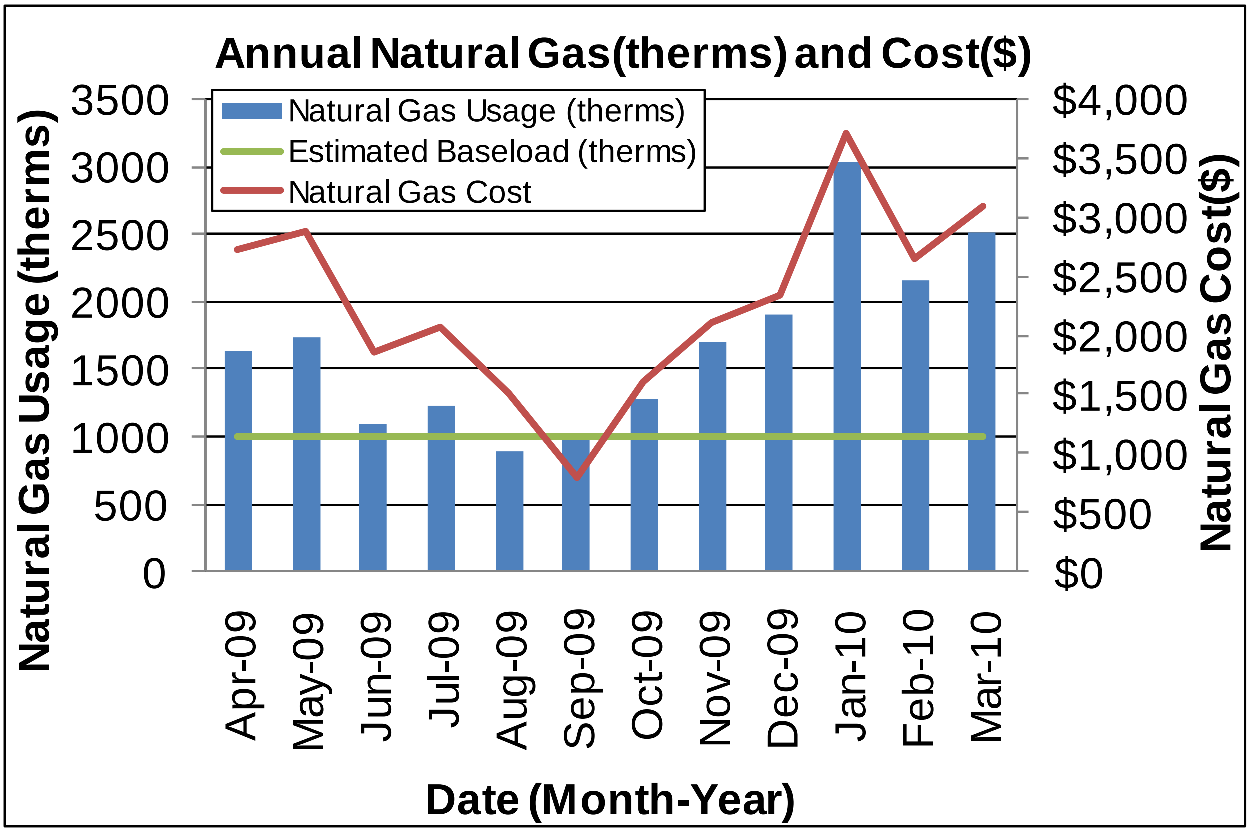
Electricity – Cumberland County College currently buys electricity from Atlantic City Electric and Vineland Electric at **an average aggregated rate of $0.131/kWh.** There are only two electric meters for the Cumberland County College campus buildings, with no sub meters for each building. Therefore the usage of each building was estimated based on square footage compared to the total campus size. Using this method, the Student Services Gymnasium purchased **approximately 448,769 kWh, or $58,670 worth of electricity,** in the previous year. The average monthly demand was 85.0 kW and the annual peak demand was 107.4 kW.

The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate the Student Services Gymnasium.

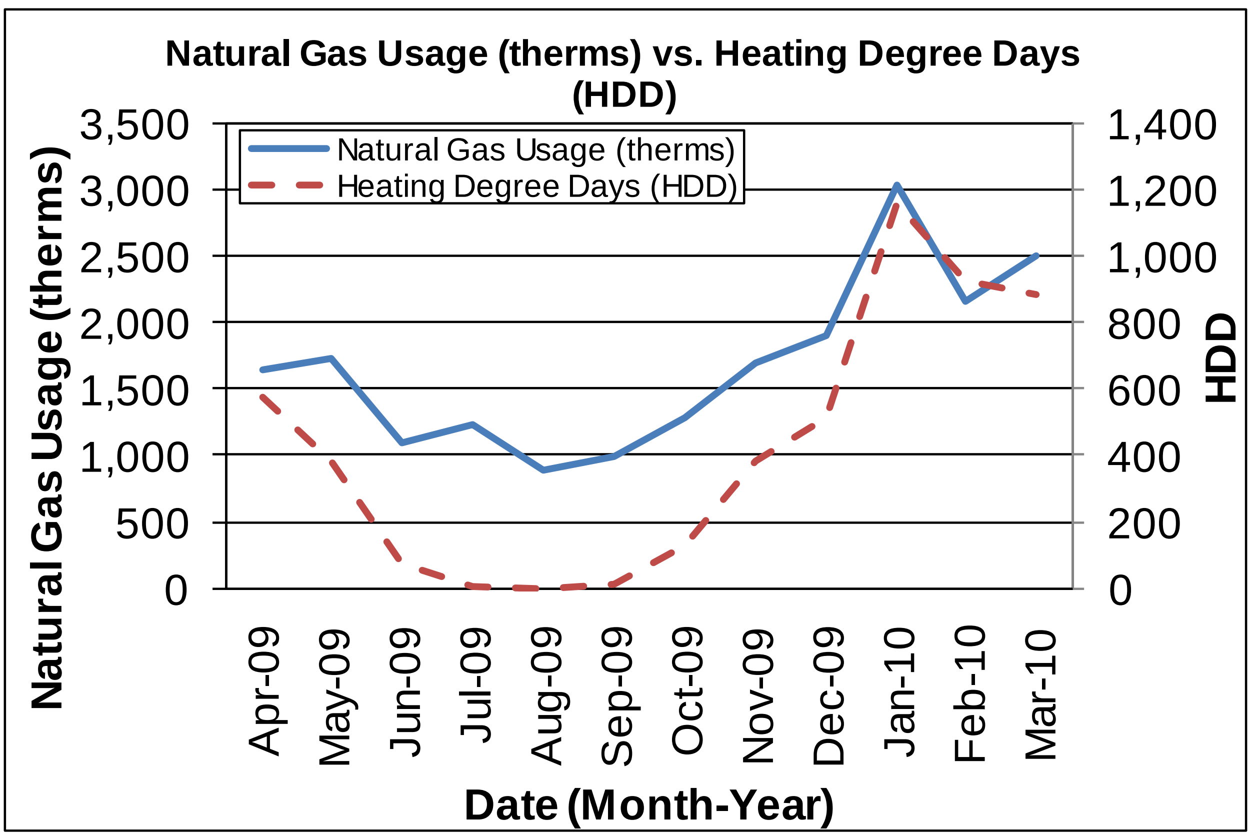


Natural gas – There is only one gas meter for all of the buildings on the Cumberland County campus. Therefore, the usage of each building was estimated based on the square footage compared to the total square footage of all buildings on the same meter. Based on this method, the Student Services Gymnasium currently buys natural gas from South Jersey Gas at **an average aggregated rate of $1.356/therm**. The Student Services Gymnasium purchased **approximately 20,162 therms, or $27,345 worth of natural gas,** in the previous year.

The chart below shows the monthly natural gas usage and costs. The green line represents the approximate baseload or minimum natural gas usage required to operate the Student Services Gymnasium.



