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

March 8, 2011

Local Government Energy Program
Energy Audit Draft Report

Eglise Baptiste de la Novelle Jerusalem

706 Nye Avenue
Irvington, NJ 07111

Project Number: LGEA87

Table of Contents

EXECUTIVE SUMMARY 3

INTRODUCTION 5

HISTORICAL ENERGY CONSUMPTION..... 6

EXISTING FACILITY AND SYSTEMS DESCRIPTION..... 12

RENEWABLE AND DISTRIBUTED ENERGY MEASURES..... 22

APPENDIX A: EQUIPMENT LIST 36

APPENDIX B: LIGHTING STUDY 37

APPENDIX C: UPCOMING EQUIPMENT PHASEOUTS 39

APPENDIX D: THIRD PARTY ENERGY SUPPLIERS 41

APPENDIX E: GLOSSARY AND METHOD OF CALCULATIONS..... 44

APPENDIX F: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®..... 48

APPENDIX G: INCENTIVE PROGRAMS 49

APPENDIX H: ENERGY CONSERVATION MEASURES..... 51

APPENDIX I: METHOD OF ANALYSIS 52

EXECUTIVE SUMMARY

The Eglise Baptiste de la Nouvelle Jerusalem (EBNJ) church is a two-story building with full basement comprising a total conditioned floor area of 12,121 square feet. The original structure was built in approximately the early 1970s, and there have been no major renovations or additions since then. The following chart provides a comparison of the current building energy usage based on the period from July 2009 through June 2010 with the proposed energy usage resulting from the installation of recommended Energy Conservation Measures (ECMs) excluding any renewable energy:

Table 1: State of Building—Energy Usage

	Electric Usage	Gas Usage (therms/yr)	Current Annual Cost of Energy	Site Energy Use Intensity (kBtu/sq	Source Energy Use Intensity (kBtu/sq ft	Joint Energy Consumption
Current	26,322	5,109	$16,383	49.6	68.9	601
Proposed	18,241	3,749	$10,706	36.1	49.5	437
Savings	8,081	1,360	$5,677*	13.5	19.3	164
% Savings	30.7%	26.6%	34.7%	27.2%	28.1%	27.2%
Proposed Renewable	8,850	0	$8,336	2.5	2.5	30
*Includes operation and maintenance savings; **Includes SRECS						

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 60 out of 100.

The EBNJ church is a typical church building that contains a simple HVAC system on a small foot print. Based on the size of the building and the limited operational hours, the focus of the recommendations is on envelope issues, equipment replacement and lighting upgrades. One major issue with the building is the use of manual thermostats to control HVAC systems, and another major issue is the outdated roof top package units. The best strategy for the building to improve efficiency would be to replace the package units and deploy programmable thermostats. Electricity used for lighting can be reduced by simple replacements and retrofits. Lastly, based on the available roof area, the building can install a 7.5 kW roof-mounted, Solar Photovoltaic system to offset electricity use and generate revenue through Solar Renewable Energy Credits.

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	$2,569	1.6	$4,236	10,748
5-10 Year	$690	6.0	$4,171	2,397
>10 year	$2,418	16.6	$40,170	16,315
Total	$5,677	8.6	$48,577	29,460
Proposed Renewable Energy	$8,336	6.3	$52,500	15,846

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
    - Provide adequate combustion air to the boiler
    - Replace unit ventilators in classrooms

- Operation and Maintenance (O&M) measures that would contribute to reducing energy usage at low cost – not cost
    - Weather-strip doors
    - Repair roof leaks
    - Provide water-efficient fixtures and controls
    - Purchase Energy Star® appliances

There may be energy procurement opportunities for the EBNJ church to reduce annual utility costs, which are $6,568 higher, when compared to the average estimated NJ commercial utility rates. SWA recommends further negotiation with energy suppliers, listed in Appendix C.

Environmental Benefits

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 2 cars from the roads each year or is equivalent of planting 72 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 EBNJ must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit per building. The minimum amount to be spent, net of other NJCEP incentives, is $2,428.

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

Recommended ECMs	Incentive Program (Appendix F for details)
Retrofit (1) refrigerated vending machine with a VendingMiser™ device	Smart Start, Direct Install
Upgrade (36) Incandescent to CFL	Direct Install
Replace (3) incandescent/fluorescent Exit signs with LED type	Smart Start, Direct Install
Install (3) Programmable Thermostats and (10) TRVs	Direct Install
Retrofit (29) fluorescent T12 light fixtures with T8 retrofit kits	Direct Install

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 Eglise Baptiste de la Nouvelle Jerusalem (EBNJ) at 706 Nye Avenue, Irvington, NJ 07111. The process of the audit included facility visits on 12/14/2010, benchmarking and energy bills analysis, assessment of existing conditions, energy modeling, energy conservation measures and evaluating 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 EBNJ to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the building.

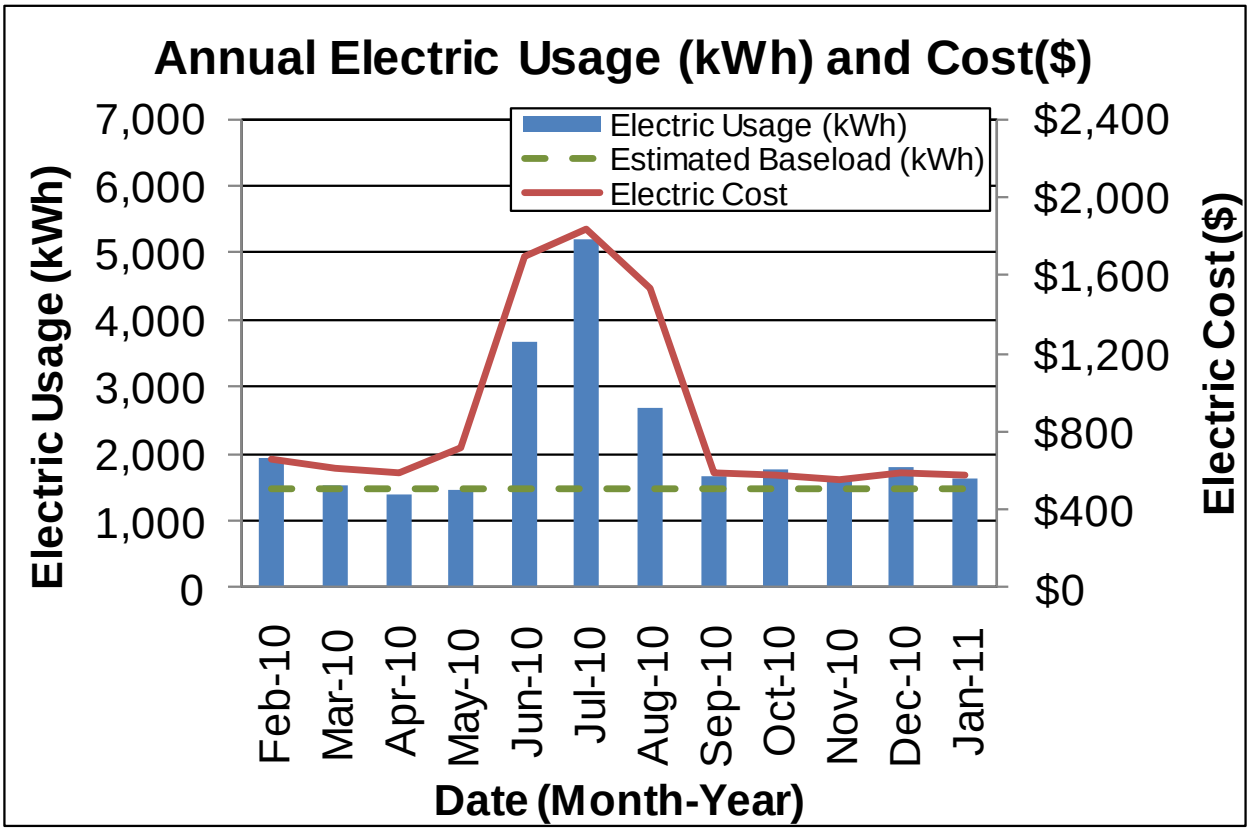
HISTORICAL ENERGY CONSUMPTION

Energy usage, load profile and cost analysis

SWA reviewed utility bills from February 2009 through January 2011 that were received from the utility companies supplying the EBNJ with electric and natural gas. A 12 month period of analysis from February 2010 through January 2011 was used for all calculations and for purposes of benchmarking the building.

