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

April 15, 2011

Local Government Energy Program
Energy Audit Report FINAL

Cumberland Christian School

Stratton Hall
1100 W. Sherman Ave
Vineland, NJ 08360

Project Number: LGEA86

Table of Contents

EXECUTIVE SUMMARY

The Cumberland Christian School Stratton Hall is a single-story building with a part mezzanine comprising a total floor area of 24,311 square feet. The original structure was built in 1988, with a major addition in 1998. The following chart provides a comparison of the current building energy usage based on the period from December 2010 through November 2010 with the proposed energy usage resulting from the installation of recommended Energy Conservation Measures (ECMs):

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	147,047	9,892	95,370	62.0	1,491
Proposed	79,763	8,677	76,244	47.6	1,139
Savings	67,284	1,215	19,126	14.4	352
% Savings	45.8%	12.3%	20.1%	23.6%	23.6%
Proposed Renewable Energy	35,400	0	26,947	5.0	-

SWA has entered energy information about the residential complex into the U.S. Environmental Protection Agency's (EPA) Energy Star Portfolio Manager Energy Benchmarking system. The building has an Energy Star Rating of 52 and a Site Energy Utilization of 62.0 kBtu/sqft/yr compared to a national average of 64.0 kBtu/sqft/yr.

Recommendations

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

Table 2: Energy Conservation Measure Recommendations

ECMs	First Year Savings ($)	Simple Payback Period	Initial Investment ($)	CO2 Savings (lbs/yr)
0-5 Year	13,028	1.1	13,794	89,228
5-10 Year	3,566	5.0	17,743	22,822
>10 year	2,531	12.0	30,365	21,815
Total	19,126	3.2	61,902	133,865
Proposed Renewable Energy	26,947	7.8	210,000	63,384

In addition to these ECMs, SWA recommends:

- Capital Investment opportunities – measures that would contribute to reducing energy usage but require significant capital resources as well as long-term financial planning
    - Install NEMA Premium motors when making replacements.
- Operation and Maintenance (O&M) measures that would contribute to reducing energy usage at low cost – not cost
    - Repair/replace sagging, damaged ceiling insulation
    - Repair downspouts, gutters and leaks

There may be energy procurement opportunities for the Cumberland Christian School to reduce annual utility costs, which are $2,685 higher, when compared to the average estimated NJ commercial utility rates. SWA recommends further negotiation with energy suppliers, listed in Appendix D.

Environmental Benefits

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 7 cars from the roads each year or is equivalent of planting 217 trees to absorb CO_2 from the atmosphere.

Energy Conservation Measure Implementation

Based on the requirements of the Local Government Energy Audit (LGEA) program, the Cumberland Christian School 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 $3,902.

SWA recommends that the Cumberland Christian School implement the following Energy Conservation Measures using an appropriate Incentive Programs for reduced capital cost:

Recommended ECMs	Incentive Program (Appendix F for details)
Install Condensing Boiler	Smart Start, Direct Install
Replace T12 Fixtures with T8	Smart Start, Direct Install
Install New CFL fixtures	Direct Install
Install T5 Fixtures	Smart Start, Direct Install
Condensing Units	Smart Start, Direct Install
Install 30.0 kW PV System	SRECS

Appendix H contains an Energy Conservation Measures table which ranks each ECM by Simple Payback.

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 Stratton Hall at 1100 W Sherman Ave. The process of the audit included a facility visit on December 29, 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 Christian School to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Stratton Hall.

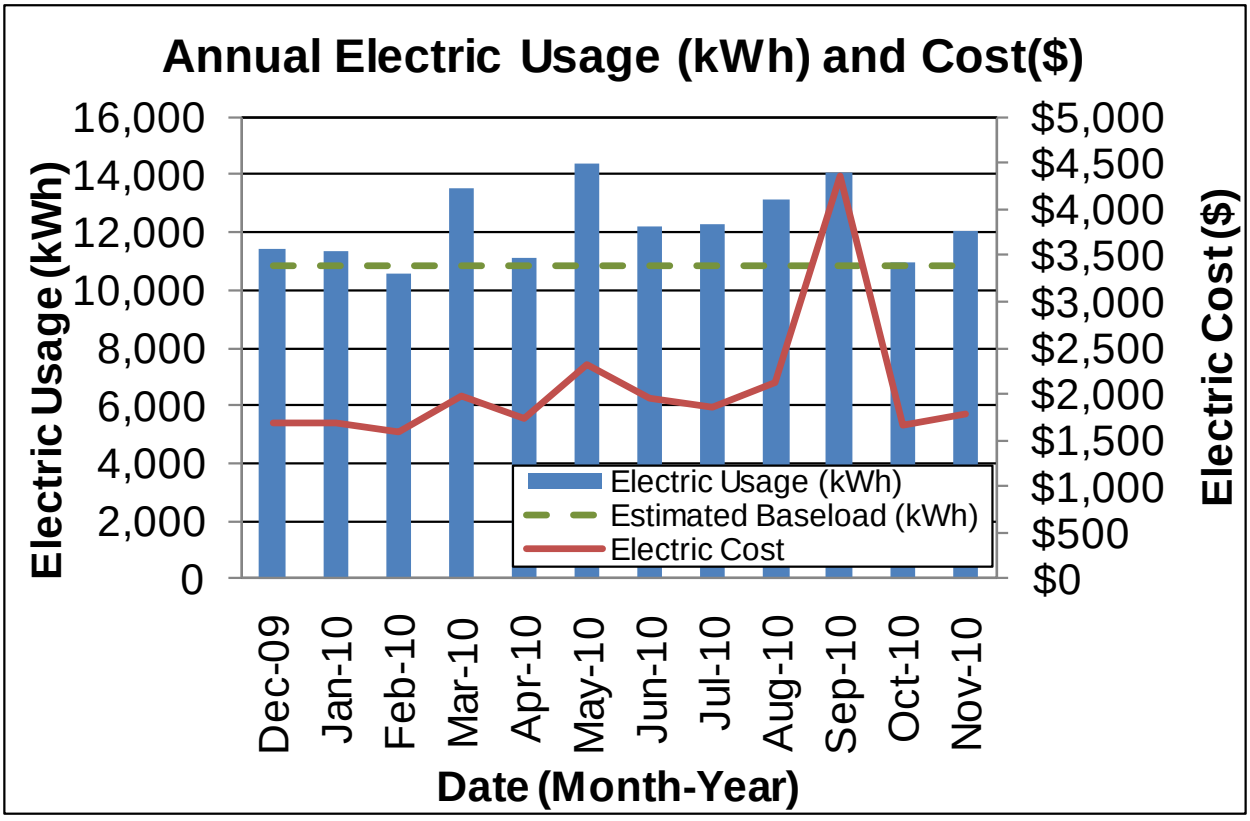
HISTORICAL ENERGY CONSUMPTION

Energy usage, load profile and cost analysis

SWA reviewed utility bills from January 2009 through November 2010 that were received from the utility companies supplying the Stratton Hall with electric and natural gas. A 12 month period of analysis from December 2009 through November 2010 was used for all calculations and for purposes of benchmarking the building.

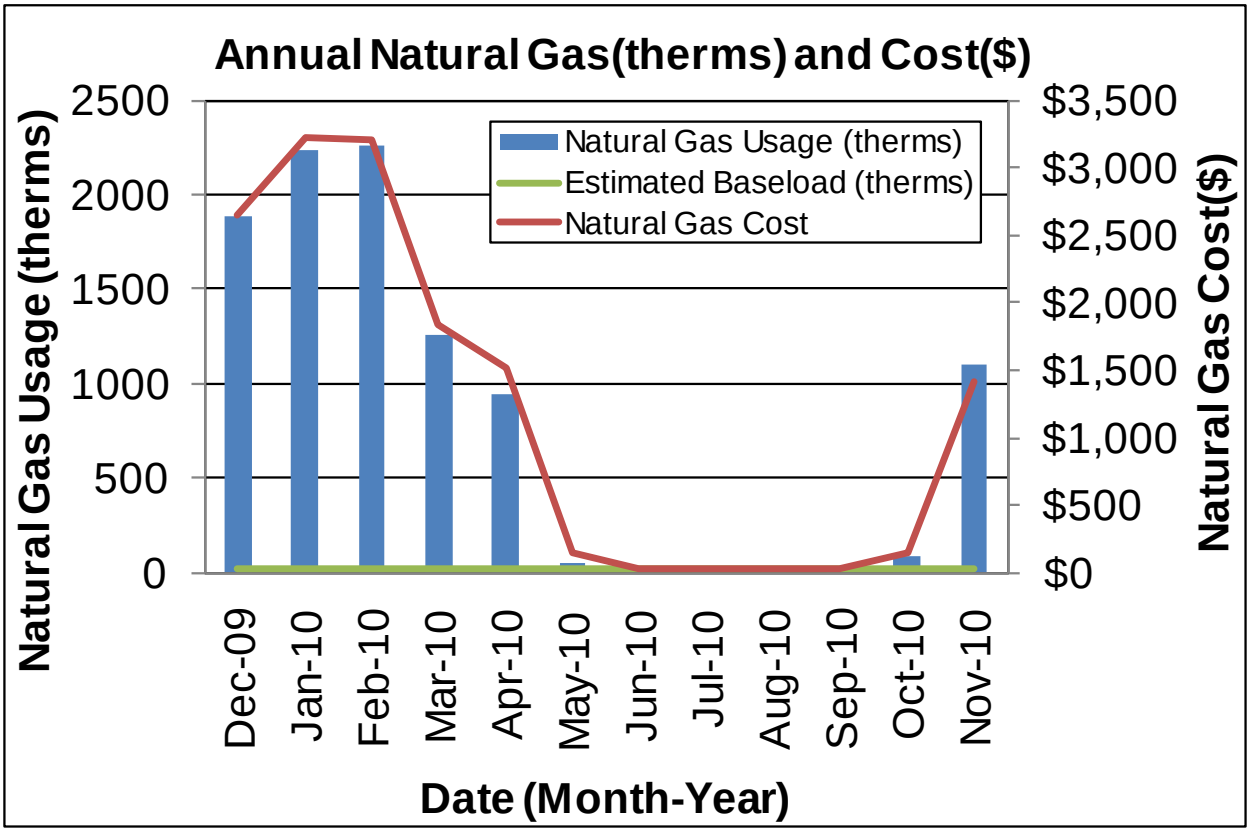
Electricity - The Stratton Hall is currently served by one electric meter that is shared with the Bower Building. The Stratton Hall currently buys electricity from Vineland Municipal Utilities at **an average aggregated rate of $0.168/kWh** and consumed **approximately 147,047 kWh, or $24,742 worth of electricity,** in the previous year. The average monthly demand was 50.2 kW and the annual peak demand was 66.2 kW.

