LOCAL GOVERNMENT ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT

PREPARED FOR:

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I. EXECUTIVE SUMMARY

This report presents the findings of the energy audit conducted for:

Collingswood Presbyterian Church
30 Fern Avenue
Collingswood, New Jersey 08108

Church Contact Person: William Ostrem, Property Committee Member

This audit is performed in connection with the New Jersey Clean Energy - Local Government Energy Audit Program for the Collingswood Presbyterian Church. The purpose of this analysis is to provide the owner insight into the energy savings potential that exists within the facility. Energy Efficiency changes and upgrades requires support from the building occupants, operations personnel and the administrators of the building in order to maximize the savings and overall benefit. The efficiency improvement of public buildings provides a benefit for the environment and the residents of New Jersey.

The Energy Conservation Measures (ECMs) identified within the report represent the potential annual savings at the facility. It is recommended to consider all ECMs as part of the Church's initiative to save energy, reduce emissions, and lower operating costs. The Church should review and be familiar with all measures presented in the report prior to making a decision on which projects to move forward with. This will enable the Church to effectively align report recommendations with those outlined in their mid/long range facility plans and financial plans. The Church should also review all conventional and unconventional funding, along with all NJCEP funding opportunities for these projects and determine which options fit their budget most positively in the short and long term. The combination of this information will enable the Church to put together an effective Energy Savings Improvement Strategy that maximizes the received benefits of the selected projects.

The annual energy costs at this facility are as follows:

Electricity	$ 7,782
Natural Gas	$ 13,711
Total	$ 21,615

The potential annual energy cost savings for each energy conservation measure (ECM) and renewable energy measure (REM) are shown below in Table 1. Be aware that all ECM's and REM's are not additive because of the interrelation of some of the measures. This audit is consistent with an ASHRAE level 2 audit. The cost and savings for each measure is ± 20%. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

Table 1
Financial Summary Table

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Lighting Upgrade - General	$25,299	$812	31.2	-51.9%
ECM #2	Exterior Lighting Upgrade	$644	$128	5.0	198.1%
ECM #3	Domestic Water Heater Upgrade	$7,200	$69	104.3	-85.6%
ECM #4	Thermostatic Controllers and Radiator Valves	$33,000	$2,177	15.2	-1.0%
ECM #5	Steam Trap Replacement	$32,085	$2,541	12.6	18.8%
ECM #6	Split System Replacements	$46,528	$1,472	31.6	-52.5%
ECM #7	Window Replacement	$5,850	$278	21.0	-5.0%
ECM #8	Water Conservation	$240	$244	1.0	916.7%
ECM #9	Destratification Fans	$10,000	$990	10.1	48.5%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	18 kW Roof Array	$78,163	$9,091	8.6	190.8%

Notes: A. Cost takes into consideration applicable NJ Smart StartTM incentives.
B. Savings takes into consideration applicable maintenance savings.

The estimated demand and energy savings for each ECM and REM is shown below in Table 2. The descriptions in this table correspond to the ECM's and REM's listed in Table 1.

Table 2
Energy Savings Summary Table

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION			
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)	WATER (kGallons)
ECM #1	Lighting Upgrade - General	6.9	6,182	0	0
ECM #2	Exterior Lighting Upgrade	0.1	428	0	0
ECM #3	Domestic Water Heater Upgrade	0.0	0	68	0
ECM #4	Thermostatic Controllers and Radiator Valves	0.0	0	2,177	0
ECM #5	Steam Trap Replacement	0.0	0	2,516	0
ECM #6	Split System Replacements	8.2	4,908	0	
ECM #7	Window Replacement	0.0	478	133	0
ECM #8	Water Conservation	0.0	0	87	24
ECM #9	Destratification Fans	0.0	-188	1,034	0
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION			
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)	WATER (kGallons)
REM #1	18 kW Roof Array	15.2	20,135	0	0

Table 3
Emissions Summary Table

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	GREENHOUSE GAS EMISSIONS REDUCTION		
		CO_2 EMISSIONS (LBS)	NO_X EMISSIONS (LBS)	SO_2 EMISSIONS (LBS)
ECM #1	Lighting Upgrade - General	9,397	17	40
ECM #2	Exterior Lighting Upgrade	651	1	3
ECM #3	Domestic Water Heater Upgrade	796	1	0
ECM #4	Thermostatic Controllers and Radiator Valves	25,471	20	0
ECM #5	Steam Trap Replacement	29,437	23	0
ECM #6	Split System Replacements	7,460	14	32
ECM #7	Window Replacement	2,283	3	3
ECM #8	Water Conservation	1,018	1	0
ECM #9	Destratification Fans	11,812	9	(1)

Notes: A. Emissions Reduction based on NJCEP published factors for electric & gas.

Table 4
Combined Project Summary Table

FACILITY PROJECT SUMMARY TABLE					
ENERGY CONSERVATION MEASURES	**ANNUAL ENERGY SAVINGS ($)**	**PROJECT COST ($)**	**SMART START INCENTIVES**	**CUSTOMER COST**	**SIMPLE PAYBACK**
Lighting Upgrade - General	$812	$25,899	$600	$25,299	31.2
Exterior Lighting Upgrade	$128	$644	$0	$644	5.0
Domestic Water Heater Upgrade	$69	$7,500	$300	$7,200	104.3
Thermostatic Controllers and Radiator Valves	$2,177	$33,000	$0	$33,000	15.2
Steam Trap Replacement	$2,541	$32,085	$0	$32,085	12.6
Split System Replacements	$1,472	$48,000	$1,472	$46,528	31.6
Window Replacement	$278	$5,850	$0	$5,850	21.0
Water Conservation	$244	$240	$0	$240	1.0
Destratification Fans	$990	$10,000	$0	$10,000	10.1
Total Project	**$8,711**	**$163,218**	**$2,372**	**$160,846**	**18.5**

This project does not qualify for additional incentives through the Pay for Performance Program; please see the Installation Funding Options section for additional program options.

Overall Assessment:

On the whole, Concord Engineering recommends that the Collingswood Presbyterian Church review and be familiar with all measures presented in this report especially the replacement of the single pane, wooden frame windows for the basement sections; the upgraded thermostatic controls for the steam radiators; and the de-stratification fans for the Sanctuary.

Other Considerations:

Renewable Energy Conservation Measures:

Renewable Energy Measures (REMs) were also reviewed for implementation at the Collingswood Presbyterian Church. The Church has a small amount of available area on the roof that could accommodate solar. The total potential for this facility results in an installed system capacity of 18.0 kW. The potential for wind generation was also reviewed for the Church; however based on historical wind speed data, makes it a nonviable option.

Energy Procurement Recommendations:

The Collingswood Presbyterian Church recently contracted with a third party supplier for electric. It is recommended that the Church also utilize a 3rd party purchasing approach for natural gas. Further recommendations are outlined in the Energy Procurement Section of this report that could assist the Church in finding additional savings through their utility bills.

Maintenance and Operational Recommendations:

In addition to the ECMs and REMs, there are maintenance and operational measures that can provide significant energy savings and provide immediate benefit. The ECMs listed above represent investments that can be made to the facility which are justified by the savings seen overtime. However, the maintenance items and small operational improvements below are typically achievable with onsite staff or maintenance contractors and in turn have the potential to provide substantial operational savings compared to the costs associated. The following are recommendations which should be considered a priority in achieving an energy efficient building and further recommendations for the building are provided in the report:

1. Chemically clean the condenser and evaporator coils in the window and rooftop split units periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.

2. Maintain all weather stripping on windows and doors.

3. Clean all light fixtures to maximize light output.

4. Provide more frequent air filter changes to decrease overall system power usage and maintain better Indoor Air Quality (IAQ).

5. Verify that the programmable thermostats are utilizing setback and scheduling capabilities.

6. The Church should consider the installation of advanced power strips in offices that can be used to charge tablets and laptop computers, plug in computer peripherals, and small appliances in order to reduce the amount of idle power draw from these devices. (Smart Power Strips Model LPG3, Price ~$30)

7. Shutdown all non-essential equipment during unoccupied periods.

8. Educate staff on awareness of wasteful energy practices such as leaving lights on unnecessarily, leaving on of non-essential computer and/or equipment at the end of the day, leaving of outside doors/windows open as a means to control room temperature, etc.

II. INTRODUCTION

This comprehensive energy audit covers the 33,000 SF Collingswood Presbyterian Church. The audit is performed in connection with the New Jersey Clean Energy - Local Government Energy Audit Program. The energy audit is conducted to promote the mission of the office of Clean Energy, which is to use innovation and technology to solve energy and environmental problems in a way that improves the State's economy. This can be achieved through the wiser and more efficient use of energy.

Electrical and fuel oil utility information is collected and analyzed for one full year's energy use of the building. The utility information allows for analysis of the building's operational characteristics; calculate energy benchmarks for comparison to industry averages, estimated savings potential, and baseline usage/cost to monitor the effectiveness of implemented measures. A computer spreadsheet is used to calculate benchmarks and to graph utility information (see the utility profiles below).

The Energy Use Index (EUI) is established for the building. Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year (BTU/ft^2/yr), which is used to compare energy consumption to similar building types or to track consumption from year to year in the same building. The EUI is calculated by converting the annual consumption of all energy sources to BTU's and dividing by the area (gross square footage) of the building. Blueprints (where available) are utilized to verify the gross area of the facility. The EUI is a good indicator of the relative potential for energy savings. A low EUI indicates less potential for energy savings, while a high EUI indicates poor building performance therefore a high potential for energy savings.

Existing building architectural and engineering drawings (where available) are utilized for additional background information. The building envelope, lighting systems, HVAC equipment, and controls information gathered from building drawings allow for a more accurate and detailed review of the building. The information is compared to the energy usage profiles developed from utility data. Through the review of the architectural and engineering drawings a building profile can be defined that documents building age, type, usage, major energy consuming equipment or systems, etc. The preliminary audit information is gathered in preparation for the site survey. The site survey provides critical information in deciphering where energy is spent and opportunities exist within a facility. The entire site is surveyed to inventory the following to gain an understanding of how each facility operates:

- Building envelope (roof, windows, etc.)
- Heating, ventilation, and air conditioning equipment (HVAC)
- Lighting systems and controls

The building site visit is performed to survey all major building components and systems. The site visit includes detailed inspection of energy consuming components. Summary of building occupancy schedules, operating and maintenance practices, and energy management programs provided by the building manager are collected along with the system and components to determine a more accurate impact on energy consumption.

III. METHOD OF ANALYSIS

This audit is consistent with an ASHRAE Level II energy audit. The cost and savings for each measure is ± 20%. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

Post site visit work includes evaluation of the information gathered, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on HVAC, lighting and building envelope improvements. Data collected is processed using energy engineering calculations to anticipate energy usage for each of the proposed energy conservation measures (ECMs). The actual building's energy usage is entered directly from the utility bills provided by the owner. The anticipated energy usage is compared to the historical data to determine energy savings for the proposed ECMs. It is pertinent to note, that the savings noted in this report are not additive. The savings for each recommendation is calculated as standalone energy conservation measures. Implementation of more than one ECM may in some cases affect the savings of each ECM. The savings may in some cases be relatively higher if an individual ECM is implemented in lieu of multiple recommended ECMs. For example implementing reduced operating schedules for inefficient lighting will result in a greater relative savings. Implementing reduced operating schedules for newly installed efficient lighting will result in a lower relative savings, because there is less energy to be saved.

The project / entity summary tables are based on the implementation of multiple measures. The analysis is reviewed and determined if the nature of the ECMs will cause a major conflict of the overall savings. When additive measures do not cause a major effect on the overall savings the ECMs are included. Where a major conflict is identified, the combined savings is evaluated appropriately to ensure the overall estimates are ± 20%.

ECMs are determined by identifying the building's unique properties and deciphering the most beneficial energy saving measures available that meet the specific needs of the facility. The building construction type, function, operational schedule, existing conditions, and foreseen future plans are critical in the evaluation and final recommendations. Energy savings are calculated based on industry standard methods and engineering estimations. Energy consumption is calculated based on manufacturer's cataloged information when new equipment is proposed.

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment costs to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers. The NJ Smart Start Building® program incentives savings (where applicable) are included for the appropriate ECM's and subtracted from the installed cost. Maintenance savings are calculated where applicable and added to the energy savings for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The costs and savings are applied and a simple payback, simple lifetime savings, and simple return on investment are calculated. See below for calculation methods:

ECM Calculation Equations:

$$\text{Simple Payback} = \left(\frac{\text{Net Cost}}{\text{Yearly Savings}}\right)$$

$$\text{Simple Lifetime Savings} = (\text{Yearly Savings} \times \text{ECM Lifetime})$$

$$\text{Simple Lifetime Return on Investment (ROI)} = \frac{(\text{Simple Lifetime Savings} - \text{Net Cost})}{\text{Net Cost}}$$

$$\text{Lifetime Maintenance Savings} = (\text{Yearly Maintenance Savings} \times \text{ECM Lifetime})$$

$$\text{Net Present Value} = \sum_{n=0}^{N}\left(\frac{\text{Cash Flow of Period}_n}{(1+\text{DR})^n}\right)$$

$$\text{Internal Rate of Return (IRR)} \rightarrow \text{Net Present Value} = 0 = \sum_{n=0}^{N}(\frac{\text{Cash Flow of Period}_n}{(1+\text{IRR})^n}$$

Net Present Value calculations are based on Discount Rate (DR) of 3%.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

The energy usage for the facility has been tabulated and plotted in graph form as depicted within this section. Each energy source has been identified and monthly consumption and cost noted per the information provided by the Owner.

The electric usage profile represents the actual electrical usage for the facility. The facility receives electric distribution service through Public Service Electric & Gas under their General Lighting and Power (GLP) rate structure. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. Rates used in this report reflect the historical data received for the facility prior to the facility contracting recently with a third party supplier for electric.

The gas usage profile within each facility report shows the actual natural gas energy usage for the facility. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy. The facility received Natural Gas through Public Service Electric & Gas under Large Volume Gas (LVG) Rate Service.

The overall cost for utilities is calculated by dividing the total cost by the total usage. Based on the utility history provided, the average cost for utilities at this facility is as follows:

Description	Average
Electricity	30¢ / kWh
Natural Gas	$1.01 / therm

Table 5
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: PSE&G Electric
Rate: GLP
Meter No: 226003909
Account # 65 146 166 07
Third Party Utility Provider: N/A
TPS Meter / Acct No: N/A

MONTH OF USE	CONSUMPTION KWH	DEMAND KW	TOTAL BILL
Jan-13	2,436	21	$563
Feb-13	2,208	18	$548
Mar-13	1,944	16	$527
Apr-13	1,890	15	$517
May-13	1,506	15	$481
Jun-13	2,334	32	$922
Jul-13	2,808	31	$958
Aug-13	2,154	25	$805
Sep-13	1,956	23	$761
Oct-13	1,452	18	$489
Nov-13	2,076	17	$543
Dec-13	3,168	20	$667
Totals	**25,932**	**39 Max**	**$7,782**