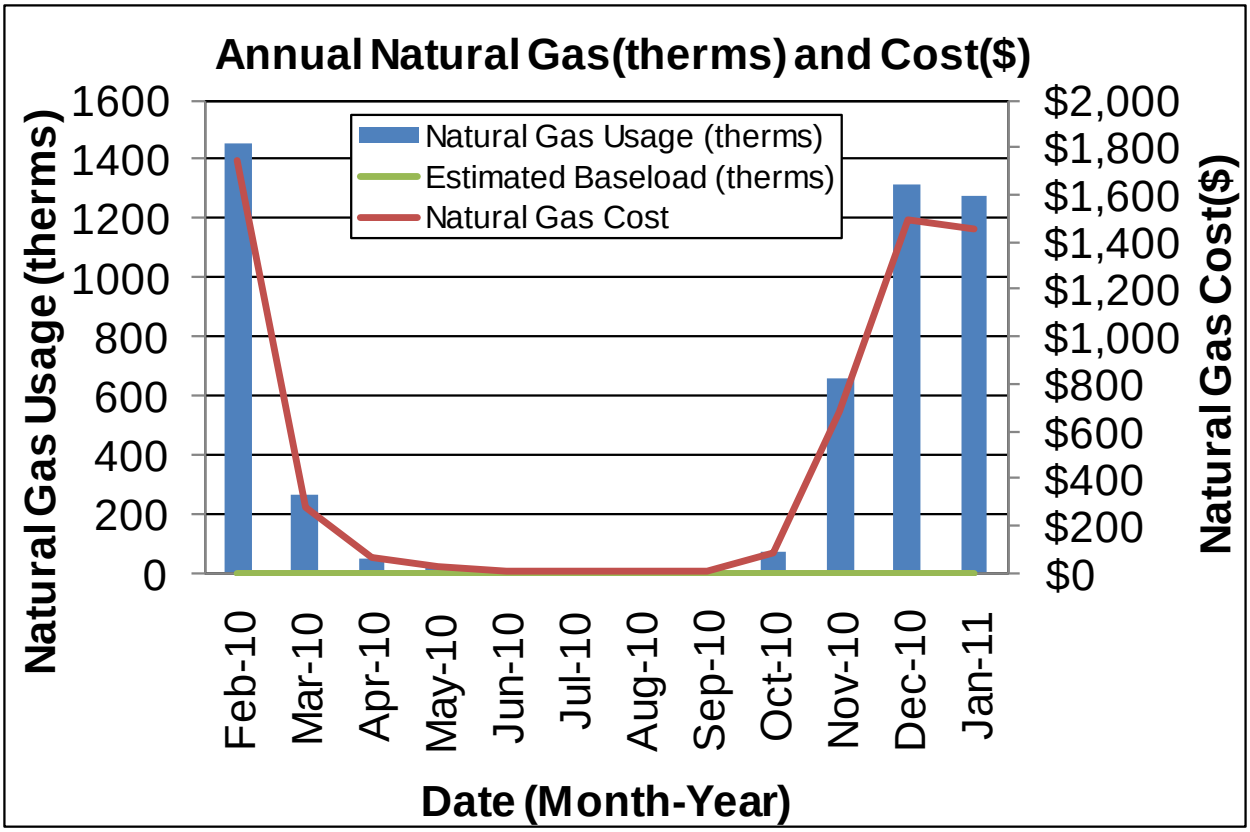
Electricity - The EBNJ is currently served by one electric meter. The EBNJ currently buys electricity from PSE&G at **an average aggregated rate of $0.400/kWh** and consumed **approximately 26,322 kWh, or $10,517 worth of electricity,** in the previous year. The average monthly demand was 29.2 kW and the annual peak demand was 75.9 kW.

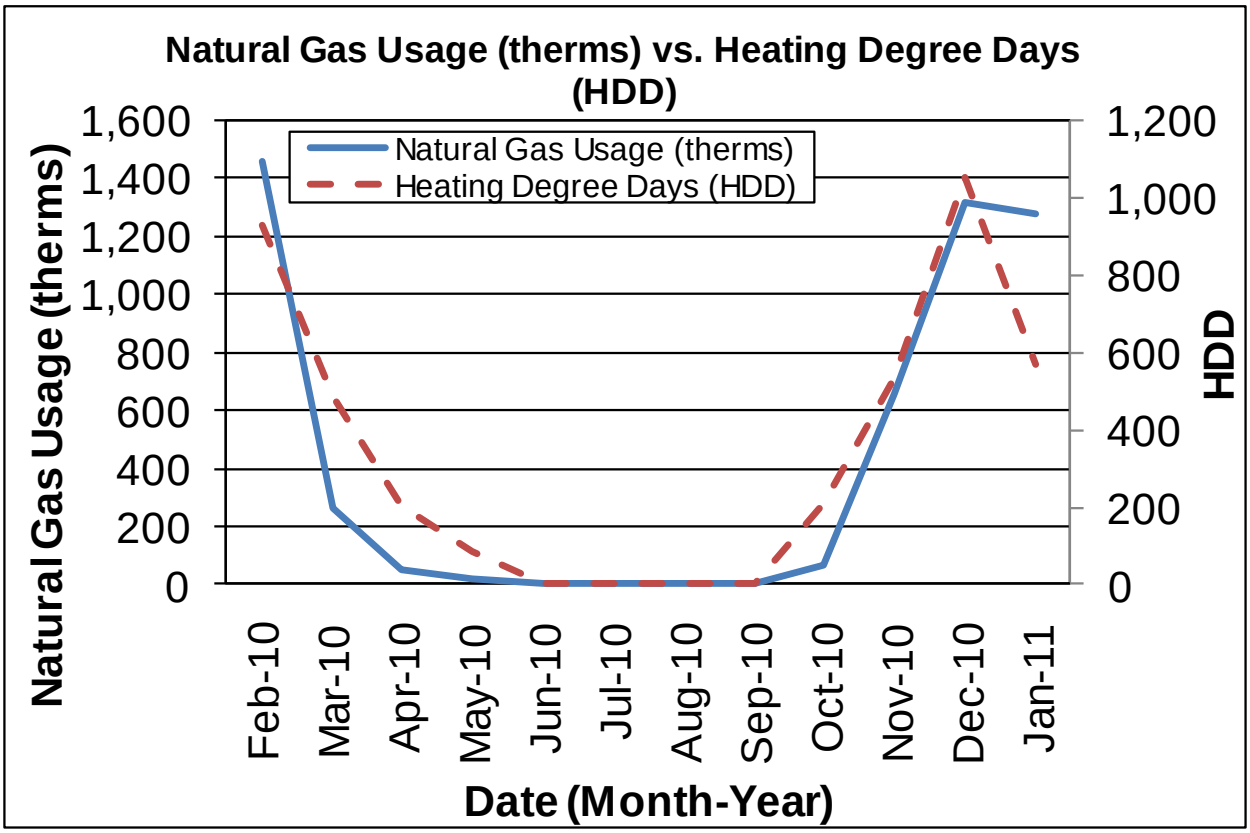
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate the EBNJ.



Natural gas - The EBNJ is currently served by one meter for natural gas. The EBNJ currently buys natural gas from PSE&G. at **an average aggregated rate $1.148/therm** and consumed **approximately 5,109 therms, or $5,866 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 EBNJ.

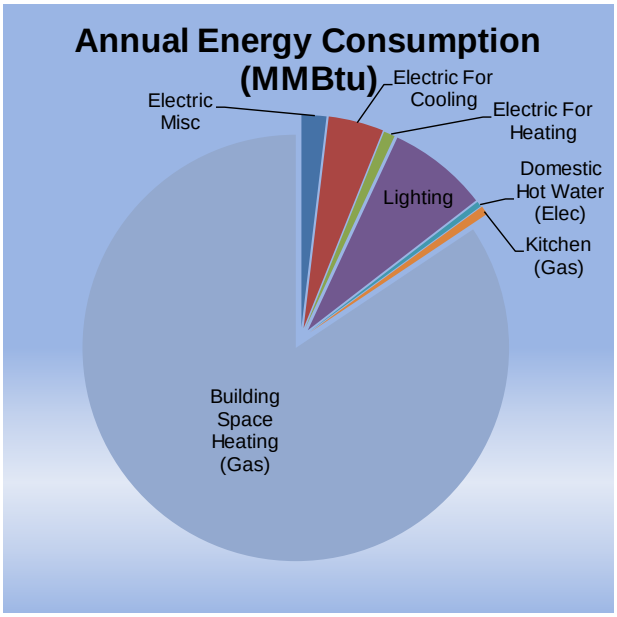

Annual Natural Gas(therms) and Cost($)
Natural Gas Usage (therms)
Estimated Baseload (therms)
Natural Gas Cost
Natural Gas Usage (therms)
Natural Gas Cost($)
1600
1400
1200
1000
800
600
400
200
0
$2,000
$1,800
$1,600
$1,400
$1,200
$1,000
$800
$600
$400
$200
$0
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Jul-10
Aug-10
Sep-10
Oct-10
Nov-10
Dec-10
Jan-11
Date (Month-Year)