Annual Natural Gas(therms) and Cost($)
Natural Gas Usage (therms)
Estimated Baseload (therms)
Natural Gas Cost
Natural Gas Usage (therms)
Natural Gas Cost($)
3500
3000
2500
2000
1500
1000
500
0
$4,000
$3,500
$3,000
$2,500
$2,000
$1,500
$1,000
$500
$0
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Jan-10
Feb-10
Mar-10
Date (Month-Year)

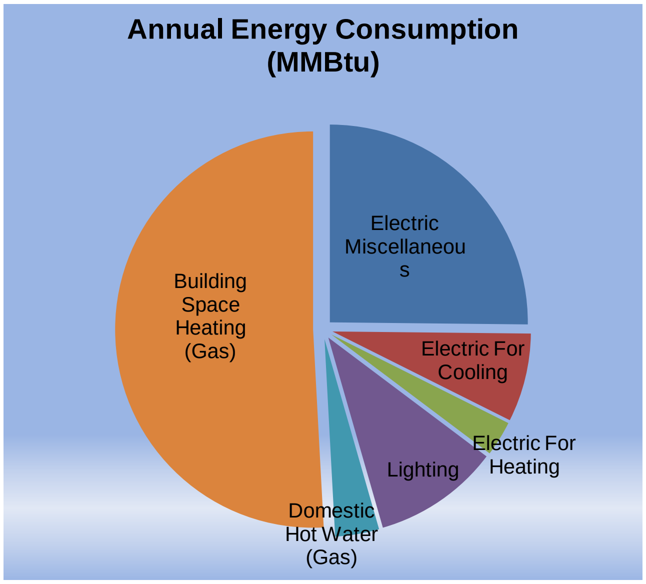


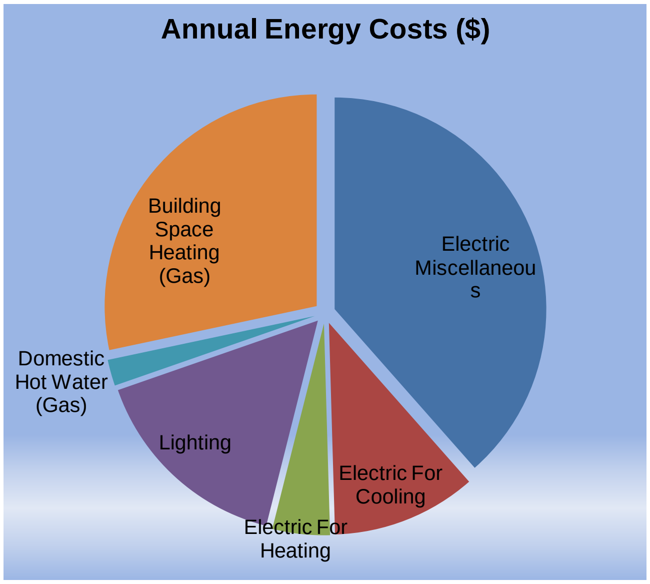
Natural Gas Usage (therms) vs. Heating Degree Days (HDD)
Natural Gas Usage (therms)
Heating Degree Days (HDD)
Natural Gas Usage (therms)
HDD
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1,400
1,200
1,000
800
600
400
200
0
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Jan-10
Feb-10
Mar-10
Date (Month-Year)

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

The following graphs, pie charts, and table show energy use for the gymnasium based on utility bills for the 12 month period. Note: electrical cost at $39/MMBtu of energy is over 2.5 times as expensive as natural gas at $15/MMBtu

Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	839	25%	$32,411	38%	39
Electric For Cooling	241	7%	$9,304	11%	39
Electric For Heating	96	3%	$3,695	4%	39
Lighting	343	10%	$13,260	15%	39
Domestic Hot Water (Gas)	120	4%	$1,790	2%	15
Building Space Heating	1,694	51%	$25,369	30%	15
Totals	3,332	100%	$85,829	100%	
Total Electric Usage	1,518	46%	$58,670	68%	39
Total Gas Usage	1,814	54%	$27,159	32%	15
Totals	3,332	100%	$85,829	100%	

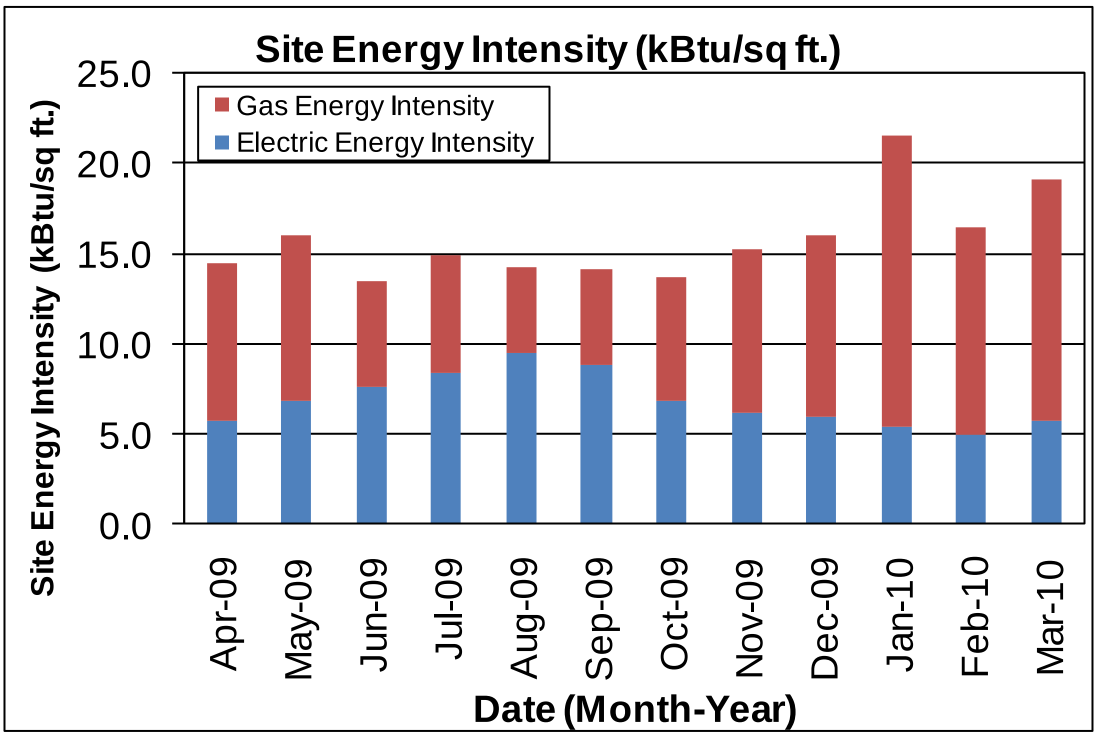




Energy benchmarking

SWA has entered energy information about the Student Services Gymnasium in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. This recreation facility is categorized as a non-eligible ("Other") space type. Because it is an "Other" space type, there is no rating available. Consequently, the Student Services Gymnasium is not eligible to receive a national energy performance rating at this time. The Site Energy Use Intensity is 186.0kBtu/ft^2-yr compared to the national average of a recreation building consuming 65.0kBtu/ft^2-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 Cumberland County College desire to reach this average there are other large scale and financially less advantageous improvements that can be made, such as envelope window, door and insulation upgrades that would help the building reach this goal.



Per the LGEA program requirements, SWA has assisted the Cumberland County College to create an *ENERGY STAR® Portfolio Manager* account and share the Student Services Gymnasium 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 Cumberland County College (user name of "cumberlandcollege" with a password of *"cumberland2010")* and TRC Energy Services (user name of "TRC-LGEA").

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 Cumberland County College 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 by the hot water boiler units. 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 needed for cooling equipment.

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 Cumberland County College is paying a general service rate for natural gas. Demand is not broken out in the bill. Thus the building pays for fixed costs such as meter reading charges during the summer months.

