Local Government Energy Audit:
Energy Audit Report

St. Stephen's Malankara Orthodox Church

497 Goodwin Avenue

Midland Park, NJ 07432

September 8, 2017

Report by:

TRC Energy Services

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Disclaimer

The intent of this energy analysis report is to identify energy savings opportunities associated with recommended upgrades to the facility's systems at this site. Approximate savings are included in this report to make decisions about reducing energy use at the facility. This report, however, is not intended to serve as a detailed engineering design document. It should be noted that detailed design efforts are required in order to implement several of the improvements evaluated as part of this energy analysis.

The energy conservation measures and estimates of energy consumption contained in this report have been reviewed for technical accuracy. However, all estimates contained herein of energy consumption at the site are not guaranteed, because energy consumption ultimately depends on behavioral factors, the weather, and many other uncontrollable variables. The energy assessor and New Jersey Board of Public Utilities (NJBPU) shall in no event be liable should the actual energy consumption vary from the estimated consumption shown herein.

Estimated installation costs are based on a variety of sources, including our own experience at similar facilities, our own pricing research using local contractors and vendors, and cost estimating handbooks such as those provided by RS Means. The cost estimates represent our best judgment for the proposed action. The owner is encouraged to independently confirm these cost estimates and to obtain multiple estimates when considering measure installations. Since actual installed costs can vary widely for a particular installation, and for conditions which cannot be known prior to in-depth investigation and design, the energy assessor does not guarantee installed cost estimates and shall in no event be liable should actual installed costs vary from the estimated costs herein.

New Jersey's Clean Energy Program (NJCEP) incentive values provided in this report are estimates and are based on program information available at the time this report is written. The NJBPU reserves the right to extend, modify, or terminate programs without prior or further notice, including incentive levels and eligibility requirements. The owner should review available program incentives and requirements prior to selecting and/or installing any recommended measures.

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1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for St. Stephen's Malankara Orthodox Church.

The goal of a LGEA is to provide you with information on how your facility uses energy, identify energy conservation measures (ECMs) that can reduce your energy use, and help put you in a position to implement the ECMs. The LGEA also sets you on the path to receive financial incentives from New Jersey's Clean Energy Program (NJCEP) for implementing the ECMs.

This study was conducted by TRC Energy Services (TRC), as part of a comprehensive effort to assist St. Stephen's Malankara Orthodox Church in controlling energy costs and protecting our environment by offering a full spectrum of energy management options.

1.1 Facility Summary

St. Stephen's Malankara Orthodox Church is a 15,126 square foot facility comprised of various space types. The building has two floors. The first floor has the church sanctuary, a meeting hall and a kitchen. The ground floor is where the day care center is located.

St. Stephen's Malankara Orthodox Church mostly consists of T8 lighting and incandescent bulbs. The meeting hall and kitchen were recently reconstructed on account of a fire accident. So the equipment in these areas were upgraded but the installed lighting are not very efficient. A thorough description of the facility and our observations are located in Section 2 "Facility Information and Existing Conditions".

1.2 Your Cost Reduction Opportunities

Energy Conservation Measures

TRC evaluated five (5) projects which represents an opportunity for t the church to reduce annual energy costs by roughly $3,003.68 and annual greenhouse gas emissions by 11,988 lbs. CO_2e. The measures would pay for themselves in roughly 5.79 years. The breakdown of existing and potential utility costs is illustrated in Figure 1 and Figure 2, respectively. These measures together represent an opportunity to reduce St. Stephen's Malankara Orthodox Church's annual energy use by 7.9%.

Figure 1 – Previous 12 Month Utility Costs

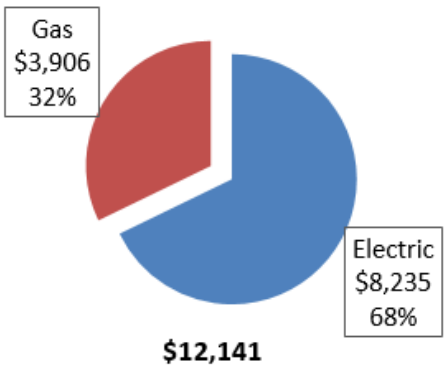
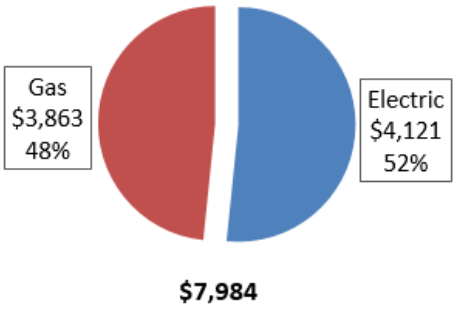


Figure 2 – Potential Post-Implementation Costs



A detailed description of St. Stephen's Malankara Orthodox Church's existing energy usage can be found in Section 3.

The evaluated measures have been listed and grouped into major categories as shown in Figure 3. Brief descriptions of the categories can be found below and descriptions of the individual opportunities can be found in Section 4.

Figure 3 – Summary of Energy Reduction Opportunities

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	*Annual Natural Gas Savings (MMBtu)*	*Annual N/A Savings (MMBtu)*	*Annual N/A Savings (MMBtu)*	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**10,680**	**7.5**	**0.0**	**0.0**	**0.0**	**0.0**	**$2,795.57**	**$19,837.15**	**$3,285.00**	**$16,552.15**	**5.92**	**10,755**
ECM 1	Install LED Fixtures	2,540	0.6	0.0	0.0	0.0	0.0	$664.78	$2,344.06	$600.00	$1,744.06	2.62	2,557
ECM 2	Retrofit Fixtures with LED Lamps	5,858	6.6	0.0	0.0	0.0	0.0	$1,533.28	$16,525.10	$2,685.00	$13,840.10	9.03	5,899
ECM 3	Install LED Exit Signs	2,283	0.3	0.0	0.0	0.0	0.0	$597.51	$968.00	$0.00	$968.00	1.62	2,299
Lighting Control Measures		**629**	**0.5**	**0.0**	**0.0**	**0.0**	**0.0**	**$164.75**	**$928.00**	**$160.00**	**$768.00**	**4.66**	**634**
ECM 4	Install Occupancy Sensor Lighting	629	0.5	0.0	0.0	0.0	0.0	$164.75	$928.00	$160.00	$768.00	4.66	634
HVAC System Improvements		**0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**0.00**	**0**
ECM 5	Install Low-Flow Domestic Hot Water	0	0.0	5.1	0.0	0.0	5.1	$43.36	$86.04	$0.00	$86.04	1.98	599
TOTALS		**11,309**	**8.0**	**5.1**	**0.0**	**0.0**	**5.1**	**$3,003.68**	**$20,851.19**	**$3,445.00**	**$17,406.19**	**5.79**	**11,988**

* - All incentives presented in this table are based on NJ Smart Start Building equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

Lighting Upgrades generally involve the replacement of existing lighting components such as lamps and ballasts (or the entire fixture) with higher efficiency lighting components. These measure save energy by reducing the power used by the lighting components due to improved electrical efficiency.

Lighting Controls measures generally involve the installation of automated controls to turn off lights or reduce light output when conditions allow. Automated control reduces reliance on occupant behavior for adjusting lights. These measures save energy by reducing the amount of time lights are on.

Motor Upgrades generally involve replacing old standard efficiency motors with motors of the current efficiency standard (EISA 2007). Motors will be replaced with the same size motors. This measure saves energy by reducing the power used by the motors due to improved electrical efficiency. Some of the motors (ex: sewage ejection pump) have reached the end of it's useful like and we recommend that they be replaced on the basis of the age/condition of the existing equipment alone. They do not represent considerable energy cost benefits.

Domestic Water Heating upgrade measures generally involve replacing old inefficient domestic water heating systems with modern energy efficient systems. New domestic water heating systems can provide equivalent or greater capacity as older systems, but use less energy. These measures save energy by reducing the fuel used by the domestic water heating systems due to improved efficiency or the removal of standby losses.

Energy Efficient Practices

TRC also identified five (5) low cost (or no cost) energy efficient practices. A facility's energy performance can be significantly improved by employing certain behavioral and operational adjustments as well as performing routine maintenance on building systems. Through these practices equipment lifetime can be extended; occupant comfort, health and safety can be improved; and annual energy, operation, and maintenance costs can be reduced. Opportunities identified at St. Stephen's Malankara Orthodox Church include:

- Perform Proper Lighting Maintenance
- Develop a Lighting Maintenance Schedule
- Ensure Lighting Controls Are Operating Properly
- Practice Proper Use of Thermostat Schedules and Temperature Resets
- Water Conservation

For details on these Energy Efficient Practices, please refer to section 5.

Self-Generation Measures

TRC evaluated the potential for installing self-generation sources for St. Stephen's Malankara Orthodox Church. Based on the configuration of the site and its loads there is a low potential for installing combined heat and power self-generation measures. At the customer's request, we performed a solar PV analysis for St. Stephen's Malankara Church. Based on our analysis we found that the church may have some potential for installation of a cost-effective roof top solar array however a more detailed site analysis of PV should be done by a qualified installer to confirm this potential.