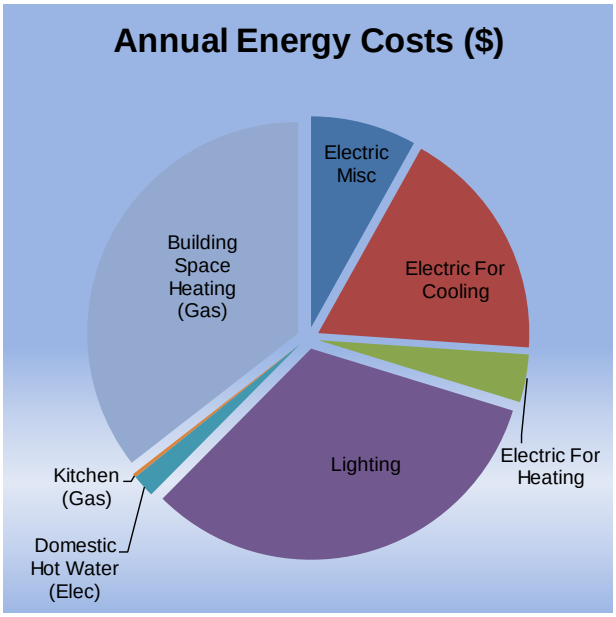

Natural Gas Usage (therms) vs. Heating Degree Days (HDD)
Natural Gas Usage (therms)
Heating Degree Days (HDD)
Natural Gas Usage (therms)
HDD
1,600
1,400
1,200
1,000
800
600
400
200
0
1,200
1,000
800
600
400
200
0
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Jul-10
Aug-10
Sep-10
Oct-10
Nov-10
Dec-10
Jan-11
Date (Month-Year)

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

The following graphs, pie charts, and table show energy use for the EBNJ based on utility bills for the 12 month period. Note: electrical cost at $117/MMBtu of energy is over 10 times as expensive as natural gas at $11/MMBtu

Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Misc	11	2%	$1,327	8%	117
Electric For Cooling	25	4%	$2,946	18%	117
Electric For Heating	5	1%	$600	4%	117
Lighting	46	8%	$5,353	33%	117
Domestic Hot Water (Elec)	2	0%	$291	2%	117
Kitchen (Gas)	4	1%	$46	0%	11
Building Space Heating (Gas)	507	84%	$5,820	36%	11
Totals	601	100%	$16,383	100%	
Total Electric Usage	90	15%	$10,517	64%	117
Total Gas Usage	511	85%	$5,866	36%	11
Totals	601	100%	$16,383	100%	

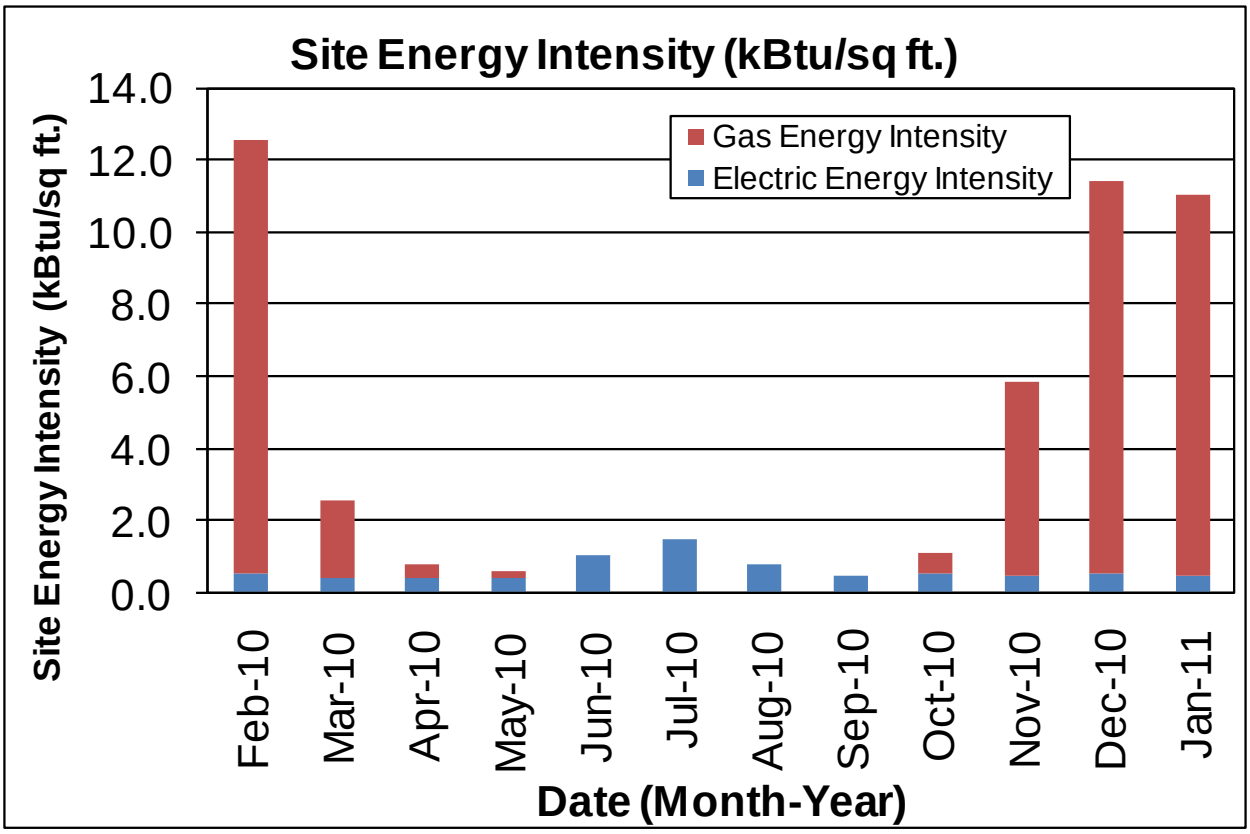




Energy benchmarking

SWA has entered energy information about the EBNJ in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager energy benchmarking system. This religious facility is categorized as a House of Worship space type. Consequently, the EBNJ is eligible to receive a national energy performance rating. The energy performance rating is 60, which does not meet the minimum rating for ENERGY STAR® certification. The Site Energy Use Intensity is 50 kBtu/sqft/yr compared to the national average of a House of Worship building consuming 56 kBtu/sqft/yr. See ECM section for guidance on how to improve the building's rating.

Due to the nature of its calculation based upon a survey of existing buildings of varying usage, the national average for House of Worship space types is very subjective, and is not an absolute bellwether for gauging performance. Additionally, should the EBNJ desire to reach this average there are other large scale and financially less advantageous improvements that can be made, such as envelope window, door and insulation upgrades that would help the building reach this goal.



Per the LGEA program requirements, SWA has assisted the EBNJ to create an ENERGY STAR® Portfolio Manager account and share the facility information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager account information with the EBNJ (user name of "ebnjchurch" with a password of "ebnjchurch") and TRC Energy Services (user name of "TRC-LGEA").

Tariff analysis

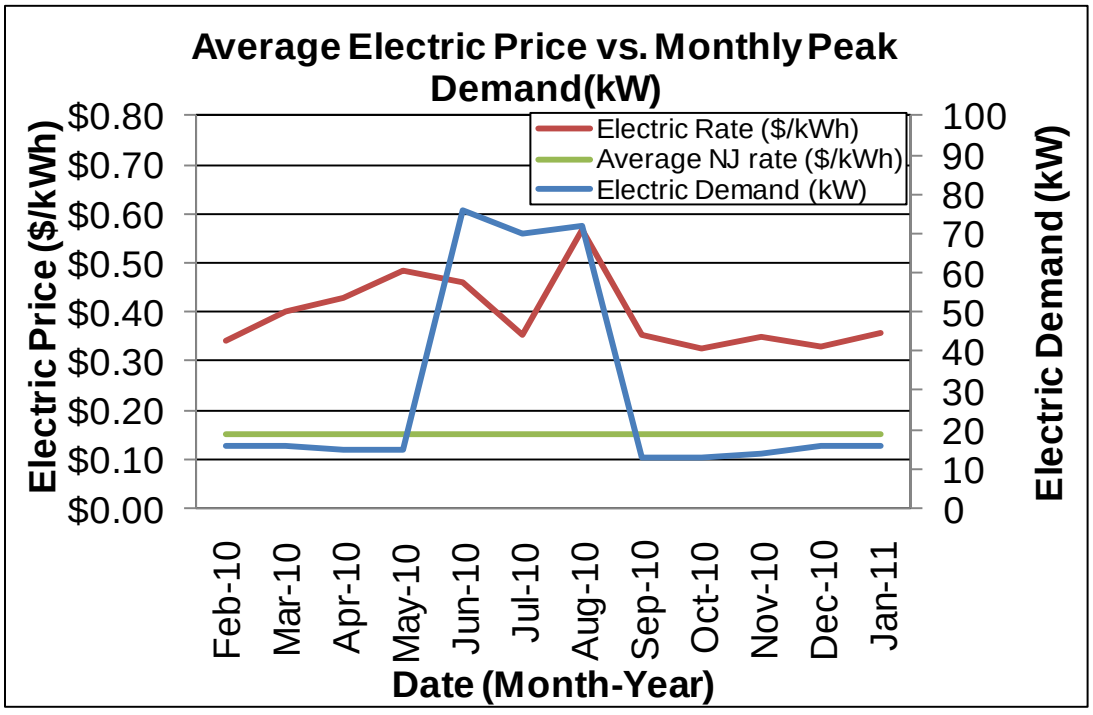
Tariff analysis can help determine if the municipality is paying the lowest rate possible for electric and gas service. Tariffs are typically assigned to buildings based on size and building type. Rate fluctuations are expected during periods of peak usage. Natural gas prices often increase during winter 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 EBNJ. The EBNJ 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.

