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
Fine and Performing Arts Building
3322 College Drive
Vineland, NJ 08360

Project Number: LGEA66

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Cumberland County College Fine and Performing Arts Building is a single-story building comprising a total conditioned floor area of 42,756 square feet. The original structure was built in 1992, with additions in 2002. 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	1,027,942	45,868	$120,881	186.0	8,094
Proposed	714,806	41,632	$44,119	149.0	6,602
Savings	313,136	4,236	$76,763	37.0	1492
% Savings	30%	9%	64%	20%	18%
Renewable Savings Including SRECs	*35,400*	*NA*	*$25,628*	*0.8*	*63*

There may be energy procurement opportunities for the Cumberland County College Fine and Performing Arts Building to reduce annual utility costs, which can be explored in more detail once the Fire Arts Building is separately metered for energy usage.

SWA has also entered energy information about the Fine and Performing Arts Building in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. This College is comprised of non-eligible ("Other") space type. The resulting score is 186.0 kBtu/sqft-yr, which is higher than the average comparable building by 55%.

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	$73,749	1.0	$76,715	586,561
5-10 Year	$1,340	9.2	$12,388	9,365
>10 year	$1,674	18.7	$31,216	11,435
Total	$76,763	1.6	$120,319	607,361
Renewable	*$25,628*	*7.3*	*$187,500*	*63,384*

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 50 cars from the roads each year or avoiding the need of 1,478 trees to absorb the annual CO_2 generated.

Further Recommendations:

SWA recommends that the Fine and Performing Arts Building further explore the following:

- Capital Improvements
  - Install premium motors when replacements are required
  - Add all HVAC equipment and space conditions to campus Electronic Building Integrator (EBI) System
- Operations and Maintenance
  - Insect nesting should be removed from all exterior surfaces
  - Install and maintain weather-stripping around all exterior doors and roof hatches.
  - Provide water-efficient fixtures and controls
  - SWA recommends that the building considers purchasing the most energy-efficient equipment
  - Use smart power electric strips
  - Create an energy educational program

See more details in Proposed Further Recommendations section on p.48.

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 $2,951.

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 Fine and Performing Arts Building

Recommended ECMs	Incentive Program (Please refer to Appendix F for details)
Install New AHU for Theatre	Pay for Performance OR Direct Install
Upgrade 27 manual thermostats to programmable	Pay for Performance
Replace 16 Std. Eff. Motors with Premium Eff.	Pay for Performance OR Direct Install OR SmartStart
Install 12 VFD's	Pay for Performance OR Direct Install OR SmartStart
Lighting: Replace Inc with CFL, MH to PSMH, T12 to T8	Direct Install OR SmartStart

There are various incentive programs that the Cumberland County College could apply for that could help lower the cost of installing the ECMs. Although the building is partially powered by a Municipal Utility, Vineland Electric, this should not limit eligibility for incentives programs. For the Fine and Performing Arts Building, and contingent upon available funding, SWA recommends the following 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. The application requires 12 months of electric bills for the building.

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.
AND For each 1,000 kWh generated by renewable energy, receive a credit between $475 and $600.

Utility Sponsored Programs : See available programs with AC Electric and South Jersey Gas.
http://www.atlanticcityelectric.com/home/
http://www.southjerseygas.com/

Energy Efficiency and Conservation Block Grant Rebate Program: Provides up to $20,000 per local government toward energy saving measures.

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 Fine and Performing Arts Building 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 Fine and Performing Arts Building.

HISTORICAL ENERGY CONSUMPTION

Energy usage, load profile and cost analysis

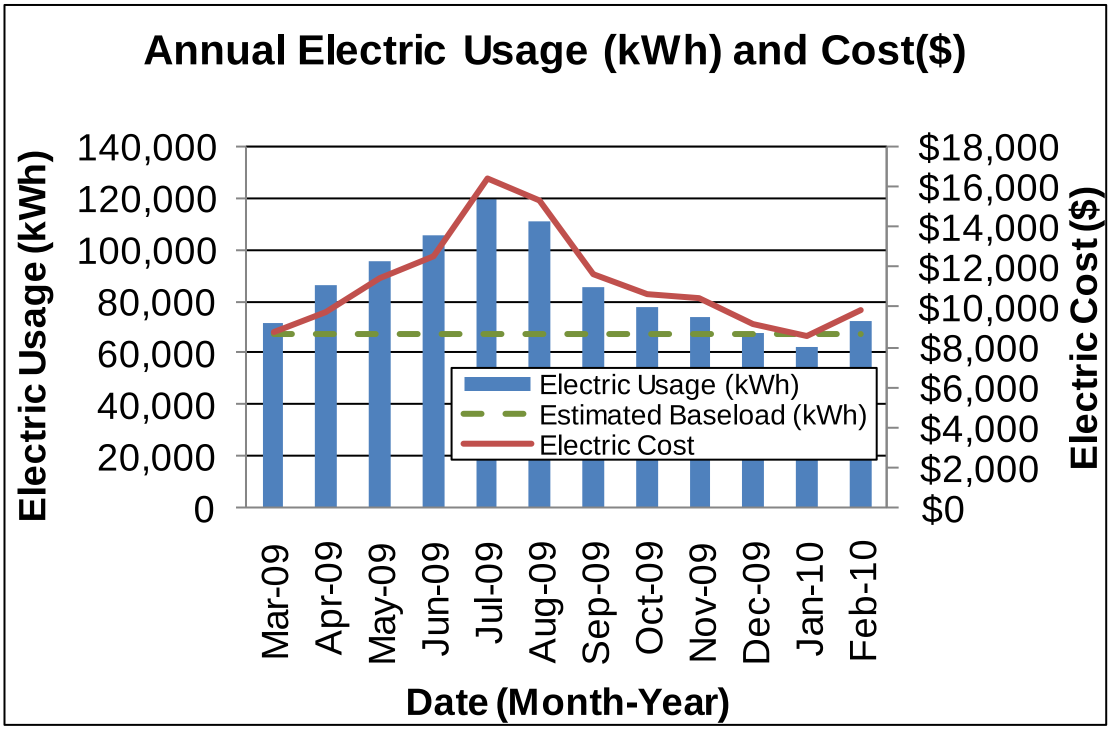
SWA reviewed utility bills from April 2008 through March 2010 that were received from the utility companies supplying the Fine and Performing Arts Building with electric and natural gas. A 12 month period of analysis from April 2009 through March 2010 was used for all calculations and for purposes of 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. Vineland Electric is a Municipal Utility and serves general power and lighting loads. The AC Electric power is used for heating and cooling loads.

It is difficult to determine the actual electric usage between these two independent electric sources for this building since there is not a separate meter for the AC electric usage for this building. Therefore, the electric consumption of both the AC Electric and Vineland electric 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.

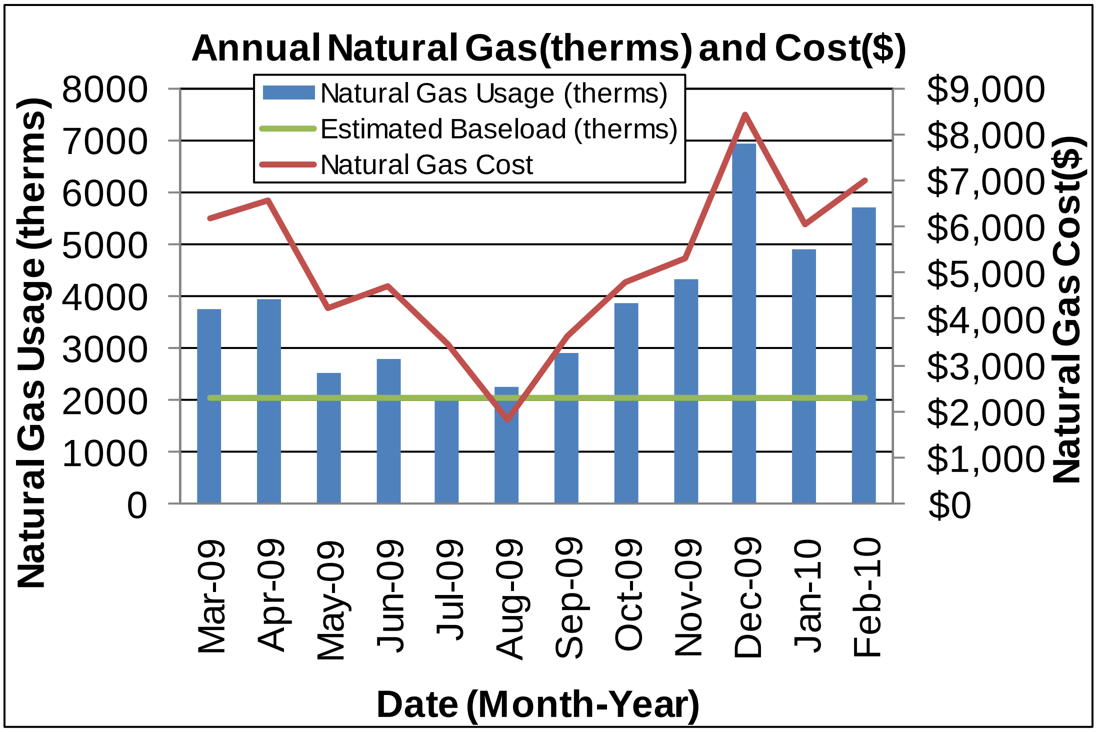
Electricity – Cumberland County College currently buys electricity from Atlantic City Electric and Vineland Electric at **an overall average aggregated rate of $0.131/kWh.** There are only two electric meters for the Cumberland County College campus buildings, with no sub meters for each building. Therefore the usage of each building was estimated based on square footage compared to the total campus size. Using this method, the Fine and Performing Arts Building purchased **approximately 1,027,942 kWh, or $134,388 worth of electricity,** in the previous year. The average monthly demand was 179.0 kW and the annual peak demand was 246.0 kW.

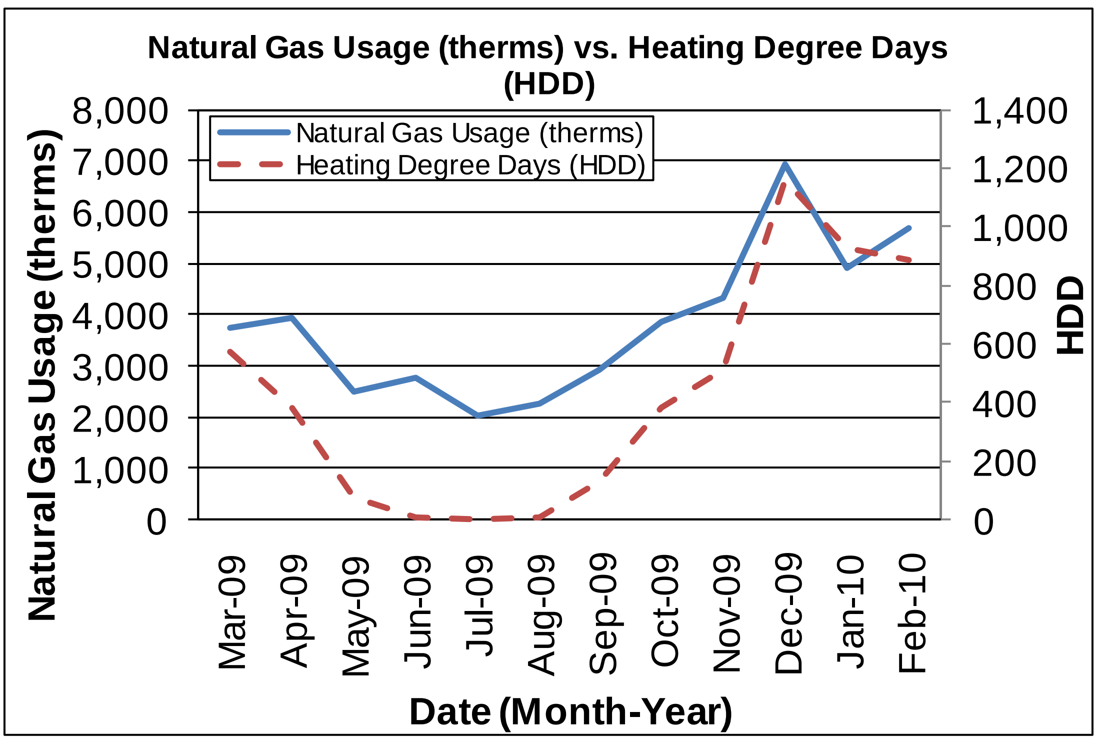
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate the Fine and Performing Arts Building.



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, the Fine and Performing Arts Building currently buys natural gas from South Jersey Gas at **an average aggregated rate of $1.356/therm**. The Fine and Performing Arts Building purchased **approximately 45,868 therms, or $62,211 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 Fine and Performing Arts Building.