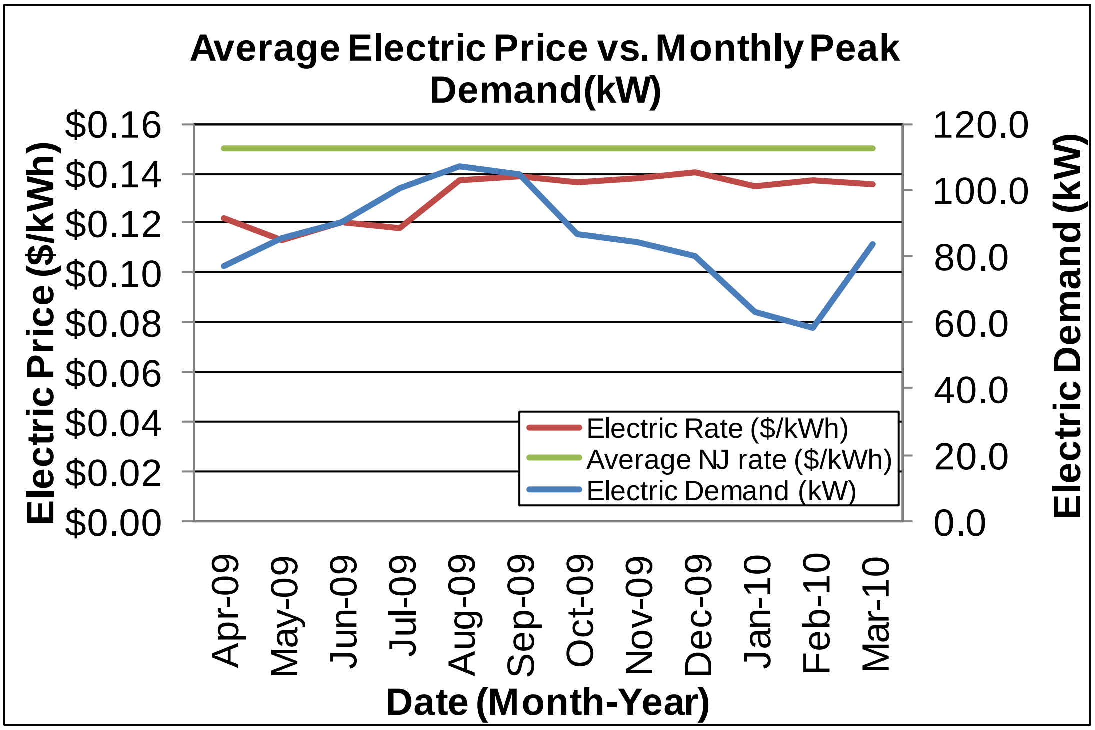
Cumberland County College has an agreement with PEPCO Energy Services as a third party electric supplier with AC Electric and also has a natural gas third party supplier. In addition, the College has an agreement with an energy services provider for a demand response program. Upon request by the provider, Cumberland County College will reduce their electric consumption in exchange for savings per kilowatt hour.

There are two electric meters and one gas meter for the entire campus. 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. Because there are not individual meters for each building, the Student Services Gymnasium usage was estimated based on square footage compared to all buildings on the same meter.

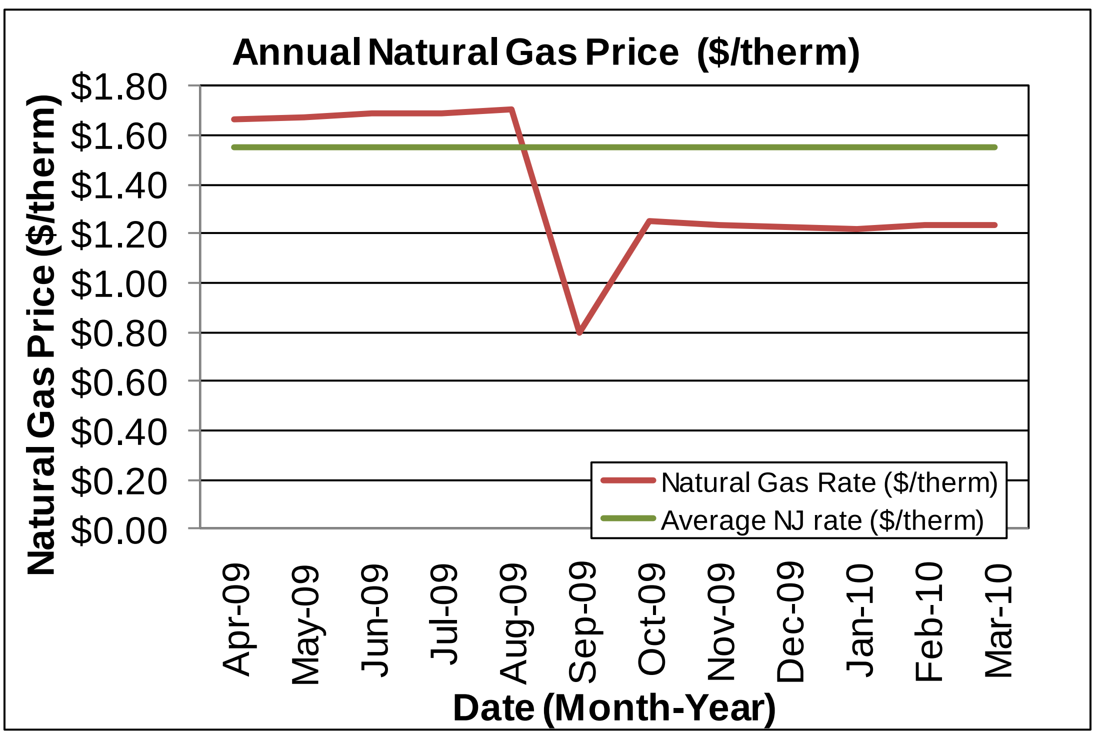
Energy Procurement strategies

Billing analysis is conducted using an average aggregated rate that is estimated based on the total energy 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 Student Services Gymnasium pays a competitive rate of $0.131/kWh. Electric bill analysis shows fluctuations up to 19% over the most recent 12 month period.



The average estimated NJ commercial utility rates for gas are $1.550/therm, while Student Services Gymnasium pays a rate of $1.356/therm. Natural gas bill analysis shows fluctuations up to 55% 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 College maintain 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 Student Services Building, as well as continue the demand response program. Appendix C contains a complete list of third-party energy suppliers for the Cumberland County College 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.

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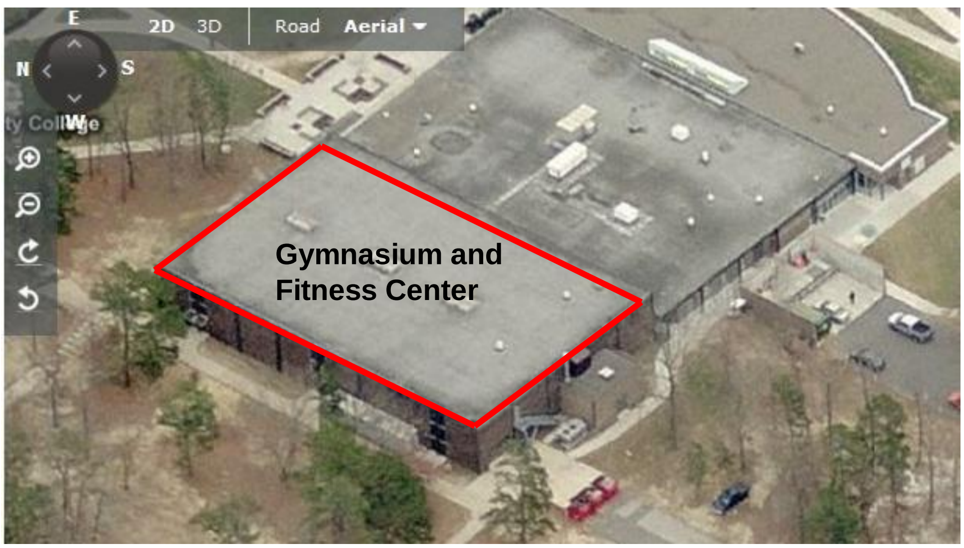
Based on visits from SWA on April 29 and June 3, 2010, the following data was collected and analyzed.

Building Characteristics

The two-story, (slab on grade,) 18,666 square feet Student Services Gymnasium-Side Building was originally constructed in 1965 with major renovations completed in 2000. This section of the building consists of a Fitness Center, offices, locker rooms and a large gymnasium.



Overall Building Site Plan

Partial Front Façade (typ.)

West Façade

Partial North Façade (typ.)