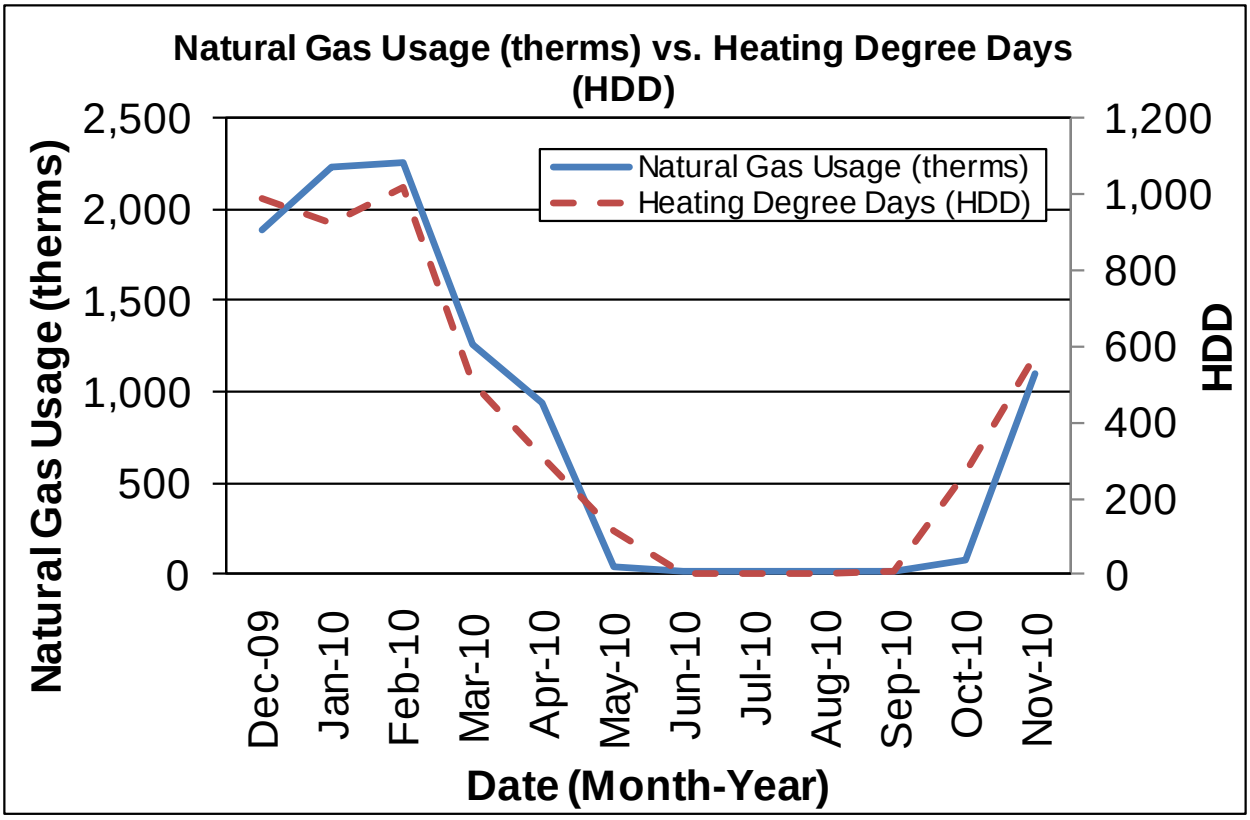
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate the Stratton Hall.



Natural gas - The Stratton Hall is currently served by one meter for natural gas. The Stratton Hall currently buys natural gas from South Jersey Gas at **an average aggregated rate of $1.443/therm** and consumed **approximately 9,892 therms, or $14,270 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 Stratton Hall.

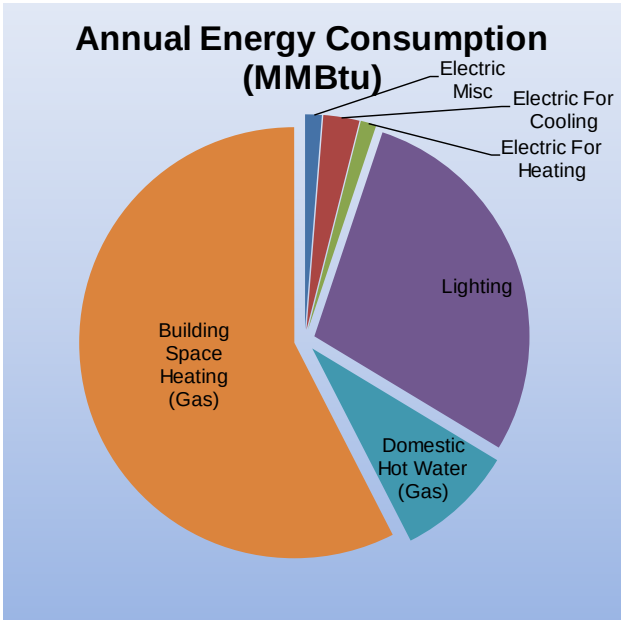


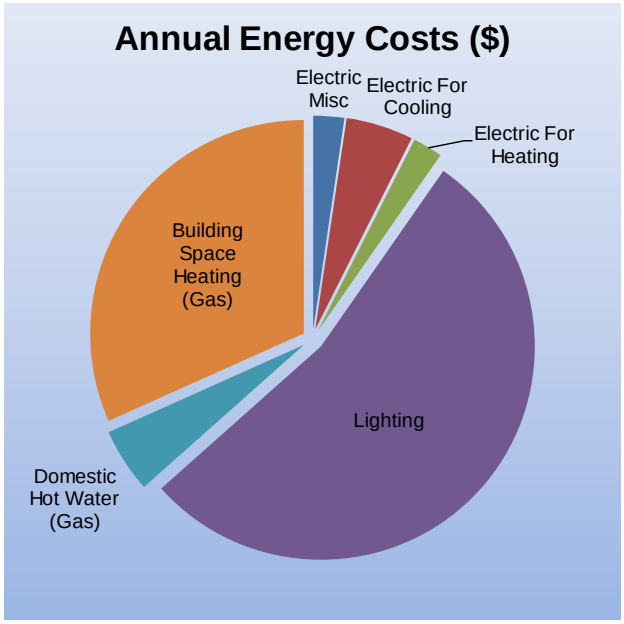


The chart above shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the base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

The following graphs, pie charts, and table show energy use for Stratton Hall based on utility bills for the 12 month period. Note: electrical cost at $49/MMBtu of energy is 3.5 times as expensive as natural gas at $14/MMBtu

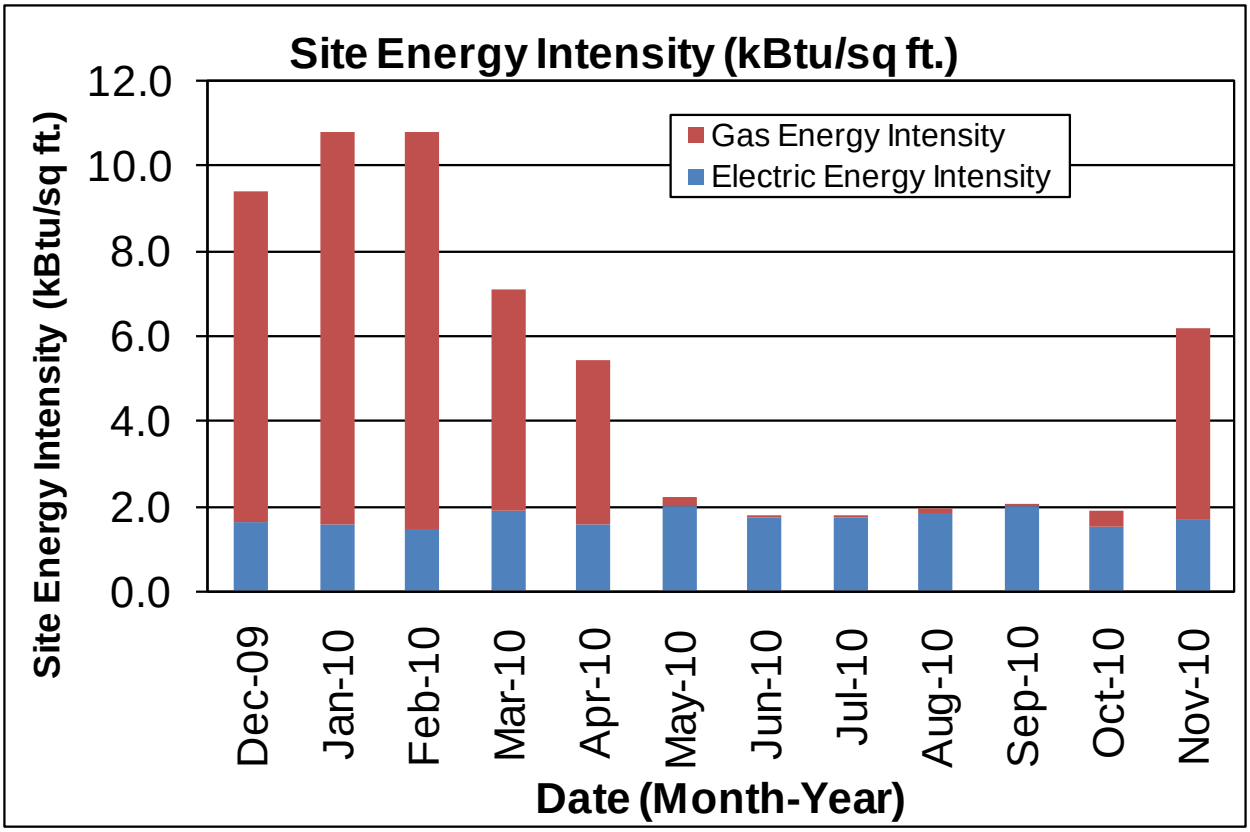
Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Misc	19	1%	$916	2%	49
Electric For Cooling	40	3%	$1,983	5%	49
Electric For Heating	18	1%	$875	2%	49
Lighting	425	29%	$20,969	54%	49
Domestic Hot Water (Gas)	132	9%	$1,897	5%	14
Building Space Heating (Gas)	858	58%	$12,373	32%	14
Totals	1,491	100%	$39,012	100%	
Total Electric Usage	502	34%	$24,742	63%	49
Total Gas Usage	989	66%	$14,270	37%	14
Totals	1,491	100%	$39,012	100%	