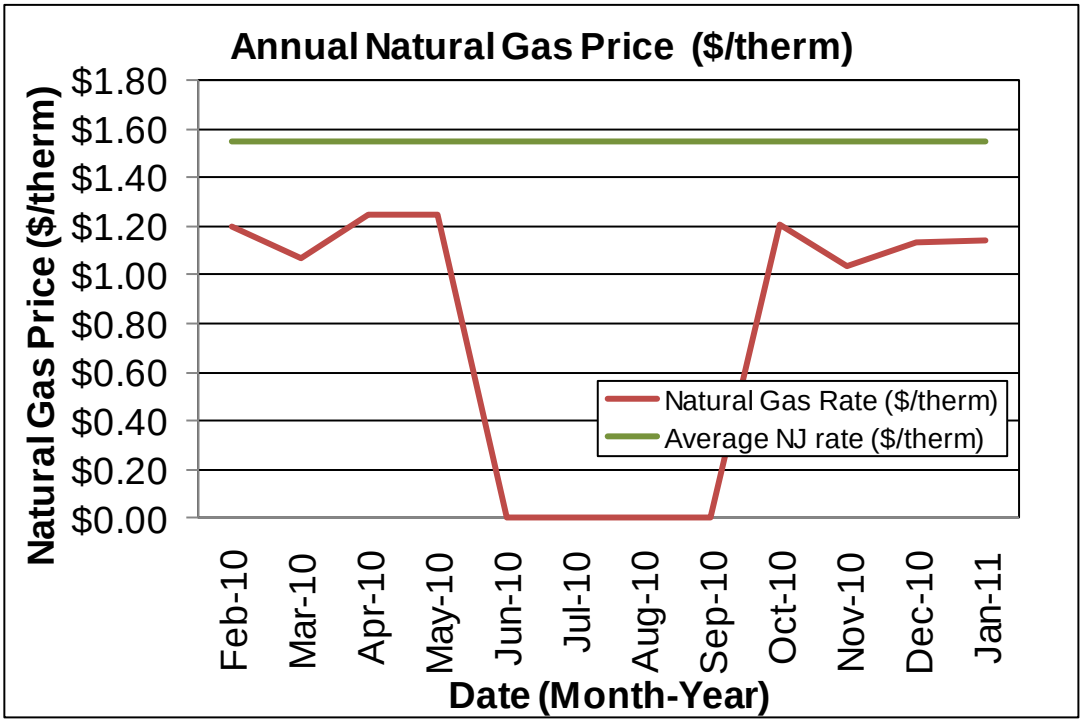
Energy Procurement strategies

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 EBNJ pays a rate of $0.400/kWh. The EBNJ annual electric utility costs are $6,568 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 43% over the most recent 12 month period.



The average estimated NJ commercial utility rates for gas are $1.550/therm, while the EBNJ pays a rate of $1.148/therm. Natural gas bill analysis shows fluctuations up to 17% 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 to no gas usage during the cooling season since the cooling equipment is electrically operated.

SWA recommends that the EBNJ 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 building. Appendix D contains a complete list of third-party energy suppliers for the EBNJ 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 Tuesday, December 14, 2010, the following data was collected and analyzed.

Building Characteristics

The two-story building (including a full basement) contains a total floor area of 12,141 square feet. EBNJ was originally constructed in approximately the early 1970s with no major renovations or additions. It houses a house of worship, classrooms, office areas and an open activity area.

Front of building (North)

North and West Side

North and East Side

Building Occupancy Profiles

Its occupancy can vary greatly as it is mostly used as a house of worship with limited classroom and office use during the weekday. Typically there are 4-5 occupants in the building and as many as approximately 430 occupants during hours of worship. The building is typically occupied from 8am to 4pm, 7 days per week; although, areas of occupation are limited for a majority of the time.

Building Envelope

Due to favorable weather conditions (min. 18 deg. F delta-T in/outside and no/low wind); some exterior envelope infrared (IR) images were taken during the field audit. IR technology helps to identify energy-compromising problem areas in a non-invasive way.

Exterior Walls

The exterior wall envelope is constructed of several different materials based on the orientation of the building. There are two main portions of the building; the front of the building that holds mostly office space and classrooms and the rear of the building that houses the house of worship and activity areas. The rear portion of the building that holds the worship area consists of exterior walls made out of brick veneer. The front façade of the building is constructed of precast concrete tiles over 8" CMU blocks. The front portion of each side of the building is constructed of metal insulated panels. The majority of the exterior walls contain no insulation.

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

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

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

Un-insulated brick façade

Cracked/deteriorated bricks and mortar joints

Roof

The building's roof is predominantly a flat and parapet type over steel decking, with a dark-colored EPDM single membrane finish. It is original to the building and has never been replaced. On the day of the site visit, the roof was not accessible. It is assumed that the underside of the roof decking contains R-19 fiberglass insulation.

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

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

The ceiling of the worship area in the rear portion of the building contained significant water damage that is most likely occurring as a result of poor installation and sealing of the rooftop packaged units on the roof. The situation could not be fully assessed since access to the roof was restricted during the audit; however, damage is clear visible on the ceiling where the rooftop packaged units are located.

Damaged ceiling in Worship area

Base

The building's base is composed of a partially below-grade basement with a slab floor with a perimeter footing with a brick foundation wall for the above grade portion and concrete block foundation walls for the below grade portion. There is no detectable slab edge/perimeter insulation.

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

The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall the base was reported to be in acceptable/ age appropriate condition with some signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues detected in some areas inside.

Windows

The building contains several different types of windows:

1. Single-pane, stain glass windows located in the area of worship in the back portion of the building.

2. Aluminum-clad, single-paned windows with no insulation, thermal break or low-e coating in the front portion of the building; in office areas as well as classrooms.

3. Wood-framed, single-paned windows with no low-e coating in the rear portion of the building; in storage areas behind the place of worship

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in acceptable/ age appropriate condition with only a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problem spots were identified:

Single-glazed window with ineffective frame

Single-glazed window

Exterior doors

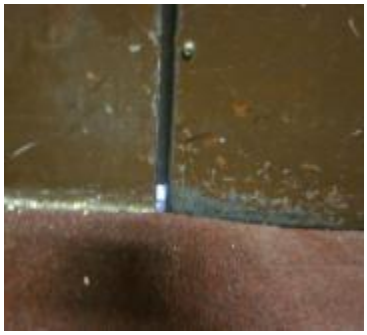
The building contains several different types of exterior doors:

1. Front doors are glass with aluminum/steel frame type exterior doors. These doors were found to contain single-pane glass with no effective thermal frame.

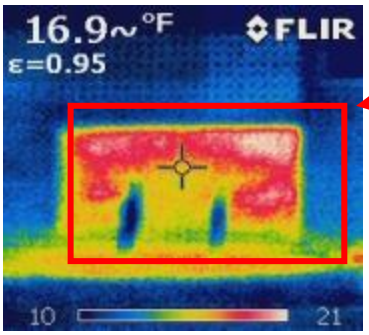
2. Side and rear doors are insulated steel doors with poor weather-stripping.