AVERAGE DEMAND **22.6 KW average**
AVERAGE RATE **$0.300** **$/kWh**

Figure 1
Electricity Usage Profile

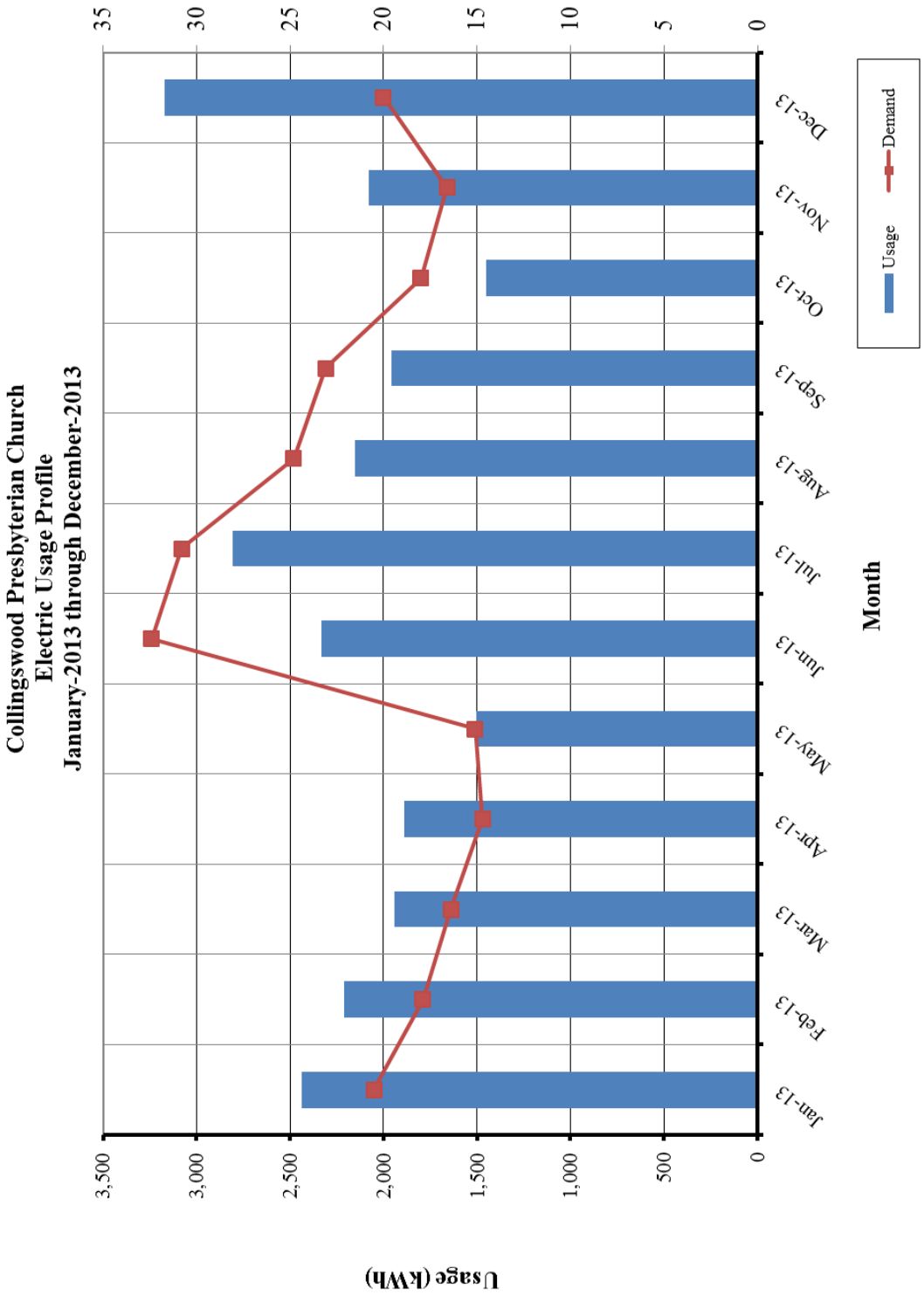
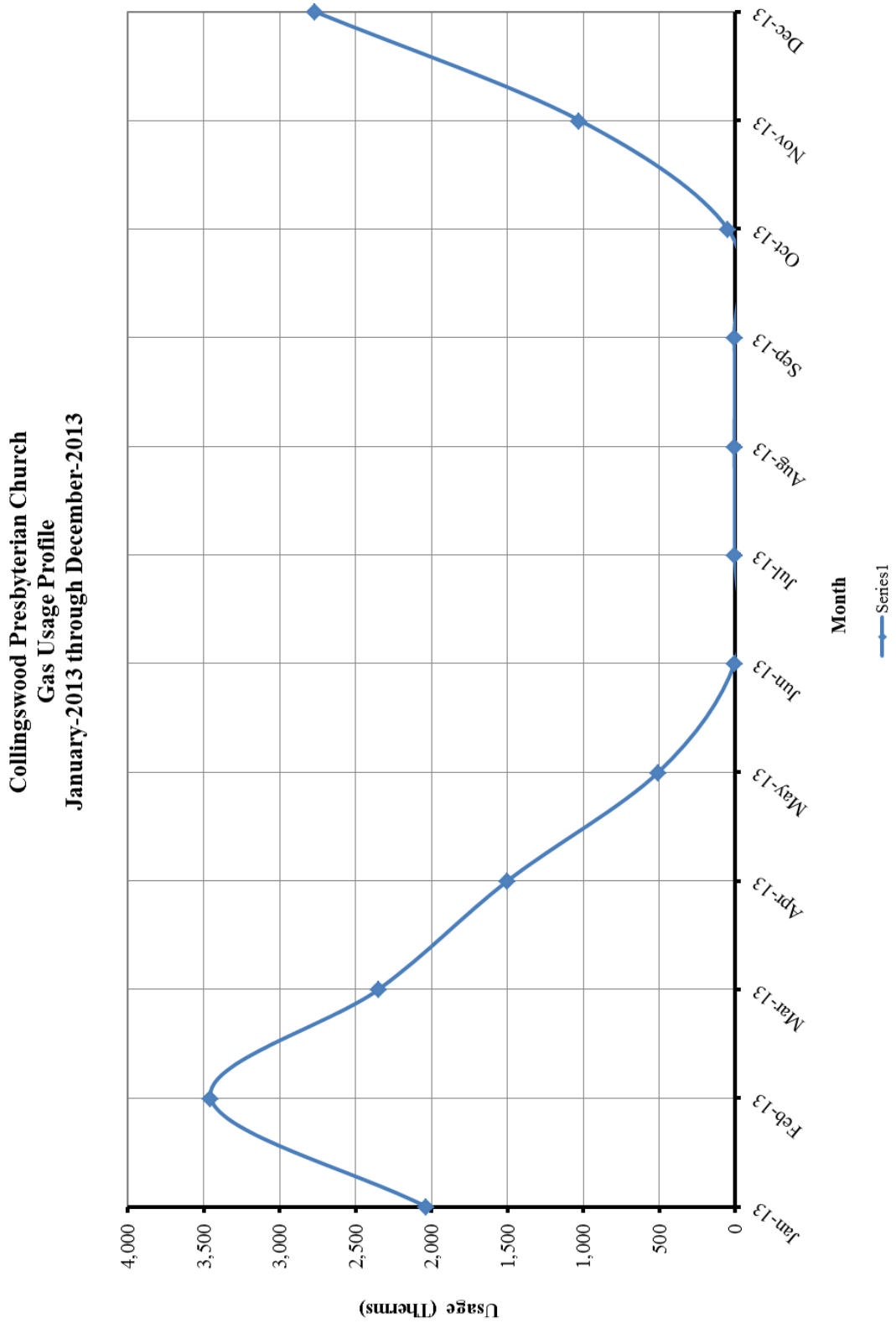


Table 6
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider:	PSE&G	
Rate:	LVG	
Meter No:	2062491	
Account Number	65 146 166 07	
Third Party Utility Provider:	N/A	
TPS Account No:	N/A	
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Jan-13	2,037	$2,084
Feb-13	3,454	$3,196
Mar-13	2,347	$2,363
Apr-13	1,498	$1,216
May-13	505	$499
Jun-13	5	$108
Jul-13	3	$107
Aug-13	5	$108
Sep-13	6	$109
Oct-13	51	$140
Nov-13	1,028	$1,249
Dec-13	2,770	$2,654
TOTALS	**13,711**	**$13,833**
AVERAGE RATE:	**$1.01**	**$/THERM**

Figure 2
Natural Gas Usage Profile



B. Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's annual energy utilization per square foot of building. This calculation is completed by converting all utility usage consumed by a building for one year, to British Thermal Units (BTU) and dividing this number by the building square footage. EUI is a good measure of a building's energy use and is utilized regularly for comparison of energy performance for similar building types. Building Benchmarking data is collected and analyzed within the Commercial Building Energy Consumption Survey (CBECS), performed by the Energy and Information Administration (EIA). Building data is grouped by function types and tabulated, from which a median site and source energy intensity is determined. The national median or PEER Group Comparable in this instance is the middle value of the national population meaning half the buildings use more energy, and half use less. The PEER Group EUI allows us to compare the relative efficiency of the audited building to that of an average building with the same or similar primary function (i.e. group type).

Source use differs from site usage when comparing a building's energy consumption with the national average. Site energy use is the energy consumed by the building at the building site only. Source energy use includes the site energy use as well as all of the losses to create and distribute the energy to the building. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses, which allows for a complete assessment of energy efficiency in a building. The type of utility purchased has a substantial impact on the source energy use of a building. The EPA has determined that **source energy** is the most comparable unit for evaluation purposes and overall global impact. Both the site and source EUI ratings for the building are provided to understand and compare the differences in energy use.

The site and source EUI for this facility is calculated as follows:

$$\text{Building Site EUI} = \frac{(\text{Electric Usage in kBtu} + \text{Fuel Usage in kBtu})}{\text{Building Square Footage}}$$

$$\text{Building Source EUI} = \frac{(\text{Electric Usage in kBtu} \times \text{SS Ratio} + \text{Fuel Usage in kBtu} \times \text{SS Ratio})}{\text{Building Square Footage}}$$

Table 7
Energy Use Index Summary

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	**BUILDING USE**			**SITE ENERGY**	**SITE-SOURCE RATIO**	**SOURCE ENERGY**
	kWh	**Therms**	**Gallons**	**kBtu**		**kBtu**
ELECTRIC	25,932.0			88,532	3.140	277,990
NATURAL GAS		13,710.7		1,371,071	1.050	1,439,625
TOTAL				1,459,603		1,717,615

*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document.

	AUDITED BUILDING		**PEER COMPARISON**	
BUILDING TYPE	Religious Worship		CBECS-Religious Worship	
BUILDING AREA	33,000	SQUARE FEET		
BUILDING SITE EUI	*44.23*	kBtu/SF/YR	*36.80*	kBtu/SF/YR
BUILDING SOURCE EUI	*52.05*	kBtu/SF/YR	*70.70*	kBtu/SF/YR

26%	More Efficient than PEER Comparison

C. EPA Energy Benchmarking System

The United States Environmental Protection Agency (EPA) in an effort to promote energy management has created a system for benchmarking energy use amongst various end users. The benchmarking tool utilized for this analysis is entitled Portfolio Manager. The Portfolio Manager tool allows tracking and assessment of energy consumption via the template forms located on the ENERGY STAR website (www.energystar.gov). The importance of benchmarking for local government municipalities is becoming more important as utility costs continue to increase and emphasis is being placed on carbon reduction, greenhouse gas emissions and other environmental impacts.

Based on information gathered from the ENERGY STAR website, Government agencies spend more than $10 billion a year on energy to provide public services and meet constituent needs. Furthermore, energy use in commercial buildings and industrial facilities is responsible for more than 50 percent of U.S. carbon dioxide emissions. It is vital that local government municipalities assess facility energy usage, benchmark energy usage utilizing Portfolio Manager, set priorities and goals to lessen energy usage and move forward with priorities and goals.

In accordance with the Local Government Energy Audit Program, Concord has updated the provided ENERGY STAR account for the Church. The login page for the account can be accessed at the following web address; the username and password are also listed below:

https://www.energystar.gov/istar/pmpam/index.cfm?fuseaction=login.login

[redacted] [redacted]

The utility bills and other information gathered during the energy audit process are entered into the Portfolio Manager. The following is a summary of the results for the facility:

Table 8
ENERGY STAR Performance Rating

ENERGY STAR PERFORMANCE RATING		
FACILITY DESCRIPTION	**ENERGY PERFORMANCE RATING**	**NATIONAL AVERAGE**
Church	73	50

V. FACILITY DESCRIPTION

The Collingswood Presbyterian Church is located at 30 Fern Avenue in Collingswood, New Jersey. This 33,000 SF facility was built in 1925 with no major additions. The building is a two-story facility with a full basement comprised of the sanctuary, administrative offices, Sunday school classrooms, kitchen, dining room, basement mechanical rooms, restrooms, gym, auditorium, lounge, nursery, etc.

Occupancy Profile

The typical hours of operation for the dining hall are four nights/week; nursery is two times per week; lounge is 3 times per week; and the classrooms on Sundays. The sanctuary has services on Sundays and is also used for other ceremonies. Due to this, the occupancy profile varies widely based on the day of the week. There are approximately 5 employees that normally occupy the facility.

Building Envelope

Exterior walls for the building are comprised of dark grey stone with light brown stonework around the windows and doors. An inspection of the stonework shows various areas where the mortar has cracked or fallen out of the joint and some areas showing water damage. Based on the year of construction, Concord Engineering estimates that there is no insulation in the wall components. The windows in the sanctuary portion of the facility are stained glass in the inside with a single glass panel on the outside to protect the stained glass. A visual inspection of each of these windows showed that caulking and weather-stripping needs to be maintained to reduce the amount of air infiltration. The windows for the basement are 1/8-inch uninsulated glass with wood frames. The windows for the first and second floors are 1/8-inch uninsulated glass with metal frames and wooden sash. As the wood shrinks and swells with humidity changes, the wooden frames and sashes have begun to show signs of cracked/ineffective caulking. This allows unconditioned air to enter the facility, leading to increased energy usage to heat and cool the spaces. The metal window frames are heavily rusted and most of the weather-stripping needs to be replaced. All exterior doors, thresholds, flashing, caulking and weather-stripping were inspected for signs of air leakage, water damage, etc. Overall the exterior doors were found to be in good condition.

Concord Engineering strongly recommends that the basement windows be replaced with a composite foam and wood frame with aluminum cladding with thermal breaking (R-6 frames) and double glazing.

The roofing system for the facility is in good condition and is comprised of rubber membrane on the flat roofs and shingle on the pitched roofing. The amount of insulation below the roofing is unknown.

HVAC Systems

The facility is heated by a Weil-McClain 88 Series I Model 688 gas-fired, steam boiler that is rated at 1,703 MBH input, 1,026 MBH output (1,254 pounds per hour of steam) with a thermal

efficiency of 83%. This 2004 steam boiler feeds numerous free-standing and ceiling-mounted steam radiators and unit/cabinet heaters. Most of these heating units have manual thermostatic controllers and radiator valves with some having pneumatic controls. Several of the existing steam valves were not operational thereby creating over-heated spaces.

Concord Engineering strongly recommends that the manual steam valves be replaced by the newest generation of thermostatic valves on the steam pipe feeding each radiator unit or unit heater which would vastly improve control of the heating.

The cooling for the lounge and administrative offices is performed by four (4) window air conditioning units that range in size from 10,000 BTUH to 12,000 BTUH and an efficiency of 9.5 EER. The sanctuary is cooled by eight (8) split, air-cooled units rated at 2 tons of cooling, each having a dedicated air-cooled condenser unit on the roofs with an efficiency of 10.5 EER each.

Exhaust System

There are small exhaust fans on the roofs that serve the restrooms, basement storage rooms, kitchen, boiler room, mechanical/electrical rooms, etc.

HVAC System Controls

The facility is divided into three heating zones (Church, Parish Hall and Basement) that are controlled by a Luxpro thermostat and a Honeywell 7-day programmable thermostat that control the facility's heating. The Honeywell programmable thermostats include 7-day scheduling, night-time setback and temperature hold.

Domestic Hot Water

The facility is provided domestic hot water by a Bradford White Model MI504S10FBN storage water heater that is rated at 50 MBH input, 50-gallons of storage and a recovery rate of 53 GPH at 90 degrees F rise. The water heater has a thermal efficiency of approximately 80%.

Lighting

The lighting was recently upgraded to a T-8 system and incandescent lamps to CFLs along with lighting occupancy sensors under the NJOCE Direct Install Program.

Refer to the **Investment Grade Lighting Audit Appendix** for a detailed list of the lighting throughout the facility and estimated operating hours per space.

VI. MAJOR EQUIPMENT LIST

The equipment list contains major energy consuming equipment that through implementation of energy conservation measures could yield substantial energy savings. The list shows the major equipment in the facility and all pertinent information utilized in energy savings calculations. An approximate age was assigned to the equipment in some cases if a manufactures date was not shown on the equipment's nameplate. The ASHRAE service life for the equipment along with the remaining useful life is also shown in the Appendix.

Refer to the **Major Equipment List Appendix** for this facility.

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade

Description:

The majority of the interior lighting throughout the Church is provided with fluorescent fixtures with both, 32W and 28W T8 lamps with electronic ballasts. Additionally, there are several areas that contain compact fluorescents and some incandescent lamps. These fixtures can be replaced and retrofit with new LED type fixtures and lamps.

This ECM includes replacing and retrofitting the interior lighting with new LED type lamps and fixtures. It is recommended the church review all fixture types and lighting requirements prior retrofitting or replacing fixtures.

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix** outlines the hours of operation, proposed retrofits, costs, savings, and payback periods for each set of fixtures in the each building.

LIGHTING UPGRADE SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Demand Savings (kW)	6.9
Electric Usage Savings (kWh)	9,182
Electric Cost Savings ($)	$812

No maintenance cost savings were estimated for this measure.

Given the lengthy payback associated with changing the lamps out to LED, we recommend that the Church look to perform many of these upgrades when the existing CFL or incandescent lamps burn out and are in need of replacement.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$25,899
NJ Smart Start Equipment Incentive ($):	$600
Net Installation Cost ($):	$25,299
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$812
Total Yearly Savings ($/Yr):	$812
Estimated ECM Lifetime (Yr):	15
Simple Payback	31.2
Simple Lifetime ROI	-51.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$12,180
Internal Rate of Return (IRR)	-8%
Net Present Value (NPV)	($15,605.40)

ECM #2: Lighting Upgrade – Exterior Lighting

Description:

The exterior lighting at the Church is currently lit by compact fluorescent lamps and an induction fixture. The compact fluorescent lamps could be upgraded to more efficient LED lamps with extended performance.

This ECM would replace the existing exterior lamps with equivalent LED lamps.

Energy Savings Calculations:

A detailed Investment Grade Lighting Audit can be found in **Investment Grade Lighting Audit Appendix** that outlines the proposed retrofits, costs, savings, and payback periods.

LIGHTING UPGRADE SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Demand Savings (kW)	0.1
Electric Usage Savings (kWh)	428
Electric Cost Savings ($)	$128

No maintenance cost savings were estimated for this measure.