Building Occupancy Profiles

This section of the building is occupied approximately 10 to 100 students and 3 to 5 staff from 9:30am to 6:30pm Monday through Thursday, and 9:30am to 4:00pm Friday and sometimes afterhours and weekends depending on athletic and other large campus events. The Center is generally closed on weekends.

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

The exterior wall envelope is mostly constructed of brick veneer and some vinyl clapboard siding accents, with 2“air gap and 8” CMU block. The interior is mostly painted CMU (Concrete Masonry Unit). The MER added to the west of the building in 2000 consists of 8” CMU with loose-fill insulation and a brick veneer.

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

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall good condition with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all facades.

Roof

The majority of the building’s roof is predominantly a flat, no parapet built-up roof with Tectum decking, an asphalt finish and gravel ballast. The roof was constructed in 1966. There was no visible ceiling insulation and drawings indicate two to three inches of rigid roof insulation. The 1989 mechanic room addition has a flat roof with steel decking.

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

Roofs, drains and related flashing were inspected during the field audit. They were reported to be in overall good condition, with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues.

Base

The building's base is composed of a slab-on-grade floor with a perimeter foundation and no detectable perimeter insulation.

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

The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall the base was reported to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

Windows

The building contains basically one type of window:

1. Approximately 12 fixed type windows with a non-insulated aluminum frame, tinted single glazing and no interior or exterior shading devices. The windows are located throughout the Gymnasium side of the building and are original.

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

Exterior doors

The building contains several different types of exterior doors:

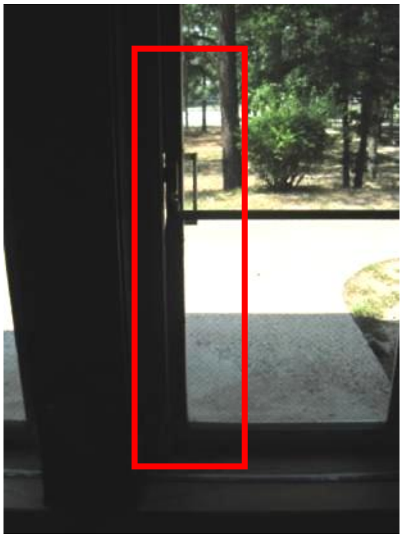
1. Three un-insulated steel type exterior doors. They are located throughout the area and are original.

2. One steel type garage exterior doors located on the west side of the building and is original.

3. Two glass with steel frame type exterior doors located at the entrance and are original.

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

The following specific door problem spots were identified:



Missing/worn weather-stripping

Building air-tightness

Overall the field auditors found the building to be reasonably air-tight, considering the building's use and occupancy, as described in more detail earlier in this chapter.

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

Mechanical Systems

Heating Ventilation Air Conditioning

There are no major thermal comfort issues however some equipment is very difficult to control and requires high maintenance. The gymnasium area is heated and cooled by the central plant, and the fitness area is served by local equipment.

Equipment

The two-story Fitness Center was added in 2000 and has separate heating and cooling equipment from the Gymnasium.

The Fitness Center is cooled by a Carrier Air-Cooled Chiller, installed outside, which cools a circulating chilled water glycol solution.

Carrier Air-Cooled Chiller

The Fitness Center is currently heated using hot water from the Central Plant. There is a stand-by Weil-McLain 305,000 Btu/hr natural gas boiler installed in the mechanical room. The boiler flue pipe is tied to the domestic hot water heater flue, and therefore has an automatic back draft damper so that the draft does not reverse into the equipment. The hot water and chilled water is used for coils in the air handling unit AHU-1 serving the Fitness Center. On AHU-1 the freeze stat can not operate properly because the heating coil is after the cooling coil; typically, if a cooling coil freezes, the hot water valve will open to heat up the flowing air and thaw the coil, however, the heating coil must be upstream of the cooling coil.

Stand-by Weil McLain NG Boiler; AHU-1

The Gymnasium is heated and cooled by the Central Plant chillers and boilers. Hot water and chilled water supply from the Plant is used for the coils within four ceiling mounted air handling units in the Gymnasium. AC-1 and AC-3 are installed with a common outside air fan and return fan. The same is true for AC-2 and AC-4. These air handling units were installed prior to 1970 and are operating well beyond their useful life. There is a natural ventilation damper in the center of the gymnasium ceiling which allows air in or out to balance the air system.

The storage area has supplemental heating by hot water unit heaters.

HW Unit Heater

The Gymnasium and Fitness Center have different outside air ventilation systems. AHU-1 serving the Fitness Center has automatic louvers to allow outside air into the mechanical room which is then drawn into the air handler. The unit has an economizer mode which optimizes outside air use when temperature and humidity levels are favorable. The four Gymnasium AC units have outside air intake directly from the roof and no economizer mode capabilities. There is a general exhaust louver on each of the four AC units.

Rooftop exhaust fans serve locker rooms and bathrooms. In general, the building exhaust fans have an estimated 50% useful operating life remaining.


Rooftop Exhaust Fan; AHU-1 MER OA Intake Damper and Exhaust Fan

Distribution Systems

A typical air handling unit draws in outside 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 heating coil, then the cooling coil. The air handler supply fan then pushes the conditioned air into the distribution system.

The Fitness Center distribution is a Variable Air Volume (VAV) system with reheat coils. VAV boxes consist of a modulating damper within the ductwork to adjust the amount of supply air to satisfy the temperature settings of the room or rooms that it serves. For dehumidification the air handler may cool the air lower than space conditions in order to condense moisture out of the air. The reheat coils installed in the ductwork at the end of the VAV assembly then heat air back to the desired space temperature. The VAVs are direct digital control and have pulse width modulation. The supply and return air fans on AHU-1 have a Variable Speed Drive to allow the fan motors to operate at a minimum speed to satisfy the needed air volume at any given time. VFD's reduce energy usage significantly since there is a cubed relationship between speed and power; when the motor speed reduces by 1/2 or 50%, the brake horsepower reduces to 1/8 or 12.5% of the power input.

The Gymnasium air handling units are ducted directly to the space and do not have any automatic volume controls.

Chilled water and hot water booster pumps are used to draw the process fluids to the air handling units. The pumps are constant speed and have approximately 50% remaining useful life.

Chilled Water Pumps

Controls

AHU-1 serving the Fitness Center has VFD controlled fans and operates to satisfy the space conditions based on local manual thermostats. As more heating or cooling is needed, valves on the heating and cooling piping will modulate to satisfy the supply air temperature set point.

AHU-1 Supply & Return Fan VFD; Manual thermostats

The Gymnasium dampers are pneumatic, requiring the use of a Honeywell air compressor.


Air Compressor

The Gymnasium air handling units were installed in 1965 and the controls for the units have not been upgraded. The chilled water valves are locked at 100% open, and therefore when it becomes too cold in the space the hot water valves open to compensate. The hot water valves do modulate based on setpoint temperature, which can only be manually and locally adjusted. The return air damper is manually adjusted as well. The controller for the all the components of the unit are manual dials with low accuracy and require regular adjustment during peak load conditions.

Since there is not an integrated control system for this building, all heating and cooling equipment operate 24 hours a day to satisfy space conditions.

AC- 1, 2, 3 & 4 Controller

Domestic Hot Water

The domestic hot water (DHW) for the Student Services Gymnasium is provided by two natural gas heated Bradford White heaters with 300,000 Btu/hr capacity and 320 gal storage each. One serves as a standby.


DHW Heaters

The heaters have 50% estimated useful operating life remaining and appear in good condition.

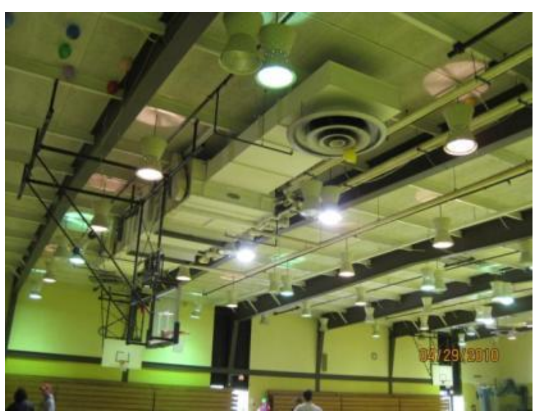
Electrical systems

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 Student Services Gymnasium currently contains a mix of CFL, T12, T8 fixtures. The Gymnasium used high bay Metal Halide fixtures. Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas.