1.3 Implementation Planning

To realize the energy savings from the ECMs listed in this report, a project implementation plan must be developed. Available capital must be considered and decisions need to be made whether it is best to pursue individual ECMs separately, groups of ECMs, or a comprehensive approach wherein all ECMs are pursued, possibly in conjunction with other facility upgrades or improvements.

Rebates, incentives, and financing are available from NJCEP, as well as other sources, to help reduce the costs associated with the implementation of energy efficiency projects. Prior to implementing any measure, please review the relevant incentive program guidelines before proceeding. This is important because in most cases you will need to submit applications for the incentives prior to purchasing materials or commencing with installation.

The ECMs outlined in this report may qualify under the following program(s):

- SmartStart
- Direct Install

For facilities wanting to pursue only selected individual measures (or planning to phase implementation of selected measures over multiple years), incentives are available through the SmartStart program. To participate in this program you may utilize internal resources, or an outside firm or contractor, to do the final design of the ECM(s) and do the installation. Program pre-approval is required for some SmartStart incentives, only after receiving pre-approval should you proceed with ECM installation. The incentive estimates listed above in Figure 3 are based on the SmartStart program. More details on this program and others are available in Section 7.

This facility may also qualify for the Direct Install program which can provide turnkey installation of multiple measures, through an authorized network of participating contractors. This program can provide substantially higher incentives that SmartStart, up to 70% of the cost of selected measures, although measure eligibility will have to be assessed and be verified by the designated DI contractor and, in most cases, they will perform the installation work.

For facilities without capital available to implement ECMs, project financing may be available through the Energy Savings Improvement Program (ESIP).Supported directly by the NJBPU, ESIP provides government agencies with external project development, design, and implementation services as well as financing for implementing ECMs. This LGEA report is the first step for participating in ESIP and should help you determine next steps.

Additional descriptions of all relevant incentive programs are located in Section 7 or www.njcleanenergy.com/ci.

2 FACILITY INFORMATION AND EXISTING CONDITIONS

2.1 Project Contacts

Figure 4 – Project Contacts

Name	Role	E-Mail	Phone #
Customer			
Joby John	Church Secretary	jobyvjohn@hotmail.com	(201) 951-1581
Jose Thomas	Church Caretaker	rnstrs@gmail.com	(201) 983-9025
TRC Energy Services			
Smruti Srinivasan	Auditor	ssrinivasan@trcsolutions.com	(732) 855-0033

2.2 General Site Information

On August 10, 2016, TRC performed an energy audit at St. Stephen's Malankara Orthodox Church located in Midland Park, New Jersey. TRCs' team met with the church caretaker, Jose Thomas to review the facility operations and focus the investigation on specific energy-using systems.

St. Stephen's Malankara Orthodox Church is a 15,126 square foot facility comprised of various spaces. This Church was purchased in August 2011 along with a parsonage next door. After approximately 16 months of renovationsthe chruch was consecrated on December 2012. The building has two floors. The first floor has the church sanctuary, a meeting hall and a kitchen. The church building has more than ten (10) large rooms for Sunday school and other activities on the ground floor. The premises also accommodate approximately 60 parking spots for the members

The building is lit mostly by of T8 lighting and incandescent bulbs. The meeting hall and kitchen were recently reconstructed on account of a fire accident. The equipment in these areas were upgraded, but the existing lighting fixtures are not very efficient.

2.3 Building Occupancy

The typical schedule of the facility is presented in the table below. Since the facility has different types of spaces, the occupancy form often varies according to the use. The church is usually closed on weekdays and open only on Sundays from 7:00amto 4:30pm for religious services. For special programs, the church is operational on Saturday from 11:00am to 6:00pm The day care center is open on weekdays 7:00AM to6:00pm and closed on Sundays.

Figure 5 - Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
Church	Weekday	No occupancy during weekday
Church	Weekend	7AM - 4:30PM on Sundays
Day Care Centre - Basement	Weekday	7AM - 6PM
Day Care Centre - Basement	Weekend	No occupancy

2.4 Building Envelope

The image below shows the exterior view of St. Stephen's Malankara Orthodox Church. The building has a mostly flat roof with a pinnacle above the sanctuary. The house shown on the right is owned by the church but not included in our energy assessment. The buildings have arch windows which are in good condition and show little sign of excessive infiltration. The exterior doors are constructed of wood and are in good condition.

Exterior view of the Church

2.5 On-site Generation

The onsite generation capacity of St. Stephen's Malankara Orthodox Church is discussed in detail in Section 6.

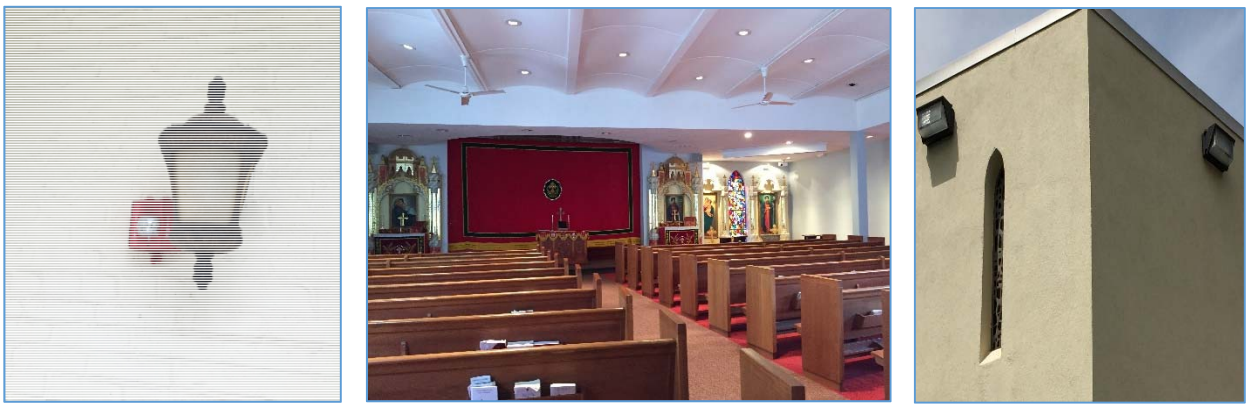
2.6 Energy-Using Systems

Lighting System

Lighting at the facility is provided predominately by linear 32 Watt fluorescent T8 lamps with electronic ballasts as well as compact fluorescent lamps (CFL). The sanctuary has recessed fixtures and the church wants the bulbs retrofitted with bulbs that protrude further from the cans in order to increase the lighting in the area. The church was very recently acquired and renovated however the lighting is not the most efficient fixtures; replacing lighting would be good opportunity for energy savings.

Lighting control in most spaces is provided by occupancy sensors. The occupancy sensors are either wall or ceiling mounted depending on the space layout.

The building's exterior lighting, primarily consists of high pressure sodium fixtures and wall mount fixtures with incandescent bulbs.



Pictures showing the various lighting at the church (both interior and exterior)

Please refer to Appendix A: Equipment Inventory & Recommendations for a full inventory of lighting equipment.

Hot Water / Steam System

The hot water system consists of three (3) gas-fired Heil furnaces with an output capacity of 120 MBH. The furnaces have a combustion efficiency of 95%. Each furnace has a 0.75 HP blower fan. The furnaces are 14 years old and are in decent condition.

They also have a Triangle tube series condensing hot water boiler with an output capacity of 99 MBH with a 96% AFUE. This is the more recently installed boiler. It is seven (7) years old and in a good condition. The images of the furnace and the condensing hot water boiler are found below..

Left: Furnace, Right: Condensing Hot water Boiler

Air Conditioning (DX)

Air conditioning at the churhc consists of four (4) rooftop packaged units. The biggest one is a 15-ton Trane rooftop unit (RTU) serving the chancel. This unit has a 3 HP supply fan and has an efficiency of 8.6 EER (or 81% AFUE). The smallest one is a 5-ton Lennox system serving the entrance/foyer with a 1-HP

supply fan and an efficiency of 12.7 EER (or 80% AFUE). Both units are 20 years old and we recommend that they be replaced with more efficient units.

There are two (2) Lennox systems each 7.5 tons serving the Parish hall with a supply fan of 2 HP and an efficiency of 11 EER (or 80% AFUE). These were recently installed (3 years old) and in good condition.

Please refer to Appendix A: Equipment Inventory & Recommendations for an inventory of your HVAC equipment.

Domestic Hot Water

The domestic hot water system for the facility consists of one (1) 50-gallon Bradford White, gas fired, and hot water heaters with an input capacity of 40 MBh. The system has an efficiency of 79%. It is ten years old and decent working condition.

Food Service & Laundry Equipment

The facility has a stove with four (4) gas burners, a gas fired oven and a range hood. Food is mostly heated and served in this area during special occasions and meetings. As the kitchen was recently redone, it contains a dishwasher, microwave oven and coffee machines all of which are ENERGY STAR® rated. The kitchen also has an efficient new double door refrigerator..