Energy benchmarking

SWA has entered energy information about Stratton Hall in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager energy benchmarking system. This school facility is categorized as a K-12 School space type. The ENERGY STAR® Portfolio Manager calculated the Energy Performance Rating, or Site Energy Intensity for the facility to be 62.0 kBtu/sqft/yr compared to the National Average of 64.0 kBtu/sqft/yr. See ECM section for guidance on how to further reduce the building's energy intensity.



Per the LGEA program requirements, SWA has assisted the Cumberland Christian School to create an ENERGY STAR® Portfolio Manager account and share the Bower 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 Christian School ([redacted]) and TRC Energy Services ([redacted]").

Tariff analysis

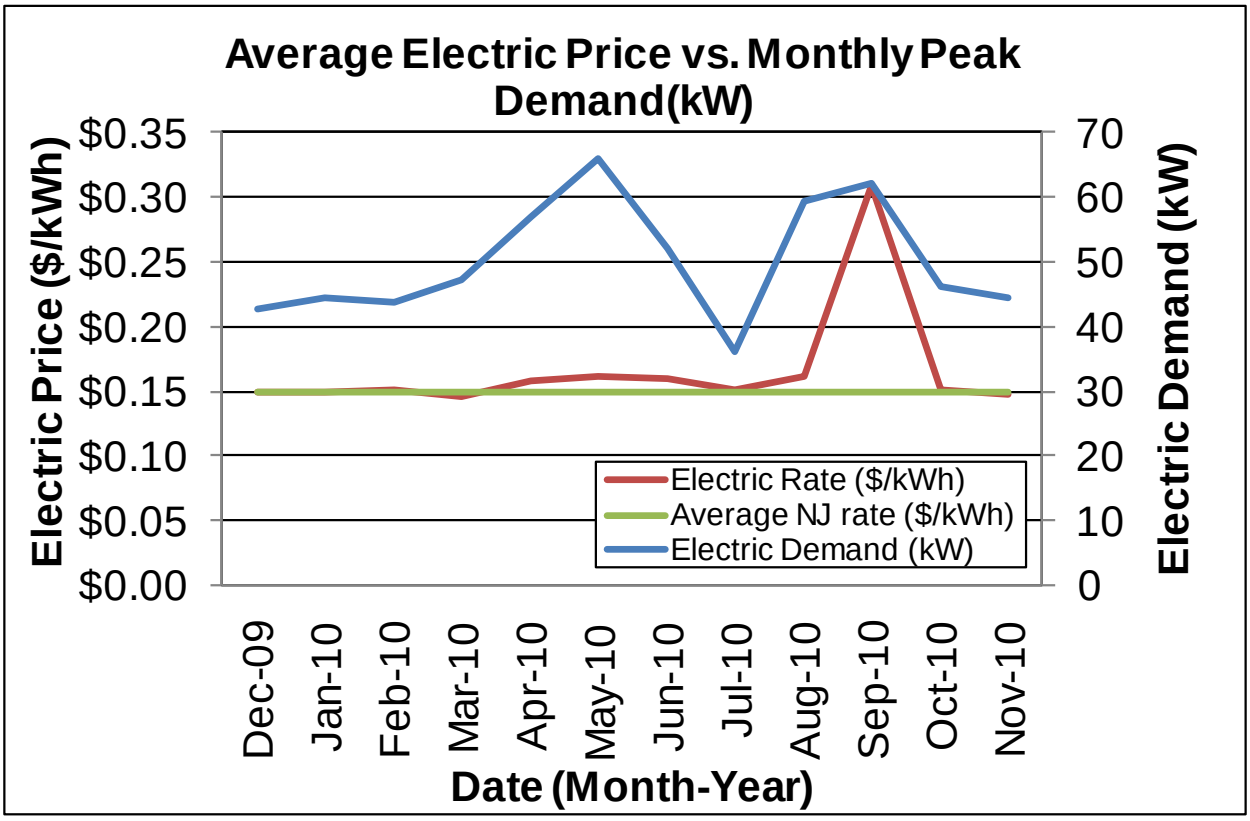
Tariff analysis can help determine if the Cumberland Christian School is paying the lowest rate possible for electric and gas service. Tariffs are typically assigned to buildings based on size and building type. Rate fluctuations are expected during periods of peak usage. Natural gas prices often increase during winter months since large volumes of natural gas is needed for heating equipment. Similarly, electricity prices often increase during the summer months when additional electricity is needed for cooling equipment.

As part of the utility bill analysis, SWA evaluated the current utility rates and tariffs for the Cumberland Christian School. The Stratton Hall is currently paying a general service rate for natural gas including fixed costs such as meter reading charges. The electric use for the building is direct-metered and purchased at a general service rate with an additional charge for electrical demand factored into each monthly bill. The general service rate is a market-rate based on electric usage and electric demand. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year.

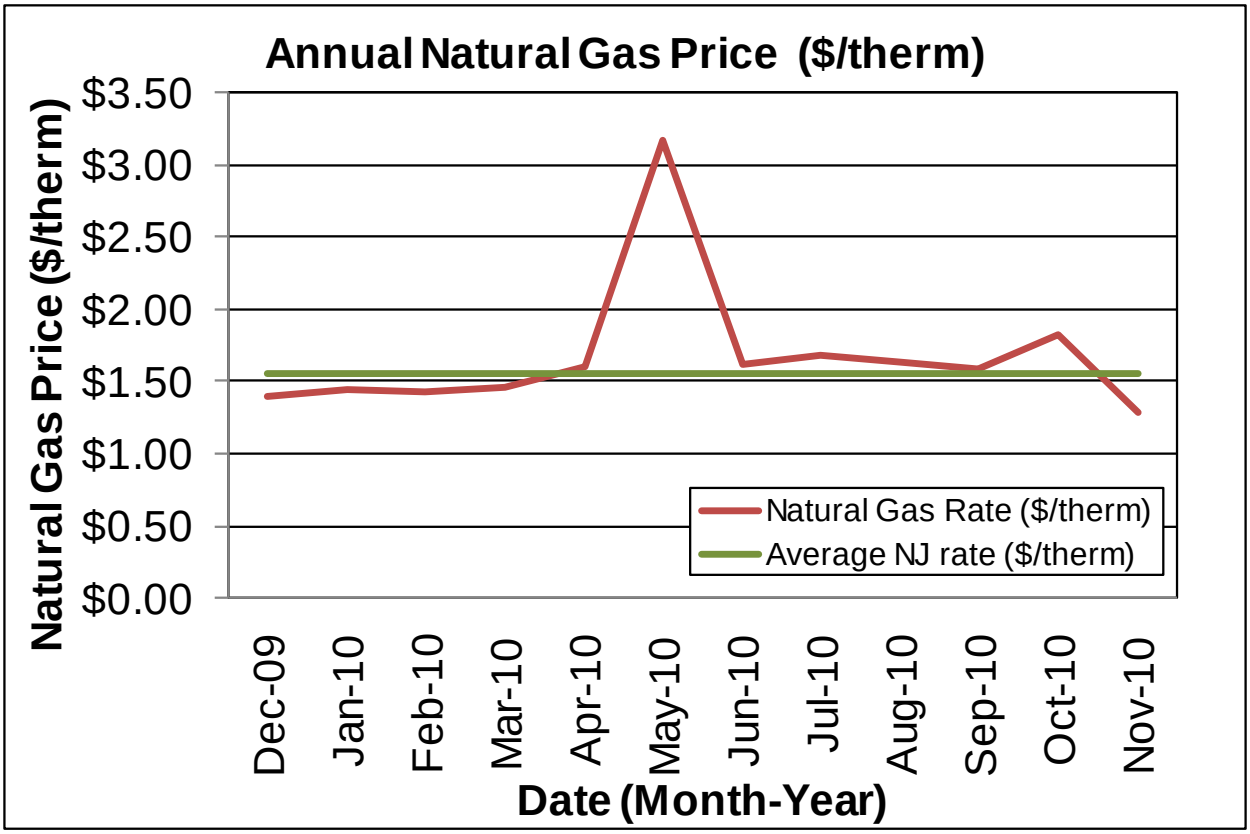
Energy Procurement strategies

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

The average estimated NJ commercial utility rates for electric are $0.150/kWh, while Stratton Hall pays a rate of $0.168/kWh. The Stratton Hall annual electric utility costs are $2,685 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 53% over the most recent 12 month period.