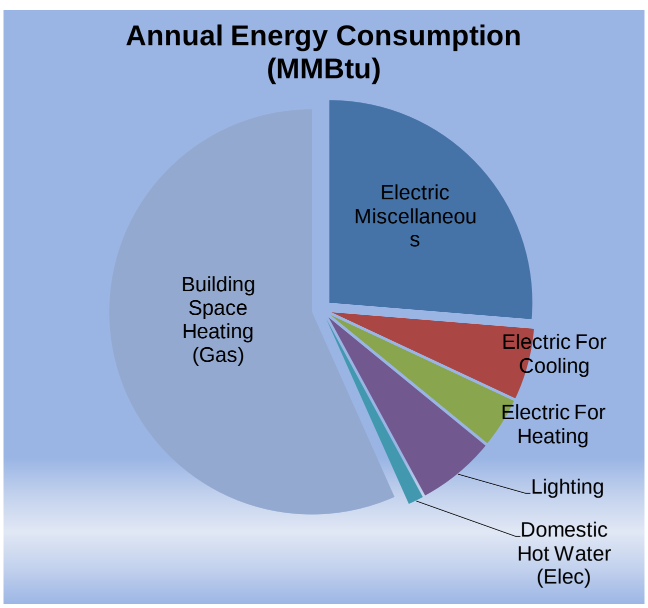


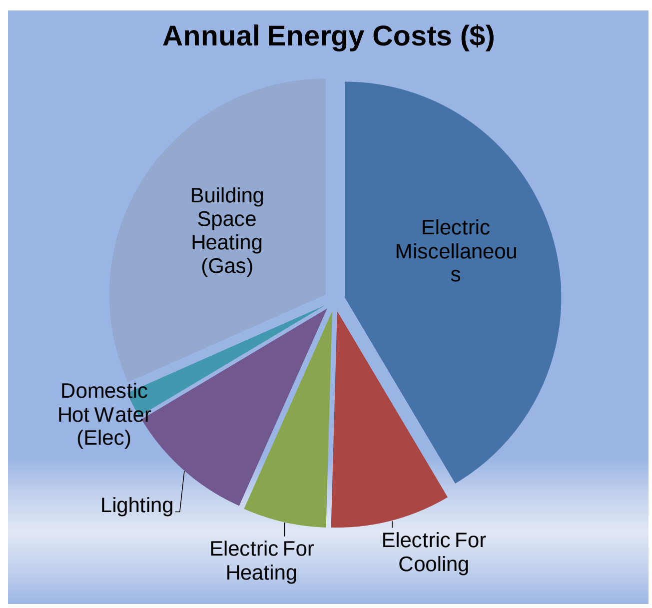


The chart above shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the base temperature. SWA's analysis used a base temperature of 65 degrees Fahrenheit. Although the Fine and Performing Arts Center does not have a reheat system installed, many of the campus buildings do use reheats for dehumidification during the summer. Since the utility information used is based on the entire campus, the reheat use for the rest of the campus is reflected in the chart.

The following graphs, pie charts, and table show energy use for the BUILDING based on utility bills for the 12 month period. Note: electrical cost at $38/MMBtu of energy is 2.5 times as expensive as natural gas at $14/MMBtu

Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	2,129	26%	$81,553	41%	38
Electric For Cooling	460	6%	$17,635	9%	38
Electric For Heating	319	4%	$12,222	6%	38
Lighting	500	6%	$19,175	10%	38
Domestic Hot Water (Elec)	99.3	1%	$3,804	2%	38
Building Space Heating	4,587	57%	$62,211	32%	14
Totals	8,094	100%	$196,599	100%	
Total Electric Usage	3,508	43%	$134,389	68%	38
Total Gas Usage	4,587	57%	$62,211	32%	14
Totals	8,094	100%	$196,599	100%	

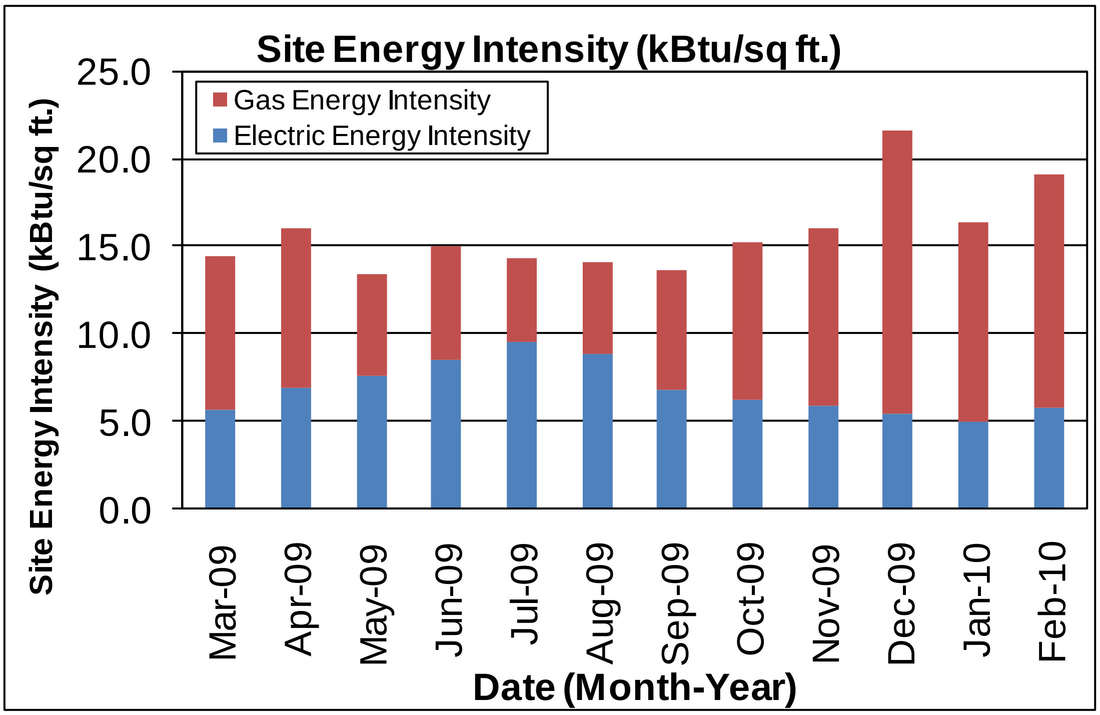




Energy benchmarking

SWA has entered energy information about the Fine and Performing Arts Building in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. This College facility is categorized as a non-eligible ("Other") space type. Because it is an "Other" space type, there is no rating available. Consequently, the Fine and Performing Arts Building is not eligible to receive a national energy performance rating at this time. The Site Energy Use Intensity is 186.0 kBtu/ft^2-yr compared to the national average of a College building consuming 120.0 kBtu/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 Fine and Performing Arts Building facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager account information with the 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.

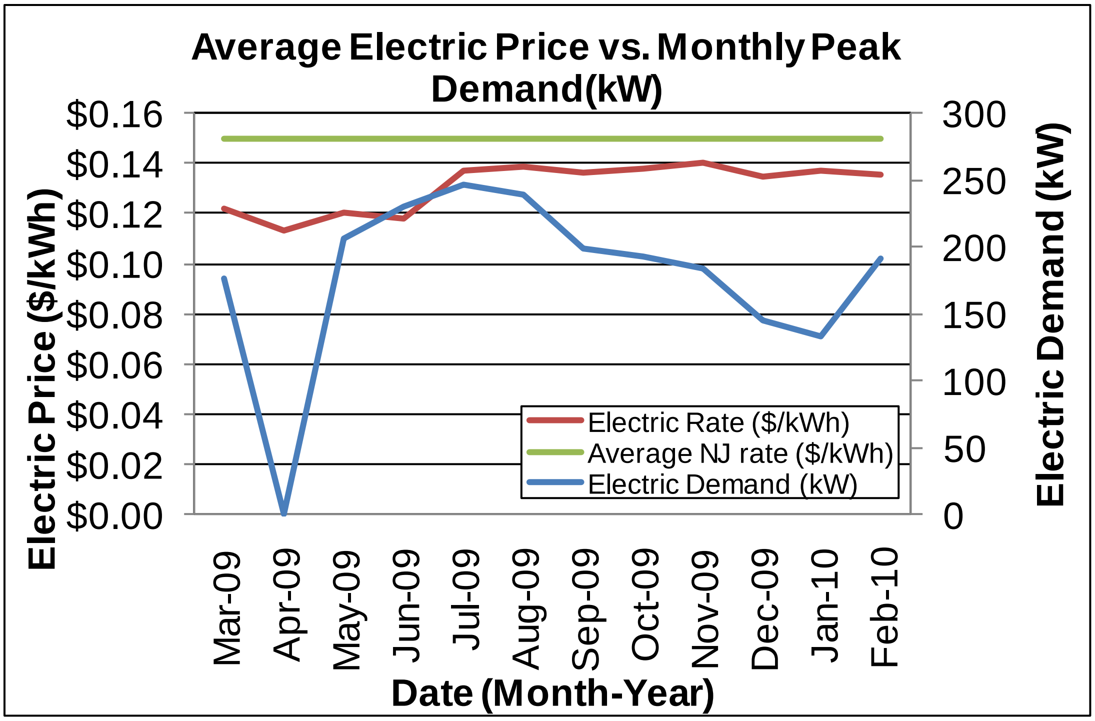
Cumberland County College has an agreement with PEPCO Energy Services as a third party electric supplier along with AC Electric and Vineland Electric. The campus also has a natural gas third party supplier. In addition, the College has an agreement with an energy services provider for a demand response 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 Fine and Performing Arts Building usage was estimated based on square footage compared to all buildings on the same meter.

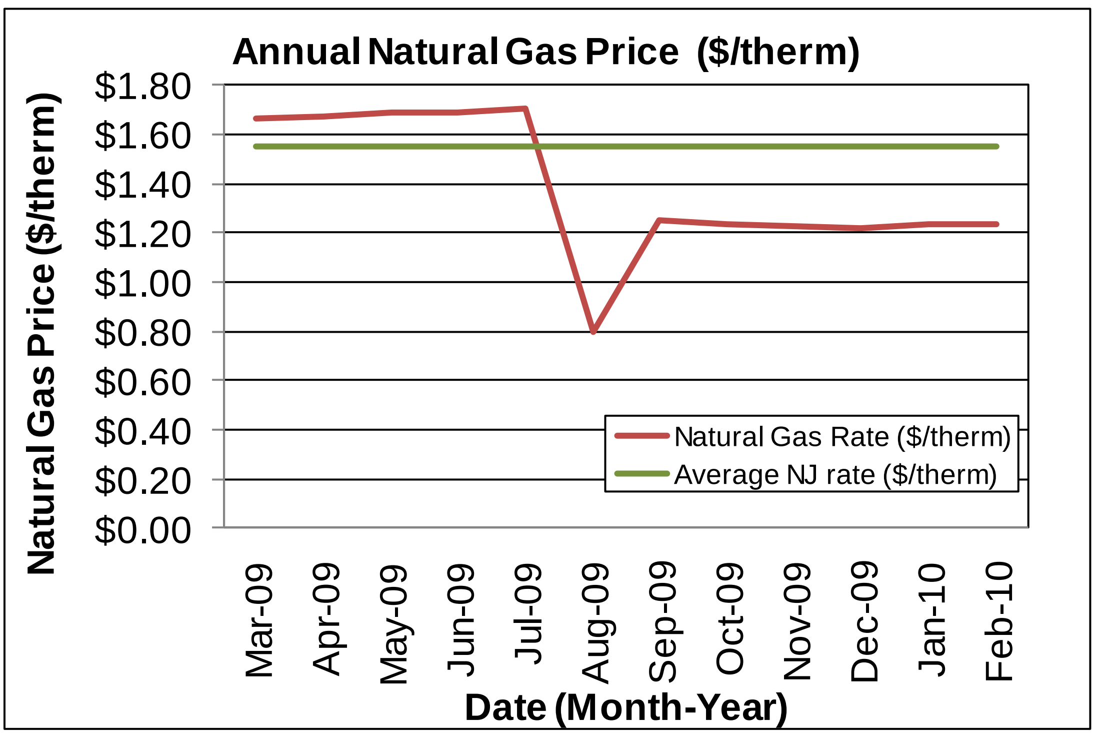
Energy Procurement strategies

Billing analysis is conducted using an average aggregated rate that is estimated based on the total 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 Fine and Performing Arts Building pays an average, 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 Fine and Performing Arts Building 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 Fine Arts 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.

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

Building Characteristics

The single-story, (slab on grade), 42,756 square feet Fine and Performing Arts Building was originally constructed in 1992 with additions completed in 2002 and interior renovations in 2008. It houses classrooms, offices, art studios, a theatre and gallery spaces. Below is a bird's eye view of the facility.

Overall Building Bird's Eye View


Front Façade


Right Side Façade

Rear Façade - Left

Rear Façade - Center

Rear Façade – East View

Left Side Façade

Front Façade – West View

Building Occupancy Profiles

The occupancy is anywhere from 30 to 150 students and up to 10 professors weekdays from 8am to 8pm. The theatre can hold up to 500 visitors and is intermittently occupied for performances throughout the year.