Gym Metal Halide

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

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be CFL fixtures. Exterior lighting is controlled by timers.

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.

Elevators

The Student Services Gymnasium has an elevator for the Fitness Center.

Other electrical systems

There are not currently any other significant energy-impacting electrical systems installed at the Student Services Gymnasium other than four transformers, ranging in capacity from 45.0 kVa to 75.0 kVa and appear to be in good operating condition.

Transformers (typical)

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 are no renewable energy systems installed in the building.

Evaluated Systems

Solar Photovoltaic

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

Based on utility analysis and a study of roof conditions, the Student Services Gymnasium is a good candidate for a 30 kW Solar Panel installation. See ECM# 5 for details.

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

Geothermal

The Student Services Gymnasium is not a good candidate for geothermal installation since it would require replacement of the entire existing HVAC system, of which major components still have between 50% and 75% remaining useful life.

Combined Heat and Power

The Student Services Gymnasium is not a good candidate for CHP installation and would not be cost-effective due to the size and operations of the building. Typically, CHP is best suited for buildings with a high electrical baseload 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 of Highly Recommended 0-5 Year Payback ECMs
1	Upgrade Fitness Center thermostats for each VAV to programmable type
2	60 New CFL fixtures to be installed
3	40 New T5 fixtures to be installed with incentives
	Description of Recommended 5-10 Year Payback ECMs
4	Replace AC-1, 2, 3, & 4 with Two New AHU's & control with Demand Control Ventilation
5	Install 30 kW Solar Photovoltaic system

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

ECM#1: ***Upgrade Fitness Center thermostats to Programmable type***

During the field audit, SWA completed a building HVAC controls analysis and observed spaces in the building where temperature is manually controlled without setbacks to reduce energy consumption during unoccupied periods of time, such as evenings and weekends. Programmable thermostats offer an easy way to save energy when correctly used. By turning the thermostat setback 8 to 10 degrees F for eight hours at a stretch (at night), the heating bill can be reduced substantially (by a minimum of 10% per year). In the summer, the cooling bill can be reduced by keeping the conditioned space warmer when unoccupied, and cooling it down only when using the space. The savings from using a programmable thermostat is greater in milder climates than in more extreme climates. 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. The Fitness Center air handling unit, AHU-1, serves several VAV boxes but does not have programmable thermostats for evening setbacks. The financial calculations below are for converting four manual thermostats to a programmable type. It is assumed that there will be evening setbacks for 8 hours a day for which the setpoint adjusts from 70 deg to 62 deg in the winter and 78 deg in the summer.

Installation cost:
Estimated installed cost: $668 (includes $256 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

ECM #	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 energy cost savings, $	simple payback, yrs	annual return on investment, %	CO_2 reduced, lbs/yr
1	668	0	668	3,837	1	234	2	467	1,286	12	15,428	0.5	2,210	9,450

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed evening setbacks for 8 hours a day for which the setpoint will adjust from 70 deg to 62 deg in the winter and 78 deg in the summer.

Rebates/financial incentives:

- *None at this time*

Please see Appendix F for more information on Incentive Programs.

ECM#2: ***Building Lighting Upgrades: 60 Incandescent lamps replaced with CFLs***

During the field audit, SWA completed a building lighting inventory (see Appendix B). The existing lighting also contains 60 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: $3,931 (includes $2,949 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

ECM #	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 energy cost savings, $	simple payback, yrs	annual return on investment, %	CO_2 reduced, lbs/yr
2	3,931	0	3,931	31,034	6	0	6	469	4,380	5	21,898	0.9	457	55,566

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 9 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

- *None at this time*

Please see Appendix F for more information on Incentive Programs.

ECM#3: ***Building Lighting Upgrades:* 40 *Metal Halide replaced with T5 fixtures***

During the field audit, SWA completed a building interior as well as exterior lighting inventory (see Appendix B). The existing Gymnasium lighting consists of 40 standard probe start Metal Halide (MH) lamps at a rated 400 Watts each. 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 by substituting each 400 W Metal Halide fixture with an 8-lamp T5 fixture. 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: $10,960 (includes $8,220 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

ECM #	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 energy cost savings, $	simple payback, yrs	annual return on investment, %	CO_2 reduced, lbs/yr
3	11,600	640	10,960	23,629	5	0	4	1,600	4,577	15	68,659	2.4	526	42,308

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 25 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

- *NJ Clean Energy - Metal Halide with T5 ($16 per fixture) - Maximum incentive amount is $640.*

Please see Appendix F for more information on Incentive Programs.

ECM#4: *Replace AC-1, 2, 3, & 4 with Two New AHUs using DCV*

The Gymnasium air handling units AC-1, 2, 3, & 4 are well beyond their useful life and are manually controlled. The four units can be replaced with two new air handling units, such as a Trane high Performance Climate Changer each sized for the capacity of two of the existing AHU's; approximately 25 tons cooling and 200,000 Btu/hr heating capacity. The piping leading to the units must also be upgraded with new automated control valves. The unit can be installed on the roof of the gym or suspended from the ceiling and ducted to the space below. The features of the new unit should include: premium efficiency fan motors with variable speed drive, economizer mode operation, automatic valve modulation, dehumidification and 2-stage filter. The unit should be controlled based primarily on demand controlled ventilation, with CO2 sensors in the return ducts.

Demand controlled ventilation (DCV) is the process of automatically modulating the rate of outdoor air supply (i.e., rate of ventilation) as the "demand" or need for ventilation varies. The objective is to keep ventilation rates at the minimum for code requirements and also to save energy by avoiding excessive ventilation rates, as energy is consumed to heat, cool, and dehumidify the ventilation air supplied to space. The need for ventilation is increased when the rate of air pollutant generation from indoor sources is high. People, especially active people, are a major source of indoor pollutants. Thus, DCV is most often implemented in spaces with sometimes high and temporally variable occupant density.

When the Gymnasium is in use the ventilation will have to increase, but all the hours in between, the ventilation can be lowered to a minimum position. In the usual application of DCV, ventilation rates are automatically modulated based on measured indoor concentrations of carbon dioxide (CO2), as CO2 is emitted by people as a metabolic by product and more easily measured than other air pollutants resulting from occupancy. When the indoor occupant density is increased, the indoor concentration of CO2 increases, unless the ventilation rate also increases. Carbon dioxide is not generally considered a directly harmful air pollutant at the concentrations found indoors - rather the concentration of CO2 is considered a proxy for the concentration of a variety of other odorous or potentially harmful pollutants emitted by people or their activities. A typical DCV system is designed to modulate ventilation rates over time so that indoor carbon dioxide concentrations do not exceed a set point value. The set point CO2 concentration is typically between 800 and 1000 parts per million with outside CO2 levels typically at low concentrations of around 400 to 450 ppm. A conservative savings of 15% heating and cooling energy can be expected with this type of control.

Installation cost:

Estimated installed cost: $62,410 (includes $19,260 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Details	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 energy cost savings, $	simple payback, yrs	annual return on investment, %	CO_2 reduced, lbs/yr
New Controls with DCV	8,000	1,550	6,450	28,778	5.5	1,404	12.8	1,000	6,667	15	99,998	1.0	97	67,003
Remove old AC Units Install Two New AHU's	56,200	240	55,960	19,185	3.6	936	8.5	1,500	5,278	15	79,165	10.6	3	44,669
TOTAL	**64,200**	**1,790**	**62,410**	**47,963**	**9.1**	**2,340**	**21.3**	**2,500**	**11,944**	**15**	**179,164**	**5.2**	**12**	**111,672**

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumed a conservative 15% savings in heating and cooling costs for DCV, as well as 10% energy savings for upgraded AHU equipment. Also, it is assumed that each unit will use premium efficiency fan motors; a 5.0 HP supply fan and a 2.0 HP return/exhaust fan.

Rebates/financial incentives:

- *NJ Clean Energy – Variable Frequency Drive on 5 HP to 10 HP motors - $155/HP - $1550 total*
- *NJ Clean Energy – Premium Efficiency Motors – 2 HP or 5 HP - $60/motor - $240 total*

Please see Appendix F for more information on Incentive Programs.