The average estimated NJ commercial utility rates for gas are $1.550/therm, while Stratton Hall pays a rate of $1.443/therm. Natural gas bill analysis shows fluctuations up to 59% 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. The unusual trend in the graph above is due low usage during shoulder months while there are still metering costs.

SWA recommends that the Stratton Hall further explore opportunities of purchasing both natural gas and electricity from third-party suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Stratton Hall. Appendix D contains a complete list of third-party energy suppliers for the Cumberland Christian School 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 Wednesday, December 29, 2010, the following data was collected and analyzed.

Building Characteristics

The partial two-story, (slab on grade,), 21,124 square feet Stratton Hall Building was originally constructed in 1988 with additions in 1998. It houses private offices, classrooms, a gymnasium, locker rooms, kitchen and a cafeteria.

Front Façade

East Façade

Rear Wind D Façade

Front Façade Connecting Main and Wing D

Building Occupancy Profiles

Its occupancy is approximately 115 students and 17 teachers and staff daily from 8am to 3pm and 2 maintenance personnel daily from 3pm to 6pm. For 10 weeks in the summer D wing is used from 8am to 3pm. The gymnasium is used weekday evenings from 3pm to 8pm for 3 months of the year.

Building Envelope

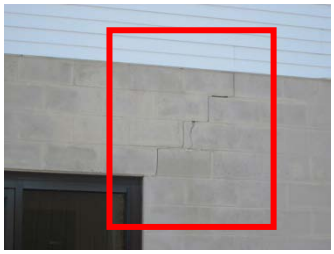
Exterior Walls

The exterior wall envelope is mostly constructed of fluted 8” concrete block with stucco accents. The block has core filled loose insulation. The interior is mostly painted CMU (Concrete Masonry Unit). One small section of the building has an expose CMU finish.

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

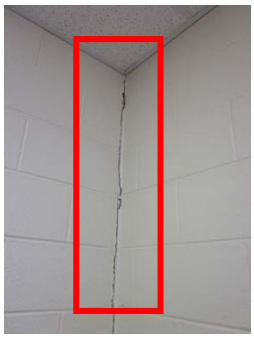
Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall good condition with only a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues.

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



Cracked/deteriorated mortar joints

Missing connection between gutter and drain



Cracked/deteriorated mortar joints

Roof

The original building’s roof is predominantly a low-pitch gable type over a metal structure, with a standing-seam metal finish. There is 6” of R-19 fiberglass batt ceiling insulation throughout the building.

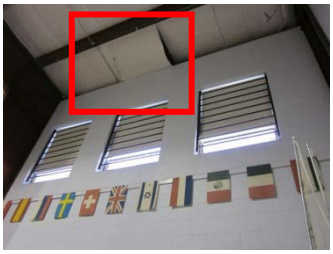
Wing D is constructed of a low-pitch gable type over a wood structure, with a asphalt shingle finish over plywood and #15 felt. There is 8” fiberglass batt, R-30 ceiling insulation.

A connection between the original building and Wing D was added and based on staff reports, the area experiences leaks. No physical evidence was observed during the field visit.

Note: Roof insulation levels could visually be verified in the field by non-destructive methods.

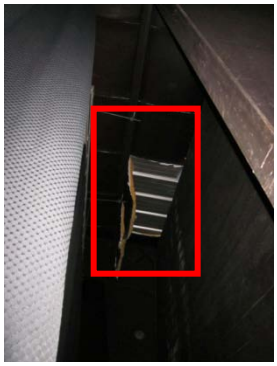
Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall good condition, with only a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues on any roof areas.

The following specific roof problem spots were identified:



Sagging acoustic ceiling insulation in most areas

Damaged acoustic ceiling insulation in most areas



Sagging acoustic ceiling insulation in most areas

Uneven/ineffective attic insulation found

Signs of water damage on interior finishes – Section between Original Building and Wind D

Base

The building's base is composed of a 4" concrete slab-on-grade floor with a perimeter footing with 12" concrete block foundation walls and 2" rigid 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 visible form the exterior only.

Windows

The building contains several different types of windows.

1. 28 awning type windows with an insulated aluminum frame, clear double glazing and interior roller blinds. The windows are located in Wing D and are original.
2. A few awning type windows with an insulated aluminum frame, double pane, wire mesh safety glazing and interior roller blinds. The windows are located on the second floor and are original.
3. Over 20 awning type windows with an insulated aluminum frame, clear double glazing and interior roller blinds, with protection bars. The windows are located in the Gymnasium section and are original.
4. A few fixed type windows with an insulated aluminum frame clear double glazing and no interior or exterior shading devices. The windows are located in the lobby and are original.

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

Exterior doors

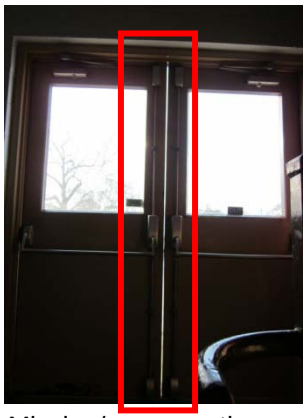
The building contains two different types of exterior doors..

1. There are approximately four aluminum type exterior doors. They are located throughout the building and are original.
2. The front lobby has several glass with aluminum type exterior doors. They are original.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in 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



Missing/worn weather-stripping

Building air-tightness

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

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

Mechanical Systems

Heating Ventilation Air Conditioning

The Stratton Building is only partially cooled. The Gymnasium and Locker room areas are not cooled, whereas the classrooms and offices have cooling. There were no major comfort related complaints.

Equipment

The Stratton Building contains hot water radiant systems, hot water boilers, and direct gas fired furnaces with split direct expansion cooling. A comprehensive Equipment List can be found in Appendix A.

The heating hot water is produced by three (3) gas-fired, Weil McLain, hot water boilers located in the boiler room. The boilers are rated for 325MBH input each and have an estimated 78% thermal efficiency. The boilers were installed in 1985 and are operating beyond their expected usable service life of a small commercial boiler of 20 years according to the LGEA equipment lifespan guidelines. The boilers are still not in bad condition as seen in the picture below.

Weil McLain boilers, no signs of rusting yet

Besides the boilers, there are three heating/cooling Carrier combination furnaces serving the classrooms and offices that were installed in 1998 (as per nameplate serial number determination). The furnaces contain a natural gas burner for heating and an evaporator section for cooling. The heating efficiency of these units is expected to be around 80%. The units have an expected 40% of service life remaining and look to be in good condition.

The cooling condensing units for the furnaces are all located outside. There are three Carrier condensing units all rated for 5 tons cooling capacity each. All units are rated 10SEER or lower and were installed in 1998. They are operating beyond an expected service life of 15 years.

Heating/Cooling furnace

Condensing units outside

Distribution Systems

Hot water pipes in the mechanical room and in the building were not properly insulated. Insulation on hot or cold water piping is a code requirement for safety from scalding as well as thermal energy savings.

Un-insulated hot water pipes in the building

Controls

The heating and cooling furnaces are controlled by three programmable thermostats. Programmable thermostats have been set for weekdays occupied modes from 6am through 4pm, and outside these times and weekends it is unoccupied mode. The winter set-point for occupied mode is 68/69 deg F, and the setback for unoccupied modes is 62 deg F.

The boilers are controlled from a combination of boiler energy management system and manual time clocks. Hot water cabinet heaters are controlled from independent thermostats wall mounted near the equipment.



Boilers controls, EMCS and time clocks


Cabinet heaters
and thermostats

Domestic Hot Water

The domestic hot water (DHW) for the Stratton Building is provided by one natural gas heater. There is one Bradford White 350MBH heater with 75 gallons tank located in the boiler room. It was installed in 1985 and is working beyond its useful service life of 13 years.


Domestic Hot Water

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 Stratton Hall currently contains mostly T12 fixtures and wall sconces with self-ballast bulbs. The Gymnasium uses Metal Halide lights. Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas.

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

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a mix of High Pressure Sodium lamp and CFL fixtures. Exterior lighting is controlled by photocell/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 and printers 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 Stratton Hall has no elevator.

Other electrical systems

There are not currently any other significant energy-impacting electrical systems installed at the Stratton Hall.

RENEWABLE AND DISTRIBUTED ENERGY MEASURES

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

Existing systems

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 Stratton Hall is a good candidate for a 30 kW Solar Panel installation. See ECM# 8 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 Stratton Hall is not a good candidate for wind power generation due to insufficient wind conditions in this area of New Jersey.

Geothermal

The Stratton Hall is not a good candidate for geothermal installation since it would require replacement of the major portions of existing HVAC system and installation of cooling systems where no cooling exists now.