Given the lengthy payback associated with changing the lamps out to LED, we recommend that the Church look to perform many of these upgrades when the existing CFL lamps burn out and are in need of replacement.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$644
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$644
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$128
Total Yearly Savings ($/Yr):	$128
Estimated ECM Lifetime (Yr):	15
Simple Payback	5.0
Simple Lifetime ROI	198.1%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$1,920
Internal Rate of Return (IRR)	18%
Net Present Value (NPV)	$884.06

ECM #3: Domestic Hot Water Heater Upgrade

Description:

The domestic hot water heater located in the basement is a standard efficient gas-fired Bradford White heater with 50 gallons of storage. The unit is 8 years old and nearing the end of its useful life expectancy. Installing a more energy efficiency condensing style, and tank less water heater will reduce energy consumption associated with heating and storing hot water.

This ECM would replace this existing gas-fired, domestic water heater with one Bradford White Model TGHE-199I-N 95% thermal efficiency gas fired boiler or equal. The new unit is rated at 199MBH and has not storage tank. *We recommend the Church consider replacement with a tank less system once the existing boiler fails given the long payback period of this measure.*

Energy Savings Calculations:

Energy Density for "Education" type building = 0.9 kBtu / SF / year

$$DHW\ \ Heat\ Usage = Energy\ Density\left(\frac{kBtu\ yr}{SF}\right) \times Building\ Square\ Footage\ \ (SF)$$

$$DHW\ Total\ Usage = \frac{Dom\ HW\ \ Heat\ Cons.(Btu)}{Heating\ \ Eff.(\%) \times Fuel\ \ Heat\ Value\left(\frac{BTU}{Fuel\ Unit}\right)}$$

$$Energy\ Cost = Heating\ \ Fuel\ Usage(Fuel\ Units) \times Ave\ Fuel\ \ Cost\left(\frac{\$}{Fuel\ Unit}\right)$$

DOM. HOT WATER HEATER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Electric Water Heater	High Efficiency Heater	
Building Type	Religous Worship		
Building Square-foot	33,000	33,000	
Domestic Water Usage, kBtu	29,700.00	29,700.00	
DHW Heating Fuel Type	Gas	Gas	
Fuel Heat Value Nat Gas (Btu/Therms)	*100,000*	*100,000*	
Heating Efficiency	78%	95%	17%
Total Usage (kBTU)	38,077	31,263	6,814
Nat Gas Cost ($/Therm)	$ 1.010	$ 1.010	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	381	313	68
Energy Cost ($)	$385	$316	$69
COMMENTS:	Savings are based on Energy Information Administration Commercial Building Energy Consumption Survey 2003 Information		

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$7,500
NJ Smart Start Equipment Incentive ($):	$300
Net Installation Cost ($):	$7,200
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$69
Total Yearly Savings ($/Yr):	$69
Estimated ECM Lifetime (Yr):	15
Simple Payback	104.3
Simple Lifetime ROI	-85.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$1,035
Internal Rate of Return (IRR)	-18%
Net Present Value (NPV)	($6,376.28)

ECM #4: New Thermostatic Steam Valves/Control

Description:

This facility has steam radiators and unit heaters on the perimeter walls of the church. Due to the equipment age, the two-way valves and controls do not function properly so the rooms are often not heated properly leading to occupant discomfort and increased energy costs. During our site survey, we counted a total of 22 existing valves that would be excellent candidates for replacement with newer electronically actuated 2-way control valves.

This measure would install the newest generation of thermostatic valves on the steam pipe feeding each radiator unit or unit heater which would improve control of the heating. Thermostatic controls are self-contained and are suitable for radiators, fin-tubes, baseboards or convector units. These new thermostatic valves have the capability of setting an upper limit to prevent overheating of the spaces. The valves include a remote sensor for accurately measuring the return air temperature for better heating control.

Energy Savings Calculations:

In our experience, we have seen a 15% to 20% reduction in heating cost from installation of new thermostatic valves/controls. Based on heating degree day analysis, the energy used to heat the spaces controlled by these valves is estimated to be approximately 14,516 Therms**.** At an average cost of $1.01/Therm, the annual heating energy cost is $14,516. Therefore, the cost savings would equate to approximately 15% of $14,516, or $2,177.

The basis of design is the ISTEC 2000 Series Thermostatic Valve/Control or equal which has a total installation cost (including valve, sensor, calibration, piping changes, etc.) of $1,500 per unit. Replacement of 22 existing older control valves x $1,500/unit for the new thermostatic valves/controls = $33,000.

Final quantities and sizes can be confirmed during the engineering phase of the project.

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$33,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$33,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,177
Total Yearly Savings ($/Yr):	$2,177
Estimated ECM Lifetime (Yr):	15
Simple Payback	15.2
Simple Lifetime ROI	-1.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$32,655
Internal Rate of Return (IRR)	0%
Net Present Value (NPV)	($7,011.12)

ECM #5: Steam Trap Replacement Program

Description:

Steam traps are required for the proper operation of steam distributions systems. Traps are mechanical devices installed on steam pipes to remove condensate from steam flow. This facility is estimated to have approximately nine (9) steam traps. Steam traps have an average life of five (5) years, and as the traps age, they develop a tendency to leak. Depending on the maintenance schedule, most facilities see an average of 20% of steam traps leaking in a given year.

This ECM would replace approximately nine (9) steam traps. All non-thermostatic traps will be replaced with either bucket or float & thermostatic traps. Schedule 80 piping and extra heavy fittings will be used, and all piping and fittings between the unions will be replaced along with the steam traps. In addition, a complete steam trap survey will be performed along with tagging and implementing a 3-year, revolving, steam trap maintenance program.

Energy Savings Calculations:

See **Appendix Stream Trap Replacement Calculations** for a detailed analysis.

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$32,085
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$32,085
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,541
Total Yearly Savings ($/Yr):	$2,541
Estimated ECM Lifetime (Yr):	15
Simple Payback	12.6
Simple Lifetime ROI	18.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$38,115
Internal Rate of Return (IRR)	2%
Net Present Value (NPV)	($1,750.71)

ECM #6: Split System Replacements

Description:

The main sanctuary has eight (8) Mitsubishi split system air conditioning only units which provide cooling in the summer. The estimated existing unit efficiencies are 10.5 EER. These split system units are approximately 10 years old and have not exceeded their ASHRAE expected service life of 15 years; however, replacing these units with newer more efficient units would result in significant energy savings.

The units currently installed have lower efficiencies compared to modern high-efficiency units. New units provide higher full load and part load efficiencies due to advances in inverter motor technologies and higher efficiency refrigerants such as R410A which would be used in place of R22 that is currently used in the units.

This ECM includes replacement of the older condensing units and evaporator coils with a new higher efficiency condensing units and R-410A coils. It is recommended to fully evaluate the capacity needed for the new split system units prior to moving forward with this ECM. A summary of the unit replacements for this ECM can be found in the table below:

IMPLEMENTATION SUMMARY					
ECM INPUTS	SERVICE FOR	NUMBER OF UNITS	COOLING CAPACITY, BTU/HR	TOTAL CAPACITY, TONS	REPLACE UNIT WITH
SS	Sanctuary	1	24,000	2.0	Mitsubishi MSY-GE24NA or Equal
SS	Sanctuary	1	24,000	2.0	Mitsubishi MSY-GE24NA or Equal
SS	Sanctuary	1	24,000	2.0	Mitsubishi MSY-GE24NA or Equal
SS	Sanctuary	1	24,000	2.0	Mitsubishi MSY-GE24NA or Equal
SS	Sanctuary	1	24,000	2.0	Mitsubishi MSY-GE24NA or Equal
SS	Sanctuary	1	24,000	2.0	Mitsubishi MSY-GE24NA or Equal
SS	Sanctuary	1	24,000	2.0	Mitsubishi MSY-GE24NA or Equal
SS	Sanctuary	1	24,000	2.0	Mitsubishi MSY-GE24NA or Equal
Total		**8**	**192,000**	**16.0**	

The high-efficiency split system used as the basis for the calculation is a Mitsubishi MSY inverter driven AC unit. The unit pricing and install costs were estimated based on current rates quotes and labor rates. The payback may change based on actual unit pricing and installed costs if the ECM is implemented.

Energy Savings Calculations:

Cooling Energy Savings:

Seasonal energy consumption of the air conditioners at the cooling mode is calculated with the equation below:

$$\text{Energy Savings, kWh} = \text{Cooling Capacity}, \frac{\text{BTU}}{\text{Hr}} \times \left(\frac{1}{\text{SEER}_{\text{Old}}} - \frac{1}{\text{SEER}_{\text{New}}}\right) \times \frac{\text{Operation Hours}}{1000\,\frac{\text{W}}{\text{kWh}}}$$

$$\text{Demand Savings, kW} = \frac{\text{Energy Savings (kWh)}}{\text{Hours of Cooling}}$$

$$\text{Cooling Cost Savings} = \text{Energy Savings, kWh} \times \text{Cost of Electricity}\left(\frac{\$}{\text{kWh}}\right)$$

ENERGY SAVINGS CALCULATIONS							
ECM INPUTS	**EXISTING COOLING CAPACITY, BTU/Hr**	**ANNUAL COOLING HOURS**	**EXISTING UNIT EER**	**NEW UNIT EER**	**# OF UNITS**	**ENERGY SAVINGS kWh**	**DEMAND SAVINGS kW**
SS	24,000	600	10.5	19	1	614	1.0
SS	24,000	600	10.5	19	1	614	1.0
SS	24,000	600	10.5	19	1	614	1.0
SS	24,000	600	10.5	19	1	614	1.0
SS	24,000	600	10.5	19	1	614	1.0
SS	24,000	600	10.5	19	1	614	1.0
SS	24,000	600	10.5	19	1	614	1.0
SS	24,000	600	10.5	19	1	614	1.0
Total					8	4,908	8.2

Project Cost, Incentives and Maintenance Savings

From the NJ Smart Start® Program appendix, the replacement of split system AC units and unitary systems with high efficiency AC systems falls under the category "Unitary HVAC Split System" and warrants an incentive based on efficiency (EER/SEER). The program incentives are calculated as follows:

$$\text{Smart Start® Incentive} = (\text{Cooling Tons} \times \text{ \$/Ton Incentive})$$

AC UNITS REBATE SUMMARY				
UNIT DESCRIPTION	**UNIT EFFICIENCY**	**REBATE $/TON**	**PROPOSED CAPACITY TONS**	**TOTAL REBATE $**
<5.4 Tons	14.0 SEER	92	16	$1,472
TOTAL			**16**	**$1,472**

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$48,000
NJ Smart Start Equipment Incentive ($):	$1,472
Net Installation Cost ($):	$46,528
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,472
Total Yearly Savings ($/Yr):	$1,472
Estimated ECM Lifetime (Yr):	15
Simple Payback	31.6
Simple Lifetime ROI	-52.5%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$22,080
Internal Rate of Return (IRR)	-8%
Net Present Value (NPV)	($28,955.36)

ECM #7: Window Replacement

Description:

The windows for the basement are 1/8-inch uninsulated glass with wood frames. The total area of single pane windows is estimated at 75 SF. This area was used as the basis for calculating energy savings and formulating a cost estimate.

Older inefficient windows can account for significant energy use through leakage heat loss and conductive heat loss. The age and condition of the windows contribute to the leakage rate of the building. The single pane construction allows higher thermal (conductive) energy loss. These factors lead to increased energy use in the heating season. The heating loss due to single pane glass is combined with heat loss due to poor seals at each operable window. New double pane windows with low E glazing offer a substantial improvement in thermal performance throughout the year.

This ECM includes the replacement of all single pane glass in the facility with double pane windows with low emissivity glass. The proposed windows include reduced outside air leakage. In addition the double pane structure will significantly increase the insulation value compared to the existing single pane window structure.

The basis for this ECM is an ASHRAE 90.1-2007 equivalent window. All of the windows in the basement will be replaced.

Energy Savings Calculations:

Conduction Loss values were calculated for each month based on the average monthly temperature obtained for 2012/2013. The cooling period used was May to September, and heating period used was October to April.

$$\text{Thermal Loss Savings (kBtu)} = (U_E - U_P) \times \text{Window Area} \times \left(T_{\text{Indoor}} - T_{\text{Avg Outdoor}}\right) \times \frac{\text{Hours}}{\text{Month}} \times \frac{1\ \text{kBtu}}{1{,}000\ \text{Btu}}$$

$$\text{Heating Savings (Therm)} = \text{Thermal Loss Savings (Heating)} \times \frac{1}{\text{Efficiency}} \times \frac{1\ \text{Therm}}{100\ \text{kBtu}}$$

$$\text{Cooling Savings (kWh)} = \text{Thermal Loss Savings (Cooling)} \times \frac{1}{\text{EER}}$$

Infiltration Loss values for the summer were calculated for each month based on the assumed infiltration rate, and the difference in enthalpy between outside air and inside conditions. In the

winter, the infiltration loss was calculated based on the assumed infiltration rate and the difference in temperature between outside air and indoor conditions.

$$\text{Summer Infiltration Losses } (kBTU) = \text{Infiltration Rate } (CFM) \times 4.5 \times (h_{outdoor} - h_{indoor}) \times \frac{1}{1000} \times \frac{24\ hours}{day} \times \frac{days}{month}$$

$$\text{Winter Infiltration Losses } (kBTU) = \text{Infiltration Rate } (CFM) \times 1.08 \times (T_{indoor} - T_{outdoor}) \times \frac{1}{1000} \times \frac{24\ hours}{day} \times \frac{days}{month}$$

$$\text{Heating Infiltration Savings (Therm)} = (\text{Winter infiltraition losses}_{Old\ Windows} - \text{Winter infiltraition losses}_{New\ Windows}) \times \frac{1}{Efficiency} \times \frac{1\ \text{Therm}}{100\ \text{kBtu}}$$

$$\text{Cooling Infiltration Savings (kWh)} = (\text{Summer infiltration losses}_{Old\ Windows} - \text{Summer infiltration losses}_{New\ Windows}) \times \frac{1}{\text{EER}}$$

The total savings was the sum of the conduction savings and the infiltration savings.

WINDOW REPLACEMENT CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Description:	Existing Single Pane Windows	Double Pane Low-E Windows	
Window (SF)	75	75	
U-Value (BTU/HR/SF*°F)	1.0	0.45	0.55
Infiltration Rate (CFM/SF)	0.8	0.4	0.40
Indoor Temperature Cooling (°F)	72	72	
Indoor Temperature Heating (°F)	70	70	
Thermal Losses due to Infiltration - Heating (kBtu)	9,726.2	4863.1104	4,863
Thermal Losses due to Infiltration - Cooling (kBtu)	9,914.4	4,957.2	4,957
Conduction Losses Heating (kBtu)	11,257	5,066	6,191
Conduction Losses Cooling (kBtu)	-326	-147	-179
Heating System Efficiency (%)	83.0%	83.0%	
Cooling System Efficiency (EER)	10.0	10.0	
Natural Gas Cost ($/Therm)	$1.01	$1.01	-
Electric Cost ($/kWh)	$0.300	$0.300	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Usage (kWh)	959	481	478
Natural Gas Usage (Therm)	253	120	133
Energy Cost Savings ($)	$543	$265	$278
Comments:	1. Proposed window U-value Based on ASHRAE 90.1 - 2007 2. Savings Based on Avg. Monthly Temperature for 2012/2013		

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$5,850
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$5,850
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$278
Total Yearly Savings ($/Yr):	$278
Estimated ECM Lifetime (Yr):	20
Simple Payback	21.0
Simple Lifetime ROI	-5.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$5,560
Internal Rate of Return (IRR)	0%
Net Present Value (NPV)	($1,714.06)

ECM #8: Water Conservation

Description:

The Collingswood Presbyterian Church utilizes standard plumbing fixtures. The typical water faucet consumption only meets the minimum federal required standard for water efficiency. New fixtures are available that use less water than today's requirements and can add up to significant water reduction over a long period.

The proposed retrofit includes installation of low flow aerators at each kitchen and bathroom sink. The basis of design used for this calculation was the Niagara Conservation Pressure Compensating Dual-Thread Bubble Spray Bath and Kitchen Aerator.

Energy Savings Calculations:

Faucets:

$$\text{Water Usage} = \text{Occupancy}\left(\frac{\text{Days}}{\text{yr}}\right) \times \frac{\text{Uses}}{\text{Day}} \times \text{Duration}\left(\frac{\text{min}}{\text{Use}}\right) \times \text{Fixture}\left(\frac{\text{Gal}}{\text{Min}}\right)$$

$$\text{Gas Usage (therm)} = \text{Faucet Water Usage (Gal)} \times 8.33\frac{\text{lbs}}{\text{Gal}} \times \text{Specific Heat (1)} \times \Delta\text{T}(70°\text{F}) \times \frac{\text{therm}}{100{,}000\ \text{Btu}} \times \frac{1}{\text{HWH Efficiency}}$$

LOW FLOW WATER SAVING DEVICES			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Quantity of Sinks	8	8	
Flow Rate (GPM)	2.2	1.0	1.2
Device Usage (min per day)	10	10	
Facility Operation (days / year)	250	250	
Heat Content of Water (Btu/gal/°F)	8.33	8.33	
Temperature Rise (°F)	70.0	70.0	
Efficiency of Heating System (%)	80%	80%	
Conversion Factor for Natural Gas	100000	100000	
Natural Gas Rate ($/Therm)	$1.01	$1.01	
Water Rate ($/1000gal)	$6.50	$6.50	
ENERGY SAVINGS CALCULATIONS			
Natural Gas Usage (Therms)	160	73	87
Water Usage (gallons)	44,000	20,000	24,000
Energy Cost ($)	$448	$204	$244
COMMENTS:	Heating Savings based on 50% Hot Cold Mix		

The cost for installation and materials is based on eight (8) faucet aerators. There are no Smart Start rebates for installation of low flow plumbing fixtures.