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 split-face concrete block over concrete block with 4 inches of rigid insulation and a 3 inch air gap. The interior is mostly painted CMU (Concrete Masonry Unit) with brick veneer accents. The mechanical penthouse on the roof is constructed of 2" painted galvanized steel panels.

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

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall good condition with only a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues.

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

Insect nesting in exterior wall cracks and cavities

Roof

The roof sections are a flat, no parapet type over steel decking, with a built-up asphalt finish and gravel ballast. All roof sections are original. No detectable ceiling insulation, and four inches of rigid roof insulation were recorded.

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

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall acceptable condition, with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues mostly detected on sloped roof areas.

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 and are based on available construction plans.

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

Windows

The building contains several different types of windows:

1. Over 30 fixed type windows with 1" insulated aluminum frames, low-E outside coated glazing and no interior or exterior shading devices. The windows are located on the front of the building and are original.

2. Two large fixed bay type windows with 1" insulated aluminum frames, low-E inside coated glazing and no interior or exterior shading devices. The windows are located on the front of the building and are original.

3. Over 30 casement bay type windows with 1" insulated aluminum frames, low-E inside coated glazing and interior roller blinds. The windows are located on the west facade and are original.

4. Nine casement bay type windows with 1" insulated aluminum frames, low-E inside coated glazing and interior roller blinds. The windows are located on the east facade 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 acceptable 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. 15 single pane glass with metal frame type exterior doors. They are located throughout the building.

2. Seven aluminum type exterior doors. They are located throughout the building and are original.

3. One aluminum garage door located in the rear of the building.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in acceptable 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 with only a few areas of suggested improvements, as described in more detail earlier in this chapter.

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

Mechanical Systems

Heating Ventilation Air Conditioning

The Fine and Performing Arts Building is both heated and cooled throughout the building. There are no major comfort issues except for high humidity in the theatre ever since the 6-story “fly” section was added in 2002.

Equipment

The Fine and Performing Arts Building has several installed heating and cooling equipment. There are five Carrier air handling units, AHU’s, with heating and cooling coils which supply heated and cooled air throughout the building. The hot water and chilled water for the units is provided by the Central Plant equipment. A comprehensive Equipment List can be found in Appendix A.

Hot Water and Chilled Water Supply and Return piping from/to the Central Plant with Pneumatic Valves

A typical AHU arrangement draws in fresh air and brings it into a mixing box, where it is combined with return air from the building. A small portion of the return air is purged and vented outside prior to entering the mixing box. The mixed air inside the air handler is sent through a filter before passing the hot water heating coil. The air handler fan then pushes the air through the chilled water coil before the conditioned air is distributed into the building spaces. In economizer mode the hot water and chilled water piping can modulate closed and only the fans will operate to circulate the air.

Air Handling Units in MER Penthouse with Heating and Cooling Coils

Both the chilled water and hot water piping arrangement is designed with a bypass so that regardless of the operation of each unit there is constant flow through the system.

The AHU-1 supply air fan has automatic dampers which are designed to adjust the air volume according to space conditions. The mechanism is damaged and is therefore deactivated.

The AHU-1 supply fan damper blades inoperable

There are also supplemental hot water heating throughout the building all based on hot water. Fin tube radiators are installed throughout the buildings' perimeter and are designed to offset envelope heat loss. There are six Cabinet Unit Heaters, CUH which are located at entrances and vestibules to compensate for heat loss through exterior doors. The MER Penthouse is not cooled but is provided heat by three hot water unit heaters.


MER Penthouse HW Heaters; Fin Tube Radiators, Typ.

Cabinet Unit Heater, Typ.

Motorized outside air intake dampers in the Penthouse mechanical room are used to ensure proper ventilation. Fresh air enters the AHU mechanical room and is drawn into each air handling unit. The dampers are controlled to maintain a minimum outside air position as per code ventilation requirements.

There are six exhaust fans located on the roof, which serve the bathrooms, mechanical rooms and general exhaust. In general, the building exhaust fans have an estimated 25% useful operating life left.

Rooftop Exhaust Fan, Typ., Outside Air Damper into MER Penthouse

Distribution Systems

The hot water and chilled water from the Central Plant is distributed to the air handling units by a series of booster pumps. There are six Bell & Gossett pumps in the building in sets of two. There are two chilled water booster pumps for cooling coils, two hot water pumps for heating coils and two hot water pumps for fin tube radiation. There is a lead pump and standby for each function. The pumps have rated efficiencies between 80% and 90%, and most have 25% remaining useful life. The hot water pumps serving fin tube radiation were found with their manual isolation valves 50% closed, likely in an effort to balance the system.


Hot Water Coil Booster Pumps; Chilled Water Coil Booster Pumps

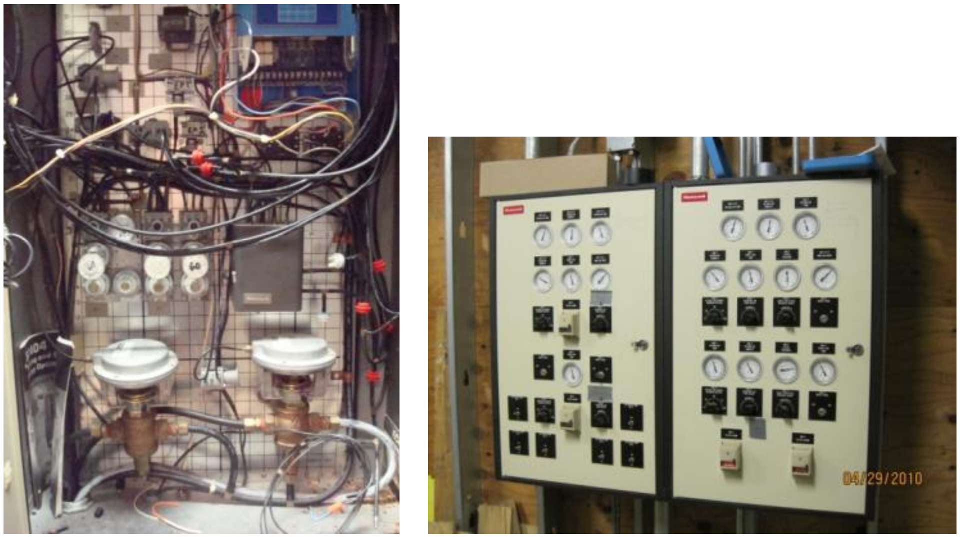
The Fine and Performing Arts Building has sections of the building which are constant volume with Constant Volume Boxes (CVB) in the ductwork but most of the building spaces are served by Variable Volume Boxes, (VVB). There are 27 VVB's in the ductwork system serving classrooms, hallways and offices. The theatre is the only area with a constant volume system with 4 CVB's. The VVB's have a modulating damper within the ductwork to adjust the amount of supply air to satisfy the temperature settings of the room(s) that it serves. There are no reheats for dehumidification in the building.


Variable Volume Box damper actuator, typ.

The theatre area has humidity issues in the summer and there is no permanent dehumidification system. Ever since a mold issue occurred in 2003, the College a 4,500 CFM Munters Electric Heater has been rented to dry out the air in conjunction with AHU-4, with an installed cost of approximately $17,000 annually. The College has already spent $40,000 in repairs due to moisture issues.

Controls

Each of the 27 VVB's is controlled by a manual Honeywell thermostat in each zone. The temperature settings for the air handling units are determined by outside air temperature. The default supply air temperature in the summer is 60˚F. All valves and dampers are controlled by pneumatic pistons which operate based on electronic programming. There are no setbacks in the control system. The rooftop mechanical penthouse contains an air dryer and air compressor expressly for the pneumatic controls.



Pneumatic controller inside; outside

Honeywell thermostat, Typ.

Domestic Hot Water

The domestic hot water (DHW) for the Fine and Performing Arts Building is provided by an electric heated Lime Tamer hot water heater with 80 gal storage and 3 electric coil heating elements at 18.0 kW each.

This heater has 25% estimated useful operating life remaining and appears 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 Fine and Performing Arts Building currently contains mostly T12 fixtures, with sporadic use of incandescent lights and CFL's with self-ballast bulbs. Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas.

Ceiling Suspended T12 Fixture, Typ.; Lobby lighting

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

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be mostly Metal Halide 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 Fine and Performing Arts Building does not have an installed elevator.

Other electrical systems

There are not currently any other significant energy-impacting electrical systems installed at the Fine and Performing Arts Building except a Diesel Emergency Generator sized for 156.0 kVa, and four transformers ranging from 15.0 kVa to 300.0 kVa which appear in good operating condition.

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 Fine and Performing Arts Building is a good candidate for a 30.0 kW Solar Panel installation. See ECM# 12 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 Fine and Performing Arts Building is not a good candidate for wind power generation due to insufficient wind conditions in this area of New Jersey.

Geothermal

The Fine and Performing Arts Building 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 25% and 60% remaining useful life.

Combined Heat and Power

The Fine and Performing Arts Building 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 27 manual thermostats for each VVB to programmable
2	Install 12 VFD's to Pump / Fan Motors
3	11 New T5 fixtures to be installed with incentives
4	374 New CFL fixtures to be installed with incentives
5	Install 2 beverage and 1 Snacks vending machine energy misers in the West Wing snack area
6	Motor Upgrades: Replace two 15.0 HP standard fan motors with premium efficiency
7	Motor Upgrades: Replace five 5.0 HP and three 7.5HP motors with premium efficiency
8	Replace AHU for Stage with New unit including dehumidification
9	Replace 32 incandescent Exit signs with LED type
	Description of Recommended 5-10 Year Payback ECMs
10	Motor Upgrades: Replace one 1.0 HP standard exhaust fan motors with premium efficiency
11	Motor Upgrades: Replace two 5.0 HP standard pump CHW motors, 88.5% Eff. with premium efficiency
12	Install 30 kW Solar Photovoltaic system
13	Replace 1 old refrigerator with 18 cu ft Energy Star model
14	15 New PSMH fixtures to be installed with incentives
	Description of Recommended > 10 Year Payback ECMs
15	Motor Upgrades: Replace two 1.5 HP and two 2.0 HP standard pump CHW motors, with premium efficiency
16	Install 26 occupancy sensors
17	153 New T8 fixtures to be installed with incentives

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: *Manual Thermostats to Programmable*

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. Each of the five Air Handling units serve several VVB boxes which are controlled by manual thermostats, without programming for evening and weekend setbacks. The financial calculations below are for converting the 27 manual thermostats throughout the HVAC system 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 from 78 to 82 deg in the summer.

Installation cost:

Estimated installed cost: $4,509 (includes $2,029 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	4,509	0	4,509	102,794	18	4,587	19	467	20,127	12	241,520	0.2	5,256	234,613

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA also assumed an aggregated 12 hrs/yr to make manual adjustments vs. an installed programmable thermostat. SWA assumed that temperatures would be setback based on the operation schedule of the building and used Energy Star site: http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=TH , Excel spreadsheet for Savings Calculator

Rebates/financial incentives:

- *None at this time.*

Please see Appendix F for more information on Incentive Programs.

ECM#2: *Install VFD's to Pump and Fan Motors above 5.0 HP*

In the United States 50% of the total electrical energy generated is consumed by rotating equipment. Of the 50% total electric energy, 65% of is consumed by centrifugal or flow related applications such as fans, blowers, compressors, and pumps according to current estimates. Variable speed (frequency) drive (VFD) technology offers a cost-effective method to match driver speed to load demands and represents a state-of-the-art opportunity to reduce operating costs and improve overall productivity. VFD's work by changing the frequency or hertz of the power supplied to the electric motor. This change in frequency causes the electric motor to speed up and slow down depending the frequency. At full speed the motor operates at 60 hertz and generally (depending on drive parameter settings) 15 or lower hertz is low speed. The motor can run anywhere in between the minimum and maximum hertz ranges and will respond with the appropriate speed for the frequency.

An important tool for increasing motor system efficiency is the VFD, a device that precisely controls motor speed. In the case of a blower, without VFD to selectively slow the motor, the system is forced to counteract the motor's work after the energy has already been expended, using a baffle or other device to divert air that is already flowing. A VFD, by contrast, responds to the actual need for air flow and adjusts the motor speed accordingly. The use of VFDs can yield substantial benefits: an estimated 10% energy savings for refrigeration applications, 15% for air compressors, and 20% for pumps and fans. Adding VFDs to HVAC pumps and fans 5.0 HP or more will vary the flow according to the required heating and cooling requirements to better meet the load of the building. (Based on cost analysis VFD installation for motors less than 5.0 HP have a payback in excess of 20 years.) Because there is already Variable Volume Boxes installed throughout the system, the VFD's can operate in sync with this VVB's to optimize the air distribution system.