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

The following specific door problem spots were identified:

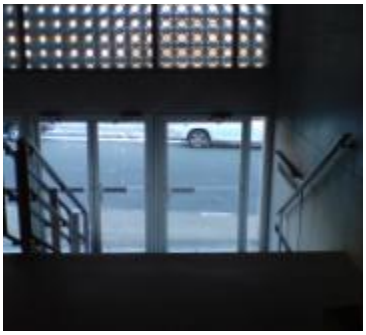


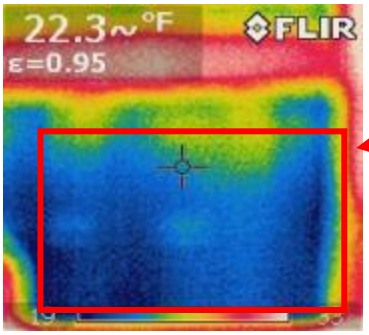
Worn/ Missing Weather-stripping



Red color shows heat escaping from interior through glass in door

Front Entrance digital image *Front Entrance thermal image*





Blue color shows cold surface from where heat has escaped through glass

Front Entrance digital image *Front Entrance thermal image*

Building air-tightness

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

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

Mechanical Systems

Heating Ventilation Air Conditioning

The EBNJ has heating and ventilation for all occupied spaces and cooling for a portion of the occupied spaces. During the field visit, it was determined that there are severe HVAC problems with the classrooms located on the second floor. Unit ventilators that provide HVAC to these classrooms are broke and no longer operating.

Equipment

The EBNJ is heated by a Smith cast iron boiler with 762 MBH input that was installed in 2001. This boiler provides steam heat to radiators located throughout the building as well as unit ventilators located in the classrooms on the second floor. This boiler is operated manually using non-programmable thermostats on each floor. The boiler was observed to be in good operating condition with no obvious signs of deficiency, however; it appears as though there may not be adequate ventilation to bring in combustion air for the boiler. The roof of the worship area contains four packaged units that provide heating, cooling and ventilation specific to the worship area. Based on interviews with building staff, these units

have reached their useful lifetime and should be replaced. Additionally, there is an old, atmospheric boiler that is no longer used, located in a storage room behind the mechanical room. It is unclear whether this boiler has been properly disconnected from all gas and water lines and as a precaution should be removed from the building and disposed of properly.

Steam boiler located in Mechanical room

Unused boiler that should be removed

The building contains no central cooling system but classrooms on the 2nd floor contained damaged and broken unit ventilators that once provided R-22 cooling to the rooms. There are currently 3 working window AC units located in the large activity area of the basement. Each window unit uses R-22 refrigerant, has a cooling capacity of 24,000 Btuh (2 tons) and had a nameplate efficiency of 8.5 EER.

Unit ventilator in Classroom Level-4

Window AC unit in basement

A comprehensive Equipment List can be found in Appendix A.

Distribution Systems

The central boiler for the building distributes steam through the front portion of the building that includes the lobby, classrooms and office spaces. This steam provides radiant heating via cast iron radiators and unit ventilators located in each room. Fresh air is brought into classrooms and conditioned by the unit ventilators. In the rear part of the building, four packaged rooftop units condition the space for the worship area. These packaged rooftop units are ducted directly into the space, allowing for return exhaust air to be purge from the space while a mix of return air and outside air is conditioned and brought into the building. The basement contains 3 manually-operated, window air conditioning units that condition fresh air and bring it into the building during the warmer months.

Cast iron steam radiator on 2nd floor

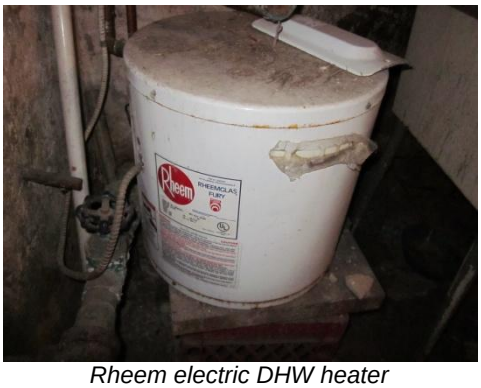
Worship Area in Rear portion of building

Controls

The heating and cooling equipment is controlled by wall-mounted manual thermostats on each floor. Manual thermostats must be reset for each operating condition by hand, and do not allow for evening or weekend set backs. The boiler does not appear to contain controls for an outside temperature cutoff that would prevent the boiler from firing if outside air temperatures were above a preset temperature. All package units are controlled from *one* programmable thermostat with a temperature set point schedule based on season and occupancy with allowed overrides of 3-4 degrees.

Domestic Hot Water

Domestic Hot Water (DHW) is provided by a Rheem electric DHW heater installed in 2006 with a total wattage of 2000 W. The DHW heater was observed to be in good working conditioned with no obvious signs of deficiency.



Rheem electric DHW heater

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 EBNJ currently contains mostly T12 fluorescent fixtures with magnetic ballasts and single fixtures containing a mix of Compact Fluorescent Lamps (CFLs) and incandescent bulbs. Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas.

Typical T12 fixture with magnetic ballast

Typical wall fixture with mixture of CFLs and Incandescent lamps

Exit Lights - Exit signs were found to be a mix of LED and incandescent exit signs.

Incandescent Exit Sign

Exterior Lighting – There were no exterior lights observed at the building. The building is located in close proximity to the city street, where city street lights provide sufficient lighting for the building.

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. SWA found one beverage vending machine.

Elevators

The EBNJ does not have an installed elevator.

Other electrical systems

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

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 EBNJ is a good candidate for a 7.5 kW Solar Panel installation. See ECM# 6 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 EBNJ is not a good candidate for wind power generation due to insufficient wind conditions in this area of New Jersey.

Geothermal

The EBNJ is not a good candidate for geothermal installation based on the small building size and it would require extensive replacement of and additions to the existing HVAC system.

Combined Heat and Power

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

PROPOSED ENERGY CONSERVATION MEASURES

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

Recommendations: Energy Conservation Measures

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1	Retrofit (1) refrigerated vending machine with a VendingMiser™ device
2	Upgrade (36) Incandescent to CFL
3	Replace (3) incandescent/fluorescent Exit signs with LED type
4	Install (3) Programmable Thermostats and (10) TRVs
	Description of Recommended 5-10 Year Payback ECMs
5	Retrofit (29) fluorescent T12 light fixtures with T8 retrofit kits
6	Install 7.5 kW Solar Photovoltaic system
	Description of Recommended >10 Year Payback ECMs
7	Replace package units and controls

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: Retrofit (1) refrigerated vending machine with a VendingMiser™ device

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

Installation cost:
Net estimated installed cost: $199 (includes $20 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

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
199	1,400	0	0	0.4	0	559	12	6,712	0	3,273	273	281	5,139	2,507

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

Rebates/financial incentives:
- This measure does not qualify for a rebate or other financial incentive at this time.

Please see Appendix G for more information on Incentive Programs.

ECM#2: Upgrade (36) Incandescent to CFL

During the field audit, SWA completed a building lighting inventory (see Appendix B). The existing lighting 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: $415 (includes $144 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

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
415	2,621	1	0	0.7	92	1,135	5	5,675	0	1,267	253	273	4,606	4,693

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA also assumed an aggregated 2 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:
- This measure does not qualify for a rebate or other financial incentive at this time.

Please see Appendix G for more information on Incentive Programs.

ECM#3: Replace (3) incandescent/fluorescent Exit signs with LED type

During the field audit, SWA completed a building lighting inventory (see Appendix B). SWA observed that the building contains a number of incandescent and/or florescent 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: $422 (includes $216 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

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
422	381	0	0	0.1	74	226	15	3,390	2	703	47	53	2,168	682

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA also assumed an aggregated 1.85 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:
- NJ Clean Energy - SmartStart - LED Exit signs ($10, per fixture) - Maximum incentive amount is $20.

Please see Appendix G for more information on Incentive Programs.

ECM#4: Install (3) Programmable Thermostats and (10) TRVs

Part of the EBNJ building is heated by a Smith cast iron boiler with 762 MBH input that was installed in 2001. This boiler provides steam heat to radiators located throughout the building. This boiler is operated manually using non-programmable thermostats on each floor. Manual thermostats must be reset for each operating condition by hand, and do not allow for evening or weekend set backs. The boiler does not appear to contain controls for an outside temperature cutoff that would prevent the boiler from firing if outside air temperatures were above a preset temperature.

SWA recommends replacing the three existing manual thermostats with three programmable thermostats capable of reducing temperature setpoints to non-occupied conditions based on a fixed daily schedule. The three new thermostats would regulate the boiler on/off schedule. Further, SWA recommends replacing the existing radiator valves (approximately 10) with new thermostatic radiator valves. TRV's regulate the amount of steam through the radiator by controlling the venting of air. The valve is self-regulating, and consists of a valve and a sensor. As the space conditions change, the valve will respond to maintain the temperature set point.
This avoids over-heating the space. The TRVs can be manually adjusted at the valve itself, or by a remote thermostat. The valves have a set point range of 41˚F to 78.8˚F, but can be limited to a smaller range through a minor adjustment.

SWA observed that the floor under the steam radiators had sunk in places resulting in the radiators not being level. SWA recommends re-leveling all the steam radiators. A correct tilt is an important element to control heating in the space served by steam radiators.