Energy Savings Summary:

ECM #8 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$240
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$240
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$244
Total Yearly Savings ($/Yr):	$244
Estimated ECM Lifetime (Yr):	10
Simple Payback	1.0
Simple Lifetime ROI	916.7%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$2,440
Internal Rate of Return (IRR)	102%
Net Present Value (NPV)	$1,841.37

ECM #9: De-stratification Fans

Description:

The Sanctuary at the Collingswood Presbyterian Church is heated by steam radiators. In rooms with high ceilings, typically stratification of heated air occurs resulting in air at ceiling level being warmer than the floor. Since temperature at the floor level dictates the comfort of occupants and is typically the location of the thermostat controlling the system, this results in additional operating hours to satisfy space conditions.

This ECM would replace the two (2) existing paddle fans with two (2) Airius Model A45 de-stratification fans in the sanctuary to be suspended from the ceiling, with all required electrical wiring and supports. These fans should only operate during heating season to help maintain a higher floor temperature and reduce cycling time.

Energy Savings Calculations:

The calculations are based on the manufacturer's percent savings utilizing the height of the ceiling and associated temperature differential between floor and ceiling. The temperature differential in this case was estimated at 12.6 degrees Fahrenheit.

$$\text{Heating Energy (kBtu)} = 80\%\ \text{Oversize Factor} \times \text{Space Heating Capacity} \times \text{HDD} \times \text{Adj. Factor} \times 24\frac{\text{hr}}{\text{day}} \times \frac{1}{\text{Design } \Delta T} \times \frac{1}{\text{Efficiency}}$$

$$\text{Savings (kBtu)} = \text{Heating Energy} \times \text{Percent Savings}$$

$$\text{Fan Power Penalty (kWh)} = \text{Fan Power (W)} \times \text{Winter Operating Hours} \times \frac{1\ \text{kWh}}{1{,}000\ \text{W}}$$

Each A45 unit has a 46-Watt fan motor.

DESTRATIFICATION FAN ANALYSIS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Description	Existing Sanctuary	Proposed Sanctuary w/ Fans	
Space Heating Type	Steam Radiators	Steam Radiators	
Space Heating Capacity (MBH)	455	455	
Heating Efficiency (%)	83%	83%	
Heating Degree Days (65 F)	5062	5062	
Degree Day Adjustment Factor	0.45	0.45	
Space Ceiling Height (ft)	25	25	
Ceiling-Floor ΔT (^{o}F)	13	13	
Percent Energy Savings	-	22%	
Destrat Fan Power (kWh)	-	188	
Heating Energy (kBtu)	470,109	366,685	
Electric Rate ($/kWh)	$0.300	$0.293	
Natural Gas Rate ($/Therm)	$1.010	$1.010	
ENERGY SAVINGS CALCULATIONS			
Electric Usage (kWh)	0	188	(188)
Natural Gas Usage (therm)	4,701	3,667	1,034
Energy Cost ($)	$4,748	$3,758	$990
COMMENTS:	Ceiling-Floor Temperature Differential Based on 0.5 F per Foot		

Energy Savings Summary:

ECM #9 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$10,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$10,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$990
Total Yearly Savings ($/Yr):	$990
Estimated ECM Lifetime (Yr):	15
Simple Payback	10.1
Simple Lifetime ROI	48.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$14,850
Internal Rate of Return (IRR)	5%
Net Present Value (NPV)	$1,818.56

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

Globally, renewable energy has become a priority affecting international and domestic energy policy. The State of New Jersey has taken a proactive approach, and has recently adopted in its Energy Master Plan a goal of 30% renewable energy by 2020. To help reach this goal New Jersey created the Office of Clean Energy under the direction of the Board of Public Utilities and instituted a Renewable Energy Incentive Program to provide additional funding to private and public entities for installing qualified renewable technologies. A renewable energy source can greatly reduce a building's operating expenses while producing clean environmentally friendly energy. Concord Engineering has assessed the feasibility of installing renewable energy measures (REM) for the municipality utilizing renewable technologies and concluded that there is potential for solar energy generation.

Solar Generation

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which are mounted on all south and southwestern facades of the building. Flat roof, as well as sloped areas can be utilized; flat areas will have the panels turned to an optimum solar absorbing angle. (A structural survey of the roof would be necessary before the installation of PV panels is considered). The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit is around $152, this value was used in our financial calculations. This equates to $0.152 per kWh generated.

CEG has reviewed the existing roof, ground, and parking lot area potential of the facility being audited for the purposes of determining a potential for a photovoltaic system. The facility was evaluated for the most economical and feasible areas for the installation of a solar array, which included a roof mounted array. A depiction of the area utilized at the facility is shown in **Renewable / Distributed Energy Measures Calculation Appendix**. Note this analysis did not include a structural evaluation to determine if the roof could accommodate the additional loading, which would be required to be performed prior to implementation. The total KWH production for the system is 20,165 kWh annually, reducing the overall utility bill for the Church by approximately 78% percent. A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix**. This analysis illustrates the payback of the system over a 15 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

The proposed photovoltaic array layout is designed based on the specifications for the Sharp Model ND-240QCJ panel. This panel has a "DC" rated full load output of 240 watts, and has a total panel conversion efficiency of 14.4%. Although panels rated at higher wattages are available through Sharp and other various manufacturers, in general most manufacturers who produce commercially available solar panels produce a similar panel in the 200 to 250 watt range. This provides more manufacturer options to the public

entity if they wish to pursue the proposed solar recommendation without losing significant system capacity.

The array system capacity was sized based on available roof space, ground area, or parking canopy style system area available at the existing facility. Estimated solar array generation is calculated based on the National Renewable Energy Laboratory PVWatts Version 1.0 Calculator. In order to calculate the array generation an appropriate location with solar data on file must be selected. In addition the system DC rated kilowatt (kW) capacity must be inputted, a DC to AC de-rate factor, panel tilt angle, and array azimuth angle. The DC to AC de-rate factor is based on the panel nameplate DC rating, inverter and transformer efficiencies (95%), mismatch factor (98%), diodes and connections (100%), dc and ac wiring(98%, 99%), soiling, (95%), system availability (95%), shading (if applicable), and age(new/100%). The overall DC to AC de-rate factor has been calculated at an overall rating of 81%. The PVWatts Calculator program then calculates estimated system generation based on average monthly solar irradiance and user provided inputs. The monthly energy generation and offset electric costs from the PVWatts calculator is shown in the **Renewable/Distributed Energy Measures Calculation Appendix**.

The proposed solar array for the facility is qualified by the New Jersey Board of Public Utilities Net Metering Guidelines as a Class I Renewable Energy Source. These guidelines allow onsite customer generation using renewable energy sources such as solar and wind with a capacity of 2 megawatts (MW) or less. This limits a customer system design capacity to being a net user and not a net generator of electricity on an annual basis. Although these guidelines state that if a customer does net generate (produce more electricity than they use), the customer will be credited those kilowatt-hours generated to be carried over for future usage on a month to month basis. Then, on an annual basis if the customer is a net generator the customer will then be compensated by the utility the average annual PJM Grid LMP price per kilowatt-hour for the over generation. Due to the aforementioned legislation, the customer is at limited risk if they generate more than they use at times throughout the year. With the inefficiency of today's energy storage systems, such as batteries, the added cost of storage systems is not warranted and was not considered in the proposed design.

Direct purchase involves the Church paying for 100% of the total project cost upfront in lieu of one of the methods noted in the Installation Funding Options section below. Calculations include a utility inflation rate as well as the degradation of the solar panels over time. The financial summary for the facility is as follows:

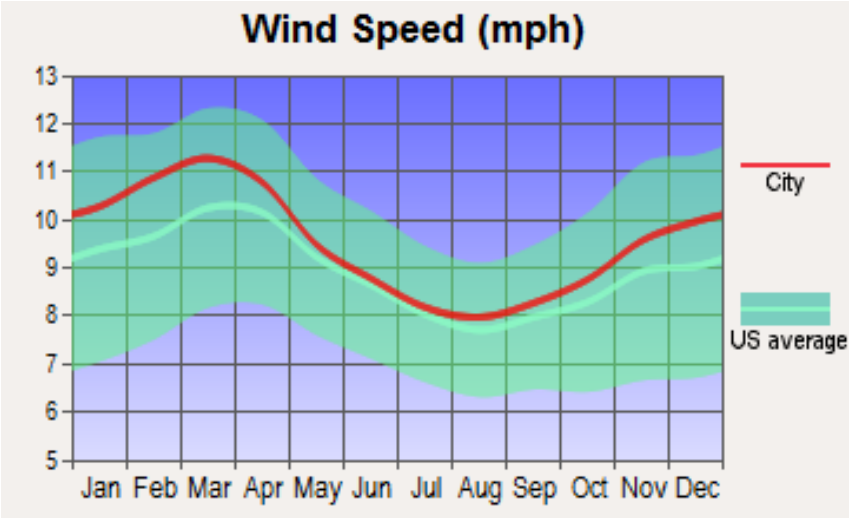
REM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$78,163
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$78,163
Maintenance Savings ($/Yr):	$3,051
Energy Savings ($/Yr):	$6,041
Total Yearly Savings ($/Yr):	$9,091
Estimated ECM Lifetime (Yr):	25
Simple Payback	8.6
Simple Lifetime ROI	190.8%
Simple Lifetime Maintenance Savings	$76,263
Simple Lifetime Savings	$227,276
Internal Rate of Return (IRR)	10.7%
Net Present Value (NPV)	$80,140.37

Concord Engineering recommends the Church review all options available for installation of solar PV systems at their facility including a Power Purchase Agreement (PPA). This option utilizes providers who will own, operate, and maintain the system for a period of 15 years. During this time the PPA Provider would sell all of the electric generated by Solar Array to the Church at a reduced rate compared to their existing electric rate. It should be noted that current SREC pricing has significantly impacted the PPA market in addition to the end of the 30% grant in lieu of the investment tax credit. These recent market changes have made it more difficult for entities to secure low cost power purchase price options.

Wind Generation

In addition to the Solar Analysis, CEG also conducted a review of the applicability of wind energy for the facility. Wind energy production is another option available through the Renewable Energy Incentive Program. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. CEG investigated the potential for smaller building mountable wind turbines, and horizontal turbines to maximize the available free space. In order to be economically viable a site requires a minimum average speed of 6 meters per second (13.5 mph). Based on the obtained wind data shown in **Figure 3** for Camden the annual average wind speed is 9.4 mph with a peak of 11 mph, making this area unattractive for wind development. Therefore, wind energy is not a viable option to implement.

Figure 3
Camden, New Jersey Average Wind Speeds



IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

Load Profile analysis was performed to determine the seasonal energy usage of the facility. Irregularities in the load profile will indicate potential problems within the facility. Consequently based on the profile a recommendation will be made to remedy the irregularity in energy usage. For this report, the facility's energy consumption data was gathered in table format and plotted in graph form to create the load profile. Refer to The Electric and Natural Gas Usage Profiles included within this report to reference the respective electricity and natural gas usage load profiles.

Electricity:

The electricity usage profile demonstrates cooling season dominated load profile. The average summer (May-September) demand is 30% more than the average winter (October-April) demand. The following table outlines the seasonal average monthly consumption and demand for the facility.

ELECTRIC UTILITY SEASONAL LOAD PROFILE				
FACILITY	SEASONAL AVERAGES			
	WINTER (OCT - APR)		SUMMER (MAY - SEP)	
DESCRIPTION	KWH PER MONTH	KW PER MONTH	KWH PER MONTH	KW PER MONTH
Collingswood Presbyterian	2,637	18.04	2,199	26.10

The historical usage profile is not favorable as typically summer commodity rates are higher due to increased demand on the grid.

Natural Gas:

The Natural Gas Usage Profile demonstrates a heating load dominated profile. The average summer (May – September) consumption is 94% less than the average winter (October- April) consumption. The follow table outlines the seasonal average monthly consumption for the facility.

NATURAL GAS UTILITY SEASONAL LOAD PROFILE		
FACILITY	SEASONAL AVERAGES	
	WINTER (OCT - APR)	SUMMER (MAY - SEP)
DESCRIPTION	THERM PER MONTH	THERM PER MONTH
Collingswood Presbyterian	1,884	105

This load profile will yield less than favorable natural gas prices due to the heating dominated profile. Higher winter month consumption will yield higher pricing which will not be offset by the summer month consumption. Nymex commodity pricing is generally higher in the winter months of November – March and lower in the summer months of April – October.

Third Party Supplier (TPS) natural gas commodity contracts that offer a product structure to include a Fixed percentage savings product structure for 100% of the facilities **metered** natural gas requirements is recommended. Several natural gas third party suppliers are offering this product service for end users for a guaranteed savings strategy.

Tariff Analysis:

Electricity:

The facility receives electrical service from Public Service Electric & Gas (PSEG) on rate schedule General Lighting and Power (GLP). The facility very recently contracted electric via a Third Party Supplier (TPS) although no bills were available with the new electric supplier.

Each year since 2002, the four New Jersey Electric Distribution Companies (EDCs) - Public Service Gas & Electric Company (PSE&G), Atlantic City Electric Company (ACE), Jersey Central Power & Light Company (JCP&L), and Rockland Electric Company (RECO) - have procured several billion dollars of electric supply to serve their Basic Generation Service (BGS) customers through a statewide auction process held in February. BGS refers to the service of customers who are not served by a third party supplier or competitive retailer. his service is sometimes known as Standard Offer Service, Default Service, or Provider of Last Resort Service.

The Auction Process has consisted of two auctions that are held concurrently, one for larger customers on an hourly price plan (BGS-CIEP) and one for smaller commercial and residential customers on a fixed-price plan (BGS-FP). This facility's rate structure is based on the fixed-price plan (BGS-FP).

The utility will continue to be responsible for maintaining the existing network of wires, pipes and poles that make up the delivery system, which will serve all consumers, regardless of whom they choose to purchase their electricity or natural gas from. PSEG's delivery service rate includes the following charges: Customer Service Charge, Distribution Charge (kWh and Demand), Societal Benefits Charge (SBC), and Securitization Transition Charge.

Natural Gas:

The facilities currently receive natural gas distribution service from Public Service Electric & Gas (PSEG) under rate schedule LVG (Large Volume Gas). The facility has not contracted with a Third Party Supplier (TPS). For natural gas supply service, the client has a choice to either use PSEG's default service rate BGSS or contract with a Third Party Supplier (TPS) to supply natural gas commodity service.

PSEG provide basic gas supply service (BGSS) to customers who choose not to shop from a Third Party Supplier (TPS) for natural gas commodity. The option is essential to protect the reliability of service to consumers as well as protecting consumers if a third party supplier defaults or fails to provide commodity service.

The utilities are responsible for maintaining the existing network of wires, pipes and poles that make up the delivery system, which will serve all consumers, regardless of whom they choose to purchase their electricity or natural gas from. PSEG's delivery service rate includes the following charges: Customer Service Charge, Distribution Charge, & Societal Benefits Charge (SBC).

Electric and Natural Gas Commodities Market Overview:

Current electricity and natural gas market pricing has remained relatively stable over the last couple of years. Commodity pricing in 2008 marked historical highs in both natural gas and electricity commodity. Commodity pricing commencing spring of 2009 continuing through 2013, has decreased dramatically over 2008 historic highs and continues to be favorable for locking in long term (2-5 year) contracts with 3rd Party Supplier's for both natural gas and electricity supply requirements.

It is important to note that both natural gas and electric commodity market prices are moved by supply and demand, political conditions, market technical and trader sentiment. This market is continuously changing. Energy commodity pricing is also correlated to weather forecasts. Because weather forecasts are dependable only in the short-term, prolonged temperature extremes can really cause extreme price swings.