Installation cost:
Estimated installed cost: $12,088 (includes $4,700 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

VFD 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
Install VFDs for five 5.0 HP fan premium efficiency motors	6,000	3,875	2,125	51,785	9.1	0	4.1	0	6,770	20	135,403	0.3	314	92,721
Install VFDs for two 5.0 HP pump CHW motors, premium efficiency	2,400	1,550	850	9,966	1.7	0	0.8	0	1,303	20	26,058	0.7	148	17,844
Install VFDs for two 15.0 HP fan motors, premium efficiency	7,200	3,600	3,600	60,348	10.6	0	4.8	0	7,890	20	157,793	0.5	214	108,053
Install VFDs for three 7.5 HP fan premium efficiency motors	9,000	3,488	5,513	45,618	8.0	0	3.6	0	5,964	20	119,278	0.9	103	81,679
TOTAL	**24,600**	**12,513**	**12,088**	**167,717**	**29.4**	**0**	**13.4**	**0**	**21,927**	**20**	**438,533**	**0.6**	**176**	**300,297**

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit, nameplate data and using the billing analysis. SWA assumed a reduction in operating hours for pumps to EPA published full load hours based on weather data, of 2340 hours heating and 1007 hours cooling. Fan motors hours were reduced by the sum of the heating and cooling full load hours; 3347 hours since the peak loads for heating and cooling do not occur simultaneously.

Rebates/financial incentives:

- *NJ Clean Energy – VFD installation*
    - *5.0 HP to 7.5HP –$155 per HP - Maximum incentive amount is $8,913*
    - *15.0 HP – $120 per HP – Maximum incentive amount is $3,600*

Please see Appendix F for more information on Incentive Programs.

ECM#3: ***Building Lighting Upgrades: Metal Halide to T5***

During the field audit, SWA completed a building interior as well as exterior lighting inventory (see Appendix B). The existing building lighting consists of 11 recessed standard probe start Metal Halide (MH) lamps at a rated 100 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 100 W Metal Halide fixture with a 4-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: $2,134 (includes $1,601 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	2,310	176	2,134	5,396	1	0	0	975	1,682	15	25,234	1.3	1,082	9,662

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 20 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 $176.*

Please see Appendix F for more information on Incentive Programs.

ECM#4: ***Building Lighting Upgrades: Replace Incandescent with CFL's***

During the field audit, SWA completed a building lighting inventory (see Appendix B). The existing lighting also contains over 150 inefficient incandescent lamps and many high wattage halogen lamps. SWA recommends that each incandescent and halogen 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: $21,285 (includes $15,964 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
4	21,285	0	21,285	49,302	10	0	4	7,385	13,844	5	69,219	1.5	225	88,275

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 180 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#5: *Install Vending Energy Misers*

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

Snack vending miser devices can be used on snack vending machines to achieve maximum energy savings that result in reduced operating costs and decreased greenhouse gas emissions with existing machines. Snack vending miser devices also use a Passive Infrared Sensor (PIR) to determine if there is anyone within 25 feet of the machine. It waits for 15 minutes of vacancy, then powers down the machine. If a customer approaches the machine while powered down, the snacks vending miser will sense the presence and immediately power up. SWA recommends adding these devices to at least two drink vending machines and one snack machine found in the West Wing snack area.

Installation cost:

Estimated installed cost: $637 (includes $287 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	637	0	637	3,100	1	0	0	0	405	12	4,863	1.6	663	5,551

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

Rebates/financial incentives:

- *None at this time.*

Please see Appendix F for more information on Incentive Programs.

ECM#6: *Replace Standard Efficiency Motors with Premium Efficiency*

During the field audit, SWA completed the building equipment inventory and observed standard efficiency motors. Efficiency varies by motor size, with larger motors tending toward higher efficiency. The highest-efficiency motors available commercially today have efficiencies of 93-94%, and higher for the largest motors. Focusing on the entire motor system, not just the motor, offers even greater potential for energy savings. An important tool for increasing motor system efficiency is the adjustable speed drive (ASD), a device that precisely controls motor speed which is evaluated on a case by case basis. Premium-efficiency motors cost 15-25% more than standard motors, or $8-$40 more per horsepower, they pay for themselves quickly in saved operating costs. The exact length of the payback period depends on several factors, including annual hours of use, energy rates, costs of installation and downtime, and the availability of utility rebates. 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.

There are 17 standard efficiency pumps installed in the Fine Arts Building between 1.0 HP to 15.0 HP; 6 for hot water and chilled water pumps, 1 exhaust fan and 10 air handling supply and return fans. Most motors are approaching the end of their useful life, and should be replaced with premium efficiency motors for optimized performance and energy savings.

Installation cost:

Estimated installed cost: $2,148 (includes $614 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	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
Replace two 15.0 HP standard fan motors, 91% Eff. with premium efficiency	2,378	230	2,148	9,498	1.7	0.8	0	1,242	20	24,835	1.7	53	17,006

ECM#7: *Replace Standard Efficiency Motors with Premium Efficiency*

During the field audit, SWA completed the building equipment inventory and observed standard efficiency motors. Efficiency varies by motor size, with larger motors tending toward higher efficiency. The highest-efficiency motors available commercially today have efficiencies of 93-94%, and higher for the largest motors. Focusing on the entire motor system, not just the motor, offers even greater potential for energy savings. An important tool for increasing motor system efficiency is the adjustable speed drive (ASD), a device that precisely controls motor speed which is evaluated on a case by case basis. Premium-efficiency motors cost 15-25% more than standard motors, or $8-$40 more per horsepower, they pay for themselves quickly in saved operating costs. The exact length of the payback period depends on several factors, including annual hours of use, energy rates, costs of installation and downtime, and the availability of utility rebates. 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.

There are 17 standard efficiency pumps installed in the Fine Arts Building between 1.0 HP to 15.0 HP; 6 for hot water and chilled water pumps, 1 exhaust fan and 10 air handling supply and return fans. Most motors are approaching the end of their useful life, and should be replaced with premium efficiency motors for optimized performance and energy savings.

Installation cost:

Estimated installed cost: $4,638 (includes $1,169 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	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
Replace five 5.0 HP standard fan motors with premium efficiency	2,850	300	2,550	9,385	1.6	0.7	0	1,227	20	24,539	2.1	43	16,804
Replace three 7.5 HP standard fan motors with premium efficiency	2,358	270	2,088	7,767	1.4	0.6	0	1,015	20	20,309	2.1	44	13,907
TOTAL	5,208	570	4,638	17,152	3	1	0	2,242	20	44,848	2.1	867	30,711

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA used MotorMaster+ International Savings Calculator - http://www1.eere.energy.gov/industry/bestpractices/software_motormaster_intl.html . SWA estimated savings based on the following assumptions: the heating and cooling season is 7 months each and pumps operate at full capacity for 16 hours a day, (based on staff reports of continuous use) for total of 3406 hours of full load operation annually. There is a 4-pipe system, so the seasons can overlap. For each set of pumps there is a primary pump and a standby pump, therefore the cost and incentives for both motors is included, but only the electric savings for one motor is used because it is unlikely that they will operate at the same time. For fan motors it was assumed 16 hours of full load operation throughout the year, for a total 5840 hours.

Rebates/financial incentives:

- *NJ Clean Energy – Premium Efficiency Motors*
    - *2 HP to 5 HP - $60/Motor - Maximum incentive amount $300*
    - *7.5 HP - $90/Motor - Maximum incentive amount $270*

Please see Appendix F for more information on Incentive Programs.

ECM#8: *Install New Air Handler with Dehumidification*

There is a humidity issues in the theatre which may be due to the difference in elevation between the main seating area and the recently installed "fly" section of the stage. The stage area of the theatre is currently served by AHU-4 which does not have any dehumidification capabilities. Ever since a mold issue occurred in 2003, the College annually rents an electric air dryer a Munters, 4500 CFM, 115 kW unit each summer to dry out the air in the theatre. Not only is the rental an annual installation and labor cost of $17,000. The existing AHU-4 unit has 25% remaining useful life and does not have high efficiency motors or VFD's. SWA recommends discontinuing the summer rentals of the electric dryer and replacing AHU-4 with a similarly sized unit with the following features: Dehumidification via preheat section or desiccant system, premium efficiency motors, and VFD fan operation. The motor and fan upgrade savings are reflected in ECM's #2, 6, 7, 10, 11 and 15.

Installation cost:
Estimated installed cost: $25,100 (includes $7,530 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Details	est. installed cost, $	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
Savings for discontinuing Temporary Air Dryer	0	50,732	8.9	0	4.0	17,000	23,632	15	354,486	NA
Installing & Operating New AHU-4 with Dehumidification	25,100	-106,478	-18.6	-351	-9.3	1,500	-12,897	15	-193,448	-1.9
Replace AHU-4 with New unit including dehumidification and discontinue rented dryer	25,100	-55,747	-9.8	-351	-5.3	18,500	10,736	15	161,038	2.3

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. The air dryer rental for the season is $17,000 installed cost according to staff, plus additional electric costs for operating the unit for the cooling season. The air handling unit electric and gas costs are assumed based on the peak heating and cooling load hours published by the EPA, 2,340 peak heating, and 1,091 peak cooling for New Jersey.

Rebates/financial incentives:
- *None at this time*

Please see Appendix F for more information on Incentive Programs.

ECM#9: *Building Lighting Upgrades: Replace Inc Exit Signs with LED Type*

During the field audit, SWA completed a building lighting inventory (see Appendix B). SWA observed that the building contains over 30 incandescent Exit signs. SWA recommends replacing these with LED type. Replacing existing Exit signs with LED Exit signs can result in lower kilowatt-hour consumption, as well as lower maintenance costs. Since Exit signs operate 24 hours per day, they can consume large amounts of energy. In addition, older Exit signs require frequent maintenance due to the short life span of the lamps that light them. LED Exit sign last at least 5 years. In addition, LED Exit signs offer better fire code compliance because they are maintenance free in excess of 10 years. LED Exit signs are usually brighter than comparable incandescent or fluorescent signs, and have a greater contrast with their background due to the monochromatic nature of the light that LEDs emit. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $4,176 (includes $2,714 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
9	4,816	640	4,176	2,306	0	0	0	1,242	1,544	15	23,161	2.7	455	4,129

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 30 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

- *NJ Clean Energy – Inc Exit Sign to LED Type - $20/fixture - $640 Total*

Please see Appendix F for more information on Incentive Programs.

ECM#10: *Replace Standard Efficiency Motors with Premium Efficiency*

During the field audit, SWA completed the building equipment inventory and observed standard efficiency motors. Efficiency varies by motor size, with larger motors tending toward higher efficiency. The highest-efficiency motors available commercially today have efficiencies of 93-94%, and higher for the largest motors. Focusing on the entire motor system, not just the motor, offers even greater potential for energy savings. An important tool for increasing motor system efficiency is the adjustable speed drive (ASD), a device that precisely controls motor speed which is evaluated on a case by case basis. Premium-efficiency motors cost 15-25% more than standard motors, or $8-$40 more per horsepower, they pay for themselves quickly in saved operating costs. The exact length of the payback period depends on several factors, including annual hours of use, energy rates, costs of installation and downtime, and the availability of utility rebates. 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.

There are 17 standard efficiency pumps installed in the Fine Arts Building between 1.0 HP to 15.0 HP; 6 for hot water and chilled water pumps, 1 exhaust fan and 10 air handling supply and return fans. Most motors are approaching the end of their useful life, and should be replaced with premium efficiency motors for optimized performance and energy savings.

Installation cost:
Estimated installed cost: $353 (includes $93 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	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
Replace one 1.0 HP standard exhaust fan motors with premium efficiency	403	50	353	471	0.1	0.0	0	62	20	1,232	5.7	12	843

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA used MotorMaster+ International Savings Calculator - http://www1.eere.energy.gov/industry/bestpractices/software_motormaster_intl.html . SWA estimated savings based on the following assumptions: the heating and cooling season is 7 months each and pumps operate at full capacity for 16 hours a day, (based on staff reports of continuous use) for total of 3406 hours of full load operation annually. There is a 4-pipe system, so the seasons can overlap. For each set of pumps there is a primary pump and a standby pump, therefore the cost and incentives for both motors is included, but only the electric savings for one motor is used because it is unlikely that they will operate at the same time. For fan motors it was assumed 16 hours of full load operation throughout the year, for a total 5840 hours.

Rebates/financial incentives:

- *NJ Clean Energy – Premium Efficiency Motors*
    - *1HP to 1.5 HP - $50/Motor – Maximum incentive amount $50*

Please see Appendix F for more information on Incentive Programs.