The gas burner at the kitchen

Plug load & Vending Machines

The plug loads for the building consist mostly of two (2) computers, two (2)printers, air coolers, ceiling fans, TVs, space heaters, water dispenser etc. These are mainly in the day care center, located in the ground floor of the facility. No centralized PC power management software installed was found.

2.7 Water-Using Systems

There are four (4) restrooms at this facility; two (2) for men and two (2) for women. A sampling of restrooms found that all of the faucets are rated for 2.2 gallons per minute or higher, the toilets are rated at 2.5 gallons per flush (gpf) and the urinals are rated at 2 gpf.

3 SITE ENERGY USE AND COSTS

Utility data for electricity and natural gas was analyzed to identify opportunities for savings. In addition, data for Electricity and Natural Gas was evaluated to determine the annual energy performance metrics for the building in energy cost per square foot and energy usage per square foot. These metrics are an estimate of the relative energy effectiveness of this building. There are a number of factors that could cause the energy use of this building to vary from the "typical" energy use for other facilities of similar type, such as: specific local climate conditions, daily occupancy hours, seasonal fluctuations in occupancy, operating hours for energy using systems, and the energy efficient behavior of occupants (such as turning off appliances or leaving windows open). Please refer to the Benchmarking section within Section 3.4 for additional information.

3.1 Total Cost of Energy

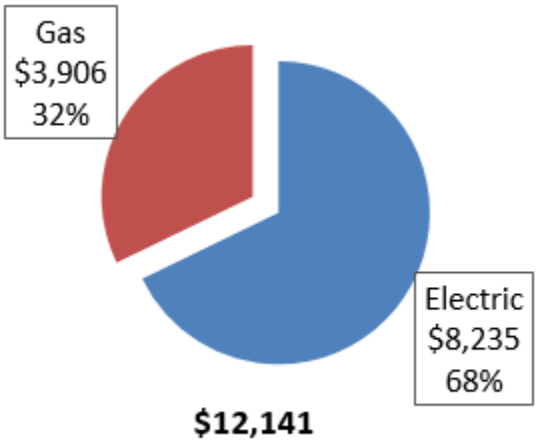
The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. A profile of the annual energy consumption and energy cost of the facility was developed from this information.

Figure 6 - Utility Summary

Utility Summary for St.Stephen's Malakara		
Fuel	**Usage**	**Cost**
Electric	26,415 kWh	$8,235
Gas	4,609 Therms	$3,906
Total		$12,141

The current utility cost for this site is $16,313 as shown in the chart below.

Figure 7 - Energy Cost Breakdown



3.2 Electricity Usage

Electricity is provided by PSE&G. The average electric cost over the past 12 months was $0.262/kWh, which is the blended rate that includes energy supply, distribution, and other charges. This rate is used throughout the analyses in this report to assess energy costs and savings. The demand charges are approximately $4.30/kW and the facility does not have a third-party energy supplier. The monthly electricity consumption and peak demand is represented graphically in the chart below.

Figure 8 - Electric Usage & Demand

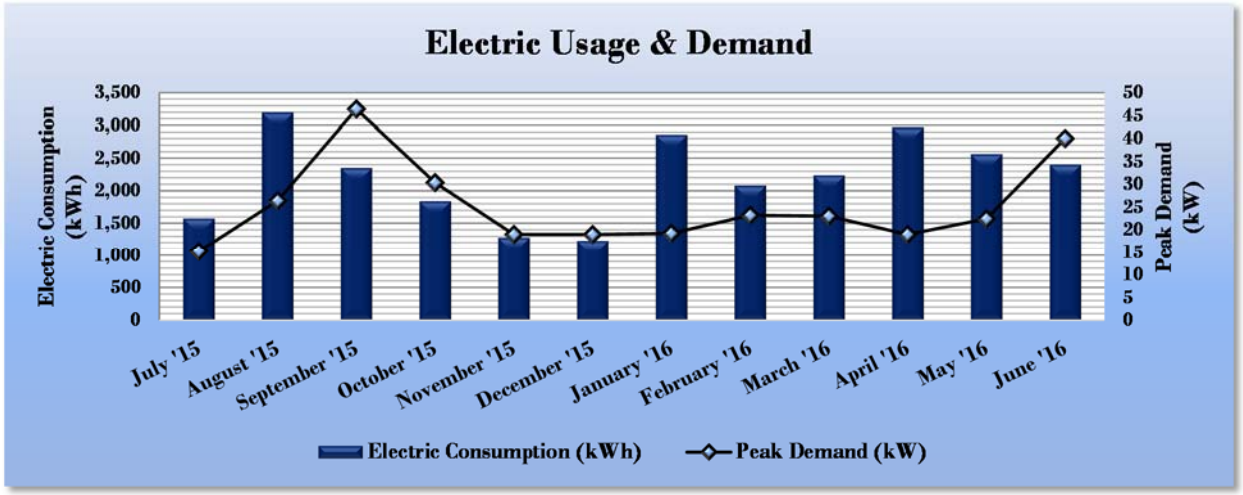


Figure 9 - Electric Usage & Demand

Electric Billing Data for St.Stephen's Malankara Orthodox Church						
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost	TRC Estimated Usage?
7/21/15	32	1,574	15	$66	$572	Yes
8/19/15	29	3,195	26	$115	$1,161	Yes
9/18/15	30	2,351	46	$202	$854	Yes
10/19/15	31	1,840	30	$133	$540	No
11/17/15	29	1,278	19	$84	$355	Yes
12/18/15	31	1,227	19	$84	$341	Yes
1/21/16	34	2,855	19	$84	$792	Yes
2/19/16	29	2,080	23	$101	$591	No
3/21/16	31	2,234	23	$101	$561	Yes
4/20/16	30	2,965	19	$84	$744	Yes
5/19/16	29	2,561	22	$99	$642	Yes
6/20/16	32	2,400	40	$176	$1,128	No
Totals	**367**	**26,560**	**46.4**	**$1,328**	**$8,280**	
Annual	**365**	**26,415**	**46.4**	**$1,321**	**$8,235**	

3.3 Natural Gas Usage

Natural gas is provided by PSE&G. The average gas cost for the past 12 months is $0.847/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is represented graphically in the chart below.

Figure 10 - Natural Gas Usage

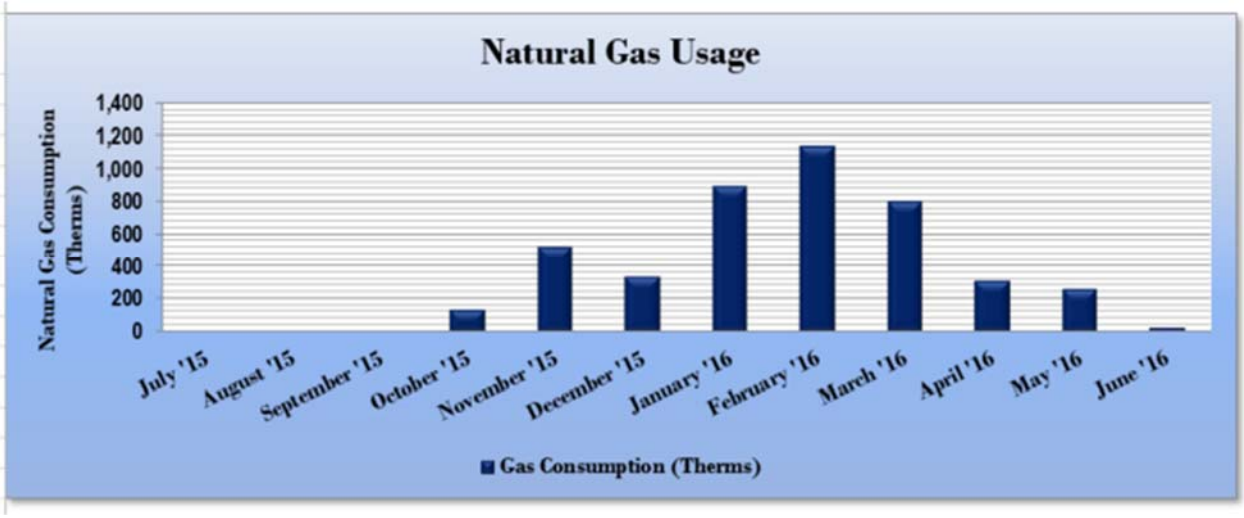


Figure 11 - Natural Gas Usage

Gas Billing Data for St.Stephen's Malankara Orthodox Church				
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost	TRC Estimated Usage?
7/20/15	29	5	$27	Yes
8/18/15	32	5	$27	Yes
9/18/15	30	7	$28	Yes
10/18/15	29	133	$123	No
11/16/15	32	526	$443	Yes
12/17/15	29	339	$299	Yes
1/21/16	29	894	$764	Yes
2/18/16	22	1,144	$953	No
3/20/16	31	804	$618	Yes
4/19/16	31	314	$248	Yes
5/18/16	29	259	$207	Yes
6/19/16	30	27	$43	No
Totals	**353**	**4,458**	**$3,778**	9
Annual	**365**	**4,609**	**$3,906**	

3.4 Benchmarking

This facility was benchmarked through Portfolio Manager, an online tool created and managed by the United State Environmental Protection Agency (EPA) through the ENERGY STAR® program. Portfolio Manager analyzes your building's consumption data, cost information, and operational use details and compares its performance against national medians for similar buildings. Metrics used in this comparison are the energy use intensity (EUI) and ENERGY STAR® Score.