Short Term Energy Outlook - US Energy Information Administration (July, 2014):

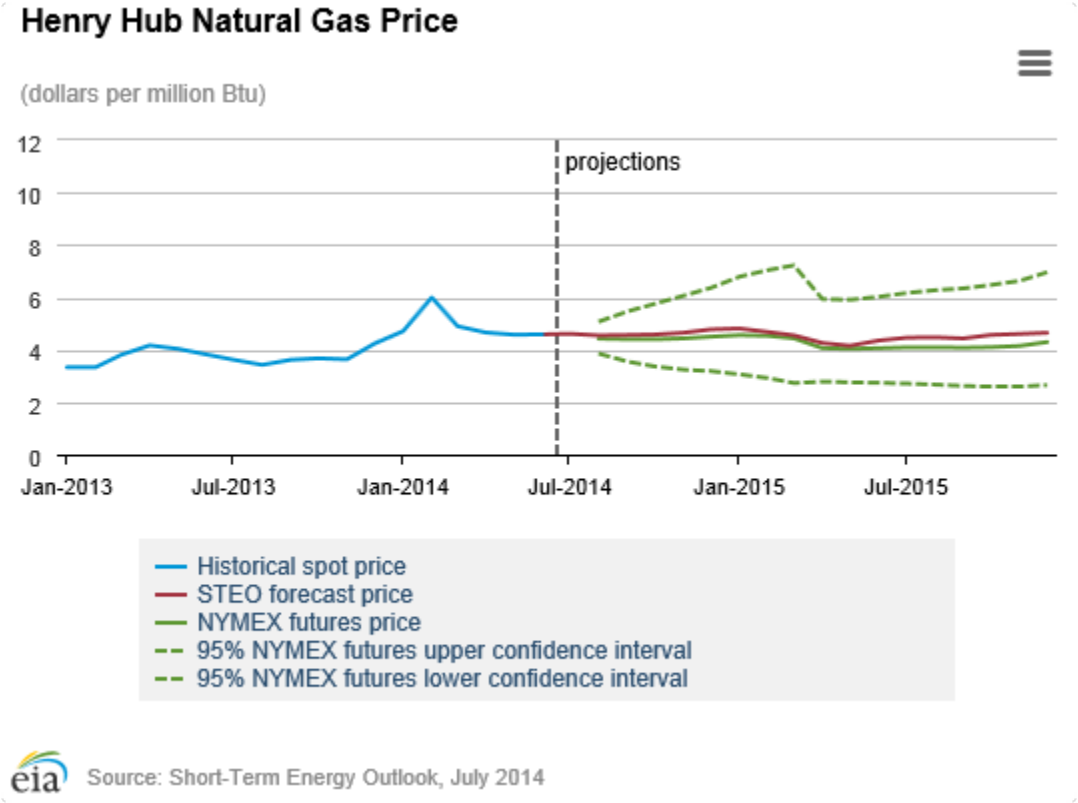
Natural Gas

While this year's natural gas injection season began slowly in April, injections into storage during May and June were very strong. According to preliminary data from EIA's Weekly Natural Gas Storage Report, net injections were 100 billion cubic feet (Bcf) or greater for each of the past eight weeks. Over the previous four years, weekly injections during May and June exceeded 100 Bcf on only three occasions. EIA expects injections will slow during July and August as more natural gas goes to the electric power sector to meet air conditioning demand. The strength in storage injections is the result of strong production growth and moderate demand. Marketed production in April set a record high, at 73.5 Bcf/d, according to EIA's most recent data, with the largest increases coming from areas in Texas.

Natural gas spot prices averaged $4.59/MMBtu at the Henry Hub in June. EIA expects spot prices will remain near current levels until the start of the next winter heating season. Projected Henry Hub natural gas prices average $4.77/MMBtu in 2014 and $4.50/MMBtu in 2015.

Natural gas futures prices for October 2014 delivery (for the five-day period ending July 2) averaged $4.40/MMBtu. Current options and futures prices imply that market participants place the lower and upper bounds for the 95% confidence interval for October 2014 contracts at

$3.37/MMBtu and $5.76/MMBtu, respectively. At this time last year, the natural gas futures contract for October 2013 averaged $3.62/MMBtu and the corresponding lower and upper limits of the 95% confidence interval were $2.69/MMBtu and $4.88/MMBtu.

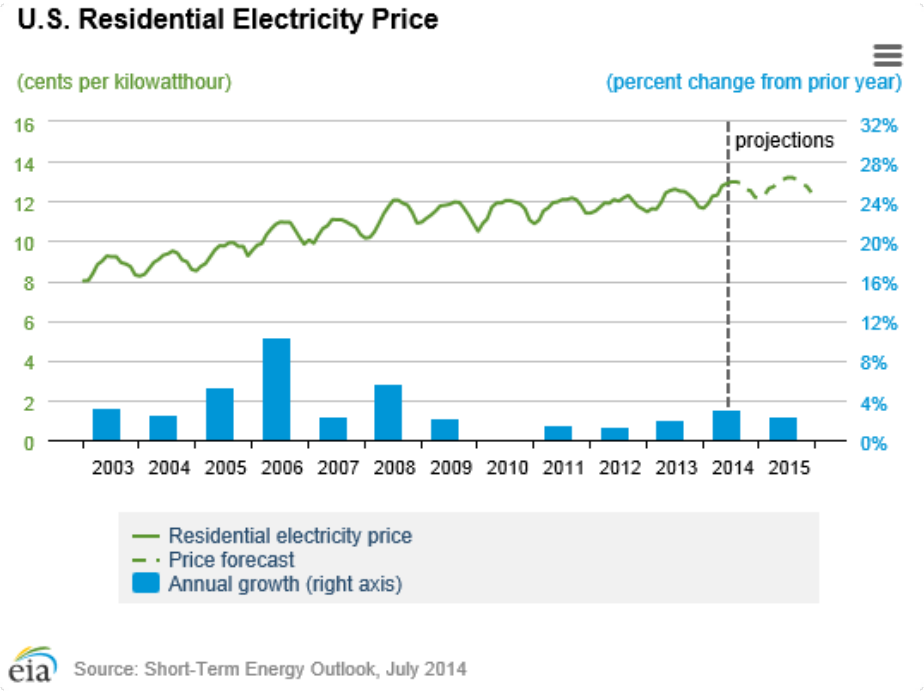


Electricity

A large proportion of U.S. conventional hydroelectric output is produced in states west of the Mississippi River, especially in the Pacific Northwest. The level of hydroelectric generation is heavily influenced by precipitation patterns, and the western states have experienced widely divergent levels of rainfall and snowfall in recent months. A higher-than-normal snowpack in the Rocky Mountains contributed to an 11.6% increase in year-to-date (January-April) hydroelectric generation in the Mountain Census Division, compared with the same period in 2013. Low precipitation levels in the Pacific Northwest earlier this year were offset by a very wet March, leading to relatively flat year-to-date change in hydroelectric generation in Oregon and Washington. In contrast, exceptional drought in California has caused a 46.6% year-to-date decline in that state's hydroelectric generation.

EIA projects that total U.S. electricity generation in 2014 will grow by 1.6% from last year to an average of 11,300 gigawatthours per day. Recently rising costs for natural gas have driven power generators to use relatively more coal for supplying electricity. During the first half of 2014, EIA estimates that 40.0% of total generation was fueled by coal, compared with 39.0% during the first half of last year. In contrast, the share of generation supplied by natural gas fell from 26.1% last year to 24.8% during the first half of 2014. EIA expects that coal's share of generation will fall to an average of 38.8% in 2015 while the natural gas fuel share rises to 27.5%.

EIA expects the U.S. residential annual average electricity price to increase by 3.1% this year, which would be the highest growth rate since 2008, primarily in response to higher fuel costs for power generation. The largest price increases occur in the Northeast region. Projected residential prices increase by an additional 2.4% during 2015.



The below recommendations presented by Concord Engineering are based on current information provided by the Church for their facility's historical energy usage. Any savings presented with these recommendations are estimates only based on that information. It is recommended that further analysis and review of more recent utility data and actual TPS electricity and natural gas supply contracts and historical billings be performed prior to performing any of the presented recommendations.

Recommendations:

1. Concord strongly recommends that the Church consider third party commodity supply procurement strategies for the purchase of natural gas. Aggregating the usage of the facility for both electricity and natural gas supply service will allow the Church to achieve lower prices in commodity supply costs over the utility default service programs. Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive and contract terms longer than 12 months are desirable. Contracts due to expire in the near term would continue to yield very favorable pricing. It is important to aggregate usage where available and take advantage of these current market prices quickly, before energy increases.

2. After review of the utility consumption report and current commodity pricing outlook, Concord recommends that the Church utilize the advisement of a 3rd party unbiased Energy Consulting Firm licensed by the State of New Jersey Board of Public Utilities that is experienced in the procurement of commodities, New Jersey procurement laws, aggregation of facilities and energy supply risk and commodity management. This firm should be able to provide full service advisement over the term of the contract, provide market watch opportunities and identify any additional opportunities that may further reduce costs. Many of these opportunities may include: energy rates; utility bill auditing; energy data analytics; and efficiency improvements.

   It is important that a rational, defensible strategy for purchasing commodity in volatile markets is incorporated. Examples include:

   - Budgets that reflect sound market intelligence
   - An understanding of utility and market historical prices and trends
   - Awareness of seasonal opportunities (e.g. shoulder months)
   - Negotiation of fair contractual terms
   - An aggressive, market based price

3. Concord also recommends that the Church consider utilizing a third party utility billing-auditing service to further analyze historical utility invoices such as water, sewer, natural gas, and electricity for incorrect billings and rate tariff optimization services. This service can be based on a shared savings model with no direct cost. The service could provide refunds on potential incorrect billings that may have been passed through by the utilities and paid by the Church.

X. INSTALLATION FUNDING OPTIONS

Concord Engineering has reviewed various funding options for the facility owner to utilize in subsidizing the costs for installing the energy conservation measures noted within this report. Below are a few alternative funding methods:

A. Incentive Programs:

Pay For Performance *(Not Qualified)*

The New Jersey Smart Start Pay for Performance program includes incentives based on savings resulted from implemented ECMs. The program is available for all buildings that were audited as part of the NJ Clean Energy's Local Government Energy Audit Program. The facility's participation in the program is assisted by an approved program partner. An "Energy Reduction Plan" is created with the facility and approved partner to shown at least 15% reduction in the building's current energy use. Multiple energy conservation measures implemented together are applicable toward the total savings of at least 15%. No more than 50% of the total energy savings can result from lighting upgrades / changes.

Total incentive is capped at 50% of the project cost. The program savings is broken down into three benchmarks; Energy Reduction Plan, Project Implementation, and Measurement and Verification. Each step provides additional incentives as the energy reduction project continues. The benchmark incentives are as follows:

1. Energy Reduction Plan – Upon completion of an energy reduction plan by an approved program partner, the incentive will grant $0.10 per square foot between $5,000 and $50,000, and not to exceed 50% of the facility's annual energy expense. (Benchmark #1 is capped at 50% of this value if the entity has completed a local government energy audit.)

2. Project Implementation – Upon installation of the recommended measures along with the "Substantial Completion Construction Report," the incentive will grant savings per KWH or Therm based on the program's rates. Minimum saving must be 15%. (Example $0.11 / kWh for 15% savings, $0.12/ kWh for 17% savings, … and $1.10 / Therm for 15% savings, $1.20 / Therm for 17% saving, …). Increased incentives result from projected savings above 15%.

3. Measurement and Verification – Upon verification 12 months after implementation of all recommended measures, that actual savings have been achieved, based on a completed verification report, the incentive will grant additional savings per kWh or Therm based on the program's rates. Minimum savings must be 15%. (Example $0.07 / kWh for 15% savings, $0.08/ kWh for 17% savings, … and $0.70 / Therm for 15% savings, $0.80 / Therm for 17% saving, …) Increased incentives result from verified savings above 15%.

Based on the provided data within the facility report and the estimated energy savings of each measure, the facility is does not qualify for the Pay for Performance Program.

Direct Install Program

The New Jersey Clean Energy's Direct Install Program is a state funded program that targets small commercial and industrial facilities with peak demand of less than 200 kW. This turnkey program is aimed at providing owners a seamless, comprehensive process for analysis, equipment replacement and financial incentives to reduce consumption, lower utility costs and improve profitability. The program covers up to 70% of the cost for eligible upgrades including lighting, lighting controls, refrigeration, HVAC, motors, variable speed drives, natural gas and food service. Participating contractors (refer to www.njcleanenergy.com) conduct energy assessments in addition to your standard local government energy audit and install the cost-effective measures.

The Collingswood Presbyterian Church has already participated in the Direct Install Program at their facility recently.

Smart Start Program

Prescriptive Measures - The New Jersey Clean Energy's Smart Start prescriptive measures incentives include unit pricing incentives for installation of energy efficient equipment and controls. Proposed equipment and controls must meet the minimum efficiency requirements as well as other application requirements. The Smart Start prescriptive incentives applicable for new construction, renovations, remodeling and equipment replacements, for a wide range of equipment including:

- Electric Unitary HVAC
- Gas Heating
- Variable Frequency Drives
- Gas Water Heating
- Premium Motors
- Prescriptive Lighting
- Lighting Controls

Custom Measures - The New Jersey Clean Energy's Smart Start prescriptive measures incentives include all measures not identified in the prescriptive measures category or measures that must have savings verified through additional analysis such as energy model simulations.

CEG recommends the Owner review the use of the above-listed funding options in addition to utilizing their standard method of financing for facilities upgrades in order to fund the proposed energy conservation measures.

B. Financing Options:

Municipal Bonds

Municipal bonds are a bond issued by a city or other local government, or their agencies. Potential issuers of municipal bonds include cities, counties, redevelopment agencies, school districts, publicly owned airports and seaports, and any other governmental entity (or group of governments) below the state level. Municipal bonds may be general obligations of the issuer or secured by specified revenues. Interest income received by holders of municipal bonds is often exempt from the federal income tax and from the income tax of the state in which they are issued, although municipal bonds issued for certain purposes may not be tax exempt.

Power Purchase Agreement

Public Law 2008, Chapter 3 authorizes contracts of up to fifteen (15) years for energy purchase contracts commonly known as "power purchase agreements." These are programs where the contracting unit (Owner) procures a contract for, in most cases, a third party to install, maintain, and own a renewable energy system. These renewable energy systems are typically solar panels, windmills or other systems that create renewable energy. In exchange for the third party's work of installing, maintaining and owning the renewable energy system, the contracting unit (Owner) agrees to purchase the power generated by the renewable energy system from the third party at agreed upon energy rates.

Energy Savings Improvement Program (ESIP):

Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and pay for the costs using the value of energy savings that result from the improvements. The "Energy Savings Improvement Program (ESIP)" law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources. This program provides public entities to make valuable facility infrastructure improvements that are associated with energy savings. All energy savings projects are eligible as long as the financing period does not extend beyond 15 years. The financing can be utilized for all aspects of energy efficiency project implementation including, energy savings plan development, engineering, construction management, construction management, commissioning, and measurement and verification.

This program provides the much needed financing for energy efficiency projects without the burden of increased debt. The program allows for procurement of financing without voter approval or extending existing dept. The program requires evaluation to ensure a positive cash-flow through the entire 15 year financing period. The first phase of implementing an ESIP is the development of an Energy Savings Plan (ESP) to verify the energy savings, construction costs, and overall financial model.

The underlining program requirement is the limitation of the project term to 15 years. The ESIP project size is open for multiple buildings to be included within one project. In addition all applicable incentive programs can also be utilized to help reduce the overall construction cost.

XI. ADDITIONAL RECOMMENDATIONS

In addition to the ECMs and REMs, there are maintenance and operational measures that can provide significant energy savings and provide immediate benefit, many of which facility's staff are already performing. Maintenance items and small operational improvements are typically achievable with on-site staff or maintenance contractors and in turn have the potential to provide substantial operational savings compared to the costs associated. The following are recommendations which should be considered a priority in achieving an energy efficient building:

A. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.

B. Maintain all weather stripping on windows and doors.

C. Clean all light fixtures to maximize light output.

D. Provide more frequent air filter changes to decrease overall system power usage and maintain better Indoor Air Quality (IAQ).

E. Perform annual steam trap surveys to minimize energy waste caused by failed traps, and to maintain an inventory of system equipment.

F. Verify all programmable thermostats are utilizing setback and scheduling capabilities.

G. Shutdown all non-essential equipment during unoccupied periods.

H. A water treatment system is needed for the boiler make-up water.

I. A combustion air louver is needed for the basement boiler room in lieu of keeping a basement window open at all times. The louver needs to be adequately sized for the required amount of combustion air.