ECM#11: *Replace Standard Efficiency Motors with Premium Efficiency*

During the field audit, SWA completed the building equipment inventory and observed standard efficiency motors. Efficiency varies by motor size, with larger motors tending toward higher efficiency. The highest-efficiency motors available commercially today have efficiencies of 93-94%, and higher for the largest motors. Focusing on the entire motor system, not just the motor, offers even greater potential for energy savings. An important tool for increasing motor system efficiency is the adjustable speed drive (ASD), a device that precisely controls motor speed which is evaluated on a case by case basis. Premium-efficiency motors cost 15-25% more than standard motors, or $8-$40 more per horsepower, they pay for themselves quickly in saved operating costs. The exact length of the payback period depends on several factors, including annual hours of use, energy rates, costs of installation and downtime, and the availability of utility rebates. 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.

There are 17 standard efficiency pumps installed in the Fine Arts Building between 1.0 HP to 15.0 HP; 6 for hot water and chilled water pumps, 1 exhaust fan and 10 air handling supply and return fans. Most motors are approaching the end of their useful life, and should be replaced with premium efficiency motors for optimized performance and energy savings.

Installation cost:
Estimated installed cost: $1,020 (includes $255 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	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
Replace two 5.0 HP standard pump CHW motors, 88.5% Eff. with premium efficiency	1,140	120	1,020	1,095	0.2	0.1	0	143	20	2,863	7.1	9	1,961

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA used MotorMaster+ International Savings Calculator - http://www1.eere.energy.gov/industry/bestpractices/software_motormaster_intl.html . SWA estimated savings based on the following assumptions: the heating and cooling season is 7 months each and pumps operate at full capacity for 16 hours a day, (based on staff reports of continuous use) for total of 3406 hours of full load operation annually. There is a 4-pipe system, so the seasons can overlap. For each set of pumps there is a primary pump and a standby pump, therefore the cost and incentives for both motors is included, but only the electric savings for one motor is used because it is unlikely that they will operate at the same time. For fan motors it was assumed 16 hours of full load operation throughout the year, for a total 5840 hours.

Rebates/financial incentives:

- *NJ Clean Energy – Premium Efficiency Motors*
    - *2 HP to 5 HP - $60/Motor - Maximum incentive amount $120*

Please see Appendix F for more information on Incentive Programs.

ECM#12: *Install 30 kW PV 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 roof equipment and safety, as well as the facilities' annual base load and mode of operation. A PV system could be installed on the west wing of the building since there is over 3,000 sqft of open space and easily accessible. A commercial multi-crystalline 123 watt panel has 10.5 square feet of surface area. A 30 kW 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
12	210,000	22500	187,500	35,400	30	0	3	0	25,628	25	640,701	7.3	242	63,384

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.

ECM#13: *Replace 18 Cu Ft. Refrigerator with Energy Star Type*

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

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

Installation cost:
Estimated installed cost: $750 (includes $70 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
13	750	0	750	350	0	0	0	50	96	12	1,149	7.8	53	627

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA assumed annual labor and parts insurance for old refrigerators.

Rebates/financial incentives:
- *None at this time*

Please see Appendix F for more information on Incentive Programs.

ECM#14: *Building Lighting Upgrades: Replace MH with PSMH*

During the field audit, SWA completed a building interior as well as exterior lighting inventory (see Appendix B). The existing exterior lighting contains 15 standard probe start Metal Halide (MH) lamps. SWA recommends replacing the higher wattage MH fixtures with pulse start MH lamps which offer the advantages of standard probe start MH lamps, but minimize the disadvantages. They produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. Due to these characteristics, energy savings can be realized via one-to-one substitution of lower-wattage systems, or by taking advantage of higher light output and reducing the number of fixtures required in the space. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:
Estimated installed cost: $10,265 (includes $6,159 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
14	10,640	375	10,265	3,314	1	0	0	605	1,040	15	15,593	9.9	52	5,935

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 15 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

- *NJ Clean Energy – MH to PSMH - $25/fixture - $375 Total*

Please see Appendix F for more information on Incentive Programs.

ECM#15: *Replace Standard Efficiency Motors with Premium Efficiency*

During the field audit, SWA completed the building equipment inventory and observed standard efficiency motors. Efficiency varies by motor size, with larger motors tending toward higher efficiency. The highest-efficiency motors available commercially today have efficiencies of 93-94%, and higher for the largest motors. Focusing on the entire motor system, not just the motor, offers even greater potential for energy savings. An important tool for increasing motor system efficiency is the adjustable speed drive (ASD), a device that precisely controls motor speed which is evaluated on a case by case basis. Premium-efficiency motors cost 15-25% more than standard motors, or $8-$40 more per horsepower, they pay for themselves quickly in saved operating costs. The exact length of the payback period depends on several factors, including annual hours of use, energy rates, costs of installation and downtime, and the availability of utility rebates. 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.

There are 17 standard efficiency pumps installed in the Fine Arts Building between 1.0 HP to 15.0 HP; 6 for hot water and chilled water pumps, 1 exhaust fan and 10 air handling supply and return fans. Most motors are approaching the end of their useful life, and should be replaced with premium efficiency motors for optimized performance and energy savings.

Installation cost:
Estimated installed cost: $1,606 (includes $402 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	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
Replace two 1.5 HP standard HW pump motors, 80% Eff. with premium efficiency, 86.5%	844	100	744	532	0.1	0.0	0	70	20	1,391	10.7	4	953
Replace two 2.0 HP standard HW pump motors, 82% eff. with premium efficiency	962	120	842	426	0.1	0.0	0	56	20	1,114	15.1	2	763
TOTAL	**1,806**	**220**	**1,586**	**958**	**0.2**	**0.1**	**0**	**125**	**20**	**2,505**	**12.7**	**58**	**1,715**

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA used MotorMaster+ International Savings Calculator - http://www1.eere.energy.gov/industry/bestpractices/software_motormaster_intl.html . SWA estimated savings based on the following assumptions: the heating and cooling season is 7 months each and pumps operate at full capacity for 16 hours a day, (based on staff reports of continuous use) for total of 3406 hours of full load operation annually. There is a 4-pipe system, so the seasons can overlap. For each set of pumps there is a primary pump and a standby pump, therefore the cost and incentives for both motors is included, but only the electric savings for one motor is used because it is unlikely that they will operate at the same time. For fan motors it was assumed 16 hours of full load operation throughout the year, for a total 5840 hours.

Rebates/financial incentives:

- *NJ Clean Energy – Premium Efficiency Motors*
    - *1HP to 1.5 HP - $50/Motor – Maximum incentive amount $100*
    - *2 HP to 5 HP - $60/Motor - Maximum incentive amount $120*

Please see Appendix F for more information on Incentive Programs.

ECM#16: *Building Lighting Upgrades: Install Occupancy Sensors*

During the field audit, SWA completed a building lighting inventory (see Appendix B). SWA observed that the existing lighting has minimal to no control via occupancy sensors. SWA identified a number of areas that could benefit from the installation of occupancy sensors. SWA recommends installing occupancy sensors in areas that are occupied only part of the day and the payback on savings is justified. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advance micro-phonic lighting sensors include sound detection as a means to control lighting operation. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $5,200 (includes $3,120 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
16	5,720	520	5,200	2,865	1	0	0	0	375	15	5,629	13.9	8	5,129

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

Rebates/financial incentives:

- *NJ Clean Energy – Wall Mounted Occupancy Sensors - $20 per Sensor - $520 Total*

Please see Appendix F for more information on Incentive Programs.

ECM#17: *Building Lighting Upgrades: Replace MH with PSMH*

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

Installation cost:

Estimated installed cost: $24,430 (includes $17,101 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
17	26,725	2295	24,430	2,564	1	0	0	837	1,173	15	17,599	20.8	-28	4,590

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 – T12 to T8 - $15/fixture - $2,295 Total*

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 Fine and Performing Arts Building:

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

- 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, VVB box position and high/low pressure alarms.

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.

- Insect nesting should be removed from all exterior surfaces

- Install 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 $2,951.

APPENDIX A: EQUIPMENT LIST

Inventory

- Equipment *italicized* are assumed to be abandoned with switch-over to Central Plant by 2011, or are rented equipment
- Equipment **bolded** are recommended to be upgraded/replaced in this report

Building System	Description	Location	Make/ Model	Fuel	Space Served	Date Installed	Estimated Remaining Useful Life %
Compressor	Compressor for Pneumatic Controls, Two-Stage: 3.0 HP, 1725 RPM, Magnetek Motor, 1.5 HP, 1745 RPM, Marathon Motor	Penthouse MER	Honeywell, Marathon Motor, M#FVD 56T17D5398A P, Magnetek Motor: P# 364414	Elec	All Areas	1995	25%
Controls	Air Dryer for Pneumatic Controls	Penthouse MER	Honeywell	Elec	Pneumatics	1995	25%
Cooling	*CT-1 & 2, 4635 MBH, 12.0kW, 2 Elements*	*Central Plant*	*BAC*	*Elec*	*All Areas*	*NA*	*NA*
Cooling	*CT-2, 2250 MBH, 6.0 kW, 1 Element*	*Central Plant*	*BAC*	*Elec.*	*All Areas*	*NA*	*NA*
Cooling	**MP-5&6 Two Chilled Water Booster Pumps, one Standby, 1745 RPM, 450 GPM, 88.5% NEMA eff., 1745 RPM, 5 HP**	**Penthouse MER**	**Bell & Gossett Pump Marathon Electric Motor, M#Z1H254TTR R5043ABL,**	**Elec**	**AHU Chilled Water Coil & Standby**	**1995**	**25%**
Cooling	WC-3, Electric Chiller, 2-Pass, 192 Tons, 385 GPM, 142kW	Central Plant	Dunham-Bush	Elec	All Areas	NA	NA
Dehumidification	*HC 4500 EA, Drier Equip 8006, Summer Rental to dehumidify air, 115 kW – Works with AHU-4*	*Roof*	*Munters/SN# 1304*	*Elec.*	*Auditorium*	*2002*	*60%*
Domestic Hot Water	Cap. 80 Gal, Total 18 kW, 3 elements, 6.0 kW each	Penthouse MER	Lime Tamer/DVE 80 916, SN# ME94-0339931-916	Elec	All Areas	1995	25%
Domestic Hot Water	Hot Water Return Pump 1/4 HP, 1725 RPM, 1 phase, S.F. 1.35	Penthouse MER	Bell&Gossett/M 10534 K39	Elec	All Areas	1995	25%
Heating	Fin Tube Radiators 650 Btu/Linear Ft, 3/4" copper pipe	All Areas	Vulvan Dua-Vane	NA	All Areas	1995	25%

Building System	Description	Location	Make/ Model	Fuel	Space Served	Date Installed	Estimated Remaining Useful Life %
Heating	**MP-1&2 Two Hot water Booster Pumps 1.5 HP, 1735 RPM, 80.0% NEMA Eff., Valves are 50% closed to balance**	**Penthouse MER**	**Bell&Gossett Pump, M#L.5X9.5, S#1792075, US Motors, M#G154A, Type DF4**	**Elec**	**Fin Tube Radiator & Standby**	**1995**	**25%**
Heating	**MP-3&4, Two Hot Water Booster Pumps, one Standby, 195 GPM, 2 HP, 1800 RPM; Motor, 82.5% NEMA Eff.**	**Penthouse MER**	**Bell&Gossett/ M2.5x7 8F K39, Baldor Motor: JMM3558T**	**Elec**	**AHU Hot Water Coil & Standby**	**2008**	**90%**
Heating	Two Vulcan Hot Water Unt Heater	Penthouse MER	Vulcan	Elec	Penthouse MER	1995	25%
Heating	CUH-1, Hot Water Cabinet Unit Heaters, 1/10 HP, 45.0 MBH Heating	W Wing Vestibule	Vulcan RW-1190	Elec.	W Wing Vestibule	1995	25%
Heating	CUH-2, Hot Water Cabinet Unit Heaters, 1/10 HP, 45.0 MBH Heating	W Wing Vestibule	Vulcan RW-1190	Elec.	W Wing Vestibule	1995	25%
Heating	CUH-3, Hot Water Cabinet Unit Heaters, 1/10 HP, 45.0 MBH Heating	E Wing Vestibule	Vulcan RW-1190	Elec.	E Wing Vestibule	1995	25%
Heating	CUH-4, Hot Water Cabinet Unit Heaters, 1/10 HP, 45.0 MBH Heating	E Wing Vestibule	Vulcan RW-1190	Elec.	E Wing Vestibule	1995	25%
Heating	CUH-5, Hot Water Cabinet Unit Heaters, 1/10 HP, 45.0 MBH Heating	Auditorium Entrance	Vulcan RW-1120	Elec.	Auditorium Entrance	1995	25%
Heating	CUH-6, Hot Water Cabinet Unit Heaters, 1/10 HP, 45.0 MBH Heating	Auditorium Entrance	Vulcan RW-1120	Elec.	Auditorium Entrance	1995	25%
Heating	UH-1, Hot water Unit Heater, 1/20 HP, 87.1 MBH	E Pent Mech Rm	Vulcan HV-120	Elec.	E Pent Mech Rm	1995	25%
Heating	UH-2, Hot water Unit Heater, 1/20 HP, 87.1 MBH	E Pent Mech Rm	Vulcan HV-120	Elec.	E Pent Mech Rm	1995	25%
Heating	UH-3, Hot water Unit Heater, 1/20 HP, 87.1 MBH	W Pent Mech Rm	Vulcan HV-120	Elec.	W Pent Mech Rm	1995	25%