The EUI is a measure of a facility's energy consumption per square foot, and it is the standard metric for comparing commercial building energy performance. Comparing the EUI of a building with the national median EUI for that building type indicates whether the building may be using more per square foot basis than a typical building of its size, type, age, occupancy, and other building characteristics. EUI is presented in both site energy and source energy. Site energy is the amount of fuel and electricity consumed by a building as reflected in utility bills. Source energy includes the total fuel consumed to generate the electricity consumed at the site, factoring in energy production and distribution losses.

Figure 12 - Energy Use Intensity Comparison – Existing Conditions

Energy Use Intensity Comparison - Existing Conditions		
	St.Stephen's Malankara Orthodox Church	National Median Building Type: Religious
Source Energy Use Intensity (kBtu/ft^2)	50.7	70.7
Site Energy Use Intensity (kBtu/ft^2)	36.4	36.8

By implementing all recommended measures covered in this reporting, the Project's estimated post-implementation EUI improves as shown in the Table below:

Figure 13 - Energy Use Intensity Comparison – Following Installation of Recommended Measures

Energy Use Intensity Comparison - Following Installation of Recommended Measures		
	St.Stephen's Malankara Orthodox Church	National Median Building Type: Religious
Source Energy Use Intensity (kBtu/ft^2)	42.3	70.7
Site Energy Use Intensity (kBtu/ft^2)	33.5	36.8

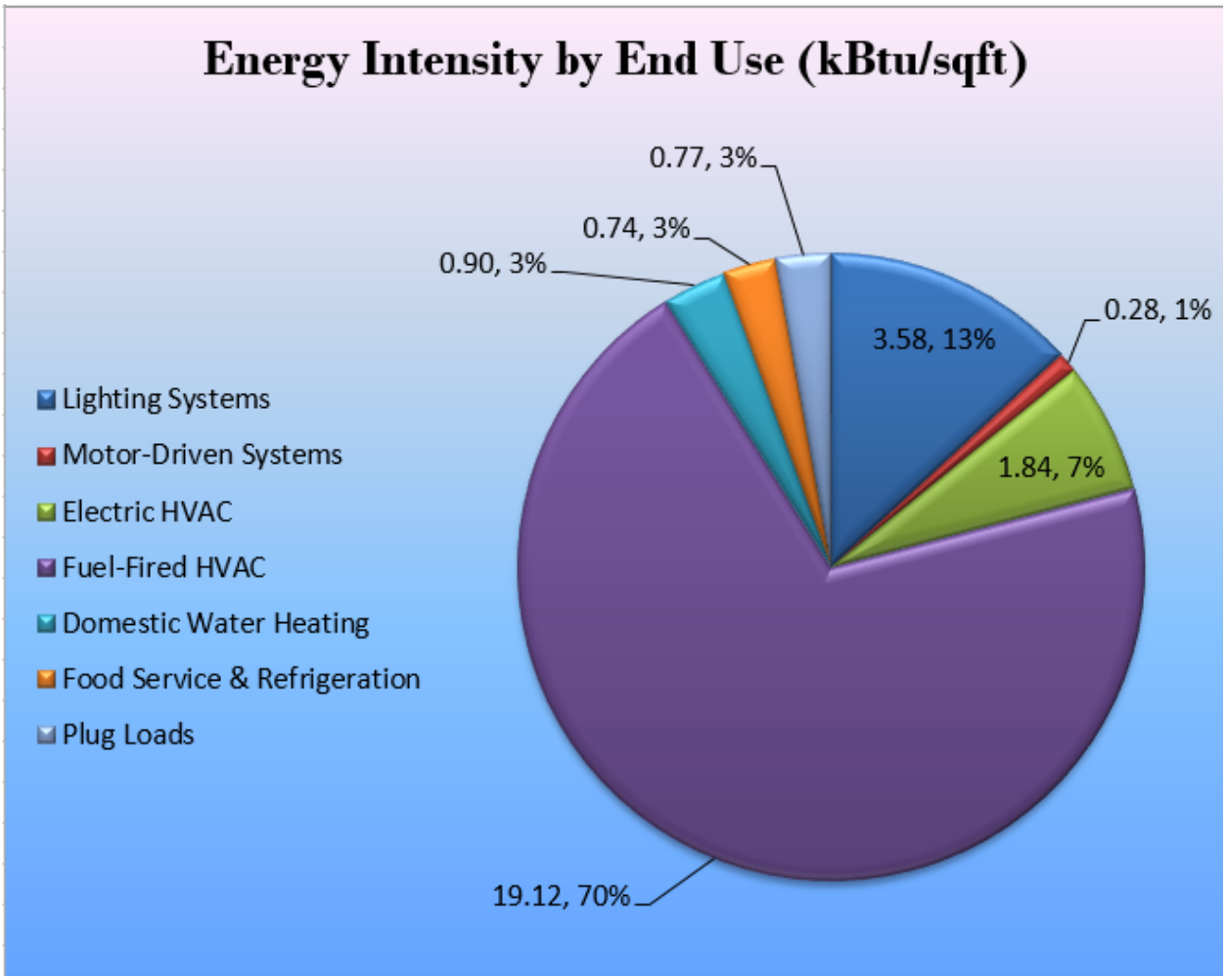
Many types of commercial buildings are also eligible to receive an ENERGY STAR® score. This score is a percentile ranking from 1 to 100. It compares your building's energy performance to similar buildings nationwide. A score of 50 represents median energy performance, while a score of 75 means your building performs better than 75 percent of all similar buildings nationwide and may be eligible for ENERGY STAR® certification. This facility has the current score of 90.

From the Portfolio Manager, Statement of Energy Performance and the score card can be found in Appendix B: ENERGY STAR® Statement of Energy Performance.

3.5 Energy End-Use Breakdown

In order to provide a complete overview of energy consumption across building systems, an energy balance was performed at this facility. An energy balance utilizes standard practice engineering methods to evaluate all components of the various electric and fuel-fired systems found in a building and determine their proportional contribution to overall building energy usage. This visual representation of energy end uses highlights systems that may benefit most from energy efficiency projects.

Figure 14 - Energy Balance (% and kBtu/SF)



4 Energy Conservation Measures

Level of Analysis

The goal of this audit report is to identify potential energy efficiency opportunities, help prioritize specific measures for implementation, and provide information to St. Stephen's Malankara Orthodox Church regarding financial incentives for which they may qualify to implement the recommended measures. For this audit report, most measures have received only a preliminary analysis of feasibility which identifies expected ranges of savings and costs. This level of analysis is considered sufficient to make "Go/No-Go" decisions and to prioritize energy projects. Savings are based on the New Jersey Board of Public Utilities New Jersey Clean Energy Program Protocols to Measure Resource Savings dated March 17, 2014. Further analysis or investigation may be required to calculate more accurate savings to support any custom SmartStart, Pay for Performance, or Large Energy Users incentive applications. Financial incentives for the ECMs identified in this report have been calculated based the NJ prescriptive SmartStart program. Depending on your implementation strategy, the project may be eligible for more lucrative incentives through other programs as identified in Section 7.

The following sections describe the evaluated measures.

4.1 Recommended ECMs

The measures below have been evaluated by the auditor and are recommended for implementation at the facility.

Figure 15 – Summary of Recommended ECM

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**10,680**	**7.5**	**0.0**	**$2,795.57**	**$19,837.15**	**$3,285.00**	**$16,552.15**	**5.92**	**10,755**
ECM 1	Install LED Fixtures	2,540	0.6	0.0	$664.78	$2,344.06	$600.00	$1,744.06	2.62	2,557
ECM 2	Retrofit Fixtures with LED Lamps	5,858	6.6	0.0	$1,533.28	$16,525.10	$2,685.00	$13,840.10	9.03	5,899
ECM 3	Install LED Exit Signs	2,283	0.3	0.0	$597.51	$968.00	$0.00	$968.00	1.62	2,299
Lighting Control Measures		**629**	**0.5**	**0.0**	**$164.75**	**$928.00**	**$160.00**	**$768.00**	**4.66**	**634**
ECM 4	Install Occupancy Sensor Lighting	629	0.5	0.0	$164.75	$928.00	$160.00	$768.00	4.66	634
HVAC System Improvements		**0**	**0.0**	**0.0**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**0.00**	**0**
ECM 5	Install Low-Flow Domestic Hot Water	0	0.0	5.1	$43.36	$86.04	$0.00	$86.04	1.98	599
TOTALS		**11,309**	**8.0**	**5.1**	**$3,003.68**	**$20,851.19**	**$3,445.00**	**$17,406.19**	**5.79**	**11,988**

* - All incentives presented in this table are based on NJ Smart Start Building equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

4.1.1 Lighting Upgrades

Recommended Lighting Upgrades are summarized in Figure 16 below.