Installation cost:
Net estimated installed cost: $3,200 (includes $2,000 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
3,200	0	0	260	2.1	350	649	12	7,783	5	143	12	17	3,081	2,866

Assumptions: SWA calculated the savings for this measure assuming that all existing radiators will be retrofitted with TRV's. It is also assumed that 2% of the heating cost can be saved by installing TRVs, and 3% of the heating costs can be saved by scheduling the boiler from the programmable thermostats. SWA also assumed averting 10min/day for 200days/yr to make minor manual changes @$35/h, resulting in annual operating cost savings of $350.

Rebates/financial incentives:
- This measure does not qualify for a rebate at this time.
- NJ Clean Energy – Direct Install program (Up to 60% of installed cost)

Please see Appendix G for more information on Incentive Programs.

ECM#5: Retrofit (29) fluorescent T12 light fixtures with T8 retrofit kits

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

Installation cost:
Net estimated installed cost: $4,461 (includes $2,755 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

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
4,171	1,339	0	0	0.4	157	690	15	10,350	6	148	10	14	3,826	2,397

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

Rebates/financial incentives:
- This measure does not qualify for a rebate or other financial incentive at this time.

Please see Appendix G for more information on Incentive Programs.

ECM#6: Install a 7.5 kW roof-mounted Solar Photovoltaic System

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

The size of the system was determined considering the available roof surface area, without compromising service space for roof equipment and safety, as well as the facilities' annual base load and mode of operation. A PV system could be installed on a portion of the roof with panels facing South as shown in the photo below. A commercial multi-crystalline 230 watt panel has 17.5 square feet of surface area (providing 13.11 watts per square foot). A 7.5 kW system needs approximately 33 panels which would take up 578 square feet.

Area in red highlights maximum available area for recommended Solar PVsystem

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. In addition to generating electricity in order to offset building electric use, the Solar PV would allow the building to earn Solar Renewable Energy Credits (SRECs). SRECs are credits that are earned for every 1 MWh (1,000 kWh) of electricity generated by the Solar PV system. These credits would then be brokered to the local utility company who can purchase them at market price for a period of 15 years. In the past 2 years, SRECs have been earned at an average value of $600 per SREC.

Installation cost:

Net estimated installed cost: $52,500 (includes $22,500 of labor)
Source of cost estimate: RS Means; Published and established costs; Similar projects

Economics:

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
52,500	8,850	8	0	2.5	0	8,336	25	208,399	6	297	12	14	62,213	15,846

Annual Solar PV Cost Savings Breakdown				
Rated Capacity (kW)	7.5			
Rated Capacity (kWh)	8,850			
Annual Capacity Loss	0%			
Year	kWh Capacity	Installed Cost	Incentives	Electric Savings ($)
0		$52,500	$0	
1	8,850		$4,800	$3,536
2	8,850		$4,800	$3,536
3	8,850		$4,800	$3,536
4	8,850		$4,800	$3,536
5	8,850		$4,800	$3,536
6	8,850		$4,800	$3,536
7	8,850		$4,800	$3,536
8	8,850		$4,800	$3,536
9	8,850		$4,800	$3,536
10	8,850		$4,800	$3,536
11	8,850		$4,800	$3,536
12	8,850		$4,800	$3,536
13	8,850		$4,800	$3,536
14	8,850		$4,800	$3,536
15	8,850		$4,800	$3,536
16	8,850		$0	$3,536
17	8,850		$0	$3,536
18	8,850		$0	$3,536
19	8,850		$0	$3,536
20	8,850		$0	$3,536
21	8,850		$0	$3,536
22	8,850		$0	$3,536
23	8,850		$0	$3,536
24	8,850		$0	$3,536
25	8,850		$0	$3,536
	kWh	Cost	Saving	
Lifetime Total	**221,250**	**($52,500)**	**$72,000**	**$88,399**

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-U23-C1). PV systems are sized based on 230 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 of $4,800/year, based on $600/SREC, has been incorporated in the above costs for a period of 15 years; however it requires proof of performance, application approval and negotiations with the utility.

Please see Appendix G for more information on Incentive Programs.

ECM#7: Replace package units and provide new controls for temperature and ventilation

The roof of the worship area contains four packaged units that provide heating, cooling and ventilation to the worship area. SWA assumes that each package unit has 5 tons of cooling capacity and approximately 100MBH of gas heating. Based on interviews with building staff, these units have reached the end of their useful lifetime and should be replaced. SWA recommends replacing the four units with one large unit of 20 tons cooling capacity, and approximately 350MBH of gas heating. The cooling should be based on R-410A refrigerant.

The existing units are controlled from one programmable thermostat. SWA recommends installing a new programmable thermostat that is capable of reducing temperature setpoints to non-occupied conditions based on a fixed daily schedule. SWA also recommends that the new unit has motorized dampers with 100% modulation for ventilation. The fresh air dampers should be controllable from a carbon dioxide sensor placed in the return air duct. The CO2 sensor and interlocking of the damper should be carried out as part of this measure.

SWA estimates the dollar savings for this measure will be realized from kWh and therms saved from electricity and gas. The current equipment is assumed to have a cooling Energy Efficiency Ratio (EER) of approximately 9.0. The new equipment should have a minimum 11.5 EER rating, preferably closer to 12.5 or 13.0. The higher EER will involve increased cost for the equipment over units with lower EER, but 11.5 EER is the minimum required for this equipment capacity to qualify for a NJ Clean Energy Program rebate. Both electric and gas savings will also be realized due to a reduction in ventilation air. It is proposed to completely shut down ventilation during unoccupied modes setting in the new thermostat, and to have the CO2 sensor control ventilation based on the amount of CO2 in the return air duct.

Installation cost:
Net estimated installed cost: $40,170 (includes $21,300 of labor); includes thermostats, CO2 sensor, wiring, and new ductwork
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

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
40,170	2,340	0	1,100	9.7	220	2,418	15	36,271	17	-10	-1	-1	-11,353	16,315

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. Assumptions are based on thermostat settings of 72°F in occupied mode and 60°F in unoccupied mode.

Rebates/financial incentives:
- NJ Clean Energy – Direct Install program (Up to 60% of installed cost)
- NJ Clean Energy – Unitary HVAC Systems ($73-$92 per ton) and Dual enthalpy economizer controls $250/unit ; Maximum incentive is $250+$1,580=$2,340 incorporated above

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 EBNJ:

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

- Provide adequate combustion air to boiler - The EBNJ is heated by a Smith cast iron that provides steam heat to radiators located throughout the building as well as unit ventilators located in the classrooms on the second floor. The boiler did not have adequate ventilation provision to bring in enough combustion air as required by codes. SWA recommends that EBNJ hire the services of a professional and carry out improvements that will allow enough combustion air for proper boiler operation.

- Replace unit ventilators in classrooms - The EBNJ classrooms on the 2nd floor contained damaged and broken unit ventilators that once provided R-22 cooling to the rooms. If the classrooms are going to be used for in future, then SWA recommends EBNJ to install new unit ventilators for adequate comfort of occupants. There will be no energy savings and hence this measure is listed as 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.

- Weather-strip doors – SWA recommends repairing or replacing all weather-stripping on exterior doors and ensure that any new exterior doors installed have a proper seal. Large openings were observed around all doors and cold air was allowed to infiltrate the building.

- Repair roof leaks – SWA observed leaks under roof where the package units were located. SWA recommends that EBNJ inspect the roof and make improvements to stop the various leaks.

- 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 EBNJ. Based on the requirements of the LGEA program, EBNJ must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The minimum amount to be spent, net of other NJCEP incentives, is $2,428.