Combined Heat and Power

The Stratton Hall is not a good candidate for CHP installation and would not be cost-effective due to the size and operations of the building. Typically, CHP is best suited for buildings with a 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	net est. ECM cost with incentives, $	kWh, 1st yr savings	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	total 1st yr savings, $	life of measure, yrs	simple payback, yrs	net present value, $	CO_2 reduced, lbs/yr
1	Upgrade (17) Incandescent to CFL	153	2,428	0	0.3	510	5	0.3	2,169	4,347
2	New T5 fixtures to be installed with incentives	1,957	24,186	0	3.4	5,501	15	0.4	62,776	43,305
3	175 New T8 fixtures to be installed with incentives	10,981	21,709	0	3.0	6,610	15	1.7	66,801	38,870
4	Replace 5 incandescent/fluorescent Exit signs with LED type	703	1,511	0	0.2	407	15	1.7	4,084	2,705
5	Upgrade (14) High Pressure Sodium fixtures to pulse start MH	17,743	12,746	0	1.8	3,566	15	5.0	24,222	22,822
6	Replace One Existing Boiler with a Lead Condensing Boiler	19,625	-	1215	5.0	1,741	23	11.3	8,419	13,393
7	Replace 5 tons condensing units, 3 nos.	10,740	4,704	0	0.7	790	15	13.6	-1,441	8,423
8	Install 30 kW Solar Photovoltaic system	210,000	35,400	0	5.0	26,947	25	8	138,397	63,384
	TOTALS	271,902	102,684	1,215	19.4	46,073		5.9	305,427	197,249

Assumptions: Discount Rate: 3.2%; Energy Price Escalation Rate: 0%
Note: A 0.0 electrical demand reduction/month indicates that it is very low/negligible

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

ECM#1: Upgrade Incandescent Lights to CFL

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

Installation cost:
Net estimated installed cost: $153 (includes $68 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

ECM #	Description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1	Upgrade (17) Incandescent to CFL	153	0	153	2,428	0.7	0	0.3	102	510	5	2,550	0.3	1,900	380	333	2,169	4,347

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 – Direct Install – Up to 60% installation cost.

Please see Appendix G for more information on Incentive Programs.

ECM#2: Replace Metal Halide with T5 Fixtures

The existing Stratton Hall lighting consists of standard probe start Metal Halide (MH) lamps in the Gymnasium. SWA recommends replacing the interior higher wattage MH fixtures with 4-lamp T5 fixtures and electronic ballasts which offer the advantages of standard probe start MH lamps, but minimize the disadvantages. They produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. Due to these characteristics, energy savings can be realized via one-to-one substitution of lower-wattage systems, or by taking advantage of higher light output and reducing the number of fixtures required in the space.

The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:
Net estimated installed cost: $1,957 (includes $2,470 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

ECM #	Description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
2	New T5 fixtures to be installed with incentives	4,557	2,600	1,957	24,186	7.3	0	3.4	1,438	5,501	15	82,519	0.4	5,219	348	281	62,776	43,305

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 - Metal Halide with T5 High Bay ($100 per fixture) - Maximum incentive amount is $2,600.
- NJ Clean Energy – Direct Install – Up to 60% installation cost.

Please see Appendix G for more information on Incentive Programs.

ECM#3: Building Lighting Upgrades

The existing lighting contains inefficient T12 fluorescent fixtures with magnetic ballasts. SWA recommends replacing each existing fixture with more efficient, T8 fluorescent fixtures with electronic ballasts. T8 fixtures with electronic ballasts provide equivalent or better light output while reducing energy consumption by 30% when compared to T12 fixtures with magnetic ballasts. T8 fixtures also provide better lumens for less wattage when compared to incandescent, halogen and Metal Halide fixtures. Based on the type of lighting fixture, the T12 lighting can be replaced with packaged T8 Retro-Kit for ease of installation and reduction of cost. The economic breakdown below separates the areas that can accommodate the Retro-Kits. 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:
Net estimated installed cost: $10,981 (includes $7,687 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
	41 T8 Fixtures	5,297	0	5,297	1,644	0.3	0	0.3	1,438	1,684	15	25,265	3.1	377	25	31	14,072	2,944
	134 T8 Retro Kits	7,024	1,340	5,684	20,065	4.2	0	3.2	1,526	4,535	15	68,031	1.3	1097	73	80	46,206	35,926
3	175 New T8 fixtures to be installed with incentives	12,321	1,340	10,981	21,709	4.5	0	3.5	2,963	6,220	15	93,296	1.8	750	50	57	60,278	38,870

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 – T12 with T8 Retro Kits ($10 per fixture) - Maximum incentive amount is $1,340.
- NJ Clean Energy – Direct Install – Up to 60% installation cost.

Please see Appendix G for more information on Incentive Programs.

ECM#4: Replace Incandescent Exit Signs with LED Type

SWA observed that the building contains at least five 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:
Net estimated installed cost: $703 (includes $360 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

ECM #	Description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr sawings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr sawings, $	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
4	Replace 5 incandescent/fluorescent Exit signs with LED type	753	50	703	1,511	0.5	0	0.2	153	407	15	6,103	1.7	1,095	73	58	4,084	2,705

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 – Replace Inc Exit with LED ($10 per fixture) - Maximum incentive amount is $50.
- NJ Clean Energy – Direct Install – Up to 60% installation cost.

Please see Appendix G for more information on Incentive Programs.

ECM#5: Replace HPS with Pulse-Start Metal Halide fixtures

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

Installation cost:
Net estimated installed cost: $17,743 (includes $9,758 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

ECM #	Description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
5	Upgrade (14) High Pressure Sodium fixtures to pulse start MH	18,093	350	17,743	12,746	3.8	0	1.8	1,425	3,566	15	53,495	5.0	322	21	17	24,222	22,822

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 - HPS with pulse start MH ($25 per fixture) - Maximum incentive amount is $350.
- NJ Clean Energy – Direct Install – Up to 60% installation cost.

Please see Appendix G for more information on Incentive Programs.

ECM #6: Replace One Existing Boiler with a Lead Condensing Boiler

Description:
There are three boilers in the Stratton building. Although the boilers are working beyond their expected service lives they don't have any major issues. All of the boilers are rated for 80% efficiency, though they may be operating around 78% efficiency due to efficiency degradation over time. In this light, SWA recommends replacing one existing 325MBH boiler with a new 500MBH condensing boiler. The new boiler will become the lead boiler and work to meet 85% or more of the regular heating load. The back up boilers would fire only in extreme weather and for any emergencies.

Condensing boilers allow condensation of moisture in flue gases resulting in lower flue gas temperatures with increased efficiencies up to 95%. The new high efficiency condensing boilers should have a guaranteed minimum thermal efficiency of 85% and efficiencies of up to 95% achievable during condensing mode at lower return water temperatures.

Installation cost

Estimated installed cost: $19,625 (estimated labor cost of $8,500)
Source of cost estimate: RS Means and similar projects

Economics:

ECM #	Description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
6	Replace One Existing Boiler with a Lead Condensing Boiler	20,500	875	19,625	-	0.0	1215	5.0	0	1,741	23	40,045	11.3	104	5	1	8,419	13,393

Assumptions: SWA assumed the efficiency of the new condensing boilers as 92% for calculating the therms saved, and that of the existing boiler as 78%. SWA assumed that the new boiler would take over 85% of the heating load and serve as the lead boiler.

Rebates/financial incentives: NJ Clean Energy - Gas-fired boilers > 300 MBH ($1.75 per MBH) – Maximum incentive amount is $875

Please see Appendix G for more information on Incentive Programs.

ECM#7: Replace Condensing Units

SWA recommends replacing the three existing Carrier, each of 5 tons cooling capacity, condensing units with ENERGY STAR® rated condensing units with higher operating efficiencies. A split-system central air conditioner consists of an outdoor metal cabinet called the condensing unit which contains the condenser coil and compressor, and an indoor cabinet contains the evaporator coil and supply air fan. Central air conditioners are rated according to their seasonal energy efficiency ratio (SEER - Btu/Watt-hr), which indicates the relative amount of energy needed to provide a specific cooling output. The existing condensing units have an estimated SEER rating of 10; the minimum SEER allowed today is 13. ENERGY STAR® label central air conditioners with SEER ratings of 13 or greater, and up to 16 SEER condensing units are now available. More information can be found in the "Products" section of the ENERGY STAR® website at: http://www.energystar.gov. SWA recommends at least 14 SEER units.

Installation cost:

Estimated installed cost: $10,740 (includes $2,400 of labor)
Source of cost estimate: Manufacturer's data and similar projects

Economics:

ECM #	Description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1 st yr savings	kW, demand reduction/mo	therms, 1 st yr savings	kBtu/sq ft, 1 st yr savings	est. operating cost, 1 st yr savings, $	total 1 st 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
7	Replace 5 tons condensing units, 3 nos.	12,120	1,380	10,740	4,704	1.4	0	0.7	0	790	15	11,854	13.6	10	1	-2	-1,441	8,423

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

Rebates/financial incentives:

NJ Clean Energy – Unitary HVAC/Split Systems, 14 SEER minimum, <5.4 tons cooling, $92/ton; maximum incentive available is $1,380

Please see Appendix G for more information on Incentive Programs.

ECM#8: Install a 30 kW solar photovoltaic rooftop 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, especially during the peak summer months when the school is generally closed. A PV system could be installed on a portion of the roof with panels facing south. A commercial multi-crystalline 230 watt panel has 17.5 square feet of surface area (providing 13.1 watts per square foot). A 30 kW system needs approximately 131 panels which would take up 2,293 square feet. SWA found the available roof area for solar panels to be 8,000 square feet which could easily accommodate the recommended size.

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 note that this analysis did not consider the structural capability of the existing building to support the above recommended system. SWA recommends that the school 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 school should include these costs in the financial analysis of the project.

Installation cost:

Estimated installed cost: $210,000 (including $89,480 total labor cost)
Source of cost estimate: Similar projects

Economics:

ECM #	Description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
8	Install 30 kW Solar Photovoltaic system	210,000	0	210,000	35,400	30	0	5	0	26,947	25	463,680	7.8	121	483	7	138,397	63,384

Cash Flow Year 0	-$210,000								
Cash Flow Year 1	$26,947	Cash Flow Year 6	$26,947	Cash Flow Year 11	$26,947	Cash Flow Year 16	$5,947	Cash Flow Year 21	$5,947
Cash Flow Year 2	$26,947	Cash Flow Year 7	$26,947	Cash Flow Year 12	$26,947	Cash Flow Year 17	$5,947	Cash Flow Year 22	$5,947
Cash Flow Year 3	$26,947	Cash Flow Year 8	$26,947	Cash Flow Year 13	$26,947	Cash Flow Year 18	$5,947	Cash Flow Year 23	$5,947
Cash Flow Year 4	$26,947	Cash Flow Year 9	$26,947	Cash Flow Year 14	$26,947	Cash Flow Year 19	$5,947	Cash Flow Year 24	$5,947
Cash Flow Year 5	$26,947	Cash Flow Year 10	$26,947	Cash Flow Year 15	$26,947	Cash Flow Year 20	$5,947	Cash Flow Year 25	$5,947

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 (230 Watts, model #ND-U230C1). PV systems are sized based on 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 - 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 annual SREC credit of $21,000 has been incorporated in the above costs however it requires proof of performance, application approval and negotiations with the utility.