Figure 16 – Summary of Lighting Upgrade ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**10,680**	**7.5**	**0.0**	**$2,795.57**	**$19,837.15**	**$3,285.00**	**$16,552.15**	**5.92**	**10,755**
ECM 1	Install LED Fixtures	2,540	0.6	0.0	$664.78	$2,344.06	$600.00	$1,744.06	2.62	2,557
ECM 2	Retrofit Fixtures with LED Lamps	5,858	6.6	0.0	$1,533.28	$16,525.10	$2,685.00	$13,840.10	9.03	5,899
ECM 3	Install LED Exit Signs	2,283	0.3	0.0	$597.51	$968.00	$0.00	$968.00	1.62	2,299

ECM 1: Install LED Fixtures

Measure Description

We recommend replacing existing, including all fluorescent, HID, and incandescent lamps with new high performance LED light fixtures. This measure saves energy by installing LED sources which use less power than other technologies with a comparable light output.

Maintenance savings can be anticipated too, since LEDs have lifetimes which are generally more than twice that of a fluorescent source and can be more than ten (10) times that of an incandescent bulb

During planning and design for the installation of new fixtures, we recommend a comprehensive approach that considers both the efficiency of the lighting technology and how they are controlled.

ECM 2: Retrofit Fixtures with LED Lamp

Measure Description

We recommend replacing linear fluorescent lamps with LED tube lamps and replacing incandescent and halogen screw-in/plug-in based lamps with LED lamps. Many LED tube lamps are direct replacements for existing fluorescent lamps and can be installed although there is a fluorescent fixture ballast in place. Other tube lamps require that fluorescent fixture ballasts be removed or replaced with LED drivers. LED lamps can be used as a direct replacement for most types of screw-in or plug-in lamps. This measure saves energy by installing LED sources which use less power than other technologies with a comparable light output.

ECM 3: Install LED Exit Signs

Measure Description

We recommend replacing incandescent EXIT signs with LED EXIT signs. LED EXIT signs require virtually no maintenance and LED exit signs have a life expectancy of at least 20 years.

4.1.2 Lighting Control Measures

Lighting control measures are summarized in Figure 17 below.

Figure 17 – Summary of Lighting Control ECMs

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
629	0.5	0.0	$164.75	$928.00	$160.00	$768.00	4.66	634

ECM 4: Install Occupancy Sensor Lighting Controls

Measure Description

We recommend installing occupancy sensors to better control lighting in areas that are currently only manually controlled, such as certain hallways and child rooms at the facility. Sensors detect occupancy using ultrasonic and/or infrared technologies. Lighting systems are enabled when an occupant is detected. Fixtures are automatically turned off after an area has been vacant for a preset period. Occupants will also be able to manually turn off fixtures. Energy savings result from only operating lighting systems when they are required.

Occupancy sensors may be mounted on the wall at existing switch locations or mounted on the ceiling. Ceiling-mounted or corner-mounted sensors require the use of low voltage switching relays or a wireless signal to the switch. In general, we recommend using wall switch replacement sensors for single-occupant offices and other small rooms. Install ceiling-mounted or corner mounted sensors in locations without local switching, in situations where the existing wall switches are not in the line-of-sight of the main work area, and in large spaces. We recommend a comprehensive approach that considers both the technology of the lighting sources and how they are controlled.

4.1.3 Domestic Water Heating Conservation

Domestic water heating measures include several "submeasures" as outlined in Figure 18 below.

Figure 18 - Summary of Domestic Water Heating ECMs

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
0	0.0	5.1	$43.36	$86.04	$0.00	$86.04	1.98	599

ECM 5: Install Low-Flow DHW Devices

Measure Description

This measure evaluates the savings from installing low flow domestic water devices to reduce overall water flow in general and hot water flow in particular. Low-flow showerheads and faucet aerators reduce the water flow from the fixture, relative to standard showerheads and aerators.

Reduction in overall water flow from the fixture reduces the amount of hot water used resulting in energy and water savings.

5 Energy Efficient Practices

In addition to the quantifiable savings estimated in Section 4, a facility's energy performance can also be improved through application of low or no-cost efficiency strategies. By employing certain behavioral and operational adjustments as well as performing routine maintenance on building systems, equipment lifetime can be extended; occupant comfort, health and safety can be improved; and annual energy, operation, and maintenance costs can be reduced. The recommendations below are provided as a framework for developing a whole building maintenance plan that is customized to your facility. Consult with qualified equipment specialists for details on proper maintenance and system operation.

Perform Proper Lighting Maintenance

In order to sustain optimal lighting levels, lighting fixtures should undergo routine maintenance. Light levels decrease over time due to lamp aging, lamp and ballast failure, and buildup of dirt and dust on lamps, fixtures and reflective surfaces. Together, these factors can reduce total illumination by 20 - 60% or more, while operating fixtures continue drawing full power. To limit this reduction, lamps, reflectors and diffusers should be thoroughly cleaned of dirt, dust, oil, and smoke film buildup approximately every 6 – 12 months.

Develop a Lighting Maintenance Schedule

In addition to routine fixture cleaning, development of a maintenance schedule can both ensure maintenance is performed regularly and can reduce the overall cost of fixture re-lamping and re-ballasting. By re-lamping and re-ballasting fixtures in groups, lighting levels are better maintained and the number of site visits by a lighting technician or contractor can be minimized, decreasing the overall cost of maintenance.

Ensure Lighting Controls Are Operating Properly

Lighting controls are very cost effective energy efficient devices, when installed and operating correctly. As part of a lighting maintenance schedule, lighting controls should be tested annually to ensure proper functioning. For occupancy sensors, this requires triggering the sensor and verifying that the sensor's timer settings are correct. For daylight sensors, maintenance involves cleaning of sensor lenses and confirming setpoints and sensitivity are appropriately configured.

Practice Proper Use of Thermostat Schedules and Temperature Resets

Ensure thermostats are correctly set back. By employing proper set back temperatures and schedules, facility heating and cooling costs can be reduced dramatically during periods of low or no occupancy. As such, thermostats should be programmed for a setback of 5-10°F during low occupancy hours (reduce heating setpoints and increase cooling setpoints). Cooling load can be reduced further by increasing the facility's occupied setpoint temperature. In general, during the cooling season, thermostats should be set as high as possible without sacrificing occupant comfort.

Water Conservation

Installing low flow faucets or faucet aerators, low flow showerheads, and kitchen sink pre-rinse spray valves saves both energy and water. These devices save energy by reducing the overall amount of hot water used hence reducing the energy used to heat the water. The flow ratings for EPA WaterSense™ (http://www3.epa.gov/watersense/products) labeled devices are 1.5 gallons per minute (gpm) for bathroom faucets, 2.0 gpm for showerheads, and 1.28 gpm for pre-rinse spray valves.

Installing dual flush or low flow toilets and low flow or waterless urinals are additional ways to reduce the sites water use, however, these devices do not provide energy savings at the site level. Any reduction in water use does however ultimately reduce grid level electricity use since a significant amount of electricity is used to deliver water from reservoirs to end users. The EPA WaterSense™ ratings for urinals is 0.5 gallons per flush (gpf) and toilets that use as little as 1.28 gpf (this is lower than the current 1.6 gpf federal standard).

6 SELF-GENERATION MEASURES

Self-generation measures include both renewable (e.g. solar, wind) and non-renewable (e.g. micro turbines) on-site technologies that generate power to meet all or a portion of the electric energy needs of a facility, often repurposing any waste heat where applicable. Also referred to as distributed generation, these systems contribute to Greenhouse Gas (GHG) emission reductions, demand reductions and reduced customer electricity purchases, resulting in the electric system reliability through improved transmission and distribution system utilization.

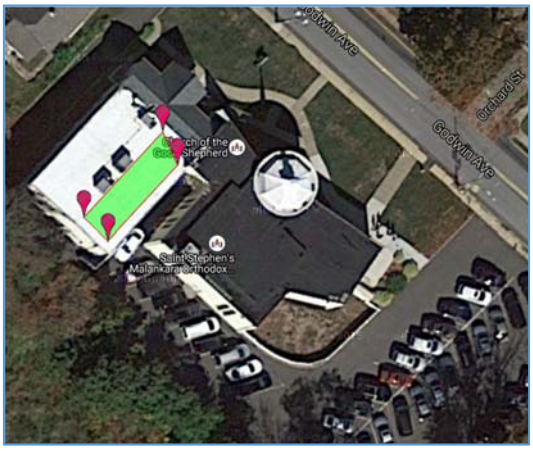
The State of New Jersey's Energy Master Plan (EMP) encourages new distributed generation of all forms and specifically focuses on expanding use of combined heat and power (CHP) by reducing financial, regulatory and technical barriers and identifying opportunities for new entries. The EMP also outlines a goal of 70% of the State's electrical needs to be met by renewable sources by 2050.

Preliminary screenings were performed to determine the potential that a generation project could provide a cost-effective solution for your facility. Before making a decision to implement, a feasibility study should be conducted that would take a detailed look at existing energy profiles, siting, interconnection, and the costs associated with the generation project including interconnection costs, departing load charges, and any additional special facilities charges.