APPENDIX A: EQUIPMENT LIST

Inventory

Building System	Description	Model #	Fuel	Location	Space Served	Date Installed	Estimated Remaining Useful Life %
Heating	Eight (8) American Standard unit ventilators, cooling is no longer working, R-22 refrigerant	American Standard, Type 41 - Remotaire, Model #TW-90-B, Series CC-11	Natural Gas/ Electricity	2nd Floor Classrooms, 1st Floor Offices	2nd Floor Classrooms, 1st Floor Offices	1971	0%
Cooling	Three (3) Thermal Zone window air conditioning units, R-22 refrierant, 8.5 EER, 24,000 Btu (2 ton) cooling capacity	Thermal Zone, Model #WAC24230R	Elec.	Basement Area	Basement Area	2004	53%
Heating	Smith Cast Iron boiler, 762,000 Btuh input, 657,000 Btuh output, 86% thermal efficiency	Smith, Serial #SN9845	Natural Gas	Basement Mechanical Room	All Areas	2001	60%
Domestic Hot Water	Rheemglas Fury electric domestic wate herater, 2000W upper element, 2000W lower element, 6 gallons	Rheemglas Fury, Model #81VP6S, Serial #RH 1006605678	Elec.	Basement Mechanical Room	All Areas	2006	67%
HVAC	4 roof top package units, estimated 9 EER, 5 tons cooling, and 100MBH heating input each	Nameplate N/A	Natural Gas/ Electricity	Roof	Worship area	N/A	0%

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

Appendix B: Lighting Study

Location			Existing Fixture Information												Retrofit Information													Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	2	Classroom - English L-4	Ceiling Mounted	M	4'T12	1	4	40	Sw	2	208	12	172	72	T8 Kit	Ceiling Mounted	4'T8	E	Sw	1	4	32	2	208	5	133	55	16	0	16
2	2	Classroom - English L-2	Ceiling Mounted	S	CFL	1	2	23	Sw	2	208	0	46	19	N/A	Ceiling Mounted	CFL	S	Sw	1	2	23	2	208	0	46	19	0	0	0
3	2	Eben-ezer room	Ceiling Mounted	S	Inc	1	2	75	Sw	2	208	0	150	62	CFL	Ceiling Mounted	CFL	S	Sw	1	2	23	2	208	0	46	19	43	0	43
4	2	Open Area	Ceiling Mounted	S	Inc	3	1	75	Sw	4	208	0	225	187	CFL	Ceiling Mounted	CFL	S	Sw	3	1	23	4	208	0	69	57	130	0	130
5	2	Open Area	Ceiling Mounted	S	CFL	1	1	23	Sw	4	208	0	23	19	N/A	Ceiling Mounted	CFL	S	Sw	1	1	23	4	208	0	23	19	0	0	0
6	1	Congregational Area	Pendant	S	Inc	6	1	100	Sw	4	208	0	600	499	CFL	Pendant	CFL	S	Sw	6	1	35	4	208	0	210	175	324	0	324
7	1	Congregational Area	Pendant	S	CFL	3	1	23	Sw	4	208	0	69	57	N/A	Pendant	CFL	S	Sw	3	1	23	4	208	0	69	57	0	0	0
8	1	Altar Area	Ceiling Suspende	S	Hal	5	1	150	Sw	1	208	33	915	190	CFL	Ceiling Suspende	CFL	S	Sw	5	1	50	1	208	0	250	52	138	0	138
9	1	Altar Area	Ceiling Suspende	S	Inc	1	1	60	Sw	1	208	0	60	12	CFL	Ceiling Suspende	CFL	S	Sw	1	1	20	1	208	0	20	4	8	0	8
10	1	Hallway - Stage Left	Ceiling Suspende	S	CFL	1	1	23	Sw	1	208	0	23	5	N/A	Ceiling Suspende	CFL	S	Sw	1	1	23	1	208	0	23	5	0	0	0
11	1	Hallway - Stage Left	Ceiling Suspende	S	Inc	1	1	75	Sw	1	208	0	75	16	CFL	Ceiling Suspende	CFL	S	Sw	1	1	23	1	208	0	23	5	11	0	11
12	1	Front Entrance	Ceiling Suspende	S	CFL	2	1	13	Sw	4	365	0	26	38	N/A	Ceiling Suspende	CFL	S	Sw	2	1	13	4	365	0	26	38	0	0	0
13	1	Front Entrance	Ceiling Suspende	S	Hal	8	1	75	Sw	4	208	17	732	609	CFL	Ceiling Suspende	CFL	S	Sw	8	1	23	4	208	0	184	153	456	0	456
14	1	Office - Room #2	Ceiling Suspende	M	8'T12	1	2	80	Sw	4	208	20	180	150	T8 Kit	Ceiling Suspende	8'T8	E	Sw	1	2	58	4	208	7	123	102	48	0	48
15	1	Office - Room #1	Ceiling Suspende	M	4'T12	2	4	40	Sw	4	208	12	344	286	T8 Kit	Ceiling Suspende	4'T8	E	Sw	2	4	32	4	208	5	266	221	65	0	65
16	1	Hallway - Right, Down	Ceiling Mounted	S	Inc	1	2	100	Sw	10	208	0	200	416	CFL	Ceiling Mounted	CFL	S	Sw	1	2	35	10	208	0	70	146	270	0	270
17	1	Hallway - Left, Down	Ceiling Mounted	M	2'T12	1	1	20	Sw	4	208	6	26	22	T8 Kit	Ceiling Mounted	2'T8	E	Sw	1	1	17	4	208	2	19	16	6	0	6
18	1	Stairwell	Ceiling Mounted	M	4'T12	1	2	40	Sw	8	208	12	92	153	T8 Kit	Ceiling Mounted	4'T8	E	Sw	1	2	32	8	208	5	69	115	38	0	38
19	1	Stairwell	Ceiling Mounted	S	CFL	1	1	23	Sw	8	208	0	23	38	N/A	Ceiling Mounted	CFL	S	Sw	1	1	23	8	208	0	23	38	0	0	0
20	Bsmt	Open Lobby Area	Ceiling Mounted	M	4'T12	1	8	40	Sw	4	208	12	332	276	T8 Kit	Ceiling Mounted	4'T8	E	Sw	1	8	32	4	208	5	261	217	59	0	59
21	Bsmt	Men's Room	Ceiling Mounted	S	Inc	4	2	100	Sw	2	208	0	800	333	CFL	Ceiling Mounted	CFL	S	Sw	4	2	35	2	208	0	280	116	216	0	216
22	Bsmt	Women's Room	Ceiling Mounted	E	2'T8	1	2	17	Sw	2	208	2	36	15	N/A	Ceiling Mounted	2'T8	E	Sw	1	2	17	2	208	2	36	15	0	0	0
23	Bsmt	Women's Room	Ceiling Mounted	E	4'T8	2	2	32	Sw	2	208	5	138	57	N/A	Ceiling Mounted	4'T8	E	Sw	2	2	32	2	208	5	138	57	0	0	0
24	Bsmt	Activity Open Area	Ceiling Mounted	M	4'T12	11	8	40	Sw	4	208	12	3,652	3,038	T8 Kit	Ceiling Mounted	4'T8	E	Sw	11	8	32	4	208	5	2871	2389	650	0	650
25	Bsmt	Bathroom Signs	Ceiling Mounted	S	Inc	2	1	75	N	24	365	0	150	1,314	CFL	Ceiling Mounted	CFL	S	N	2	1	23	24	365	0	46	403	911	0	911
26	Bsmt	Activity Open Area	Exit Sign	S	Inc	2	1	20	N	24	365	0	40	350	LEDex	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	254	0	254
27	Bsmt	Open Lobby Area	Exit Sign	S	Inc	1	1	20	N	24	365	0	20	175	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	127	0	127
28	Bsmt	Youth Ministry	Ceiling Mounted	M	4'T12	1	4	40	Sw	2	208	12	172	72	T8 Kit	Ceiling Mounted	4'T8	E	Sw	1	4	32	2	208	5	133	55	16	0	16
29	Bsmt	Youth Ministry	Ceiling Mounted	S	Inc	1	3	75	Sw	2	208	0	225	94	CFL	Ceiling Mounted	CFL	S	Sw	1	3	23	2	208	0	69	29	65	0	65
30	Bsmt	Class 4 - English L-4	Ceiling Mounted	M	8'T12	1	8	80	Sw	2	208	20	660	275	T8 Kit	Ceiling Mounted	8'T8	E	Sw	1	8	58	2	208	7	471	196	79	0	79
31	Bsmt	Ecole Du Dimanche Office	Ceiling Mounted	M	8'T12	1	8	80	Sw	2	208	20	660	275	T8 Kit	Ceiling Mounted	8'T8	E	Sw	1	8	58	2	208	7	471	196	79	0	79
32	Bsmt	Class 3	Ceiling Mounted	M	8'T12	1	8	80	Sw	2	208	20	660	275	T8 Kit	Ceiling Mounted	8'T8	E	Sw	1	8	58	2	208	7	471	196	79	0	79
33	Bsmt	Class 2	Ceiling Mounted	M	8'T12	1	8	80	Sw	2	208	20	660	275	T8 Kit	Ceiling Mounted	8'T8	E	Sw	1	8	58	2	208	7	471	196	79	0	79
34	Bsmt	Stage	Ceiling Mounted	S	Inc	1	3	12	Sw	1	208	0	36	7	CFL	Ceiling Mounted	CFL	S	Sw	1	3	5	1	208	0	15	3	4	0	4
35	Bsmt	Audio/Light Room	Exit Sign	S	LED	1	7	5	N	24	365	1	36	311	N/A	Exit Sign	LED	S	N	1	7	5	24	365	1	36	311	0	0	0
36	Bsmt	Audio/Light Room	Ceiling Mounted	M	4'T12	1	2	40	Sw	2	208	12	92	38	T8 Kit	Ceiling Mounted	4'T8	E	Sw	1	2	32	2	208	5	69	29	10	0	10
37	Bsmt	Storage behind Kitchen	Ceiling Mounted	M	8'T12	1	2	80	Sw	1	208	20	180	37	T8 Kit	Ceiling Mounted	8'T8	E	Sw	1	2	58	1	208	7	123	26	12	0	12
38	Bsmt	Storage behind Kitchen	Exit Sign	S	LED	1	7	5	N	24	365	1	36	311	N/A	Exit Sign	LED	S	N	1	7	5	24	365	1	36	311	0	0	0
39	Bsmt	Kitchen	Ceiling Mounted	M	8'T12	2	2	80	Sw	4	208	20	360	300	T8 Kit	Ceiling Mounted	8'T8	E	Sw	2	2	58	4	208	7	246	204	95	0	95
40	Bsmt	Kitchen	Exit Sign	S	LED	1	7	5	N	24	365	1	36	311	N/A	Exit Sign	LED	S	N	1	7	5	24	365	1	36	311	0	0	0
41	Bsmt	Kitchen	Ceiling Mounted	S	Inc	2	1	75	Sw	2	208	0	150	62	CFL	Ceiling Mounted	CFL	S	Sw	2	1	23	2	208	0	46	19	43	0	43
42	Bsmt	Storage behind Stage	Ceiling Mounted	M	4'T12	2	2	40	Sw	1	208	12	184	38	T8 Kit	Ceiling Mounted	4'T8	E	Sw	2	2	32	1	208	5	138	29	10	0	10
43	Bsmt	Storage behind Stage	Exit Sign	S	LED	1	7	5	N	24	365	1	36	311	N/A	Exit Sign	LED	S	N	1	7	5	24	365	1	36	311	0	0	0
44	Bsmt	Boiler Room	Ceiling Mounted	S	CFL	1	1	23	Sw	1	208	0	23	5	N/A	Ceiling Mounted	CFL	S	Sw	1	1	23	1	208	0	23	5	0	0	0
45	Bsmt	Boiler Room	Exit Sign	S	LED	1	7	5	N	24	365	1	36	311	N/A	Exit Sign	LED	S	N	1	7	5	24	365	1	36	311	0	0	0
46	Ext	Exterior	Wall Mounted	S	MH	2	1	150	PC	12	365	42	384	1,682	MH	Wall Mounted	MH	S	PC	2	1	150	12	365	42	384	1682	0	0	0
Totals:						88	143	2,362				343	13,773	13,399						88	143	1,405			143	8,647	9,058	4,341	0	4,341