ECM#5: *Install 30.0 kW Solar Photovoltaic system*

Currently, the building does not use any renewable energy systems. Renewable energy systems such as photovoltaic (PV) panels can be mounted on the building roof facing south which can offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, electric demand at a power station is high, due to the amount of air conditioners, lights, and other equipment being used within the region. Demand charges increase to offset the utility's cost to provide enough electricity at that given time. Photovoltaic systems offset the amount of electricity used by a building and help to reduce the building's electric demand, resulting in a higher cost savings. Installing a PV system will offset electric demand and reduce annual electric consumption, while utilizing available state incentives. PV systems are modular and readily allow for future expansions.

The size of the system was determined considering the available roof surface area, without compromising service space for safety, as well as the facilities' annual base load and mode of operation. According to building staff, the existing roof structure is not adequate to support the weight of the panels; therefore, the panels can be installed on available land and pitched south. A commercial multi-crystalline 123 watt panel has 10.5 square feet of surface area. A 30.0kW system needs approximately 244 panels which would take up 2,609 square feet.

A PV system would reduce the building's electric load and allow more capacity for surrounding buildings as well as serve as an example of energy efficiency for the community. The building is not eligible for a residential 30% federal tax credit. The building owner may want to consider applying for a grant and / or engage a PV generator / leaser who would install the PV system and then sell the power at a reduced rate. Typically, a major utility provides the ability to buy SREC's at $600/MWh or best market offer. Please see below for more information. Calculation details and annual cost savings breakdown is provided in Appendix D.

Please note that this analysis did not consider the structural capability of the existing building to support the above recommended system. SWA recommends that the Cumberland County College contract with a structural engineer to determine if additional building structure is required to support the recommended system and what costs would be associated with incorporating the additional supports prior to system installation. Should additional costs be identified, the College should include these costs in the financial analysis of the project.

Installation cost:

Estimated installed cost: $187,500 (includes $120,000 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

ECM #	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 energy cost savings, $	simple payback, yrs	annual return on investment, %	CO_2 reduced, lbs/yr
5	210,000	22,500	187,500	35,400	30	0	6	0	25,628	25	640,701	7.3	242	63,384

For 25 Year Cash Flow, see Appendix D.

Assumptions: SWA estimated the cost and savings of the system based on past PV projects. SWA projected physical dimensions based on a typical Polycrystalline Solar Panel (123 Watts, Model ND-123UJF). PV systems are sized based on 30,000 Watts and physical dimensions for an array will differ with the efficiency of a given solar panel (W/sq ft).

Rebates/financial incentives:

- *NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on $0.75/watt Solar PV application for systems 30.0 kW or less. Incentive amount for this application is $22,500 for the Cumberland County College.* http://www.njcleanenergy.com/renewable-energy/programs/renewable-energy-incentive-program

- *NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1,000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. A total of $21,000/year, based on $600/SREC, has been incorporated in the above costs for a period of 15 years; however it requires proof of performance, application approval and negotiations with the utility.*

Please see Appendix 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 Student Services Gymnasium:

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

- There are 23 T12 fixtures and magnetic ballasts which should be replaced with T8 fixtures and electronic ballasts as they fail. This measure typically has a payback less than 10 years, however due to low electric rates and using 34 W T12 lamps instead of 40W, in this case, the payback is in excess of 20 years.

- Following completion of ECM#4 for replacing AC-1, 2, 3, & 4 and ECM#1 for upgrading thermostats to programmable type: Add all HVAC equipment and space condition set points to campus-wide Electronic Building Integrator System for remote access to all control points such as: supply air temperatures, outside air temperatures, space temperature set points, humidity, valve position, damper position, VAV box position and high/low pressure alarms. Installed cost of controls upgrade is approximately $8,500.

- Once Air Cooled chiller reaches end of useful life, approximately by year 2015, remove the chiller and connect AHU-1 cooling piping to the Central Plant if there is ample thermal and pumping capacity at the Central Plant without major plant upgrades.
    - During this change-over, it is a good opportunity to reverse the position of the AHU-1 heating and cooling coils to allow proper freezestat operation.

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.

- Install/replace and maintain weather-stripping around all exterior doors and roof hatches.

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

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

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

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

Note: The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for Cumberland County College. Based on the requirements of the LGEA program, Cumberland County 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 $1,946.

APPENDIX A: EQUIPMENT LIST

Inventory

Building System	Description	Location	Make/ Model	Fuel	Space Served	Date Installed	Estimated Remaining Useful Life %
Heating	*Boiler, Not Active, 305,000 BTU/HR, back draft damper, shares flue with DHW heater*	*MER*	*Weil-McLain/PFG Boiler/PFG-6-PIN*	*Gas*	Athletic Center	2000	50%
Cooling	Chiller, 3 phase, R-22, 2 Fans (1HP, 0.75kW out), 23.8 Tons, 27.9kW input, 9.6 EER	Outdoor	Carrier/30GTN02 5---600, SN#0900F82946	Elec.	Athletic Center	1995	25%
Cooling	CHW (glycol) pump Motor, 1.5 HP, 1725 RPM, 78.5% eff, 3 phase	MER	Baldor/VJMW315 41	Elec.	Athletic Center	2000	50%
Cooling	CHW (glycol) pump Motor, 1.5 HP, 1725 RPM, 78.5% eff, 3 phase	MER	Baldor/VJMW315 41	Elec.	Athletic Center	2000	50%
Cooling	Hot Water Pump Motor, 1.0 HP, 1750RPM, NEMA EFF 78.5%	MER	US Motors/Cat#DJ1S 2AMR	Elec.	Athletic Center	2000	50%
Cooling	Hot Water Pump Motor, 1.0HP, 1750RPM, NEMA EFF 78.5%	MER	US Motors/Cat#DJ1S 2AMR	Elec.	Athletic Center	2000	50%
Cooling	Motor, 3 Phase, 10 HP, NEMA EFF 86.5-89.5%, 1430-1745 RPM	MER	MagneTek Century E-Plus/6-850095-01-F3/SN# BUZ	Elec.	Elevator	2000	50%
Dehumidification	Air Dryer 10 SCFM @ 100 PSIG & 100*F, R-134a (3.0 oz.)	MER	Hankison/HKNHP R5-10-V, SN#H510A11504 11187	Elec.	Athletic Center	2000	50%
Ventilation	Exhaust Vent	MER	Loren Cook/120C3B 33	Elec.	Athletic Center	2000	50%
Pneumatics	Compressor, Motor 2HP, 1725 RPM, NEMA NOM EFF 84%, 3 Phase	MER	Honeywell, Baldor M3157F, Spec#35B101T69 8HI	Elec.	Athletic Center	2000	50%
DHW	Min. 300,000 BTU/HR, Max. 600,000 BTU/HR, 320 gal cap., recovery rate 600 GPH, Min. 300 MBH, 600 MBH, 1/4 HP, 83% Thermal Eff	MER	Bradford White/R320-700-5NA, SN#T-15372 TK.1, Power Flame Burner/JR15A-10-700, SN#089936459	Gas	Athletic Center	2000	50%
DHW	Min. 300,000 BTU/HR, Max. 600,000 BTU/HR, 320 gal cap., recovery rate 600 GPH, Min. 300 MBH, 600 MBH, 1/4 HP, 83% Thermal Eff.	MER	Bradford White/R320-700-5NA, SN#T-15372 TK.2, Power Flame Burner/JR15A-10-700, SN#089831158	Gas	Athletic Center	2000	50%
DHW	Recirculation Pump, 3/4 HP Motor, 3 phase, 1725 RPM	MER	Bell&Gossett/7VB 48T17D164D P/ part#903583	Elec.	Athletic Center	2000	50%