6.1 Photovoltaic

Sunlight can be converted into electricity using photovoltaics (PV) modules. Modules are racked together into an array that produces direct current (DC) electricity. The DC current is converted to alternating current (AC) through an inverter. The inverter is interconnected to the facility's electrical distribution system. The amount of unobstructed area available determines how large of a solar array can be installed. The size of the array combined with the orientation, tilt, and shading elements determines the energy produced.

In order to be cost-effective, a solar PV array generally needs a minimum square footage of flat or south-facing rooftop, or other unshaded space, on which the PV panels are to be placed. Image 1 and Image 2 (from google maps) show two potential unshaded rooftop areas where the facility might be able to cost-effectively install solar PV array. The highlighted roof area has an orientation which is predominantly south-east.



: Left: Roof 1, Right: Roof 2 (The markings on the images indicate the possible areas for the installation of the solar panels)

Parameters	Roof 1	Roof 2
Potentially Available Rooftop Areas for Solar PV Installation	900 square foot	700 square foot
Potential Capacity of PV System	10.6 kW	9.3kW
Number of PV Panels (@ 300W per panel)	35	31
Estimated Installed Cost of PV Array	$37,100	$32,550
Estimated kWh production per year	13,507 kWh/year	11,851 kWh/year
Estimated Annual Savings ($/yr) *(@ 26.2¢/kWh)*	$3,538.83	$3,104.96
Estimated Annual SREC Income (@ $235/MWh) *(Source: http://www.njsrec.com/)*	$3,055	$2,820
Estimated Combined Simple Payback Period	5.6 yrs.	

Based on solar potential for the area, estimated using *PV-Watts*™ (an online solar calculator provided by the United States Department of Energy), we estimate that such an array might produce about 25,358 kWh per year. This could potentially offset up to 95% of the facility's current annual electricity purchases. This production of the PV array meets the pre-implementation usage of the church. If the recommended ECMs are installed, then the usage of the church goes down considerably and the PV array needs to be downsized accordingly.

Additional subsidies and/or low-interest loans for such a project may be available. We recommend that St. Stephen's Malankara Church check with a qualified solar installer to find out more on currently available solar subsidies and have a more in-depth on-site analysis done by qualified solar technicians, before making any decisions regarding whether to pursue solar development for the site.

For more information on solar PV technology and commercial solar markets in New Jersey, or to find a qualified solar installer, who can provide a more detailed assessment of the specific costs and benefits of solar develop of the site, please visit the following links below:

- **Basic Info on Solar PV in NJ**: http://www.njcleanenergy.com/whysolar
- **NJ Solar Market FAQs**: http://www.njcleanenergy.com/renewable-energy/program-updates-and-background-information/solar-transition/solar-market-faqs
- **Approved Solar Installers in the NJ Market**: http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/?id=60&start=1

6.2 Combined Heat and Power

Combined heat and power (CHP) is the on-site generation of electricity and recovery of heat which is put to beneficial use. Heat is recovered from the exhaust stream and the ancillary cooling system and interconnected to the existing hot water (or steam) distribution system.

CHP systems are typically used to produce a portion of the electricity needed by a facility, with the balance of electric needs satisfied by purchase from the grid. The heat is used to supplement (or supplant) existing boilers for the purpose of space heating and/or domestic hot water heating. Waste heat can also be routed through absorption chillers for the purpose of space cooling. The key criteria used for screening, however, is the amount of time the system operates at full load and the facility's ability to use the recovered heat. Facilities with continuous use for large quantities of waste heat are the best candidates for CHP. Due to the facility's low hot water demand, the facility has a low potential for cost-effective installation of a CHP system.

7 PROJECT FUNDING / INCENTIVES

The NJCEP is able to provide the incentive programs described below, and others, because of the Societal Benefits Charge (SBC) Fund. The SBC was created by the State of New Jersey's 1999 Electricity Restructuring Law which requires all customers of investor-owned electric and gas utilities to pay this charge on their monthly energy bills. As a contributor to the fund you were able to participate in the LGEA program and are also eligible to utilize the equipment incentive programs. Also available through the NJBPU are some alternative financing programs described later in this section. Please refer to Figure 18 for a list of the eligible programs identified for each recommended ECM.

Figure 18 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive	SmartStart Custom	Direct Install
ECM 1	Install LED Fixtures	x		x
ECM 2	Retrofit Fixtures with LED Lamps	x		x
ECM 3	Install LED Exit Signs			x
ECM 4	Install Occupancy Sensor Lighting Controls	x		x
ECM 5	Install Low-Flow Domestic Hot Water Devices			x

SmartStart is generally well suited for implementation of individual or small sets of measures, with the flexibility to install projects at your own pace using in-house staff or a preferred contractor. Direct Install caters to small to mid-size facilities to bundle measures and simplify participation, but requires the use of pre-approved contractors. The Pay for Performance (P4P) program is a "whole-building" energy improvement program designed for larger facilities and requires implementation of multiple measures meeting minimum savings thresholds, as well as use of pre-approved consultants. The Large Energy Users Program (LEUP) is available to New Jersey's largest energy users giving them flexibility to install as little or as many measures, in a single facility or several facilities, with incentives capped based on the entity's annual energy consumption; applicants can use in-house staff or preferred contractor.

Generally, the incentive values provided throughout the report assume the SmartStart program is utilized because it provides a consistent comparison of available incentives.

Brief descriptions of all relevant alternative financing and incentive programs are located in the sections below or: www.njcleanenergy.com/ci.

7.1 SmartStart

Overview

The SmartStart program offers incentives for installing prescriptive and custom energy efficiency measures at your facility. Routinely the program adds, removes or modifies incentives from year to year for various energy efficiency equipment based on market trends and new technologies.

Prescriptive Equipment Incentives Available:

Electric Chillers
Electric Unitary HVAC
Gas Cooling
Gas Heating
Gas Water Heating
Ground Source Heat Pumps
Lighting
Lighting Controls
Refrigeration Doors
Refrigeration Controls
Refrigerator/Freezer Motors
Food Service Equipment
Variable Frequency Drives

Most equipment sizes and types are served by this program. This program provides an effective mechanism for securing incentives for energy efficiency measures installed individually or as part of a package of energy upgrades.

Incentives

The SmartStart prescriptive incentive program provides fixed incentives for specific energy efficiency measures, whereas the custom SmartStart program provides incentives for more unique or specialized technologies or systems that are not addressed through prescriptive incentive offerings for specific devices.

Since your facility is an existing building, only the retrofit incentives have been applied in this report. Custom Measure incentives are calculated at $0.16/kWh and $1.60/therm based on estimated annual savings, capped at 50% of the total installed incremental project cost, or a project cost buy down to a one year payback (whichever is less). Program incentives are capped at $500,000 per electric account and $500,000 per natural gas account, per fiscal year.

How to Participate

To participate in the SmartStart program submit an application for the specific equipment to be installed. Many applications are designed as rebates, although others require application approval prior to installation. Applicants may work with a contractor of their choosing and can also utilize internal personnel, which provides added flexibility to the program. Using internal personnel also helps improve the economics of the ECM by reducing the labor cost that is included in the tables in this report.

Detailed program descriptions, instructions for applying and applications can be found at: www.njcleanenergy.com/SSB

7.2 Direct Install

Overview

Direct Install is a turnkey program available to existing small to medium-sized facilities with a peak electric demand that does not exceed 200 kW in the preceding12-monthsYou will work directly with a pre-approved contractor who will perform a free energy assessment at your facility, identify specific eligible measures, and provide a clear scope of work for installation of selected measures. Energy efficiency measures may include lighting and lighting controls, refrigeration, HVAC, motors, variable speed drives and controls.

Incentives

The program pays up to 70% of the total installed cost of eligible measures, up to $125,000 per project. Direct Install participants will also be held to a fiscal year cap of $250,000 per entity.

How to Participate

To participate in the Direct Install program you will need to contact the participating contractor who the region of the state where your facility is located. A complete list of contractors are located on the Direct Install website identified below. The contractor will be paid the measure incentives directly by the program which will pass on to you in the form of reduced material and implementation costs. This means up to 70% of eligible costs are covered by the program, subject to program caps and eligibility, while the remaining 30% of the cost is paid to the contractor by the customer.

Since Direct Install offers a free assessment, LGEA applicants that do not meet the audit program eligibility requirements, but do meet the Direct Install requirements, may be moved directly to this program.

Detailed program descriptions and applications can be found at: www.njcleanenergy.com/DI.

7.3 SREC Registration Program

The SREC Registration Program (SRP) is used to register currently planned existing solar projects in New Jersey. Owners of solar projects must register their projects in the SRP prior to the start of construction in order to be eligible to earn SRECs. The SREC program provides market participants with information about the pipeline of anticipated new solar capacity and insight into future SREC pricing.

After the registration is accepted, the construction is completed, and all final paperwork has been completed, the project will be issued a New Jersey SREC certification number which enables it to earn SRECs.

Each time a solar installation generates 1,000 kilowatt-hours (kWh) of electricity, one SREC is earned. Solar project owners report the energy production to the SREC Tracking System. This reporting allows SREC's to be placed in the customer's electronic account. SRECs can then be sold via the SREC Tracking System, providing revenue to the project for the first 15 years of the project's life.