Please see Appendix G for more information on Incentive Programs.

PROPOSED FURTHER RECOMMENDATIONS

Capital Improvements

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

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

- Install cooling systems for gymnasium – SWA recommends installing cooling systems for the gymnasium and locker rooms for the comfort of students and teachers when funds are available.

- Install a building management system – There is no central building management system currently. Many lights and HVAC systems are manually controlled. It is recommended to install a fully automatic building management system to control boilers, air handling units, lights, and other equipment.

- Replace domestic hot water tank – the DHW heater for the building is working beyond its service live. SWA recommends replacing the heater with an in-kind replacement. The energy savings alone may not justify the replacement and hence it is categorized as a capital improvement.

Operations and Maintenance

Operations and Maintenance measures consist of low/no cost measures that are within the capability of the current building staff to handle. These measures typically require little investment, and they yield a short payback period. These measures may address equipment settings or staff operations that, when addressed will reduce energy consumption or costs.

- Replace broken/deteriorated bricks and re-point cracked mortar joints.

- Install/repair and maintain gutters, downspouts and downspout deflectors to minimize uncontrolled roof water run-off causing exterior wall damage.

- Repair/replace sagging, missing acoustic ceiling insulation.

- Hot water pipes in various sections of the building including mechanical rooms were not insulated. SWA recommends insulating all hot water pipes – insulation not only prevents scalding but also conserves energy that is otherwise wasted.

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

- Provide water-efficient fixtures and controls - Adding controlled on/off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building

staff can also easily install faucet aerators and/or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consumption fixtures/appliances will reduce energy consumption for water heating, while also decreasing water/sewer bills.

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

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

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

Note: The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for Cumberland Christian School. Based on the requirements of the LGEA program, Cumberland Christian School 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 $3,902.

APPENDIX A: EQUIPMENT LIST

Inventory

Building System	Description	Model #	Fuel	Location	Space Served	Year Installed	Estimated Remaining Useful Life %
HVAC	Heating furnace unit with split DX cooling ; 135/110 MBH in/out, est. 81% eff., 115/1/60, 3/4hp supply fan motor	Wing D attic	Carrier, model 58RAV135-10128, S/N 1208010383	Elec./Gas	Wing D	1998	40%
Cooling	Condensing units (3), 5 tons cooling capacity each, 208-230/3/60, MCA 30, R-22	Outdoors	Carrier, model 38CKC060520, S/N 2598E19379	Elec.	Wing D	1998	20%
Heating	(3) Well McLain hot water boiler; 325/257 MBH input/output (**79% rated eff**)	Wing D Boiler room	Weil McLain, model P-56-6-P, S/N 3	Gas	Whole building	1985	0%
Heating	Hot water cabinet heaters (14), 0.05hp motor, 115/1/60	Near exterior doors and under windows/corrid or	KHD Hydronic unit heaters, model C4-08, S/;N R1754	Elec.	Whole building	1985	0%
DHW	Domestic Water Heater, 350/318.2 MBH input/output, 75 gallons tank	Wing D Boiler room	Bradford White, model M-I-75U-350-3NA, S/N EL 7373765	Gas	Whole building	1985	0%
Lighting	See details - Appendix B	-	Electric	See details - Appendix B	Library	2004	70%

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 (402)	Recessed Parabolic	M	4'T12	8	4	40	Sw	9	190	12	1,376	2,353	T8 Kit	Recessed Parabolic	4'T8	E	Sw	8	3	30	9	190	5	758	1295	1058	0	1058
2	1	Classroom (404)	Recessed Parabolic	M	4'T12	8	4	40	Sw	9	190	12	1,376	2,353	T8 Kit	Recessed Parabolic	4'T8	E	Sw	8	3	30	9	190	5	758	1295	1058	0	1058
3	1	Classroom (406)	Recessed Parabolic	M	4'T12	8	4	40	Sw	9	190	12	1,376	2,353	T8 Kit	Recessed Parabolic	4'T8	E	Sw	8	3	30	9	190	5	758	1295	1058	0	1058
4	1	Lunch Rm (405)	Recessed Parabolic	M	4'T12	39	4	40	Sw	8	190	12	6,708	10,196	T8 Kit	Recessed Parabolic	4'T8	E	Sw	39	3	30	8	190	5	3693	5613	4583	0	4583
5	1	Lunch Rm (405)	Exit Sign	S	LED	2	2	5	N	24	365	1	21	184	N/A	Exit Sign	LED	S	N	2	2	5	24	365	1	21	184	0	0	0
6	1	Vestibule	Recessed Parabolic	M	4'T12	11	4	40	Sw	16	261	12	1,892	7,901	T8 Kit	Recessed Parabolic	4'T8	E	Sw	11	3	30	16	261	5	1042	4350	3551	0	3551
7	1	Vestibule	Exit Sign	S	LED	5	2	5	N	24	365	1	53	460	N/A	Exit Sign	LED	S	N	5	2	5	24	365	1	53	460	0	0	0
8	1	Vestibule	Recessed Parabolic	M	4'T12	6	4	40	Sw	9	261	12	1,032	2,424	T8 Kit	Recessed Parabolic	4'T8	E	Sw	6	3	30	9	261	5	568	1335	1090	0	1090
9	1	Bathroom Men	Recessed Parabolic	M	4'T12	2	4	40	Sw	9	261	12	344	808	T8 Kit	Recessed Parabolic	4'T8	E	Sw	2	3	30	9	261	5	189	445	363	0	363
10	1	Bathroom Women	Recessed Parabolic	M	4'T12	2	4	40	Sw	9	261	12	344	808	T8 Kit	Recessed Parabolic	4'T8	E	Sw	2	3	30	9	261	5	189	445	363	0	363
11	1	Office	Ceiling Mounted	M	4'T12	3	2	40	Sw	9	261	12	276	648	T8	Ceiling Mounted	4'T8	E	Sw	3	2	32	9	261	5	207	486	162	0	162
12	1	Office Athletic	Recessed Parabolic	M	4'T12	2	4	40	Sw	9	261	12	344	808	T8 Kit	Recessed Parabolic	4'T8	E	Sw	2	3	30	9	261	5	189	445	363	0	363
13	1	Storage Rm	Recessed Parabolic	M	4'T12	4	4	40	Sw	2	261	12	688	359	T8 Kit	Recessed Parabolic	4'T8	E	Sw	4	3	30	2	261	5	379	198	161	0	161
14	1	Storage Rm	Ceiling Mounted	M	4'T12	6	2	40	Sw	2	261	12	552	288	T8	Ceiling Mounted	4'T8	E	Sw	6	2	32	2	261	5	414	216	72	0	72
15	1	Shop	Ceiling Mounted	M	4'T12	7	2	40	Sw	8	261	12	644	1,345	T8	Ceiling Mounted	4'T8	E	Sw	7	2	32	8	261	5	483	1009	336	0	336
16	1	Backstage Area	Ceiling Mounted	M	4'T12	2	2	40	Sw	9	261	12	184	432	T8	Ceiling Mounted	4'T8	E	Sw	2	2	32	9	261	5	138	324	108	0	108
17	1	Stage	Ceiling Mounted	S	Inc	6	1	60	Sw	8	261	0	360	752	CFL	Ceiling Mounted	CFL	S	Sw	6	1	20	8	261	0	120	251	501	0	501
18	1	Gymnasium	High Bay	S	MH	26	1	400	Sw	9	261	112	13,312	31,270	T5	High Bay	4'T5	E	Sw	26	4	28	9	261	4	3016	7084	24186	0	24186
19	1	Gymnasium	Exit Sign	S	Inc	5	2	20	N	24	365	0	200	1,752	LEDex	Exit Sign	LED	S	N	5	1	5	24	365	1	28	241	1511	0	1511
20	1	Kitchen	Recessed Parabolic	M	4'T12	4	4	40	Sw	9	190	12	688	1,176	T8 Kit	Recessed Parabolic	4'T8	E	Sw	4	3	30	9	190	5	379	648	529	0	529
21	1	Kitchen	Ceiling Mounted	M	4'T12	1	2	40	Sw	9	190	12	92	157	T8	Ceiling Mounted	4'T8	E	Sw	1	2	32	9	190	5	69	118	39	0	39
22	1	Kitchen	Recessed Parabolic	M	4'T12 U-Shaped	1	2	40	Sw	9	190	12	92	157	T8	Recessed Parabolic	4'T8 U-Shaped	E	Sw	1	2	32	9	190	5	69	118	39	0	39
23	1	Locker Room Women	Ceiling Mounted	M	4'T12	8	2	40	Sw	9	190	12	736	1,259	T8	Ceiling Mounted	4'T8	E	Sw	8	2	32	9	190	5	552	944	315	0	315
24	1	Locker Room Women	Ceiling Mounted	E	4'T8	8	2	32	Sw	9	190	5	552	944	N/A	Ceiling Mounted	4'T8	E	Sw	8	2	32	9	190	5	552	944	0	0	0
25	1	Locker Room Women	Ceiling Mounted	M	4'T12	1	4	40	Sw	9	190	12	172	294	T8 Kit	Ceiling Mounted	4'T8	E	Sw	1	3	30	9	190	5	95	162	132	0	132
26	1	Locker Room Women	Exit Sign	S	LED	1	2	5	N	24	365	1	11	92	N/A	Exit Sign	LED	S	N	1	2	5	24	365	1	11	92	0	0	0
27	2	Classroom	Recessed Parabolic	M	4'T12	8	4	40	Sw	9	190	12	1,376	2,353	T8 Kit	Recessed Parabolic	4'T8	E	Sw	8	3	30	9	190	5	758	1295	1058	0	1058