Building System	Description	Location	Make/ Model	Fuel	Space Served	Date Installed	Estimated Remaining Useful Life %
Heating/ Cooling	**AHU-1, Air Handler, V-Belt Drive Kit, 15 HP Supply Fan, 1770 RPM, 91.0% NEMA Eff., 5 HP Return Fan, 593 MBH Cooling, 328.3 MBH Heating**	**E Wing Penthouse**	**Carrier, 39NXH39-N-41267, Browning/LX4 1267, SN#3493T41267, Dayton Motor M#3KW46**	**Elec**	**East Wing**	**1995**	**25%**
Heating/ Cooling	**AHU-2 V-Belt Drive Kit, 15 HP Supply Fan RPM 1349, 5 HP Return Fan, Air Handler, 465.9 MBH Cooling, 293.5 MBH Heating, Vanes for VVB**	**W Wing Penthouse**	**Carrier 39NXH321NVL 41268-S, Browning/LX4 1268, SN# 3593T41268**	**Elec**	**Lobby/Gallery/Labs**	**1995**	**25%**
Heating/ Cooling	**AHU-3 V-Belt Drive Kit, 7.5 HP, RPM 1957, Supply Fan, 5 HP Return Fan, 333.1 MBH Cooling, 150.2 MBH Heating, w/vanes, VVB Box**	**W Wing Penthouse**	**Carrier 39NXH171NVR 41269-S, Browning/LX4 1269, SN#3493T41269**	**Elec**	**Back Stage Area**	**1995**	**25%**
Heating/ Cooling	**AHU-4, V-Belt Drive Kit, 7.5 HP, RPM 1340, Supply Fan, 5 HP Return Fan 380.6 MBH Cooling, 248.1 MBH Heating, No vanes, Constant Volume Unit**	**W Wing Penthouse**	**Carrier 39NXH261NVL 41270-S Browning/LX4 1270, SN# 3493T41270**	**Elec**	**Front Auditorium (Theatre Side Stage)**	**1995**	**25%**
Heating/ Cooling	**AHU-5 V-Belt Drive Kit, 7.5 HP, 1521 RPM Supply Fan, 5 HP Return Fan, 354.3 MBH Cooling, 251.4 MBH Heating, Constant Volume**	**W Wing Penthouse**	**Carrier 39NXH211NVR 41271-SBrowning/LX 41271, SN# 3493T41271**	**Elec**	**Rear Auditorium (Balcony)**	**1995**	**25%**
HVAC	Variable Volume Boxes, no reheats VVB-1 to 12 & 23 to 27 served by AHU-1, VVB-13 to 22 served by AHU-2, VVB20&21 by AHU-3, Four Constant Volume Boxes CVB's	Throughout Ductwork	Anemostat	Elec	All Areas	1995	25%
Ventilation	Back-up generator, 1800 RPM, 1PH:83.3 kW, 3PH:125kW	Exterior	All Power Onan, Model#125DGEA, SN#G940549740	Diesel	All Areas	1995	25%

Building System	Description	Location	Make/ Model	Fuel	Space Served	Date Installed	Estimated Remaining Useful Life %
Ventilation	EF-1, 1/4HP, 1510 RPM	W Wing Roof	Green Heck M# GB-90-4	Elec.	Toilet	1995	25%
Ventilation	EF-2, 1/4HP, 1510 RPM	E Wing Roof	Green Heck M# GB-90-4	Elec.	Toilet	1995	25%
Ventilation	EF-3, 1/4HP, 1510 RPM	E Wing Roof	Greenheck M#SB-091-4-X, S#109408060707	Elec.	Toilet	1995	25%
Ventilation	EF-4, 1/4HP, 1510 RPM	E Wing Penthouse	Green Heck M# GB-160-5	Elec.	Mech Rm Exhaust	1995	25%
Ventilation	EF-5, 1/4HP, 1510 RPM	W Wing Penthouse	Green Heck M# GB-100-4-3A	Elec.	Mech Rm Exhaust	1995	25%
Ventilation	**EF-6,1 HP, 1510 RPM**	**E Wing Roof**	**Green Heck M# GB-180-10**	**Elec.**	**Transformer Room Exh**	**1995**	**25%**
Ventilation	nameplace not legible	Roof	Penn Ventilator Co.	Elec	Art Room	1995	25%
Ventilation	Outside Air Dampers	Penthouse MER	Honeywell	Electric	All Areas	1995	25%
Transformer	Transformer, 300.0 kVa,	1st Floor Storage	Square D Company, S#35949-17232-026	Elec	All Areas	1995	25%
Transformer	Transformer, 30.0 kVa,	1st Floor Storage	Square D Company, S#33749-17212-058, Cat #30T3HB	Elec	All Areas	1995	25%
Transformer	Transformer, 15.0 kVa,	1st Floor Storage	Square D Company, S#33349-17212-055	Elec	All Areas	1995	25%
Transformer	Transformer, 30.0 kVa,	1st Floor Storage	Square D Company, S#33349-17212-058	Elec	All Areas	1995	25%
Generator	Emergency Generator, 1800 ROM, 3 PH, 156 kVa, 125 kW		Onan Gen Set M#125DGEA, S#G940549740, Cummins Engine		All Areas	1995	25%
Lighting	See Appendix A	-	-	-	-	-	-

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	Classroom (102)	Recessed Parabolic	M	4'T12	9	3	34	Sw	12	260	10	1,010	3,151	T8	Recessed Parabolic	4'T8	E	Sw	9	3	32	12	260	5	909	2836	314	0	314
2	1	Classroom (103)	Recessed Parabolic	M	4'T12	9	3	34	Sw	12	260	10	1,010	3,151	T8	Recessed Parabolic	4'T8	E	Sw	9	3	32	12	260	5	909	2836	314	0	314
3	1	Art Studio 2 (104)	Ceiling Suspended	S	4'T8	4	3	32	Sw	12	260	5	404	1,260	N/A	Ceiling Suspended	4'T8	S	Sw	4	3	32	12	260	5	404	1260	0	0	0
4	1	Art Studio 2 (104)	Track	S	Hal	16	1	75	Sw	12	260	17	1,464	4,568	CFL	Track	CFL	S	Sw	16	1	25	12	260	0	400	1248	3320	0	3320
5	1	Art Studio 1	Track	S	Hal	19	1	75	Sw	12	260	17	1,739	5,424	CFL	Track	CFL	S	Sw	19	1	25	12	260	0	475	1482	3942	0	3942
6	1	Art Studio 1 (104)	Ceiling Suspended	S	4'T8	6	3	32	Sw	12	260	5	606	1,891	N/A	Ceiling Suspended	4'T8	S	Sw	6	3	32	12	260	5	606	1891	0	0	0
7	1	Corridor	Recessed	S	CFL	15	2	13	Sw	12	260	0	390	1,217	N/A	Recessed	CFL	S	Sw	15	2	13	12	260	0	390	1217	0	0	0
8	1	Corridor	Exit Sign	S	Inc	1	1	15	N	24	365	0	15	131	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	83	0	83
9	1	Corridor	Recessed	S	CFL	7	2	26	Sw	12	362	0	364	1,581	N/A	Recessed	CFL	S	Sw	7	2	26	12	362	0	364	1581	0	0	0
10	1	Corridor	Exit Sign	S	Inc	1	1	15	N	24	365	0	15	131	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	83	0	83
11	1	Vending Rm (107)	Recessed Parabolic	M	4'T12	2	3	34	Sw	12	260	10	224	700	T8	Recessed Parabolic	4'T8	E	Sw	2	3	32	12	260	5	202	630	70	0	70
12	1	Office (108)	Recessed Parabolic	M	4'T12	2	3	34	Sw	8	260	10	224	467	T8	Recessed Parabolic	4'T8	E	OS	2	3	32	6	260	5	202	315	47	105	152
13	1	Office (109)	Recessed Parabolic	M	4'T12	2	3	34	Sw	8	260	10	224	467	T8	Recessed Parabolic	4'T8	E	OS	2	3	32	6	260	5	202	315	47	105	152
14	1	Office (110)	Recessed Parabolic	M	4'T12	2	3	34	Sw	8	260	10	224	467	T8	Recessed Parabolic	4'T8	E	OS	2	3	32	6	260	5	202	315	47	105	152
15	1	Office (111)	Recessed Parabolic	M	4'T12	2	3	34	Sw	8	260	10	224	467	T8	Recessed Parabolic	4'T8	E	OS	2	3	32	6	260	5	202	315	47	105	152
16	1	Office (112)	Recessed Parabolic	M	4'T12	2	3	34	Sw	8	260	10	224	467	T8	Recessed Parabolic	4'T8	E	OS	2	3	32	6	260	5	202	315	47	105	152
17	1	Corridor	Recessed	S	CFL	8	2	13	Sw	12	260	0	208	649	N/A	Recessed	CFL	S	Sw	8	2	13	12	260	0	208	649	0	0	0
18	1	Corridor	Exit Sign	S	Inc	1	1	15	N	24	365	0	15	131	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	83	0	83
19	1	Vestibule	Recessed	S	CFL	3	2	9	Sw	12	365	0	54	237	N/A	Recessed	CFL	S	Sw	3	2	9	12	365	0	54	237	0	0	0
20	1	Bathroom Men	Recessed Parabolic	M	4'T12	2	2	34	Sw	12	365	10	156	685	T8	Recessed Parabolic	4'T8	E	OS	2	2	32	9	365	5	138	453	81	151	232
21	1	Bathroom Women	Recessed Parabolic	M	4'T12	2	2	34	Sw	12	365	10	156	685	T8	Recessed Parabolic	4'T8	E	OS	2	2	32	9	365	5	138	453	81	151	232
22	1	Electric Closet	Wall Mounted	S	CFL	1	1	13	Sw	2	260	0	13	7	N/A	Wall Mounted	CFL	S	Sw	1	1	13	2	260	0	13	7	0	0	0
23	1	Admin. Support	Recessed Parabolic	M	4'T12	6	3	34	Sw	8	260	10	673	1,400	T8	Recessed Parabolic	4'T8	E	OS	6	3	32	6	260	5	606	945	140	315	455
24	1	Conference /Seminar	Recessed Parabolic	M	4'T12	9	2	34	Sw	8	260	10	704	1,464	T8	Recessed Parabolic	4'T8	E	OS	9	2	32	6	260	5	621	969	172	323	495
25	1	Conference /Seminar	Recessed	S	Inc	4	1	150	Sw	8	260	0	600	1,248	CFL	Recessed	CFL	S	OS	4	1	50	6	260	0	200	312	832	104	936
26	1	Corridor	Recessed	S	CFL	5	2	13	Sw	12	365	0	130	569	N/A	Recessed	CFL	S	Sw	5	2	13	12	365	0	130	569	0	0	0
27	1	Corridor	Exit Sign	S	Inc	2	1	15	N	24	365	0	30	263	LEDex	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	166	0	166
28	1	Office (123)	Recessed Parabolic	M	4'T12	2	3	34	Sw	8	260	10	224	467	T8	Recessed Parabolic	4'T8	E	OS	2	3	32	6	260	5	202	315	47	105	152
29	1	Office (124)	Recessed Parabolic	M	4'T12	2	3	34	Sw	8	260	10	224	467	T8	Recessed Parabolic	4'T8	E	OS	2	3	32	6	260	5	202	315	47	105	152
30	1	Office (125)	Recessed Parabolic	M	4'T12	2	3	34	Sw	8	260	10	224	467	T8	Recessed Parabolic	4'T8	E	OS	2	3	32	6	260	5	202	315	47	105	152