XII. ENERGY AUDIT ASSUMPTIONS

The assumptions utilized in this energy audit include but are not limited to following:

A. Cost Estimates noted within this report are based on industry accepted costing data such as RS Means™ Cost Data, contractor pricing and engineering estimates. All cost estimates for this level of auditing are +/- 20%. Prevailing wage rates for the specified region has been utilized to calculate installation costs. The cost estimates indicated within this audit should be utilized by the owner for prioritizing further project development post the energy audit. Project development would include investment grade auditing and detailed engineering.
B. Energy savings noted within this audit are calculated utilizing industry standard procedures and accepted engineering assumptions. For this level of auditing, energy savings are not guaranteed.
C. Information gathering for each facility is strongly based on interviews with operations personnel. Information dependent on verbal feedback is used for calculation assumptions including but not limited to the following:
    a. operating hours
    b. equipment type
    c. control strategies
    d. scheduling
D. Information contained within the major equipment list is based on the existing owner documentation where available (drawings, O&M manuals, etc.). If existing owner documentation is not available, catalog information is utilized to populate the required information.
E. Equipment incentives and energy credits are based on current pricing and status of rebate programs. Rebate availability is dependent on the individual program funding and applicability.
F. Equipment (HVAC, Plumbing, Electrical, & Lighting) noted within an ECM recommendation is strictly noted as a **basis for calculation** of energy savings. The owner should use this equipment information as a benchmark when pursuing further investment grade project development and detailed engineering for specific energy conservation measures.
G. Utility bill annual averages are utilized for calculation of all energy costs unless otherwise noted. Accuracy of the utility energy usage and costs are based on the information provided. Utility information including usage and costs is estimated where incomplete data is provided.
H. Greenhouse Gas Emissions are calculated for each ECM, the basis for these emissions reductions are NJCEP published standard emissions factors, which are the following:.
    a. Electric Savings:
        1. CO_2: 1.52 lbs/kWh
        2. NO_X: 0.0028 lbs/kWh
        3. SO_2: 0.0065 lbs/kWh
    b. Natural Gas Savings:
        1. CO_2: 11.7 lbs/therm
        2. NO_X: 0.0092 lbs/therm

APPENDIX A

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Collingswood Presbyterian Church

ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^{n_i}}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^{n_i}}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	Lighting Upgrade - General	$17,664	$8,235	$600	$25,299	$812	$0	$812	15	$12,180	$0	-51.9%	31.2	-8.00%	($15,605.40)
ECM #2	Exterior Lighting Upgrade	$354	$290	$0	$644	$128	$0	$128	15	$1,920	$0	198.1%	5.0	18.27%	$884.06
ECM #3	Domestic Water Heater Upgrade	$4,000	$3,500	$300	$7,200	$69	$0	$69	15	$1,035	$0	-85.6%	104.3	-18.06%	($6,376.28)
ECM #4	Thermostatic Controllers and Radiator Valves	$20,000	$13,000	$0	$33,000	$2,177	$0	$2,177	15	$32,655	$0	-1.0%	15.2	-0.13%	($7,011.12)
ECM #5	Steam Trap Replacement	$8,685	$23,400	$0	$32,085	$2,541	$0	$2,541	15	$38,115	$0	18.8%	12.6	2.23%	($1,750.71)
ECM #6	Split System Replacements	$20,000	$28,000	$1,472	$46,528	$1,472	$0	$1,472	15	$22,080	$0	-52.5%	31.6	-8.14%	($28,955.36)
ECM #7	Window Replacement	$4,500	$1,350	$0	$5,850	$278	$0	$278	20	$5,560	$0	-5.0%	21.0	-0.48%	($1,714.06)
ECM #8	Water Conservation	$160	$80	$0	$240	$244	$0	$244	10	$2,440	$0	916.7%	1.0	101.57%	$1,841.37
ECM #9	Destratification Fans	$7,000	$3,000	$0	$10,000	$990	$0	$990	15	$14,850	$0	48.5%	10.1	5.41%	$1,818.56
REM #1	18 kW Roof Array	$46,898	$31,265	$0	$78,163	$6,041	$3,051	$9,091	25	$227,276	$76,263	190.8%	8.6	10.72%	$80,140.37

Notes: 1) The variable Cn in the formulas for Internal Rate of Return and Net Present Value stands for the cash flow during each period.
2) The variable DR in the NPV equation stands for Discount Rate
3) For NPV and IRR calculations: From n=0 to N periods where N is the *lifetime of ECM* and Cn is the *cash flow during each period* .

APPENDIX B

Concord Engineering Group, Inc.

520 BURNT MILL ROAD
VOORHEES, NEW JERSEY 08043
PHONE: (856) 427-0200
FAX: (856) 427-6508

SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives from July 1, 2014 to June 30, 2015:

Electric Chillers

Water-Cooled Chillers	$16 - $170 per ton
Air-Cooled Chillers	$8 - $52 per ton

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Cooling

Gas Absorption Chillers	$185 - $450 per ton
Gas Engine-Driven Chillers	Calculated through custom measure path)

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	$73 - $92 per ton
Air-to-Air Heat Pumps	$73 - $92 per ton
Water-Source Heat Pumps	$81 per ton
Packaged Terminal AC & HP	$65 per ton
Central DX AC Systems	$40- $72 per ton
Dual Enthalpy Economizer Controls	$250
Occupancy Controlled Thermostat (Hospitality & Institutional Facility)	$75 per thermostat
A/C Economizing Controls	≤ 5 tons $85/unit; >5 tons $170/unit

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Heating

Gas Fired Boilers < 300 MBH	$2.00 per MBH, but not less than $300 per unit
Gas Fired Boilers ≥ 300 - 1500 MBH	$1.75 per MBH
Gas Fired Boilers ≥1500 - ≤ 4000 MBH	$1.00 per MBH
Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	$400 per unit, AFUE ≥ 95%
Boiler Economizing Controls	$1,200 - $2,700
Low Intensity Infrared Heating	$300 - $500 per unit

Ground Source Heat Pumps

Closed Loop	$450 per ton, EER ≥ 16 $600 per ton, EER ≥ 18 $750 per ton, EER ≥ 20

Energy Efficiency must comply with ASHRAE 90.1-2007

Variable Frequency Drives

Variable Air Volume	$65 - $155 per hp
Chilled-Water Pumps ≥ 20 hp	$60 per VFD rated hp
Rotary Screw Air Compressors ≥ 25 hp	$5,250 to $12,500 per drive
Centrifugal Fan Applications on Constant Volume HVAC Systems	$80 per VFD rated hp, maximum $6,000 per drive
Cooling Towers ≥ 10 hp	$60 per VFD rated hp
Boiler Fans ≥ 5 HP	$65 to $155 per hp
Boiler Feed Water Pumps ≥ 5 HP	$60 to $155 per hp
Commercial Kitchen Hood up to 50 HP	Retrofit $55 – $300 per hp New Hood $55 - $250 per hp

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons, 0.67 energy factor or better	$50 per unit
Gas-Fired Water Heaters > 50 gallons	$1.00 - $2.00 per MBH
Gas-Fired Booster Water Heaters	$17 - $35 per MBH
Gas Fired Tankless Water Heaters	$300 per unit

Prescriptive Lighting

T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	$10 per fixture
For retrofit of T-8 fixtures by permanent de-lamping & new reflectors (Electronic ballast replacement required)	$15 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $200 per fixture
HID ≥ 100w Replace with new induction fixture. (must be 30% less watts/fixture than HID system)	$70 per fixture
HID ≥ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	$50 per fixture

Prescriptive Lighting - LED

LED Display Case Lighting	$30 per display case
LED Shelf-Mtd. Display & Task Lights	$15 per linear foot
LED Portable Desk Lamp	$20 per fixture
LED Wall-wash Lights	$30 per fixture
LED Recessed Down Lights	$35 per fixture
LED Architectural Flood and Spot Luminaires	$50 per fixture
LED Outdoor Pole/Arm-Mounted Area and Roadway Luminaries	$175 per fixture
LED Outdoor Pole/Arm-Mounted Decorative Luminaries	$175 per fixture
LED Outdoor Wall-Mounted Area Luminaries	$100 per fixture
LED Parking Garage Luminaries	$100 per fixture
LED Track or Mono-Point Directional Lighting Fixtures	$30 per fixture
LED High-Bay and Low-Bay Fixtures for Commercial & Industrial Bldgs.	$150 per fixture
LED High-Bay-Aisle Lighting	$150 per fixture
LED Linear Ambient Luminaires (Indirect, Indirect/Direct, Direct/Indirect, Direct)	2’ Fixtures - $20/fixture 3’ Fixtures - $30/fixture 4’ Fixtures - $45/fixture 6’ Fixtures - $60/fixture 8’ Fixtures - $75/fixture
LED Stairwell and Passageway Luminaires	$40 per fixture
LED Bollard Fixtures	$50 per fixture
Luminaires for Ambient Lighting of Interior Commercial Spaces (1x4, 2x2, 2x4)	$50 per fixture
LED Fuel Pump Canopy	$100 per fixture
LED Screw-based & Pin-based (PAR, MR, BR, R) Standards (A-Style) and Decorative Lamps	$5 per lamp for R/PAR20,MR/PAR16,Globe,Candelabra or Misc $10 per lamp for LED R/BR/PAR 30, R/BR/PAR 38-40, A-Lamp

LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	$30 per 4 foot $42 per 5 foot $65 per 6 foot
LED Retrofit Kits	To be evaluated through the customer measure path

Lighting Controls – Occupancy Sensors

Wall Mounted (Existing Facilities Only)	$20 per control
Remote Mounted (Existing Facilities Only)	$35 per control
Daylight Dimming Controls	$45 per fixture controlled
Occupancy Based hi-low Dimming Control	$35 per fixture controlled
Occupancy Sensor Remote Mounted	$35 per control

Refrigeration Doors/Covers

Energy-Efficient Doors/Covers for Installation on Open Refrigerated Cases	$100 per door
Aluminum Night Curtains for Installation on Open Refrigerated Cases	$3.50 per linear foot

Refrigeration Controls

Door Heater Controls	$50 per control
Electric Defrost Controls	$50 per control
Evaporator Fan Controls	$75 per control
Novelty Cooler Shutoff	$50 per control

Food Service Equipment

Combination Oven/Steamer (Electric)	$1,000/oven
Combination Oven/Steamer (Natural Gas)	$750/oven
Convection Oven (Electric)	$350/oven
Convection Oven (Natural Gas)	$500/oven
Rack Oven (Natural Gas)	$1,000/single oven, $2,000/double oven
Conveyor Oven (Natural Gas)	$500/small deck $750/large deck
Fryer (Electric)	$250/vat
Fryer (Natural Gas)	$749/vat
Large Vat Fryer (Electric)	$200/vat
Large Vat Fryer (Natural Gas)	$500/vat
Griddle (Electric)	$300/griddle
Griddle (Natural Gas)	$125/griddle
Steam Cooker (Electric)	$1,250/steamer
Steam Cooker (Natural Gas)	$2,000/steamer
Insulated Holding Cabinets	$200 to $300/unit
Glass Door Refrigerators	$75 to $150/unit
Solid Door Refrigerators	$50 to $200/unit
Glass Door Freezers	$200 to $1,000/unit
Solid Door Freezers	$100 to $600/unit
Ice Machines	$50 to $500/unit
Dishwashers	$400 to $1,500/unit

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2007 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive
Custom Measures	$0.16 KWh and $1.60/Therm of 1st year savings, or a buy down to a 1 year payback on estimated savings. Minimum required savings of 75,000 KWh or 1,500 Therms and an IRR of at least 10%.

APPENDIX C

ENERGY STAR® Statement of Energy Performance

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ENERGY STAR® Score[1]

Collingswood Presbyterian Church

Primary Property Function: Worship Facility
Gross Floor Area (ft²): 33,000
Built: 1925

For Year Ending: November 30, 2013
Date Generated: December 05, 2014

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
Collingswood Presbyterian Church 30 Fern Avenue Collingswood, New Jersey 08108	Collingswood Presbyterian Church 30 Fern Avenue Collingswood, NJ 08108 (____)____-_____	Anne Rahikainen 101 South 3rd Ave #12 Highland Park, NJ 08904 19146715832 arahikainen@greenfaith.org

Property ID: 4005568

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
45 kBtu/ft²

Source EUI
52.8 kBtu/ft²

Annual Energy by Fuel	
Natural Gas (kBtu)	1,397,627 (94%)
Electric - Grid (kBtu)	87,700 (6%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	59.6
National Median Source EUI (kBtu/ft²)	70
% Diff from National Median Source EUI	-24%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	86

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: _____Date: _____

Licensed Professional

____ _____
,
(____)____-_____
_____

Professional Engineer Stamp (if applicable)

APPENDIX D

MAJOR EQUIPMENT LIST

Concord Engineering Group

Collingswood Presbyterian Church

Split System Units

Tag	CU-1 thru CU-8	
Unit Type	Split Air-Cooled Condenser Unit	
Qty	8	
Location	Flat Roofs	
Area Served	Sanctuary	
Manufacturer	Mitsubshi	
Model #	-	
Serial #	-	
Cooling Type	DX Coil	
Cooling Capacity (Tons)	2-Tons	
Cooling Efficiency (SEER/EER)	EER=10.5	
Heating Type	N/A	
Heating Input (MBH)	N/A	
Efficiency	N/A	
Fuel	Electric	
Approx Age	10	
ASHRAE Service Life	15	
Remaining Life	5	
Comments	Serves Evaporator Units in Church	

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Collingswood Presbyterian Church

Domestic Water Heaters

Tag	DHW-1
Unit Type	Automatic Storage Water Heater
Qty	1
Location	Basement
Area Served	Entire Facility
Manufacturer	Bradford White
Model #	MI504S10FBN
Serial #	HC11605673
Size (Gallons)	50
Input Capacity (MBH/KW)	50,000 BTUH
Recovery (Gal/Hr)	53 GPH at 90 degree F Rise
Efficiency %	80%
Fuel	Natural Gas
Approx Age	8
ASHRAE Service Life	10
Remaining Life	2
Comments	

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Collingswood Presbyterian Church

Boiler

Tag	B-1
Unit Type	Cast Iron Sectional Steam Boiler
Qty	1
Location	Church Basement
Area Served	Entire Facility
Manufacturer	Weil-McClain 88 Series 1
Model #	Model 688
Serial #	-
Input Capacity (MBH)	1,703 MBH
Rated Output Capacity (Btu/Hr)	1,026 MBH (1,254 lbs/hr of steam)
Approx. Thermal Efficiency %	83.0%
Fuel	Natural Gas
Approx Age	10
ASHRAE Service Life	25
Remaining Life	15
Comments	1/3 HP Blower Motor & Power Flame Model C2-G-15 Burner TA 210 C Controller for O/A Reset

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Collingswood
Presbyterian Church

Window A/C

Tag	WAC-1 & 2	WAC-3 & 4
Unit Type	Window Air Conditioner	Window Air Conditioner
Qty	2	2
Location	Parish Offices	Lounge
Area Served	Parish Offices	Lounge
Manufacturer	Fedders	Electrolux
Model #	A6V10S2B-A	FRA123KTA
Serial #	CT505295062F & CT5052950034G	KK30567113 & KK30545159
Refrigerant	R22	R22
Cooling Capacity (Btu/h)	10,000	12,000.0
Cooling Efficiency (EER)	EER=9.5	EER=9.5
Volts / Phase / Hz	115/1/60	115/1/60
Approx Age	1	1
ASHRAE Service Life	10	10
Remaining Life	9	9
Comments		

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group
Collingswood Presbyterian Church

Kitchen Equipment

Tag			
Unit Type	6-Burner Range with Hood	Refrigerator	Freezer
Qty	1	1	1
Location	Main Kitchen	Main Kitchen	Main Kitchen
Manufacturer	Vulcan	Electrolux	Glenco Guardian
Model #	-	FFUH21F2NWA	ALFA-74-TE
Serial #	-	WB35147417	-
Fuel	Natural Gas	Electric	Electric
Approx Age	10	3	4
ASHRAE Service Life	20	20	20
Remaining Life	10	17	16
Comments	Type II Heat and Fume Hood	21 Cubic Feet	

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

Kitchen Equipment

Tag		
Unit Type	2-Burner Range	Walk-In Refrigerator
Qty	1	1
Location	Small Kitchen	Kitchen
Manufacturer	Whirlpool	Kitchen
Model #	-	Bally
Serial #	-	No Tag
Fuel	Natural Gas	No Tag
Approx Age	4	10
ASHRAE Service Life	20	20
Remaining Life	16	10
Comments		

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

APPENDIX E

CEG Project #: 1C14190
Facility Name: Collingswood Presbyterian Church
Address: 30 Fern Avenue
City, State, Zip Collingswood , NJ 08108