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)
28	2	Classroom (302)	Recessed Parabolic	M	4'T12	6	4	40	Sw	9	190	12	1,032	1,765	T8 Kit	Recessed Parabolic	4'T8	E	Sw	6	3	30	9	190	5	568	971	793	0	793
29	2	Classroom (303)	Recessed Parabolic	M	4'T12	4	4	40	Sw	9	190	12	688	1,176	T8 Kit	Recessed Parabolic	4'T8	E	Sw	4	3	30	9	190	5	379	648	529	0	529
30	2	Classroom (304)	Recessed Parabolic	M	4'T12	5	4	40	Sw	9	190	12	860	1,471	T8 Kit	Recessed Parabolic	4'T8	E	Sw	5	3	30	9	190	5	473	810	661	0	661
31	2	Classroom (304)	Recessed Parabolic	E	4'T8	1	4	32	Sw	9	190	5	133	227	N/A	Recessed Parabolic	4'T8	E	Sw	1	4	32	9	190	5	133	227	0	0	0
32	2	Staircase	Wall Mounted	M	4'T12	1	2	40	Sw	16	190	12	92	280	T8	Wall Mounted	4'T8	E	Sw	1	2	32	16	190	5	69	210	70	0	70
33	2	Hallway	Ceiling Suspended	M	4'T12	3	2	40	Sw	16	190	12	276	839	T8	Ceiling Suspended	4'T8	E	Sw	3	2	32	16	190	5	207	629	210	0	210
34	2	Hallway	Exit Sign	S	LED	2	2	5	N	24	365	1	21	184	N/A	Exit Sign	LED	S	N	2	2	5	24	365	1	21	184	0	0	0
35	2	Boiler Rm	Ceiling Mounted	M	4'T12	2	2	40	Sw	2	190	12	184	70	T8	Ceiling Mounted	4'T8	E	Sw	2	2	32	2	190	5	138	52	17	0	17
36	1	Office Area	Recessed Parabolic	M	4'T12	2	4	40	Sw	9	261	12	344	808	T8 Kit	Recessed Parabolic	4'T8	E	Sw	2	3	30	9	261	5	189	445	363	0	363
37	1	Office Area	Recessed Parabolic	M	4'T12	3	4	40	Sw	9	261	12	516	1,212	T8 Kit	Recessed Parabolic	4'T8	E	Sw	3	3	30	9	261	5	284	667	545	0	545
38	1	Office Area	Recessed Parabolic	E	4'T8	2	4	32	Sw	9	261	5	266	625	N/A	Recessed Parabolic	4'T8	E	Sw	2	4	32	9	261	5	266	625	0	0	0
39	1	Office Area	Recessed Parabolic	M	4'T12	1	4	40	Sw	9	261	12	172	404	T8 Kit	Recessed Parabolic	4'T8	E	Sw	1	3	30	9	261	5	95	222	182	0	182
40	1	Storage Closet	Ceiling Mounted	M	4'T12	1	4	40	Sw	2	261	12	172	90	T8 Kit	Ceiling Mounted	4'T8	E	Sw	1	3	30	2	261	5	95	49	40	0	40
41	1	Office Area	Recessed Parabolic	M	4'T12	8	4	40	Sw	9	261	12	1,376	3,232	T8 Kit	Recessed Parabolic	4'T8	E	Sw	8	3	30	9	261	5	758	1779	1453	0	1453
42	1	Locker Room Men	Ceiling Mounted	M	4'T12	7	2	40	Sw	9	190	12	644	1,101	T8	Ceiling Mounted	4'T8	E	Sw	7	2	32	9	190	5	483	826	275	0	275
43	1	Locker Room Men	Ceiling Mounted	E	4'T8	4	2	32	Sw	9	190	5	276	472	N/A	Ceiling Mounted	4'T8	E	Sw	4	2	32	9	190	5	276	472	0	0	0
44	1	Locker Room Men Office	Ceiling Mounted	M	4'T12	1	4	40	Sw	9	190	12	172	294	T8 Kit	Ceiling Mounted	4'T8	E	Sw	1	3	30	9	190	5	95	162	132	0	132
45	1	Locker Room Men	Exit Sign	S	LED	1	2	5	N	24	365	1	11	92	N/A	Exit Sign	LED	S	N	1	2	5	24	365	1	11	92	0	0	0
46	Ext	Exterior	Pole Mounted Off Building	S	HPS	5	2	400	T	12	365	80	4,400	19,272	PSMH	Pole Mounted Off Building	PSMH	S	T	5	2	250	12	365	50	2750	12045	7227	0	7227
47	Ext	Exterior	Pole Mounted Off Building	S	HPS	3	1	400	T	12	365	80	1,440	6,307	PSMH	Pole Mounted Off Building	PSMH	S	T	3	1	250	12	365	50	900	3942	2365	0	2365
48	Ext	Exterior	Wallpack	S	HPS	6	1	250	T	12	365	50	1,800	7,884	PSMH	Wallpack	PSMH	S	T	6	1	150	12	365	30	1080	4730	3154	0	3154
49	Ext	Exterior	Spotlight	S	Inc	11	1	60	T	12	365	0	660	2,891	CFL	Spotlight	CFL	S	T	11	1	20	12	365	0	220	964	1927	0	1927
Totals:						263	141	3,063				741	50,335	124,623						263	121	1,888			315	24,973	62,043	62,580	0	62,580

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

Proposed Lighting Summary Table			
Total Gross Floor Area (SF)	21,124		
Average Power Cost ($/kWh)	0.1680		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	36,354	21,681	**14,673**
Exterior Power (watts)	8,300	4,950	**3,350**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	88,269	40,362	**47,907**
Lighting Power (watts)	42,035	20,023	**22,011**
Lighting Power Density (watts/SF)	1.99	0.95	**1.04**
Estimated Cost of Fixture Replacement ($)	25,852		
Estimated Cost of Controls Improvements ($)	0		
Total Consumption Cost Savings ($)	**15,469**		

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	FI.	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: UPCOMING EQUIPMENT PHASEOUTS

LIGHTING:

- 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.

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

- Starting **July 2012** many non energy saver model T12 lamps will be phased out of production.

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

- As of **January 1, 2014** 60 and 40 watt incandescent bulbs will be phased out in accordance with the Energy Independence and Security Act of 2007.

- Energy Independence and Security Act of 2007 incandescent lamp phase-out exclusions:
  1. Appliance lamp (e.g. refrigerator or oven light)
  2. Black light lamp
  3. Bug lamp
  4. Colored lamp
  5. Infrared lamp
  6. Left-hand thread lamp
  7. Marine lamp
  8. Marine signal service lamp
  9. Mine service lamp
  10. Plant light lamp
  11. Reflector lamp
  12. Rough service lamp
  13. Shatter-resistant lamp (including a shatter-proof lamp and a shatter-protected lamp)
  14. Sign service lamp
  15. Silver bowl lamp
  16. Showcase lamp
  17. 3-way incandescent lamp
  18. Traffic signal lamp
  19. Vibration service lamp
  20. Globe shaped “G” lamp (as defined in ANSI C78.20-2003 and C79.1-2002 with a diameter of 5 inches or more
  21. T shape lamp (as defined in ANSI C78.20-2003 and C79.1-2002) and that uses not more than 40 watts or has a length of more than 10 inches
  22. A B, BA, CA, F, G16-1/2, G-25, G30, S, or M-14 lamp (as defined in ANSI C79.1-2002 and ANSI C78.20-2003) of 40 watts or less
  23. Candelabra incandescent and other lights not having a medium Edison screw base.

- When installing compact fluorescent lamps (CFLs), be advised that they contain a very small amount of mercury sealed within the glass tubing and EPA guidelines concerning

cleanup and safe disposal of compact fluorescent light bulbs should be followed. Additionally, all lamps to be disposed should be recycled in accordance with EPA guidelines through state or local government collection or exchange programs instead.

HCFC (Hydrochlorofluorocarbons):

- As of **January 1, 2010,** no production and no importing of R-142b and R-22, except for use in equipment manufactured before January 1, 2010, in accordance with adherence to the Montreal Protocol.

- As of **January 1, 2015,** No production and no importing of any HCFCs, except for use as refrigerants in equipment manufactured before January 1, 2010.

- As of **January 1, 2020** No production and no importing of R-142b and R-22.

APPENDIX D: THIRD PARTY ENERGY SUPPLIERS

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

Third Party Electric Suppliers	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Suez Energy Resources NA, Inc. 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com

Third Party Gas Suppliers	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
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 www.intelligentenergy.org
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	(877) 750-7046 www.metromediaenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 www.mxenergy.com
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	(800) 840-4427 www.natgasco.com
NJ Gas & Electric 1 Bridge Plaza, Fl. 2 Fort Lee, NJ 07024	(866) 568-0290 www.NewJerseyGasElectric.com
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	(800) 557-1121 www.woodruffenergy.com

APPENDIX E: GLOSSARY AND METHOD OF CALCULATIONS

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

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

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

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

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

Operating Cost Savings (OCS): This calculation is an annual operating savings for the ECM. It is the difference in the operating, maintenance, and / or equipment replacement costs of the existing case versus the ECM. In the case where an ECM lifetime will be longer than the existing 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.