Building System	Description	Location	Make/ Model	Fuel	Space Served	Date Installed	Estimated Remaining Useful Life %
Transformer	75.0 kVa	Gym Storage MER	Siemens, 3F3T075K13C, Series H	Elec.	Athletic Center	2005	75%
Transformer	Three Wall Mounted Transformers, 45.0 kVa	Gym Storage MER	GE 9T23A3873	Elec.	Athletic Center	2000	50%
Transformer	Transformer, no nameplate, 75.0 kVa	Gym Storage MER	NA	Elec.	Athletic Center	1990	0%
Transformer	45.0 kVa	MER	Square D company, Cat#45T3H	Elec.		2000	50%
Ventilation	EF-1 Exhaust Fan, 1725 RPM	Rooftop	Loren Cook, 150C5B	Elec.	Athletic Center	2000	50%
Ventilation	EF-2 Exhaust Fan, 1725 RPM	Rooftop	Loren Cook, 120C3B	Elec.	Athletic Center	2000	50%
Ventilation	Two large hood-type fresh air intakes for AC-1,2,3&4 fans	Rooftop	NA	Elec.	Gym	1965	0%
Ventilation	MER Exhaust fan, 1050 RPM	MER	Loren Cook,	Elec.	Athletic Center	2000	50%
Ventilation	MER Automatic OA damper, opened upon DHW activation	MER	NA	Elec.	Athletic Center	2000	50%
Heating/Cooling	AHU-1 Air Handling Unit with heating and cooling coils, Fan motor, 89.5% eff., 10 HP,	MER	Carrier S#1300F89705, 39T7S4AP---RAKHE-AD, Marathon Fan Motor: Cat#E721	Elec.	Fitness Center Offices	2000	50%
Heating/ Cooling	AHU Gym - AC-2, AC-4, 6,000 CFM, 1,000 OA CFM, 2.0HP Motor, 159,000 Btu/hr Cooling each, 195,000 Btu/hr Heating each, shared return fan and shared OA fan	Gymnasium - Ceiling Mounted	Carrier, Cat#39AC-9	Elec.	Gym	1965	0%
Heating/Cooling	AHU Gym - AC-1, AC-3, 6,000 CFM each, 1,000 OA CFM, 2x 2.0HP Motor, 159,000 Btu/hr Cooling each, 195,000 Btu/hr Heating each, shared return fan and shared OA fan	Gymnasium - Ceiling Mounted	Carrier, Cat#39AC-9	Elec.	Gym	1965	0%
Lighting	See Appendix A	-	Various	Elec.	Athletic Center	2000	50%

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	1	Gymnasium	High Bay	S	MH	40	1	400	Sw	8	260	112	20,480	42,598	T5	High Bay	4'T5	E	Sw	40	8	28	8	260	4	9120	18969	23629	0	23629
2	1	Gymnasium	Exit Sign	S	LED	5	1	5	N	24	365	1	28	241	N/A	Equipment / Fume Hood	LED	S	N	5	1	5	24	365	1	28	241	0	0	0
3	1	Training	Recessed Parabolic	E	4'T8	5	4	32	Sw	8	260	5	665	1,383	N/A	Recessed Parabolic	4'T8	E	Sw	5	4	32	8	260	5	665	1383	0	0	0
4	1	Training	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Equipment / Fume Hood	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
5	1	Athletic storage	Recessed Parabolic	E	4'T8	2	2	32	Sw	2	260	5	138	72	N/A	Recessed Parabolic	4'T8	E	Sw	2	2	32	2	260	5	138	72	0	0	0
6	1	Locker Room Men	Recessed Parabolic	E	4'T8	10	4	32	Sw	8	260	5	1,330	2,766	N/A	Recessed Parabolic	4'T8	E	Sw	10	4	32	8	260	5	1330	2766	0	0	0
7	1	Locker Room Men	Recessed Parabolic	E	4'T8	4	2	32	Sw	8	260	5	276	574	N/A	Recessed Parabolic	4'T8	E	Sw	4	2	32	8	260	5	276	574	0	0	0
8	1	Locker Room Men	Recessed Parabolic	S	Inc	3	1	60	Sw	8	260	0	180	374	CFL	Recessed Parabolic	CFL	S	Sw	3	1	20	8	260	0	60	125	250	0	250
9	1	Locker Room Men	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Equipment / Fume Hood	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
10	1	Gymnasium	Recessed	S	Inc	1	1	60	Sw	8	260	0	60	125	CFL	Recessed	CFL	S	Sw	1	1	20	8	260	0	20	42	83	0	83
11	1	receiving	Parabolic Ceiling Suspended	M	8'T12	2	2	80	Sw	8	260	20	360	749	T8	Parabolic Ceiling Suspended	8'T8	E	Sw	2	2	59	8	260	7	250	520	229	0	229
12	1	receiving	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Equipment / Fume Hood	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
13	2	Landing	Recessed Parabolic	E	4'T8	1	4	32	Sw	8	260	5	133	277	N/A	Recessed Parabolic	4'T8	E	Sw	1	4	32	8	260	5	133	277	0	0	0
14	2	Bathroom	Recessed Parabolic	M	4'T12	1	4	34	Sw	8	260	10	146	304	T8	Recessed Parabolic	4'T8	E	Sw	1	4	32	8	260	5	133	277	27	0	27
15	2	Athletic office	Recessed Parabolic	E	4'T8	9	4	32	Sw	9	260	5	1,197	2,801	N/A	Recessed Parabolic	4'T8	E	Sw	9	4	32	9	260	5	1197	2801	0	0	0
16	2	Athletic office	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Equipment / Fume Hood	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
17	2	Athletic office (1)	Recessed Parabolic	E	4'T8	4	3	32	Sw	8	260	5	404	840	N/A	Recessed Parabolic	4'T8	E	Sw	4	3	32	8	260	5	404	840	0	0	0
18	2	Athletic office (2)	Recessed Parabolic	E	4'T8	1	4	32	Sw	8	260	5	133	277	N/A	Recessed Parabolic	4'T8	E	Sw	1	4	32	8	260	5	133	277	0	0	0
19	2	Fitness Center	Recessed Parabolic	M	4'T12	3	4	34	Sw	8	260	10	439	912	T8	Recessed Parabolic	4'T8	E	Sw	3	4	32	8	260	5	399	830	82	0	82
20	2	Fitness Center	Ceiling Suspended	S	Inc	12	1	60	Sw	8	260	0	720	1,498	CFL	Ceiling Suspended	CFL	S	Sw	12	1	20	8	260	0	240	499	998	0	998

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)
21	2	Fitness Center	Ceiling Suspended	S	CFL	2	1	13	Sw	8	260	0	26	54	N/A	Ceiling Suspended	CFL	S	Sw	2	1	13	8	260	0	26	54	0	0	0
22	2	Fitness Center	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Equipment / Fume Hood	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
23	1	Locker Room Women	Recessed Parabolic	M	4'T12	8	4	34	Sw	8	260	10	1,170	2,433	T8	Recessed Parabolic	4'T8	E	Sw	8	4	32	8	260	5	1064	2213	220	0	220
24	1	Locker Room Women	Recessed Parabolic	M	4'T12	4	2	34	Sw	8	260	10	313	651	T8	Recessed Parabolic	4'T8	E	Sw	4	2	32	8	260	5	276	574	77	0	77
25	1	Locker Room Women	Recessed	S	Inc	3	1	60	Sw	8	260	0	180	374	CFL	Recessed	CFL	S	Sw	3	1	20	8	260	0	60	125	250	0	250
26	1	Locker Room Women	Wall Mounted	S	Inc	1	1	60	Sw	8	260	0	60	125	CFL	Wall Mounted	CFL	S	Sw	1	1	20	8	260	0	20	42	83	0	83
27	1	Elevator Mech. Rm	Wall Mounted	M	4'T12	1	2	34	Sw	2	260	10	78	41	T8	Recessed	4'T8	E	Sw	1	2	32	2	260	5	69	36	5	0	5
28	1	Mechanical Rm	Ceiling Suspended	M	8'T12	2	2	80	Sw	2	260	20	360	187	T8	Ceiling Suspended	4'T8	E	Sw	4	2	32	2	260	5	276	144	44	0	44
29	1	Gymnasium	High Bay	S	Hal	40	1	400	Sw	8	260	88	19,520	40,602	CFL	High Bay	CFL	S	Sw	40	1	135	8	260	0	5400	11232	29370	0	29370
30	Ext	Exterior	Wall Mounted	S	CFL	4	1	32	PC	12	260	0	128	399	N/A	Wall Mounted	CFL	S	PC	4	1	32	12	260	0	128	399	0	0	0
31	Ext	Exterior	Wall Mounted	S	CFL	6	1	23	PC	12	260	0	138	431	N/A	Wall Mounted	CFL	S	PC	6	1	23	12	260	0	138	431	0	0	0
Totals:						181	63	1,784				334	48,699	101,425						183	70	868			84	22,021	46,079	55,346	0	55,346
Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space																														