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

Proposed Lighting Summary Table			
Total Gross Floor Area (SF)	12,121		
Average Power Cost ($/kWh)	0.400		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	1,682	1,682	**0**
Exterior Power (watts)	384	384	**0**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	11,717	7,376	**4,341**
Lighting Power (watts)	13,389	8,263	**5,125**
Lighting Power Density (watts/SF)	1.10	0.68	**0.42**
Estimated Cost of Fixture Replacement ($)	837		
Estimated Cost of Controls Improvements ($)	0		
Total Consumption Cost Savings ($)	**2,059**		

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 for PSEG Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com
ConEdison Solutions 535 State Highway 38 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450	(212) 538-3124 www.creditsuisse.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
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	(888) 536-3876 www.metroenergy.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
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 www.sel.com
Suez Energy Resources NA, Inc. 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com

Third Party Gas Suppliers for PSEG Service Territory	Telephone & Web Site
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 www.cooperativenet.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
Dominion Retail, Inc. 395 Highway 170, Suite 125 Lakewood, NJ 08701	(866) 275-4240 www.retail.dom.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com
Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateastern.com

Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Hudson Energy Services, LLC 545 Route 17 South Ridgewood, NJ 07450	(877) 483-7669 www.hudsonenergyservices.com
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 www.intelligentenergy.org
Keil & Sons 1 Bergen Blvd. Fairview, NJ 07002	(877) 797-8786 www.systrumenergy.com
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	(888) 536-3876 www.metroenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 www.mxenergy.com
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	(800) 840-4427 www.natgasco.com
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
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
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Stuyvesant Energy LLC 10 West Ivy Lane, Suite 4 Englewood, NJ 07631	(800) 646-6457 www.stuyfuel.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.

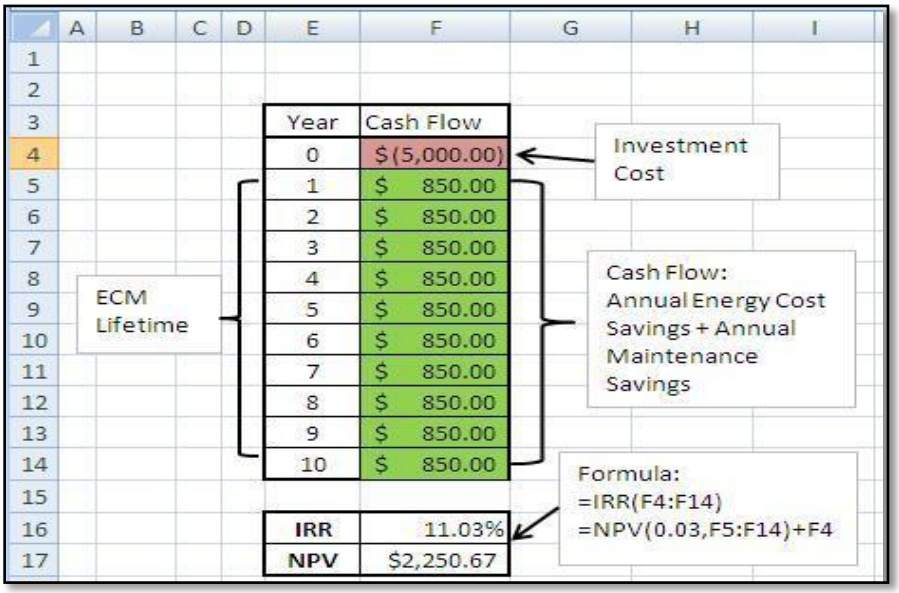
Calculation References

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
Incentive:	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
Eglise Baptiste de la Nouvelle Jerusalem

Building ID: 2586222
For 12-month Period Ending: January 31, 2011[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: February 23, 2011

Facility
Eglise Baptiste de la Nouvelle Jerusalem
706 Nye Avenue
Irvington, NJ 07111

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1950
Gross Floor Area (ft²): 12,121

Energy Performance Rating[2] (1-100) 60

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	89,817
Natural Gas (kBtu)[4]	510,854
Total Energy (kBtu)	600,671

Energy Intensity[5]

Site (kBtu/ft²/yr)	50
Source (kBtu/ft²/yr)	69

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	56
National Average Source EUI	78
% Difference from National Average Source EUI	-12%
Building Type	House of Worship

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.

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

Direct Install 2010 Program*

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

Eligibility:

- Existing small and mid-sized commercial and industrial facilities with peak electrical demand **below 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

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.

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

Renewable Energy Incentive Program*

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

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

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

Utility Sponsored Programs

Check with your local utility companies for further opportunities **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 $50,000 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 grants funding. For more information, please check http://www.dsireusa.org/.

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

APPENDIX H: ENERGY CONSERVATION MEASURES

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1	Retrofit (1) refrigerated vending machine with a VendingMiser™ device	199	none at this time	199	1,400	0	0	0.4	0	559	12	6,712	0.4	3,273	273	281	5,139	2,507
2	Upgrade (36) Incandescent to CFL	415	none at this time	415	2,621	1	0	0.7	92	1,135	5	5,675	0.4	1,267	253	273	4,606	4,693
3	Replace (3) incandescent/fluorescent Exit signs with LED type	452	30	422	381	0	0	0.1	74	226	15	3,390	1.9	703	47	53	2,168	682
4	Install (3) Programmable Thermostats and (10) TRVs	3,200	none at this time	3,200	0	0	260	2.1	350	649	12	7,783	4.9	143	12	17	3,081	2,866
5	Retrofit (29) fluorescent T12 light fixtures with T8 retrofit kits	4,461	290	4,171	1,339	0	0	0.4	157	690	15	10,350	6.0	148	10	14	3,826	2,397
6	Install 7.5 kW Solar Photovoltaic system	52,500	none at this time	52,500	8,850	8	0	2.5	0	8,336	25	208,399	6.3	297	12	14	62,213	15,846
7	Replace package units and controls	42,000	1,830	40,170	2,340	0	1,100	9.7	220	2,418	15	36,271	16.6	-10	-1	-1	-11,353	16,315
	TOTALS	**103,227**	**2,150**	**101,077**	**16,931**	**9**	**1,360**	**16.0**	**893**	**14,013**	**99**	**278,580**	**36**	**5,822**	**606**	**652**	**69,679**	**45,306**

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.