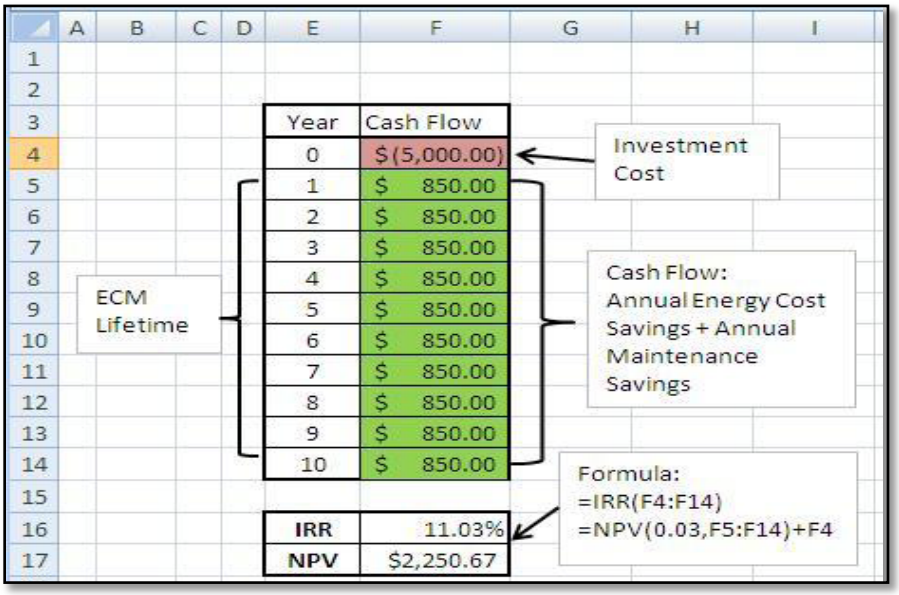
Calculation References

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 Solar Renewable Energy Credits (SRECs) – Market-rate incentive. Calculations assume $600/Megawatt hour consumed per year for a maximum of 15 years; added to annual energy cost savings for a period of 15 years. (Megawatt hour used is rounded to nearest 1,000 kWh)
Assumptions:	A Solar Pathfinder device is used to analyze site shading for the building and determine maximum amount of full load operation based on available sunlight. When the Solar Pathfinder device is not implemented, amount of full load operation based on available sunlight is assumed to be 1,180 hours in New Jersey.

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

ECM and Equipment Lifetimes

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

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

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

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

New Jersey Clean Energy Program Commercial Equipment Life Span

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

APPENDIX F: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Cumberland Christian School - Stratton Hall

Building ID: 2557878
For 12-month Period Ending: September 30, 2010[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: February 14, 2011

Facility	Facility Owner	Primary Contact for this Facility
Cumberland Christian School - Stratton Hall 1100 W. Sherman Avenue Vineland, NJ 08360	N/A	N/A

Year Built: 1988
Gross Floor Area (ft²): 24,311

Energy Performance Rating[2] (1-100) 52

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	497,409
Natural Gas (kBtu)[4]	1,012,577
Total Energy (kBtu)	1,509,986

Energy Intensity[5]	
Site (kBtu/ft²/yr)	62
Source (kBtu/ft²/yr)	112

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	N/A

Electric Distribution Utility
N/A

National Average Comparison	
National Average Site EUI	64
National Average Source EUI	115
% Difference from National Average Source EUI	-3%
Building Type	K-12 School

Stamp of Certifying Professional

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

Certifying Professional
N/A

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**

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 G: INCENTIVE PROGRAMS

New Jersey Clean Energy Pay for Performance

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

The Energy Reduction Plan must define a comprehensive package of measures capable of reducing a building's energy consumption by 15+%. P4P incentives are awarded upon the satisfactory completion of three program milestones: submittal of an Energy Reduction Plan prepared by an approved Program Partner, installation of the recommended measures, and completion of a Post-Construction Benchmarking Report. The incentives for electricity and natural gas savings will be paid based on actual savings, provided that the minimum 15% performance threshold savings has been achieved.

Energy Provider Incentives

- **South Jersey Gas** - Offers financing up to $100,000 on the customer's portion of project cost through private lender. In addition to available financing, it provides matching incentive on gas P4P incentives #2 and #3 up to $100,000 (not to exceed total project cost).
- **Elizabethtown Gas** - Provides matching incentive on gas P4P incentives #2 and #3 up to $25,000 (not to exceed total project cost).

CHP Incentive

- **New Jersey Natural Gas** - Provides matching inventive up to $1mm, requires participation in P4P

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

Direct Install 2011 Program*

Direct Install is a division of the New Jersey Clean Energy Programs' Smart Start Buildings. It is a turn-key program for small to mid-sized facilities to aid in upgrading equipment to more efficient types. It is designed to cut overall energy costs by upgrading lighting, HVAC, and other equipment with energy efficient alternatives. The program pays **up to 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 100 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

Energy Provider Incentives

- **South Jersey Gas** – Program offers financing up to $25,000 on customer's 40% portion of the project and combines financing rate based on portion of the project devoted to gas and electric measures. All gas measures financed at 0%, all electric measures financed at normal rate. Does not offer financing on projects that only include electric measures.
- **Elizabeth Town Gas** - Provides incentive for customer's portion of gas measures up to $25,000, but not to exceed total project cost.
- **Atlantic City Electric –** Provides a free audit, and additional incentives up to 20% of the current incentive up to a maximum of $5,000 per customer.

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

Smart Start

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

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

Energy Provider Incentives

- **South Jersey Gas –** Program to finance projects up to $25,000 not covered by incentive
- **Elizabeth Town Gas**- Will match 100% of Smartstart incentives but not to exceed 100% of project cost
- **New Jersey Natural Gas** – Will match SSB incentives on gas equipment
  PSE&G - Provides funding for site-specific uses of emerging technology. The incentives are determined on a case by case basis.

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

Renewable Energy Incentive Program*

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

Solar Renewable Energy Credits (SRECs) represent all the clean energy benefits of electricity generated from a solar energy system. SRECs can be sold or traded separately from the power, providing owners a source of revenue to help offset the cost of installation. All solar project

owners in New Jersey with electric distribution grid-connected systems are eligible to generate SRECs. Each time a system generates 1,000 kWh of electricity an SREC is earned and placed in the customer's account on the web-based SREC tracking system.

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

Combined Heat and Power (CHP)

Energy Provider Incentives

- South Jersey Gas - Provides additional incentive of $1.00/watt up to $1,000,000 on top of NJCEP incentive.
- Elizabethtown Gas - Provides additional incentive of 50% of the NJCEP incentive up to $500,000.

Utility Sponsored Programs

Check with your local utility companies for further opportunities **t**hat may be available.

Energy Efficiency and Conservation Block Grant Rebate Program

The Energy Efficiency and Conservation Block Grant (EECBG) Rebate Program provides supplemental funding up to $20,000 for eligible New Jersey local government entities to lower the cost of installing energy conservation measures. Funding for the EECBG Rebate Program is provided through the American Recovery and Reinvestment Act (ARRA).

For the most up to date information on how to participate in this program, go to: http://njcleanenergy.com/EECBG.

Other Federal and State Sponsored Programs

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

*Subject to availability. Incentive program timelines might not be sufficient to meet the 25% in 12 months spending requirement outlined in the LGEA program.

APPENDIX H: ENERGY CONSERVATION MEASURES

ECM Counter		ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st year cost savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO2 reduced, lbs/yr
1	0 to 5 Year Payback	Upgrade (17) Incandescent to CFL	153	0	153	2,428	0.7	0	0.3	102	510	5	2,550	0.3	1,900	380	333	2,169	4,347
2		New T5 fixtures to be installed with incentives	4,557	2,600	1,957	24,186	7.3	0	3.4	1,438	5,501	15	82,519	0.4	5,219	348	281	62,776	43,305
3		175 New T8 fixtures to be installed with incentives	12,321	1,340	10,981	21,709	6.5	0	3.0	2,963	6,610	15	99,152	1.7	1,208	81	60	66,801	38,870
4		Replace 5 incandescent/fluorescent Exit signs with LED type	753	50	703	1,511	0.5	0	0.2	153	407	15	6,103	1.7	1,095	73	58	4,084	2,705
		TOTALS	**17,784**	**3,990**	**13,794**	**49,834**	**15**	**0**	**6.9**	**4,656**	**13,028**		**190,323**	**1.1**	-	-	-	**135,830**	**89,228**
5	5 to 10 Year Payback	Upgrade (14) High Pressure Sodium fixtures to pulse start MH	18,093	350	17,743	12,746	3.8	0	1.8	1,425	3,566	15	53,495	5.0	322	21	17	24,222	22,822
		TOTALS	**18,093**	**350**	**17,743**	**12,746**	**3.8**	**0**	**1.8**	**1,425**	**3,566**		**53,495**	**5.0**	-	-	-	**24,222**	**22,822**
6	> 10 Year Paybakc (End of Life ECM)	Replace One Existing Boiler with a Lead Condensing Boiler	20,500	875	19,625	0	0.0	1,215	5.0	0	1,741	23	40,045	11.3	104	5	1	8,419	13,393
7		Replace 5 tons condensing units, 3 nos.	12,120	1,380	10,740	4,704	1.4	0	0.7	0	790	15	11,854	13.6	10	1	-2	-1,441	8,423
		TOTALS	**32,620**	**2,255**	**30,365**	**4,704**	**1**	**1,215**	**5.7**	**0**	**2,531**		**51,899**	**12.0**	-	-	-	**6,978**	**21,815**

Assumptions: Discount Rate: 3.2%; Energy Price Escalation Rate: 0%
Note: A 0.0 electrical demand reduction/month indicates that it is very low/negligible

APPENDIX I: METHOD OF ANALYSIS

Assumptions and tools

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.