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)
31	1	Corridor (126)	Recessed	S	CFL	8	2	13	Sw	12	365	0	208	911	N/A	Recessed	CFL	S	Sw	8	2	13	12	365	0	208	911	0	0	0
32	1	Corridor	Exit Sign	S	Inc	1	1	15	N	24	365	0	15	131	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	83	0	83
33	1	Pantry (127)	Recessed Parabolic	M	4'T12	1	1	34	Sw	8	260	10	44	92	T8	Recessed Parabolic	4'T8	E	Sw	1	1	32	8	260	5	37	77	15	0	15
34	1	Dir. Office (128)	Recessed Parabolic	M	4'T12	2	1	34	Sw	8	260	10	88	184	T8	Recessed Parabolic	4'T8	E	OS	2	1	32	6	260	5	74	115	30	38	68
35	1	Dir. Office	Recessed	S	Inc	4	1	150	Sw	8	260	0	600	1,248	CFL	Recessed	CFL	S	OS	4	1	50	6	260	0	200	312	832	104	936
36	1	Office (129)	Recessed Parabolic	M	4'T12	2	1	34	Sw	8	260	10	88	184	T8	Recessed Parabolic	4'T8	E	OS	2	1	32	6	260	5	74	115	30	38	68
37	1	Office (130)	Recessed Parabolic	M	4'T12	2	1	34	Sw	8	260	10	88	184	T8	Recessed Parabolic	4'T8	E	OS	2	1	32	6	260	5	74	115	30	38	68
38	1	Office (131)	Recessed Parabolic	M	4'T12	2	1	34	Sw	8	260	10	88	184	T8	Recessed Parabolic	4'T8	E	OS	2	1	32	6	260	5	74	115	30	38	68
39	1	Office (132)	Recessed Parabolic	M	4'T12	2	1	34	Sw	8	260	10	88	184	T8	Recessed Parabolic	4'T8	E	OS	2	1	32	6	260	5	74	115	30	38	68
40	1	Gallery	Track	S	Hal	14	1	150	Sw	12	260	33	2,562	7,993	CFL	Track	CFL	S	Sw	14	1	50	12	260	0	700	2184	5809	0	5809
41	1	Gallery (155)	Sconce	S	Quartz Halogen	5	1	150	Sw	12	260	30	900	2,808	N/A	Sconce	Quartz Halogen	S	Sw	5	1	150	12	260	30	900	2808	0	0	0
42	1	Gallery	Exit Sign	S	Inc	1	1	15	N	24	365	0	15	131	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	83	0	83
43	1	Corridor	Recessed	S	CFL	19	2	26	Sw	12	365	0	988	4,327	N/A	Recessed	CFL	S	Sw	19	2	26	12	365	0	988	4327	0	0	0
44	1	Corridor	Recessed	S	CFL	1	2	13	Sw	12	365	0	26	114	N/A	Recessed	CFL	S	Sw	1	2	13	12	365	0	26	114	0	0	0
45	1	Corridor	Recessed	S	Hal	9	1	150	Sw	12	365	33	1,647	7,214	CFL	Recessed	CFL	S	Sw	9	1	50	12	365	0	450	1971	5243	0	5243
46	1	Corridor	Exit Sign	S	Inc	3	1	15	N	24	365	0	45	394	LEDex	Exit Sign	LED	S	N	3	1	5	24	365	1	17	145	250	0	250
47	1	Vestibule	Recessed	S	CFL	1	2	13	Sw	12	365	0	26	114	N/A	Recessed	CFL	S	Sw	1	2	13	12	365	0	26	114	0	0	0
48	1	Vestibule	Recessed	S	MH	1	2	100	PC	12	365	28	228	999	T5	Recessed	4'T5	E	PC	1	4	28	12	365	4	116	508	491	0	491
49	1	Vestibule	Exit Sign	S	Inc	1	1	15	N	24	365	0	15	131	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	83	0	83
50	1	Bathroom Women	Recessed Parabolic	M	4'T12	2	2	34	Sw	8	365	10	156	457	T8	Recessed Parabolic	4'T8	E	OS	2	2	32	6	365	5	138	302	54	101	154
51	1	Storage Closet	Parabolic Ceiling	M	4'T12	1	2	34	Sw	2	260	10	78	41	T8	Parabolic Ceiling	4'T8	E	Sw	1	2	32	2	260	5	69	36	5	0	5
52	1	Storage Closet	Parabolic Ceiling	M	4'T12	1	2	34	Sw	2	260	10	78	41	T8	Parabolic Ceiling	4'T8	E	Sw	1	2	32	2	260	5	69	36	5	0	5
53	1	Bathroom Men (150)	Recessed Parabolic	M	4'T12	2	2	34	Sw	8	260	10	156	325	T8	Recessed Parabolic	4'T8	E	OS	2	2	32	6	260	5	138	215	38	72	110
54	1	Vestibule (152)	Recessed Parabolic	S	CFL	3	2	9	Sw	12	365	0	54	237	N/A	Recessed Parabolic	CFL	S	Sw	3	2	9	12	365	0	54	237	0	0	0
55	1	Classroom (148)	Recessed Parabolic	M	4'T12	12	3	34	Sw	8	260	10	1,346	2,801	T8	Recessed Parabolic	4'T8	E	Sw	12	3	32	8	260	5	1212	2521	280	0	280
56	1	Classroom (148)	Recessed Parabolic	S	CFL	1	2	9	Sw	8	260	0	18	37	N/A	Recessed Parabolic	CFL	S	Sw	1	2	9	8	260	0	18	37	0	0	0
57	1	Classroom	Exit Sign	S	Inc	1	1	15	N	24	365	0	15	131	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	83	0	83
58	1	Music Practice Rm	Recessed Parabolic	E	4'T8	3	4	32	Sw	8	260	5	399	830	C	Recessed Parabolic	4'T8	E	OS	3	4	32	6	260	5	399	622	0	207	207
59	1	Practice Rm 1 (147)	Recessed Parabolic	E	4'T8	2	4	32	Sw	8	260	5	266	553	C	Recessed Parabolic	4'T8	E	OS	2	4	32	6	260	5	266	415	0	138	138
60	1	Practice Rm 2 (147)	Recessed Parabolic	E	4'T8	2	4	32	Sw	8	260	5	266	553	C	Recessed Parabolic	4'T8	E	OS	2	4	32	6	260	5	266	415	0	138	138

Location			Existing Fixture Information												Retrofit Information													Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
61	1	Practice Rm 3 (147)	Recessed Parabolic	E	4'T8	6	4	32	Sw	8	260	5	798	1,660	N/A	Recessed Parabolic	4'T8	E	Sw	6	4	32	8	260	5	798	1660	0	0	0
62	1	Shower	Recessed	S	CFL	1	2	13	Sw	2	260	0	26	14	N/A	Recessed	CFL	S	Sw	1	2	13	2	260	0	26	14	0	0	0
63	1	Bathroom (145)	Recessed Parabolic	S	CFL	1	2	13	Sw	8	260	0	26	54	C	Recessed Parabolic	CFL	S	OS	1	2	13	6	260	0	26	41	0	14	14
64	1	Dressing Rm (144)	Recessed Parabolic	M	4'T12	3	3	34	Sw	8	260	10	337	700	T8	Recessed Parabolic	4'T8	E	Sw	3	3	32	8	260	5	303	630	70	0	70
65	1	Dressing Rm (144)	Ceiling Suspended	S	Inc	6	1	60	Sw	8	260	0	360	749	CFL	Ceiling Suspended	CFL	S	Sw	6	1	20	8	260	0	120	250	499	0	499
66	1	Dressing Rm (144)	Ceiling Suspended	S	CFL	4	1	13	Sw	8	260	0	52	108	N/A	Ceiling Suspended	CFL	S	Sw	4	1	13	8	260	0	52	108	0	0	0
67	1	Dressing Rm (140)	Recessed Parabolic	M	4'T12	4	3	34	Sw	8	260	10	449	934	T8	Recessed Parabolic	4'T8	E	Sw	4	3	32	8	260	5	404	840	93	0	93
68	1	Dressing Rm (140)	Ceiling Suspended	S	Inc	10	1	60	Sw	8	260	0	600	1,248	CFL	Ceiling Suspended	CFL	S	Sw	10	1	20	8	260	0	200	416	832	0	832
69	1	Shower	Recessed	S	CFL	1	2	13	Sw	2	260	0	26	14	N/A	Recessed	CFL	S	Sw	1	2	13	2	260	0	26	14	0	0	0
70	1	Bathroom (142)	Recessed Parabolic	S	CFL	1	2	13	Sw	8	260	0	26	54	C	Recessed Parabolic	CFL	S	OS	1	2	13	6	260	0	26	41	0	14	14
71	1	Corridor (149)	Recessed Parabolic	S	CFL	24	2	13	Sw	12	260	0	624	1,947	N/A	Recessed Parabolic	CFL	S	Sw	24	2	13	12	260	0	624	1947	0	0	0
72	1	Corridor	Exit Sign	S	Inc	2	1	15	N	24	365	0	30	263	LEDex	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	166	0	166
73	1	Corridor	Track	S	Hal	3	1	150	Sw	12	260	33	549	1,713	CFL	Track	CFL	S	Sw	3	1	50	12	260	0	150	468	1245	0	1245
74	1	Electrical Rm (134)	Parabolic Ceiling	M	4'T12	2	2	34	Sw	2	260	10	156	81	T8	Parabolic Ceiling	4'T8	E	Sw	2	2	32	2	260	5	138	72	10	0	10
75	1	Mechanical Rm (135)	Parabolic Ceiling	M	4'T12	2	2	34	Sw	2	260	10	156	81	T8	Parabolic Ceiling	4'T8	E	Sw	2	2	32	2	260	5	138	72	10	0	10
76	1	Costume/Prep (136)	Parabolic Ceiling	M	4'T12	4	2	34	Sw	2	260	10	313	163	T8	Parabolic Ceiling	4'T8	E	Sw	4	2	32	2	260	5	276	144	19	0	19
77	1	Stage Support	Parabolic Ceiling	M	4'T12	10	2	34	Sw	2	260	10	782	407	T8	Parabolic Ceiling	4'T8	E	Sw	10	2	32	2	260	5	690	359	48	0	48
78	1	Corridor (138)	Recessed Parabolic	S	CFL	14	2	13	Sw	12	365	0	364	1,594	N/A	Recessed Parabolic	CFL	S	Sw	14	2	13	12	365	0	364	1594	0	0	0
79	1	Corridor	Exit Sign	S	Inc	3	1	15	N	24	365	0	45	394	LEDex	Exit Sign	LED	S	N	3	1	5	24	365	1	17	145	250	0	250
80	1	Backstage Area (139)	Pendant	S	Hal	27	1	250	Sw	4	52	55	8,235	1,713	CFL	Pendant	CFL	S	Sw	27	1	85	4	52	0	2295	477	1236	0	1236
81	1	Forestage	Recessed	S	CFL	4	2	13	Sw	4	52	0	104	22	N/A	Recessed	CFL	S	Sw	4	2	13	4	52	0	104	22	0	0	0
82	1	Forestage	Exit Sign	S	Inc	3	1	15	N	24	365	0	45	394	LEDex	Exit Sign	LED	S	N	3	1	5	24	365	1	17	145	250	0	250
83	1	Auditorium	Recessed	S	CFL	1	2	13	Sw	3	52	0	26	4	N/A	Recessed	CFL	S	Sw	1	2	13	3	52	0	26	4	0	0	0
84	1	Auditorium	Exit Sign	S	Inc	3	1	15	N	24	365	0	45	394	LEDex	Exit Sign	LED	S	N	3	1	5	24	365	1	17	145	250	0	250
85	1	Vestibule	Recessed	S	CFL	1	2	13	Sw	4	52	0	26	5	N/A	Recessed	CFL	S	Sw	1	2	13	4	52	0	26	5	0	0	0
86	1	Vestibule	Recessed	S	CFL	1	2	13	Sw	4	52	0	26	5	N/A	Recessed	CFL	S	Sw	1	2	13	4	52	0	26	5	0	0	0
87	1	Storage Rm (163)	Parabolic Ceiling	M	4'T12	2	2	34	Sw	4	260	10	156	163	T8	Parabolic Ceiling	4'T8	E	Sw	2	2	32	4	260	5	138	144	19	0	19
88	1	Storage Rm (164)	Parabolic Ceiling	M	4'T12	2	2	34	Sw	4	260	10	156	163	T8	Parabolic Ceiling	4'T8	E	Sw	2	2	32	4	260	5	138	144	19	0	19
89	1	Aud. Entrance	Recessed	S	CFL	1	2	13	Sw	4	52	0	26	5	N/A	Recessed	CFL	S	Sw	1	2	13	4	52	0	26	5	0	0	0
90	1	Stair No.2 (165)	Recessed	S	CFL	2	2	13	Sw	8	260	0	52	108	N/A	Recessed	CFL	S	Sw	2	2	13	8	260	0	52	108	0	0	0