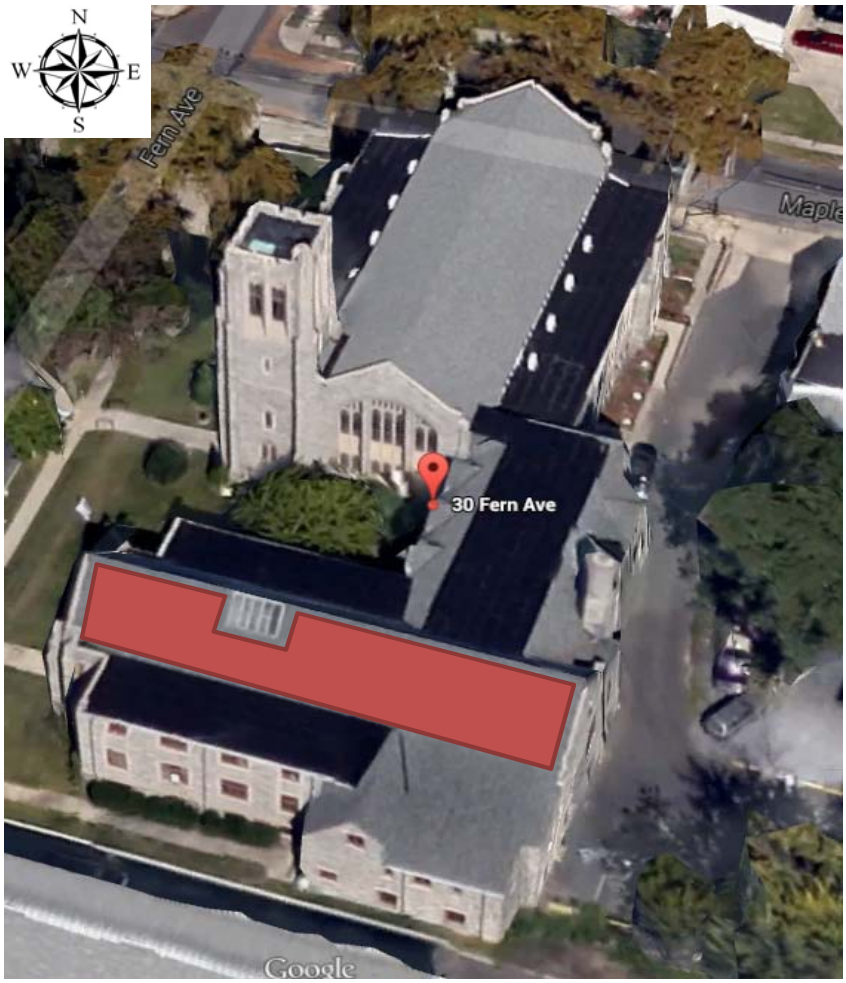
			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS						LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST				
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
1	Offices	1500	4-Lamp T8 32w Electronic 2x4 Wrap Prismatic	4	114	1	0.11	171	LED Retrofit Kit	Install Philips LED Evo 2x4 Retrofit Kit	1	39	1	0.04	59	0.08	113	$34	6	No New Controls	0	0.0%	0	$0	$110.00	$35.00	$145.00	$0.00	4.30	$0.00	$0.00	$0.00	FALSE	-
1.1	Offices	1500	2-Lamp T8 28w 2x4 Wrap Prismatic	4	54	5	0.27	405	LED Retrofit Kit	Install Philips LED Evo 2x4 Retrofit Kit	1	39	5	0.20	293	0.08	113	$34	0	No New Controls	0	0.0%	0	$0	$550.00	$175.00	$725.00	$0.00	21.48	$0.00	$0.00	$0.00	$20.00	-
7.1	Offices	1500	2-Lamp T8 28w 2x4 Surface Prismatic	4	58	1	0.06	87	Replace Fixture	50w LED Surface Mount Prismatic Wrap	1	50	1	0.05	75	0.01	12	$4	5	No New Controls	0	0.0%	0	$0	$153.00	$65.00	$218.00	$50.00	46.67	$0.00	$0.00	$0.00	FALSE	-
1.1	Library	2000	2-Lamp T8 28w 2x4 Wrap Prismatic	4	54	2	0.11	216	LED Retrofit Kit	Install Philips LED Evo 2x4 Retrofit Kit	1	39	2	0.08	156	0.03	60	$18	0	No New Controls	0	0.0%	0	$0	$220.00	$70.00	$290.00	$0.00	16.11	$0.00	$0.00	$0.00	FALSE	-
68	Auditorium	2500	13w CFL Chandelier	18	13	2	0.03	65	Re-lamp	Install 3w LED Torpedo or Flame Tip Dimmable Philips or Equal	1	3	2	0.01	15	0.02	50	$15	6	No New Controls	0	0.0%	0	$0	$40.00	$30.00	$70.00	$0.00	4.67	$0.00	$0.00	$0.00	FALSE	-
69	Auditorium	2500	15w CFL Chandelier	6	15	1	0.02	38	Re-lamp	Install 3w LED Torpedo or Flame Tip Dimmable Philips or Equal	1	3	1	0.00	8	0.01	30	$9	0	No New Controls	0	0.0%	0	$0	$20.00	$15.00	$35.00	$0.00	3.89	$0.00	$0.00	$0.00	FALSE	-
70	Auditorium	2500	13w CFL Sconce	1	13	1	0.01	33	Re-lamp	8w A19 LED	1	8	1	0.01	20	0.01	13	$4	0	No New Controls	0	0.0%	0	$0	$11.00	$15.00	$26.00	$0.00	6.93	$0.00	$0.00	$0.00	FALSE	-
71	Auditorium	2500	2x2 17w T8 Surface, Prismatic	4	73	1	0.07	183	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	1	0.03	78	0.04	105	$32	0	No New Controls	0	0.0%	0	$0	$110.00	$35.00	$145.00	$0.00	4.60	$0.00	$0.00	$0.00	FALSE	-
70	Vestibule	1000	13w CFL Sconce	1	13	2	0.03	26	Re-lamp	8w A19 LED	1	8	2	0.02	16	0.01	10	$3	4	No New Controls	0	0.0%	0	$0	$22.00	$30.00	$52.00	$0.00	17.33	$0.00	$0.00	$0.00	FALSE	-
1.1	Restroom	1200	2-Lamp T8 28w 2x4 Wrap Prismatic	4	54	1	0.05	65	LED Retrofit Kit	Install Philips LED Evo 2x4 Retrofit Kit	1	39	1	0.04	47	0.02	18	$5	0	No New Controls	0	0.0%	0	$0	$110.00	$35.00	$145.00	$0.00	26.85	$0.00	$0.00	$0.00	FALSE	-
72	Stairwell	1000	13W CFL Open Fixture	1	13	1	0.01	13	Re-lamp	8w A19 LED	1	8	1	0.01	8	0.01	5	$0	0	No New Controls	0	0.0%	0	$0	$11.00	$15.00	$26.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
73	Office	1500	1x4 2L T8 32w Wrap	2	62	4	0.25	372	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	4	0.14	216	0.10	156	$0	6	No New Controls	0	0.0%	0	$0	$320.00	$140.00	$460.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
74	Office	1500	1x4 2L T8 28w Wrap	2	54	6	0.32	486	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	6	0.22	324	0.11	162	$0	0	No New Controls	0	0.0%	0	$0	$480.00	$210.00	$690.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
74	Nursery	2000	1x4 2L T8 28w Wrap	2	54	10	0.54	1,080	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	10	0.36	720	0.18	360	$0	4	No New Controls	0	0.0%	0	$0	$800.00	$350.00	$1,150.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
75	Restroom	1200	2x2 2L T8 32W U-lamps Surface, Prism	2	62	1	0.06	74	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	1	0.03	37	0.03	37	$0	0	No New Controls	0	0.0%	0	$0	$110.00	$35.00	$145.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
74	Classroom	2000	1x4 2L T8 28w Wrap	2	54	4	0.22	432	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	4	0.14	288	0.07	144	$0	0	No New Controls	0	0.0%	0	$0	$320.00	$140.00	$460.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
74	Hallway	800	1x4 2L T8 28w Wrap	2	54	3	0.16	130	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	3	0.11	86	0.05	43	$0	0	No New Controls	0	0.0%	0	$0	$240.00	$105.00	$345.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
76	Kitchen	800	13w CFL Globe Fixture	1	13	1	0.01	10	Re-lamp	8w A19 LED	1	8	1	0.01	6	0.01	4	$0	0	No New Controls	0	0.0%	0	$0	$11.00	$15.00	$26.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
73	Stairwell	1000	1x4 2L T8 32w Wrap	2	62	2	0.12	124	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	2	0.07	72	0.05	52	$0	0	No New Controls	0	0.0%	0	$0	$160.00	$70.00	$230.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
74	Vestibule	1000	1x4 2L T8 28w Wrap	2	54	1	0.05	54	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	1	0.04	36	0.02	18	$0	0	No New Controls	0	0.0%	0	$0	$80.00	$35.00	$115.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
70	Vestibule	1000	13w CFL Sconce	1	13	2	0.03	26	Re-lamp	8w A19 LED	1	8	2	0.02	16	0.01	10	$0	0	No New Controls	0	0.0%	0	$0	$22.00	$30.00	$52.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
77	Lobby	1000	42W CFL Chandelier	1	42	3	0.13	126	Re-lamp	20w A21 LED Philips or Equal	1	20	3	0.06	60	0.07	66	$0	0	No New Controls	0	0.0%	0	$0	$87.00	$45.00	$132.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
77	Vestibule	1000	42W CFL Chandelier	1	42	1	0.04	42	Re-lamp	20w A21 LED Philips or Equal	1	20	1	0.02	20	0.02	22	$0	0	No New Controls	0	0.0%	0	$0	$29.00	$15.00	$44.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
77	Sanctuary	1200	42W CFL Chandelier	1	42	30	1.26	1,512	Re-lamp	20w A21 LED Philips or Equal	1	20	30	0.60	720	0.66	792	$0	0	No New Controls	0	0.0%	0	$0	$870.00	$450.00	$1,320.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
78	Sanctuary	1200	40W Candelabra Chandelier	1	40	60	2.40	2,880	Re-lamp	Install 3w LED Torpedo or Flame Tip Dimmable Philips or Equal	1	3	60	0.18	216	2.22	2,664	$0	0	No New Controls	0	0.0%	0	$0	$1,200.00	$900.00	$2,100.00	$300.00	-	$0.00	$0.00	$0.00	FALSE	-
79	Stairwell	1000	18W CFL Open Fixture	1	18	2	0.04	36	Re-lamp	10.5w A19 LED	1	10.5	2	0.02	21	0.02	15	$0	0	No New Controls	0	0.0%	0	$0	$22.00	$30.00	$52.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
80	Stairwell	1000	13W CFL Chandelier	1	13	2	0.03	26	Re-lamp	8w A19 LED	1	8	2	0.02	16	0.01	10	$0	0	No New Controls	0	0.0%	0	$0	$22.00	$30.00	$52.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
75	Sacristy	1200	2x2 2L T8 32W U-lamps Surface, Prism	2	62	1	0.06	74	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	1	0.03	37	0.03	37	$0	0	No New Controls	0	0.0%	0	$0	$110.00	$35.00	$145.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
76	Sacristy	1200	13w CFL Globe Fixture	1	13	2	0.03	31	Re-lamp	8w A19 LED	1	8	2	0.02	19	0.01	12	$0	0	No New Controls	0	0.0%	0	$0	$22.00	$30.00	$52.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
81	Sacristy	1200	23W CFL Open Bare Lite	1	23	1	0.02	28	Re-lamp	10.5w A19 LED	1	10.5	1	0.01	13	0.01	15	$0	0	No New Controls	0	0.0%	0	$0	$11.00	$15.00	$26.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
82	Sacristy	1200	2x2 4L 17 Watt Surface Prismatic	4	73	1	0.07	88	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	1	0.03	37	0.04	50	$0	0	No New Controls	0	0.0%	0	$0	$110.00	$35.00	$145.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS						LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST				
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
83	Music Office	1500	23W CFL Chandelier	1	23	1	0.02	35	Re-lamp	10.5w A19 LED	1	10.5	1	0.01	16	0.01	19	$0	6	No New Controls	0	0.0%	0	$0	$11.00	$15.00	$26.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
77	Choir Balcony	1200	42W CFL Chandelier	1	42	6	0.25	302	Re-lamp	20w A21 LED Philips or Equal	1	20	6	0.12	144	0.13	158	$0	0	No New Controls	0	0.0%	0	$0	$174.00	$90.00	$264.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
78	Choir Balcony	1200	40W Candelabra Chandelier	1	40	12	0.48	576	Re-lamp	Install 3w LED Torpedo or Flame Tip Dimmable Philips or Equal	1	3	12	0.04	43	0.44	533	$0	0	No New Controls	0	0.0%	0	$0	$240.00	$180.00	$420.00	$60.00	-	$0.00	$0.00	$0.00	FALSE	-
84	Choir Balcony	1200	100W PAR 38 Spot Lamp	1	23	4	0.09	110	Re-lamp	19w Par38 LED Philips or Equal	1	19	4	0.08	91	0.02	19	$0	0	No New Controls	0	0.0%	0	$0	$144.00	$100.00	$244.00	$40.00	-	$0.00	$0.00	$0.00	FALSE	-
80	Stairwell	1000	13W CFL Chandelier	1	13	2	0.03	26	Re-lamp	8w A19 LED	1	8	2	0.02	16	0.01	10	$0	0	No New Controls	0	0.0%	0	$0	$22.00	$30.00	$52.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
77	Stairwell	1000	42W CFL Chandelier	1	42	1	0.04	42	Re-lamp	20w A21 LED Philips or Equal	1	20	1	0.02	20	0.02	22	$0	0	No New Controls	0	0.0%	0	$0	$29.00	$15.00	$44.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
87	Storage Room	400	13W CFL Bare Fixture	1	13	3	0.04	16	Re-lamp	8w A19 LED	1	8	3	0.02	10	0.02	6	$0	6	No New Controls	0	20.0%	2	$0	$33.00	$45.00	$78.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
81	Closet	400	23W CFL Open Bare Lite	1	23	1	0.02	9	Re-lamp	10.5w A19 LED	1	10.5	1	0.01	4	0.01	5	$0	0	No New Controls	0	0.0%	0	$0	$11.00	$15.00	$26.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
77	Balcony	2000	42W CFL Chandelier	1	42	8	0.34	672	Re-lamp	20w A21 LED Philips or Equal	1	20	8	0.16	320	0.18	352	$0	4	No New Controls	0	0.0%	0	$0	$232.00	$120.00	$352.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
81	Closet	400	23W CFL Open Bare Lite	1	23	1	0.02	9	Re-lamp	10.5w A19 LED	1	10.5	1	0.01	4	0.01	5	$0	0	No New Controls	0	0.0%	0	$0	$11.00	$15.00	$26.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
88	Stairwell	1000	23W CFL Flood Lamp	1	23	2	0.05	46	Re-lamp	19w Par38 LED Philips or Equal	1	19	2	0.04	38	0.01	8	$0	0	No New Controls	0	0.0%	0	$0	$72.00	$50.00	$122.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
80	Stairwell	1000	13W CFL Chandelier	1	13	2	0.03	26	Re-lamp	8w A19 LED	1	8	2	0.02	16	0.01	10	$0	0	No New Controls	0	0.0%	0	$0	$22.00	$30.00	$52.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
76	Restroom	1200	13w CFL Globe Fixture	1	13	2	0.03	31	Re-lamp	8w A19 LED	1	8	2	0.02	19	0.01	12	$0	0	No New Controls	0	0.0%	0	$0	$22.00	$30.00	$52.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
89	Meeting Room	2000	2x4 2-Lamp 28W T8 recessed, prismatic w/white reflector	2	54	11	0.59	1,188	LED Retrofit Kit	Install Philips LED Evo 2x4 Retrofit Kit	1	39	11	0.43	858	0.17	330	$0	0	No New Controls	0	0.0%	0	$0	$1,210.00	$385.00	$1,595.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
81	Closet	400	23W CFL Open Bare Lite	1	23	1	0.02	9	Re-lamp	10.5w A19 LED	1	10.5	1	0.01	4	0.01	5	$2	0	No New Controls	0	0.0%	0	$0	$11.00	$15.00	$26.00	$0.00	17.33	$0.00	$0.00	$0.00	FALSE	-
74	Classroom	2000	1x4 2L T8 28w Wrap	2	54	3	0.16	324	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	3	0.11	216	0.05	108	$32	0	No New Controls	0	0.0%	0	$0	$240.00	$105.00	$345.00	$0.00	10.65	$0.00	$0.00	$0.00	FALSE	-
89	Classroom	2000	2x4 2-Lamp 28W T8 recessed, prismatic w/white reflector	2	54	2	0.11	216	LED Retrofit Kit	Install Philips LED Evo 2x4 Retrofit Kit	1	39	2	0.08	156	0.03	60	$18	0	No New Controls	0	0.0%	0	$0	$220.00	$70.00	$290.00	$0.00	16.11	$0.00	$0.00	$0.00	FALSE	-
2	Storage Room	400	2-Lamp T8 32w Electronic 1x4 Surface Prismatic	2	62	2	0.12	50	Replace Fixture	50w LED Surface Mount Prismatic Wrap	1	50	2	0.10	40	0.02	10	$3	0	No New Controls	0	0.0%	0	$0	$306.00	$130.00	$436.00	$100.00	116.67	$0.00	$0.00	$0.00	FALSE	-
89	Classroom	2000	2x4 2-Lamp 28W T8 recessed, prismatic w/white reflector	2	54	2	0.11	216	LED Retrofit Kit	Install Philips LED Evo 2x4 Retrofit Kit	1	39	2	0.08	156	0.03	60	$18	0	No New Controls	0	0.0%	0	$0	$220.00	$70.00	$290.00	$0.00	16.11	$0.00	$0.00	$0.00	FALSE	-
89	Storage Room	400	2x4 2-Lamp 28W T8 recessed, prismatic w/white reflector	2	54	1	0.05	22	LED Retrofit Kit	Install Philips LED Evo 2x4 Retrofit Kit	1	39	1	0.04	16	0.02	6	$2	0	No New Controls	0	0.0%	0	$0	$110.00	$35.00	$145.00	$0.00	80.56	$0.00	$0.00	$0.00	FALSE	-
89	Office	1500	2x4 2-Lamp 28W T8 recessed, prismatic w/white reflector	2	54	2	0.11	162	LED Retrofit Kit	Install Philips LED Evo 2x4 Retrofit Kit	1	39	2	0.08	117	0.03	45	$14	0	No New Controls	0	0.0%	0	$0	$220.00	$70.00	$290.00	$0.00	21.48	$0.00	$0.00	$0.00	FALSE	-
91	Balcony	2000	23W CFL Dimmable Recessed Hi-Hat	1	23	2	0.05	92	Re-lamp	19w Par38 LED Philips or Equal	1	19	2	0.04	76	0.01	16	$5	0	No New Controls	0	0.0%	0	$0	$72.00	$50.00	$122.00	$0.00	25.42	$0.00	$0.00	$0.00	FALSE	-
91	Stairwell	1000	23W CFL Dimmable Recessed Hi-Hat	1	23	1	0.02	23	Re-lamp	19w Par38 LED Philips or Equal	1	19	1	0.02	19	0.00	4	$1	0	No New Controls	0	0.0%	0	$0	$36.00	$25.00	$61.00	$0.00	50.83	$0.00	$0.00	$0.00	FALSE	-
92	Storage Room	400	23W CFL Recessed Hi-Hat	1	23	1	0.02	9	Re-lamp	19w Par38 LED Philips or Equal	1	19	1	0.02	8	0.00	2	$0	0	No New Controls	0	0.0%	0	$0	$36.00	$25.00	$61.00	$0.00	127.08	$0.00	$0.00	$0.00	FALSE	-
92	Attic	400	23W CFL Recessed Hi-Hat	1	23	6	0.14	55	Re-lamp	19w Par38 LED Philips or Equal	1	19	6	0.11	46	0.02	10	$3	0	No New Controls	0	0.0%	0	$0	$216.00	$150.00	$366.00	$0.00	127.08	$0.00	$0.00	$0.00	FALSE	-
74	Office	1500	1x4 2L T8 28w Wrap	2	54	1	0.05	81	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	1	0.04	54	0.02	27	$8	0	No New Controls	0	0.0%	0	$0	$80.00	$35.00	$115.00	$0.00	14.20	$0.00	$0.00	$0.00	FALSE	-
76	Storage Room	400	13w CFL Globe Fixture	1	13	6	0.08	31	Re-lamp	8w A19 LED	1	8	6	0.05	19	0.03	12	$4	0	No New Controls	0	0.0%	0	$0	$66.00	$90.00	$156.00	$0.00	43.33	$0.00	$0.00	$0.00	FALSE	-
74	Storage Room	400	1x4 2L T8 28w Wrap	2	54	1	0.05	22	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	1	0.04	14	0.02	7	$2	0	No New Controls	0	0.0%	0	$0	$80.00	$35.00	$115.00	$0.00	53.24	$0.00	$0.00	$0.00	FALSE	-
74	Meeting Room	2000	1x4 2L T8 28w Wrap	2	54	6	0.32	648	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	6	0.22	432	0.11	216	$65	0	No New Controls	0	0.0%	0	$0	$480.00	$210.00	$690.00	$0.00	10.65	$0.00	$0.00	$0.00	FALSE	-
93	Meeting Room	2000	13 W CFL Recessed Hi-Hat	1	13	1	0.01	26	Re-lamp	8w A19 LED	1	8	1	0.01	16	0.01	10	$3	0	No New Controls	0	0.0%	0	$0	$11.00	$15.00	$26.00	$0.00	8.67	$0.00	$0.00	$0.00	FALSE	-
76	Storage Room	400	13w CFL Globe Fixture	1	13	6	0.08	31	Re-lamp	8w A19 LED	1	8	6	0.05	19	0.03	12	$4	0	No New Controls	0	0.0%	0	$0	$66.00	$90.00	$156.00	$0.00	43.33	$0.00	$0.00	$0.00	FALSE	-
94	Storage Room	400	42 Watt CFL Bare Fixture	1	42	1	0.04	17	Re-lamp	20w A21 LED Philips or Equal	1	20	1	0.02	8	0.02	9	$3	0	No New Controls	0	0.0%	0	$0	$29.00	$15.00	$44.00	$0.00	16.67	$0.00	$0.00	$0.00	FALSE	-