Electricity suppliers in New Jersey must purchase SRECs or pay a Solar Alternative Compliance Payment (SACP), if they do not meet the requirements of New Jersey's Solar Renewable Portfolio Standard (RPS). They generally meet the RPS requirements is by purchasing SRECs. As SRECs are traded in a competitive market, the price may vary significantly. The actual price of an SREC during a project's lifetime may fluctuate depending on supply and demand.

Information about the SRP can be found at: www.njcleanenergy.com/srec

Appendix A: Equipment Inventory & Recommendations

Lighting Inventory & Recommendations

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Entrance	2	Incandescent: Wall mount fixture	Wall Switch	75	3,718	Relamp	No	2	LED Screw-In Lamps: Wall mount fixture	Wall Switch	11	3,718	0.10	538	0.0	$140.77	$107.51	$20.00	0.62
Entrance Hallway	13	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	3,718	Relamp	Yes	13	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	2,603	0.41	2,125	0.0	$556.13	$1,590.98	$20.00	2.82
Entrance Hallway	2	Exit Signs: Incandescent	None	45	8,760	LED Retrofit	No	2	LED Exit Signs: 2 W Lamp	None	6	8,760	0.06	772	0.0	$202.10	$215.11	$0.00	1.06
Kicthen	10	CFL Screw-In Lamps: Recessed Fixtures	Occupancy Sensor	42	2,603	Relamp	No	10	LED Screw-In Lamps: Recessed Fixture	Occupancy Sensor	10	2,603	0.26	941	0.0	$246.34	$488.53	$100.00	1.58
Kitchen exhaust	1	Incandescent: Exhaust fixture	Switch	60	52	Relamp	No	1	LED Screw-In Lamps: Hood fixture	Switch	7	52	0.04	3	0.0	$0.82	$53.75	$10.00	53.67
Kitchen	1	Exit Signs: Incandescent	None	45	8,760	LED Retrofit	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.03	386	0.0	$101.05	$107.56	$0.00	1.06
Auditorium	45	CFL Screw-In Lamps: Recessed Fixtures	Switch	42	520	Relamp	No	45	LED Screw-In Lamps: Recessed Fixture	Switch	10	520	1.17	846	0.0	$221.48	$2,198.39	$450.00	7.89
Auditoriium - On the Stage	8	CFL Screw-In Lamps: Recessed Fixtures	Switch	42	520	Relamp	No	8	LED Screw-In Lamps: Recessed Fixture	Switch	10	520	0.21	150	0.0	$39.38	$390.82	$80.00	7.89
Two storage by the stage	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,718	Relamp	No	4	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	3,718	0.18	941	0.0	$246.34	$380.53	$80.00	1.22
Bathroom - Women	6	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Occupancy Sensor	62	2,603	Relamp	No	6	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	2,603	0.14	512	0.0	$133.95	$379.20	$0.00	2.83
Bathroom - Men	6	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Occupancy Sensor	62	2,603	Relamp	No	6	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	2,603	0.14	512	0.0	$133.95	$379.20	$0.00	2.83
Prep Room	3	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Switch	62	104	Relamp	No	3	LED - Linear Tubes: (2) U-Lamp	Switch	33	104	0.07	10	0.0	$2.68	$189.60	$0.00	70.84
Church - Sanctuary	43	CFL Screw-In Lamps: Recessed Fixtures	Switch	32	208	Relamp	No	43	LED Screw-In Lamps: Recessed Fixture	Switch	10	208	0.77	222	0.0	$58.20	$2,100.68	$430.00	28.71
Church Podium	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,718	Relamp	No	16	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,718	0.43	2,218	0.0	$580.66	$936.00	$160.00	1.34
Church Podium	3	Halogen Incandescent: Spot Fixtures	Wall Switch	50	3,718	Relamp	No	3	LED Screw-In Lamps: Spot fixtures	Wall Switch	7	3,718	0.10	542	0.0	$141.87	$116.87	$15.00	0.72
Church Podium	2	Halogen Incandescent: Spot Fixtures	Wall Switch	60	3,718	Relamp	No	2	LED Screw-In Lamps: Spot fixtures	Wall Switch	10	3,718	0.08	420	0.0	$109.97	$127.30	$10.00	1.07
Narthex	9	CFL Screw-In Lamps: Recessed Fixtures	Wall Switch	42	3,718	Relamp	Yes	9	LED Screw-In Lamps: Recessed Fixture	Occupancy Sensor	10	2,603	0.26	1,323	0.0	$346.42	$555.68	$110.00	1.29
Entrance	4	CFL Screw-In Lamps: Recessed Fixtures	Wall Switch	42	3,718	Relamp	No	4	LED Screw-In Lamps: Recessed Fixture	Wall Switch	10	3,718	0.10	538	0.0	$140.77	$195.41	$40.00	1.10
Entrance	1	Exit Signs: Incandescent	None	45	8,760	LED Retrofit	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.03	386	0.0	$101.05	$107.56	$0.00	1.06
Basement	1	Exit Signs: Incandescent	None	45	8,760	LED Retrofit	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.03	386	0.0	$101.05	$107.56	$0.00	1.06
Hallway	7	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	114	2,603	Relamp	No	7	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,603	0.32	1,153	0.0	$301.77	$665.93	$140.00	1.74
Hallway	6	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Occupancy Sensor	62	2,603	Relamp	No	6	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	2,603	0.14	512	0.0	$133.95	$379.20	$0.00	2.83
Hallway	2	Exit Signs: Incandescent	None	45	8,760	LED Retrofit	No	2	LED Exit Signs: 2 W Lamp	None	6	8,760	0.06	772	0.0	$202.10	$215.11	$0.00	1.06
Pump Room	1	Incandescent: Wall mount ficture	Switch	60	20	Relamp	No	1	LED Screw-In Lamps: Wall mount fixture	Switch	7	20	0.04	1	0.0	$0.31	$53.75	$10.00	139.55
Bathroom - Women - Basement	5	CFL Screw-In Lamps: Recessed Fixtures	Occupancy Sensor	42	2,603	Relamp	No	5	LED Screw-In Lamps: Recessed Fixture	Occupancy Sensor	10	2,603	0.13	471	0.0	$123.17	$244.27	$50.00	1.58

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Stoage Closet	1	CFL Screw-In Lamps: Wall mount fixture	Wall Switch	26	3,718	Relamp	No	1	LED Screw-In Lamps: Wall mount fixture	Wall Switch	7	3,718	0.02	80	0.0	$20.89	$53.75	$10.00	2.09
Stoage Closet	1	CFL Screw-In Lamps: Wall mount fixture	Wall Switch	26	3,718	Relamp	No	1	LED Screw-In Lamps: Wall mount fixture	Wall Switch	7	3,718	0.02	80	0.0	$20.89	$53.75	$10.00	2.09
Men's Bathroom - Basement	3	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	114	2,603	Relamp	No	3	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,603	0.14	494	0.0	$129.33	$285.40	$60.00	1.74
Men's Bathroom - Basement	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Occupancy Sensor	62	2,603	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	2,603	0.02	85	0.0	$22.32	$113.46	$0.00	5.08
Kid's Classroom	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	114	2,603	Relamp	No	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,603	0.27	988	0.0	$258.66	$570.80	$120.00	1.74
Play Room	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	114	2,603	Relamp	No	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,603	0.27	988	0.0	$258.66	$570.80	$120.00	1.74
Meeting Room	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	114	2,603	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,603	0.09	329	0.0	$86.22	$190.27	$40.00	1.74
Office Room	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	114	2,603	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,603	0.09	329	0.0	$86.22	$190.27	$40.00	1.74
Playroom	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	114	2,603	Relamp	No	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,603	0.27	988	0.0	$258.66	$570.80	$120.00	1.74
Boiler Room	1	CFL Screw-In Lamps: Recessed Fixtures	Wall Switch	26	3,718	Relamp	No	1	LED Screw-In Lamps: Recessed Fixture	Wall Switch	10	3,718	0.01	67	0.0	$17.60	$48.85	$10.00	2.21
Boiler Room	2	Incandescent: Wall mount ficture	Wall Switch	60	3,718	Relamp	No	2	LED Screw-In Lamps: Wall mount fixture	Wall Switch	7	3,718	0.09	445	0.0	$116.57	$107.51	$20.00	0.75
Storage Room	1	Incandescent: Wall mount fixture	Wall Switch	60	3,718	Relamp	No	1	LED Screw-In Lamps: Wall mount fixture	Wall Switch	7	3,718	0.04	223	0.0	$58.29	$53.75	$10.00	0.75
Storage Room	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	114	2,603	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,603	0.09	329	0.0	$86.22	$190.27	$40.00	1.74
Storage Room	1	Incandescent: Wall mount fixture	Wall Switch	40	3,718	Relamp	No	1	LED Screw-In Lamps: Wall mount fixture	Wall Switch	7	3,718	0.03	139	0.0	$36.29	$53.75	$10.00	1.21
Storage Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,718	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	3,718	0.05	235	0.0	$61.59	$95.13	$20.00	1.22
Infant Sleep Room	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,718	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,603	0.36	1,850	0.0	$484.32	$686.80	$140.00	1.13
Infant Sleep Room	1	Exit Signs: Incandescent	None	45	8,760	LED Retrofit	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.03	386	0.0	$101.05	$107.56	$0.00	1.06
Toddler Room	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,718	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,603	0.54	2,775	0.0	$726.48	$972.20	$200.00	1.06
Hallway	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	3,718	Relamp	Yes	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	2,603	0.13	654	0.0	$171.12	$368.80	$20.00	2.04
Infant Room	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,718	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,603	0.24	1,234	0.0	$322.88	$496.53	$100.00	1.23
Infant Room	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,718	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,603	0.24	1,234	0.0	$322.88	$496.53	$100.00	1.23
Office	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,718	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,603	0.24	1,234	0.0	$322.88	$496.53	$100.00	1.23
Hallway	1	Exit Signs: Incandescent	Wall Switch	45	8,760	LED Retrofit	No	1	LED Exit Signs: 2 W Lamp	Wall Switch	6	8,760	0.03	386	0.0	$101.05	$107.56	$0.00	1.06
Hallway back entrance	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,718	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	3,718	0.05	235	0.0	$61.59	$95.13	$20.00	1.22
Exterior	6	High-Pressure Sodium: (1) 150W Lamp	Wall Switch	188	3,718	Fixture Replacement	No	6	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	40	3,718	0.72	3,731	0.0	$976.56	$2,344.06	$600.00	1.79