Location			Existing Fixture Information												Retrofit Information													Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
91	1	Stair No.1 (167)	Recessed	S	CFL	2	2	13	Sw	8	260	0	52	108	N/A	Recessed	CFL	S	Sw	2	2	13	8	260	0	52	108	0	0	0
92	1	Lobby	Recessed	S	CFL	3	2	13	Sw	8	365	0	78	228	N/A	Recessed	CFL	S	Sw	3	2	13	8	365	0	78	228	0	0	0
93	1	Lobby (168)	Sconce	S	Quartz Halogen	5	1	150	Sw	8	365	30	900	2,628	N/A	Sconce	Quartz Halogen	S	Sw	5	1	150	8	365	30	900	2628	0	0	0
94	1	Lobby	Exit Sign	S	Inc	4	1	15	Sw	24	365	0	60	526	LEDex	Exit Sign	LED	S	Sw	4	1	5	24	365	1	22	193	333	0	333
95	1	Vestibule	Recessed	S	CFL	3	2	13	Sw	16	365	0	78	456	N/A	Recessed	CFL	S	Sw	3	2	13	16	365	0	78	456	0	0	0
96	Ext	Exterior	Recessed	S	MH	10	2	100	T	12	365	28	2,280	9,986	T5	Recessed	4'T5	E	T	10	4	28	12	365	4	1160	5081	4906	0	4906
97	Ext	Exterior	Wall Mounted	S	MH	8	2	100	T	12	365	28	1,824	7,989	PSMH	Wall Mounted	PSMH	S	T	8	2	70	12	365	14	1232	5396	2593	0	2593
98	Ext	Exterior	Wall Mounted	S	MH	2	1	70	T	12	365	20	179	785	PSMH	Wall Mounted	PSMH	S	T	2	1	50	12	365	10	120	526	259	0	259
99	Mezz	Fly	Parabolic Ceiling	M	4'T12	6	2	34	Sw	4	52	10	469	98	T8	Parabolic Ceiling	4'T8	E	Sw	6	2	32	4	52	5	414	86	11	0	11
100	Ext	Fly	Wall Mounted	S	MH	1	2	100	T	12	365	28	228	999	PSMH	Wall Mounted	PSMH	S	T	1	2	70	12	365	14	154	675	324	0	324
101	Mezz	Fly	Parabolic Ceiling	M	4'T12	18	2	34	Sw	12	52	10	1,408	878	T8	Parabolic Ceiling	4'T8	E	Sw	18	2	32	12	52	5	1242	775	103	0	103
102	Mezz	Fly	Wall Mounted	S	MH	2	2	100	Sw	12	52	28	456	285	PSMH	Wall Mounted	PSMH	S	Sw	2	2	70	12	52	14	308	192	92	0	92
103	Mezz	Backstage	Pendant	S	Hal	27	1	250	Sw	4	52	55	8,235	1,713	CFL	Pendant	CFL	S	Sw	27	1	85	4	52	0	2295	477	1236	0	1236
104	Mezz	Auditorium	Pendant	S	Hal	55	1	250	Sw	4	52	55	16,775	3,489	CFL	Pendant	CFL	S	Sw	55	1	85	4	52	0	4675	972	2517	0	2517
105	Mezz	Auditorium	Wall Mounted	S	Inc	32	2	60	Sw	4	52	0	3,840	799	CFL	Wall Mounted	CFL	S	Sw	32	2	20	4	52	0	1280	266	532	0	532
106	Mezz	Auditorium	Wall Mounted	S	Inc	8	1	150	Sw	4	52	0	1,200	250	CFL	Wall Mounted	CFL	S	Sw	8	1	50	4	52	0	400	83	166	0	166
107	Mezz	Auditorium	Pendant	S	Hal	9	1	150	Sw	4	52	33	1,647	343	CFL	Pendant	CFL	S	Sw	9	1	50	4	52	0	450	94	249	0	249
108	Mezz	Auditorium	Exit Sign	S	Inc	2	1	15	N	24	52	0	30	37	LEDex	Exit Sign	LED	S	N	2	1	5	24	52	1	11	14	24	0	24
109	Mezz	Auditorium	Recessed	S	Inc	2	1	25	Sw	4	52	0	50	10	CFL	Recessed	CFL	S	Sw	2	1	10	4	52	0	20	4	6	0	6
110	Mezz	Projector Room	Parabolic Ceiling	M	4'T12	2	2	34	Sw	4	52	10	156	33	T8	Parabolic Ceiling	4'T8	E	Sw	2	2	32	4	52	5	138	29	4	0	4
111	Mezz	Projector	Wall Mounted	S	Inc	4	1	150	Sw	4	52	0	600	125	CFL	Wall Mounted	CFL	S	Sw	4	1	50	4	52	0	200	42	83	0	83
112	Mezz	Projector	Exit Sign	S	Inc	2	1	15	N	24	52	0	30	37	LEDex	Exit Sign	LED	S	N	2	1	5	24	52	1	11	14	24	0	24
113	Mezz	Vestibule	Recessed	S	CFL	2	2	9	Sw	4	52	0	36	7	N/A	Recessed	CFL	S	Sw	2	2	9	4	52	0	36	7	0	0	0
114	Mezz	Vestibule	Exit Sign	S	Inc	1	1	15	N	24	52	0	15	19	LEDex	Exit Sign	LED	S	N	1	1	5	24	52	1	6	7	12	0	12
115	Mezz	Vestibule 2	Recessed	S	CFL	2	2	9	Sw	4	52	0	36	7	N/A	Recessed	CFL	S	Sw	2	2	9	4	52	0	36	7	0	0	0
116	Mezz	Left Lobby	Recessed	S	Inc	6	1	300	Sw	8	365	0	1,800	5,256	CFL	Recessed	CFL	S	Sw	6	1	100	8	365	0	600	1752	3504	0	3504
117	Mezz	Main Lobby	Pendant	S	Inc	12	1	500	Sw	8	365	0	6,000	17,520	CFL	Pendant	CFL	S	Sw	12	1	165	8	365	0	1980	5782	11738	0	11738
118	Mezz	Main Lobby	Pendant	S	Inc	1	24	40	Sw	8	365	0	960	2,803	CFL	Pendant	CFL	S	Sw	1	24	15	8	365	0	360	1051	1752	0	1752
119	Mezz	Right	Recessed	S	Inc	6	1	300	Sw	8	365	0	1,800	5,256	CFL	Recessed	CFL	S	Sw	6	1	100	8	365	0	600	1752	3504	0	3504
120	Mezz	Auditorium	Spotlight	S	Inc	100	1	60	Sw	4	14	0	6,000	336	CFL	Spotlight	CFL	S	Sw	100	1	20	4	14	0	2000	112	224	0	224
121	Ext	Penthouse	Ceiling Suspended	M	4'T12	14	2	34	Sw	2	260	10	1,095	569	T8	Ceiling Suspended	4'T8	E	Sw	14	2	32	2	260	5	966	502	67	0	67
122	Ext	Penthouse	Wall Mounted	S	MH	2	1	100	T	2	260	28	256	133	PSMH	Wall Mounted	PSMH	S	T	2	1	70	2	260	14	168	87	46	0	46
Totals:						758	242	6,610				995	95,560	146,672						758	246	3,750			362	44,343	80,924	62,883	2,865	65,747

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

Proposed Lighting Summary Table			
Total Gross Floor Area (SF)	42,756		
Average Power Cost ($/kWh)	0.1310		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	20,461	12,267	**8,195**
Exterior Power (watts)	5,862	3,800	**2,062**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	126,210	68,658	**57,552**
Lighting Power (watts)	89,698	40,543	**49,155**
Lighting Power Density (watts/SF)	2.10	0.95	**1.15**
Estimated Cost of Fixture Replacement ($)	62,290		
Estimated Cost of Controls Improvements ($)	5,200		
Total Consumption Cost Savings ($)	**19,658**		

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.

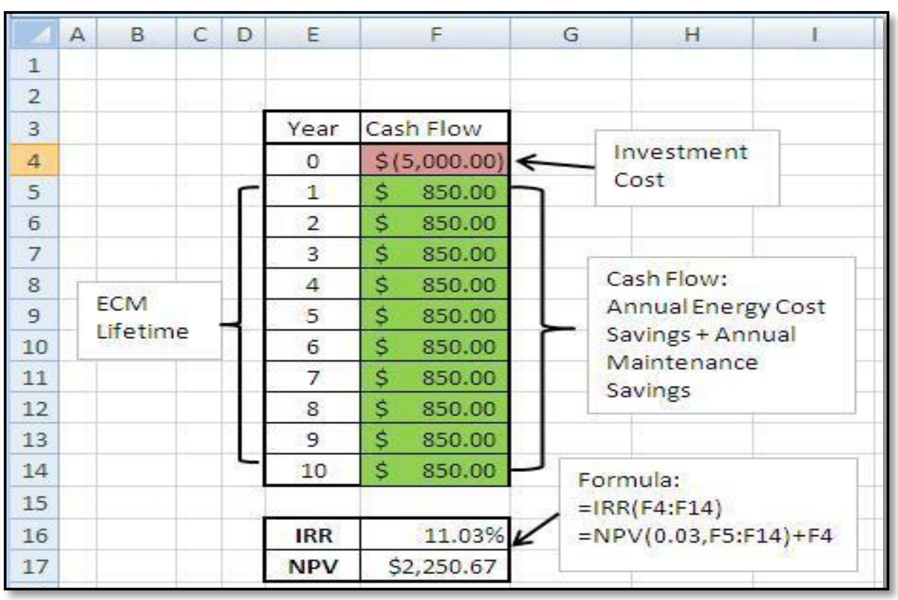
Calculation References

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 - Fine and Performing Arts Building

ENERGY STAR

Building ID: 2307050
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 - Fine and Performing Arts Building
3322 College Drive
Vineland, NJ 08360

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1995
Gross Floor Area (ft²): 42,756

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	3,499,688
Natural Gas (kBtu)[4]	4,448,775
Total Energy (kBtu)	7,948,463
Energy Intensity[5]	
Site (kBtu/ft²/yr)	186
Source (kBtu/ft²/yr)	382
Emissions (based on site energy use)	
Greenhouse Gas Emissions (MtCO_2e/year)	770
Electric Distribution Utility	
Vineland City of	
National Average Comparison	
National Average Site EUI	120
National Average Source EUI	280
% Difference from National Average Source EUI	37%
Building Type	College/University (Campus-Level)

Stamp of Certifying Professional

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

Meets Industry Standards[6] for Indoor Environmental Conditions:

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

Certifying Professional
N/A

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

EPA Form 5900-16

APPENDIX F: INCENTIVE PROGRAMS

New Jersey Clean Energy Pay for Performance

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

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

	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 27 manual thermostats for each VVB to programmable	0	4,509	102,794	18	4,587	19	467	20,127	12	241,520	0.2	5,256	438	446	187,462	234,613
	2	Install 12 VFD's to Pump / Fan Motors	0	12,088	167,717	29	0	13	0	21,927	20	438,533	0.6	3,528	176	181	298,618	300,297
	3	11 New T5 fixtures to be installed with incentives	176	2,134	5,396	1	0	0	975	1,682	15	25,234	1.3	1,082	72	79	17,114	9,662
	4	374 New CFL fixtures to be installed with incentives	none at this time	21,285	49,302	10	0	4	7,385	13,844	5	69,219	1.5	225	45	59	40,461	88,275
	5	Install 2 beverage and 1 Snacks vending machine energy misers in the West Wing snack area	0	637	3,100	1	0	0	0	405	12	4,863	1.6	663	55	63	3,246	5,551

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	6	Replace two 15.0 HP standard fan motors, 91% Eff. with premium efficiency	230	2,148	9,498	2	0	1	0	1,242	20	24,835	1.7	1,056	53	58	15,493	17,006
0-5 Year Payback	7	Replace five 5.0HP and three 7.5HP motors with premium efficiency	570	4,638	17,152	3	0	1	0	2,242	20	44,848	2.1	867	43	48	27,243	30,711
0-5 Year Payback	8	Replace AHU-4 with New unit including dehumidification	0	25,100	-55,747	-10	-351	-5	18,500	10,736	15	161,038	2.3	542	36	43	98,091	-103,683
0-5 Year Payback	9	Replace 32 incandescent Exit signs with LED type	640	4,176	2,306	0	0	0	1,242	1,544	15	23,161	2.7	455	30	37	13,559	4,129
5-10 Year	10	Replace one 1.0 HP standard exhaust fan motors with premium efficiency	50	353	471	0	0	0	0	62	20	1,232	5.7	249	12	17	529	843
5-10 Year	11	Replace two 5.0 HP standard pump CHW motors, 88.5% Eff. with premium efficiency	120	1,020	1,095	0	0	0	0	143	20	2,863	7.1	181	9	13	1,038	1,961

	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
	12	Install 30 kW Solar Photovoltaic system	22,500	187,500	35,400	30	0	3	0	25,628	25	640,701	7.3	242	10	11	134,148	63,384
	13	Replace 1 old refrigerator with 18 cu ft Energy Star model	0	750	350	0	0	0	50	96	12	1,149	7.8	53	4	7	186	627
	14	15 New PSMH fixtures to be installed with incentives	375	10,265	3,314	1	0	0	605	1,040	15	15,593	9.9	52	3	6	1,906	5,935
<10 Year Payback (End of	15	Replace two 1.5 HP and two 2.0 HP standard HW pump motors with premium efficiency	220	1,586	958	0	0	0	0	125	20	2,505	12.7	58	3	5	236	1,715
	16	Install 26 occupancy sensors	520	5,200	2,865	1	0	0	0	375	15	5,629	13.9	8	1	1	-760	5,129
	17	153 New T8 fixtures to be installed with incentives	2,295	24,430	2,564	1	0	0	837	1,173	15	17,599	20.8	-28	-2	-4	-10,295	4,590

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.