Proposed Lighting Summary Table			
Total Gross Floor Area (SF)	18,666		
Average Power Cost ($/kWh)	0.1310		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	830	830	**0**
Exterior Power (watts)	266	266	**0**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	100,595	45,249	**55,346**
Lighting Power (watts)	48,433	21,755	**26,679**
Lighting Power Density (watts/SF)	2.59	1.17	**1.43**
Estimated Cost of Fixture Replacement ($)	18,945		
Estimated Cost of Controls Improvements ($)	0		
Total Consumption Cost Savings ($)	**9,391**		

Legend							
Fixture Type		**Lamp Type**			**Control Type**	**Ballast Type**	**Retrofit Category**
Ceiling Suspended	Recessed	CFL	3'T12	8'T5	Autom. Timer (T)	S (Self)	N/A (None)
Exit Sign	Sconce	Inc	3'T12 U-Shaped	8'T5 U-Shaped	Bi-Level (BL)	E (Electronic)	T8 (Install new T8)
High Bay	Spotlight	LED	3'T5	8'T8	Contact (Ct)	M (Magnetic)	T5 (Install new T5)
Parabolic Ceiling Mounted	Track	HPS	3'T5 U-Shaped	8'T8 U-Shaped	Daylight & Motion (M)		CFL (Install new CFL)
Parabolic Ceiling Suspended	Vanity	MH	3'T8	Circline - T5	Daylight & Switch (DLSw)		LEDex (Install new LED Exit)
Pendant	Wall Mounted	MV	3'T8 U-Shaped	Circline - T8	Daylight Sensor (DL)		LED (Install new LED)
Recessed Parabolic	Wall Suspended	1'T12	4'T5	Circline - T12	Delay Switch (DSw)		D (Delamping)
Ceiling Mounted	Wallpack	1'T12 U-Shaped	4'T5 U-Shaped	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 Atlantic City Electric Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com
ConEdison Solutions 535 State Highway 38 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com

Third Party Electric Suppliers for Atlantic City Electric Service Territory	Telephone & Web Site
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 www.sel.com
Suez Energy Resources NA, Inc. 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com

Third Party Gas Suppliers for South Jersey Gas Service Territory	Telephone & Web Site
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 www.cooperativenet.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com
Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateastern.com
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 www.intelligentenergy.org
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	(877) 750-7046 www.metromediaenergy.com

Third Party Gas Suppliers for South Jersey Gas Service Territory	Telephone & Web Site
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
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.

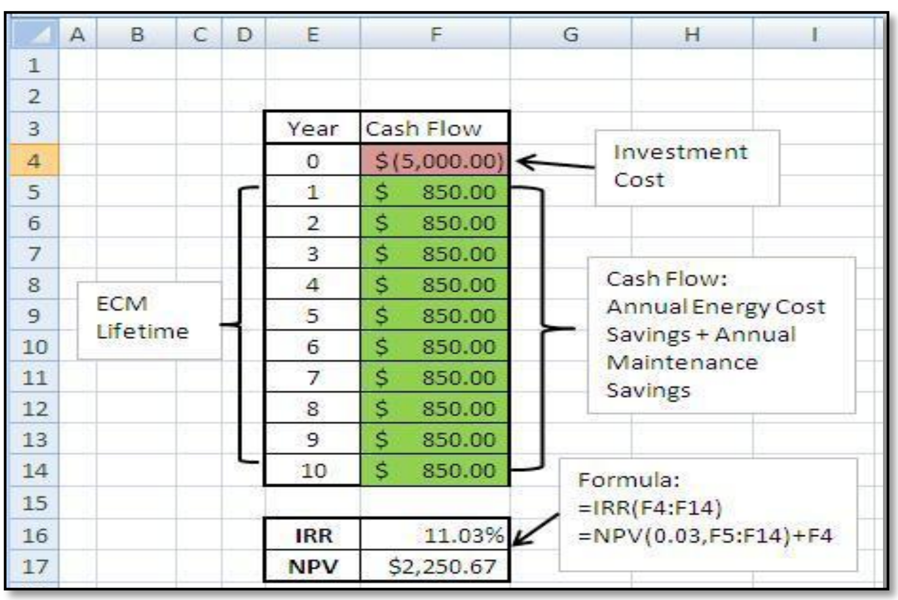
Calculation References

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 50kW or less, $1/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]

Annual Solar PV Cost Savings Breakdown				
Rated Capacity (kW)	30.0			
Rated Capacity (kWh)	35,400			
Annual Capacity Loss	0%			
Year	kWh Capacity	Installed Cost	Incentives	Electric Savings ($)
0		$210,000	$22,500	
1	35,400		$21,000	$4,628
2	35,400		$21,000	$4,628
3	35,400		$21,000	$4,628
4	35,400		$21,000	$4,628
5	35,400		$21,000	$4,628
6	35,400		$21,000	$4,628
7	35,400		$21,000	$4,628
8	35,400		$21,000	$4,628
9	35,400		$21,000	$4,628
10	35,400		$21,000	$4,628
11	35,400		$21,000	$4,628
12	35,400		$21,000	$4,628
13	35,400		$21,000	$4,628
14	35,400		$21,000	$4,628
15	35,400		$21,000	$4,628
16	35,400		$0	$4,628
17	35,400		$0	$4,628
18	35,400		$0	$4,628
19	35,400		$0	$4,628
20	35,400		$0	$4,628
21	35,400		$0	$4,628
22	35,400		$0	$4,628
23	35,400		$0	$4,628
24	35,400		$0	$4,628
25	35,400		$0	$4,628
	kWh	Cost	Saving	
Lifetime Total	**885,000**	**($210,000)**	**$337,500**	**$115,701**

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

STATEMENT OF ENERGY PERFORMANCE
Cumberland County College - Student Services Gymnasium

Building ID: 2346721
For 12-month Period Ending: February 28, 2010[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: June 24, 2010

Facility
Cumberland County College - Student Services Gymnasium
3322 College Drive
Vineland, NJ 08360

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1965
Gross Floor Area (ft²): 18,666

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	1,522,533
Natural Gas (kBtu)[4]	1,942,204
Total Energy (kBtu)	3,464,737
Energy Intensity[5]	
Site (kBtu/ft²/yr)	186
Source (kBtu/ft²/yr)	381
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	335
Electric Distribution Utility	
Vineland City of	
National Average Comparison	
National Average Site EUI	65
National Average Source EUI	136
% Difference from National Average Source EUI	180%
Building Type	Recreation

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

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

Payback	ECM #	ECM description	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
0-5 Year Payback	1	Upgrade Fitness Center thermostats for each VAV to programmable type	0	668	3,837	1	234	2	467	1,286	12	15,428	0.5	2,210	184	192	11,607	9,450
	2	60 New CFL fixtures to be installed with incentives	0	3,931	31,034	6	0	6	469	4,380	5	21,898	0.9	457	91	109	15,515	55,566
	3	40 New T5 fixtures to be installed with incentives	640	10,960	23,629	5	0	4	1,600	4,577	15	68,659	2.4	526	35	42	41,571	42,308
5-10 Year Payback	4	Replace AC-1, 2, 3, & 4 with 2 HVAC Unit serving Gym & control with demand Control Ventilation	1,790	62,410	47,963	9	2,340	21	2,500	11,944	15	179,164	5.2	187	12	17	75,716	111,672
	5	Install 30 kW Solar Photovoltaic system	22,500	187,500	35,400	30	0	6	0	25,628	25	640,701	7.3	242	10	11	134,138	63,384

APPENDIX H: METHOD OF ANALYSIS

Assumptions and tools

Energy modeling tool:	Established/standard industry assumptions
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.