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Exterior	2	Incandescent: Wall mount fixture	Wall Switch	100	3,718	Relamp	No	2	LED Screw-In Lamps: Wall mount fixture	Wall Switch	15	3,718	0.14	714	0.0	$186.95	$195.71	$20.00	0.94

Motor Inventory & Recommendations

		Existing Conditions						Proposed Conditions				Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Annual Operating Hours	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Rooftop Unit	Chancel/Nave	1	Supply Fan	3.0	81.0%	No	2,745	No	81.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Rooftop Unit	Parish Hall	2	Supply Fan	2.0	80.0%	No	2,745	No	80.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Rooftop Unit	Entrance/Foyer	1	Supply Fan	1.0	80.0%	No	2,745	No	80.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Sewer Rejection Room	Pump	2	Other	0.5	78.2%	No	2,745	Yes	78.2%	No		0.00	0	0.0	$0.00	$1,010.26	$0.00	0.00
Basement	Men's and Women's Room	2	Exhaust Fan	0.1	60.0%	No	2,745	No	60.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
1st Floor	Men's and Women's Room	2	Exhaust Fan	0.1	60.0%	No	2,745	No	60.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Electric HVAC Inventory & Recommendations

		Existing Conditions				Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Cooling Mode Efficiency (SEER/EER)	Heating Mode Efficiency (COP)	Install Dual Enthalpy Economizer?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Rooftop	Chancel/Nave	1	Packaged AC	15.00		Yes	1	Packaged AC	15.00		11.50		Yes	4.51	10,297	0.0	$2,695.40	$21,807.75	$1,435.00	7.56
Rooftop	Parish Hall	2	Packaged AC	7.50		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Rooftop	Entrance/Foyer	1	Packaged AC	5.00		Yes	1	Packaged AC	5.00		14.00		Yes	-0.14	779	0.0	$203.88	$11,844.80	$710.00	54.61

Fuel Heating Inventory & Recommendations

		Existing Conditions			Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler room in the basement	Church and Day Care Centre	3	Furnace	120.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler room in the basement	Church and Day Care Centre	1	Condensing Hot Water Boiler	99.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Programmable Thermostat Recommendations

		Recommendation Inputs				Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	Thermostat Quantity	Cooling Capacity of Controlled System (Tons)	Electric Heating Capacity of Controlled System (kBtu/hr)	Output Heating Capacity of Controlled System (MBh)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Auditorium	Auditorium	1	7.50	192.00	120.00	0.00	1,991	7.7	$583.61	$329.87	$0.00	0.57
Church	Sanctuary	1	15.00	203.00	120.00	0.00	2,059	7.7	$601.29	$329.87	$0.00	0.55

DHW Inventory & Recommendations

		Existing Conditions		Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Church and Daycare centre	1	Storage Tank Water Heater (≤ 50 Gal)	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Low-Flow Device Recommendations

	Recommedation Inputs				Energy Impact & Financial Analysis						
Location	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Kicthen	3	Faucet Aerator (Kitchen)	2.20	2.20	0.00	0	0.0	$0.00	$21.51	$0.00	0.00
Women Bathroom	2	Faucet Aerator (Lavatory)	2.20	1.00	0.00	0	13.6	$110.06	$14.34	$0.00	0.13
Men's Bathroom	2	Faucet Aerator (Lavatory)	2.20	1.00	0.00	0	13.6	$110.06	$14.34	$0.00	0.13
Prep Room	1	Faucet Aerator (Lavatory)	2.20	1.00	0.00	0	6.8	$55.03	$7.17	$0.00	0.13
Women's Bathroom - Basement	2	Faucet Aerator (Lavatory)	2.20	1.00	0.00	0	13.6	$110.06	$14.34	$0.00	0.13
Men's Bathroom - Basement	2	Faucet Aerator (Lavatory)	2.20	1.00	0.00	0	13.6	$110.06	$14.34	$0.00	0.13

Cooking Equipment Inventory & Recommendations

	Existing Conditions			Proposed Conditions	Energy Impact & Financial Analysis						
Location	Quantity	Equipment Type	High Efficiency Equipement?	Install High Efficiency Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Gas Combination Oven/Steam Cooker (<15 Pans)	No	No	0.00	0	0.0	$0.00	$16,598.81	$750.00	0.00
Kitchen	1	Gas Convection Oven (Half Size)	No	No	0.00	0	0.0	$0.00	$7,118.81	$500.00	0.00

Plug Load Inventory

	Existing Conditions			
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
Kitchen	1	Exhaust	300.0	No
Kitchen	2	Microwave	1,000.0	No
Kitchen	2	Coffee Machine	400.0	No
Kitchen	1	Double Door - Refrigerator	750.0	No
Church - Sanctuary	4	Ceiling Fans	100.0	No
Church - Sanctuary	1	Casio Keyboard	15.0	Yes
Play Room - Basement	1	Space Heater	1,500.0	No
Office Room	1	Laptop	40.0	No
Office Room	2	Printer - Small	20.0	No
Storage Room	1	Printer - Small	20.0	No
Toddler Room	1	Fan	100.0	No
Toddler Room	2	TV	150.0	No
Infant Room	2	AC	880.0	No
Office	1	Water Dispenser	500.0	No
Office	2	Computer	75.0	No

Appendix B: ENERGY STAR® Statement of Energy Performance

ENERGY STAR® Statement of Energy Performance

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ENERGY STAR® Score[1]

St.Stephan's Malankara Orthodox Church

Primary Property Type: Worship Facility
Gross Floor Area (ft²): 15,126
Built: 1952

For Year Ending: June 30, 2016
Date Generated: September 28, 2016

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
St.Stephan's Malankara Orthodox Church 497, Godwin Avenue Midland Park, New Jersey 07432	_____ , (___)___-_____	___ _____ , (___)___-_____ _____

Property ID: 5075398

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
36.5 kBtu/ft²

Source EUI
53 kBtu/ft²

Annual Energy by Fuel	
Electric - Grid (kBtu)	106,442 (19%)
Natural Gas (kBtu)	445,774 (81%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	70.1
National Median Source EUI (kBtu/ft²)	101.8
% Diff from National Median Source EUI	-48%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	38

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)

ENERGY STAR® Scorecard

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ENERGY STAR® Score

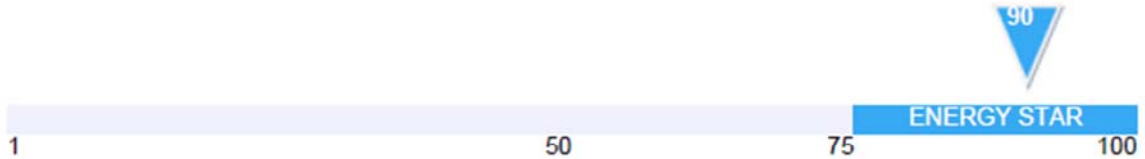
St.Stephan's Malankara Orthodox Church

Primary Function: Worship Facility
Gross Floor Area (ft²): 15,126
Built: 1952

For Year Ending: June 30, 2016
Date Generated: September 28, 2016

Property Address:
St.Stephan's Malankara Orthodox Church
497, Godwin Avenue
Midland Park, New Jersey 07432

For the year ending in June 2016, this building used 53.0 (kBtu/ft²) on a source energy basis. The Environmental Protection Agency's (EPA's) 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.



Buildings with a score of 75 or higher may qualify for EPA's ENERGY STAR.

Signature of Verifying Professional

I _____ (Name) verify that the information regarding energy use and property use details is true and correct to the best of my knowledge.

Signature: _____Date: _____