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS						LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST				
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
74	Storage Room	400	1x4 2L T8 28w Wrap	2	54	1	0.05	22	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	1	0.04	14	0.02	7	$2	0	No New Controls	0	0.0%	0	$0	$80.00	$35.00	$115.00	$0.00	53.24	$0.00	$0.00	$0.00	FALSE	-
92	Gym	2000	23W CFL Recessed Hi-Hat	1	23	9	0.21	414	Re-lamp	19w Par38 LED Philips or Equal	1	19	9	0.17	342	0.04	72	$22	0	No New Controls	0	0.0%	0	$0	$324.00	$225.00	$549.00	$0.00	25.42	$0.00	$0.00	$0.00	FALSE	-
74	Stairwell	1000	1x4 2L T8 28w Wrap	2	54	1	0.05	54	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	1	0.04	36	0.02	18	$0	0	No New Controls	0	0.0%	0	$0	$80.00	$35.00	$115.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
81	Stairwell	1000	23W CFL Open Bare Lite	1	23	1	0.02	23	Re-lamp	10.5w A19 LED	1	10.5	1	0.01	11	0.01	13	$0	0	No New Controls	0	0.0%	0	$0	$11.00	$15.00	$26.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
94	Storage Room	400	42 Watt CFL Bare Fixture	1	42	1	0.04	17	Re-lamp	20w A21 LED Philips or Equal	1	20	1	0.02	8	0.02	9	$0	0	No New Controls	0	0.0%	0	$0	$29.00	$15.00	$44.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
76	Lounge	1800	13w CFL Globe Fixture	1	13	12	0.16	281	Re-lamp	8w A19 LED	1	8	12	0.10	173	0.06	108	$0	0	No New Controls	0	0.0%	0	$0	$132.00	$180.00	$312.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
95	Kitchen	800	2x4 2-Lamp 32W T8 Lay-in, Prismatic	2	62	9	0.56	446	LED Retrofit Kit	Install Philips LED Evo 2x4 Retrofit Kit	1	39	9	0.35	281	0.21	166	$0	0	No New Controls	0	0.0%	0	$0	$990.00	$315.00	$1,305.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
87	Storage Room	400	13W CFL Bare Fixture	1	13	1	0.01	5	Re-lamp	8w A19 LED	1	8	1	0.01	3	0.01	2	$1	0	No New Controls	0	0.0%	0	$0	$11.00	$15.00	$26.00	$0.00	43.33	$0.00	$0.00	$0.00	FALSE	-
96	Dining Room	1800	2x4 2-Lamp 28W Lay-in, Prismatic	2	54	23	1.24	2,236	LED Retrofit Kit	Install Philips LED Evo 2x4 Retrofit Kit	1	39	23	0.90	1,615	0.35	621	$186	0	No New Controls	0	0.0%	0	$0	$2,530.00	$805.00	$3,335.00	$0.00	17.90	$0.00	$0.00	$0.00	FALSE	-
7.1	Dining Room	1800	2-Lamp T8 28w 2x4 Surface Prismatic	4	58	1	0.06	104	Replace Fixture	50w LED Surface Mount Prismatic Wrap	1	50	1	0.05	90	0.01	14	$4	0	No New Controls	0	0.0%	0	$0	$153.00	$65.00	$218.00	$50.00	38.89	$0.00	$0.00	$0.00	FALSE	-
97	Dining Room	1800	2x2 2L T8 32W U-lamps Surface, Prism	2	58	8	0.46	835	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	8	0.25	446	0.22	389	$117	0	No New Controls	0	0.0%	0	$0	$880.00	$280.00	$1,160.00	$0.00	9.95	$0.00	$0.00	$0.00	FALSE	-
74	Dining Room	1800	1x4 2L T8 28w Wrap	2	54	8	0.43	778	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	8	0.29	518	0.14	259	$78	0	No New Controls	0	0.0%	0	$0	$640.00	$280.00	$920.00	$0.00	11.83	$0.00	$0.00	$0.00	FALSE	-
97	Vestibule	1000	2x2 2L T8 32W U-lamps Surface, Prism	2	58	1	0.06	58	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	1	0.03	31	0.03	27	$8	0	No New Controls	0	0.0%	0	$0	$110.00	$35.00	$145.00	$0.00	17.90	$0.00	$0.00	$0.00	FALSE	-
87	Mechanical Room	600	13W CFL Bare Fixture	1	13	2	0.03	16	Re-lamp	8w A19 LED	1	8	2	0.02	10	0.01	6	$2	0	No New Controls	0	0.0%	0	$0	$22.00	$30.00	$52.00	$0.00	28.89	$0.00	$0.00	$0.00	FALSE	-
87	Storage Room	400	13W CFL Bare Fixture	1	13	2	0.03	10	Re-lamp	8w A19 LED	1	8	2	0.02	6	0.01	4	$1	0	No New Controls	0	0.0%	0	$0	$22.00	$30.00	$52.00	$0.00	43.33	$0.00	$0.00	$0.00	FALSE	-
73	Hallway	800	1x4 2L T8 32w Wrap	2	62	3	0.19	149	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	3	0.11	86	0.08	62	$19	0	No New Controls	0	0.0%	0	$0	$240.00	$105.00	$345.00	$0.00	18.43	$0.00	$0.00	$0.00	FALSE	-
74	Hallway	800	1x4 2L T8 28w Wrap	2	54	1	0.05	43	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	1	0.04	29	0.02	14	$4	0	No New Controls	0	0.0%	0	$0	$80.00	$35.00	$115.00	$0.00	26.62	$0.00	$0.00	$0.00	FALSE	-
73	Women Restroom	1200	1x4 2L T8 32w Wrap	2	62	2	0.12	149	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	2	0.07	86	0.05	62	$19	0	No New Controls	0	0.0%	0	$0	$160.00	$70.00	$230.00	$0.00	12.29	$0.00	$0.00	$0.00	FALSE	-
98	Boiler Room	600	18 Watt CFL Bare Fixture	1	18	3	0.05	32	Re-lamp	8w A19 LED	1	8	3	0.02	14	0.03	18	$5	0	No New Controls	0	0.0%	0	$0	$33.00	$45.00	$78.00	$0.00	14.44	$0.00	$0.00	$0.00	FALSE	-
87	Boiler Room	600	13W CFL Bare Fixture	1	13	2	0.03	16	Re-lamp	8w A19 LED	1	8	2	0.02	10	0.01	6	$2	0	No New Controls	0	0.0%	0	$0	$22.00	$30.00	$52.00	$0.00	28.89	$0.00	$0.00	$0.00	FALSE	-
Exterior Lighting																																		
64	Exterior Building	4000	23w CFL Sconces	1	23	6	0.14	552	Re-lamp	10.5w A19 LED	1	10.5	6	0.06	252	0.08	300	$90	0	No New Controls	0	0.0%	0	$0	$66.00	$90.00	$156.00	$0.00	1.73	$0.00	$0.00	$0.00	FALSE	-
65	Exterior Building	4000	23w Flood with Reflector	1	23	5	0.12	460	Re-lamp	19w Par38 LED Philips or Equal	1	19	5	0.10	380	0.02	80	$24	0	No New Controls	0	0.0%	0	$0	$180.00	$125.00	$305.00	$0.00	12.71	$0.00	$0.00	$0.00	FALSE	-
66	Exterior Building	4000	23w Par 38 Flood w/Reflector	1	23	3	0.07	276	Re-lamp	19w Par38 LED Philips or Equal	1	19	3	0.06	228	0.01	48	$14	0	No New Controls	0	0.0%	0	$0	$108.00	$75.00	$183.00	$0.00	12.71	$0.00	$0.00	$0.00	FALSE	-
67	Exterior Building	4000	100w Induction Wall Mount	1	120	1	0.12	480	Existing to Remain	No Change	1	120	0	0.12	480	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
	TOTAL					**362**	**15**	**21,509**					**361**	**8**	**11,899**	**7**	**9,610**	**$940**			**0**	**0**	**2**	**$0**	**$18,018**	**$8,525**	**$26,543**	**$600**	**27.60**	**$0**	**$0**	**$0**	**$20.00**	-

APPENDIX F

Location Description	Area (Sq FT)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW_{DC}	Total Annual kWh	Total KW_{AC}	Panel Weight (41.9 lbs)	W/SQFT
Collingswood Presbyterian	1500	SHARP ND-240QCJ	78	17.5	1,368	18.72	20,135	13.8	3,268	13.68



= Proposed PV Roof Layout

= Proposed PV Parking Layout

Notes:

1. Estimated kWH based on the National Renewable Energy Laboratory PVWatts Version 1 Calculator Program.

Project Name: **LGEA Solar PV Project - Collingswood Presbyterian**
Location: **Collingswood, NJ**
Description: **Photovoltaic System 100% Financing - 15 year**

Simple Payback Analysis

	Photovoltaic System 100% Financing - 15 year
Total Construction Cost	$78,163
Annual kWh Production	20,135
Annual Energy Cost Reduction	$6,041
Average Annual SREC Revenue	$3,051

Simple Payback: **8.60** Years

Life Cycle Cost Analysis

Analysis Period (years): 15
Discount Rate: 3%
Average Energy Cost ($/kWh) **$0.300**
Financing Rate: 6.00%
Financing %: 100%
Maintenance Escalation Rate: 3.0%
Energy Cost Escalation Rate: 3.0%
Average SREC Value ($/kWh) $0.152

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$0	0	0	0	$0	0	0	0	0
1	$0	20,135	$6,041	$0	$5,034	$4,600	$3,315	$3,159	$3,159
2	$0	20,034	$6,222	$0	$5,009	$4,395	$3,520	$3,315	$6,475
3	$0	19,934	$6,408	$0	$4,984	$4,178	$3,737	$3,477	$9,952
4	$0	19,834	$6,601	$0	$3,967	$3,947	$3,967	$2,653	$12,604
5	$0	19,735	$6,799	$203	$3,947	$3,703	$4,212	$2,627	$15,232
6	$0	19,637	$7,003	$202	$3,927	$3,443	$4,472	$2,813	$18,044
7	$0	19,538	$7,213	$201	$2,931	$3,167	$4,748	$2,027	$20,071
8	$0	19,441	$7,429	$200	$2,916	$2,874	$5,041	$2,230	$22,301
9	$0	19,344	$7,652	$199	$2,902	$2,563	$5,352	$2,439	$24,741
10	$0	19,247	$7,881	$198	$1,925	$2,233	$5,682	$1,693	$26,434
11	$0	19,151	$8,118	$197	$1,915	$1,883	$6,032	$1,921	$28,354
12	$0	19,055	$8,361	$196	$1,905	$1,511	$6,404	$2,156	$30,510
13	$0	18,960	$8,612	$195	$948	$1,116	$6,799	$1,450	$31,960
14	$0	18,865	$8,871	$194	$943	$697	$7,218	$1,705	$33,665
15	$0	18,770	$9,137	$193	$939	$251	$7,664	$1,967	$35,632
	Totals:	291,680	$112,347	$2,181	$44,191	$40,562	$78,163	$35,632	$319,133

Net Present Value (NPV) **$27,508**

AC Energy & Cost Savings

(Type comments here to appear on printout; maximum 1 row of 80 characters.)

Station Identification	
City:	Philadelphia
State:	Pennsylvania
Latitude:	39.88° N
Longitude:	75.25° W
Elevation:	9 m
PV System Specifications	
DC Rating:	17.0 kW
DC to AC Derate Factor:	0.810
AC Rating:	13.8 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	30.0 ¢/kWh

Results			
Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	2.36	998	299.40
2	3.27	1283	384.90
3	4.23	1778	533.40
4	5.02	1994	598.20
5	5.59	2228	668.40
6	6.07	2266	679.80
7	6.06	2309	692.70
8	5.79	2222	666.60
9	4.67	1761	528.30
10	3.74	1504	451.20
11	2.54	1000	300.00
12	1.93	791	237.30
Year	4.28	20135	6040.50

APPENDIX G

STEAM TRAP REPLACEMENT ANALYSIS

Calculation Assumptions		
Description	**Value**	**Units**
Ann. Gas Usage	17,693	Therm
Less DHW Gas Usage	2,578	Therm
Less Other Gas Usage	0	Therm
Net Heating Gas Usage	15,115	Therm
Est. Steam Production	1,247,063	lbs
Boiler Efficiency	83%	
Makeup Water	50	°F
Condenstate Return	200	°F
30% Makeup		
Feedwater Enthalpy	155	btu/lb
Steam Enthalpy	1161	btu/lb
Steam Production Conversion	82.50	lb / Th
Hours per Day On	8	
Days per Week	5	
Htg Months per Year	6	
Ann. System Operation	1,040	hrs / yr
Gas Cost ($/Th)	$1.01	
Trap Failure Rate	25.00%	

Building Area	Estimated Quantity
Boiler Plant	2
Condensate Pumps	1
Radiators and Unit Heaters	22
TOTAL	25

STEAM TRAP LOSS CALCULATION

Steam Trap Sizes	Trap Orifice Diamter (in)	Steam Loss lb/hr (15 PSI)	Quantity of Traps	Estimated Quantity Failed	Annual Steam Loss lbs	Annual Steam Loss Therm	Cost Savings
1/2" Trap	1/8"	13.70	1	0	3,562	43	$44
3/4" Trap	3/16"	30.70	22	6	175,604	2,128	$2,150
1" Trap	1/4"	54.70	2	1	28,444	345	$348
1 -1/2" Trap	3/8"	123.00	0	0	0	0	$0
TOTAL			**25**	**6**	**207,610**	**2,516**	**$2,541**