ENERGY AUDIT – FINAL REPORT

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RECREATION AND SENIOR CENTER
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I. EXECUTIVE SUMMARY

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

Ocean Township
Recreation and Senior Center
615 West Park Avenue
Oakhurst, NJ 07755

Municipal Contact Person: Andrew Brannen
Facility Contact Person: Mark Disakias

This audit was performed in connection with the New Jersey Clean Energy Local Government Energy Audit Program. These energy audits are conducted to promote the office of Clean Energy's mission, 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.

The annual energy costs at this facility are as follows:

Electricity	$ 24,141
Natural Gas	$ 4,551
Total	$ 28,692

The potential annual energy cost savings are shown below in Table 1. Be aware that the measures are not additive because of the interrelation of several of the measures. The cost of each measure for this level of auditing is ± 20% until detailed engineering, specifications, and hard proposals are obtained.

Table 1
Energy Conservation Measures (ECM's)

ECM NO.	DESCRIPTION	NET INSTALL COST[A]	ANNUAL SAVINGS	SIMPLE PAYBACK (YEARS)	SIMPLE LIFETIME ROI
1	Interior Lighting Upgrade	$565	$347	1.6	1,152%
2	Lighting Controls	$1,260	$220	5.7	162%
3	Air to Air Heat Pump Upgrade	$72,894	$513	142.0	(25%)
4	HVAC System Replacement	$53,147	$2,927	18.2	10%

Note: Net Installation Cost includes applicable incentives.

The estimated demand and energy savings are shown below in Table 2. The information in this table corresponds to the ECM's in Table 1.

Table 2
Estimated Energy Savings

ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECT DEMAND (KW)	ELECT CONSUMPTION (KWH)	NATURAL GAS (THERMS)
1	Interior Lighting Upgrade	1.12	1,747.2	-
2	Lighting Controls	-	1,356	-
3	Air to Air Heat Pump Upgrade	-	16,896	-
4	HVAC System Replacement	-	18,480	-

Recommendation:

Concord Engineering Group strongly recommends the implementation of all ECM's that provide a calculated simple payback at or under seven (7) years. The potential energy and cost savings from these ECM's are too great to pass upon. The following Energy Conservation Measures are recommended for the Ocean Township Recreation and Senior Center:

- **ECM #1: Interior Lighting Control**
- **ECM #2: Lighting Controls**

II. INTRODUCTION

This comprehensive energy audit covers the 10,442 square foot split-level Recreation and Senior Center facility that includes two (2) large halls, a basement recreation room, a kitchen, mechanical room, card room, etc.

Electrical and natural gas 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
- Facility-specific equipment

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

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. If multiple ECM's are recommended to be implemented, the combined savings is calculated and identified appropriately.

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 base 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 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:

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

$$Simple\ Lifetime\ Savings = \left(Yearly\ Savings \times ECM\ Lifetime \right)$$

$$Simple\ Lifetime\ ROI = \frac{(Simple\ Lifetime\ Savings - Net\ Cost)}{Net\ Cost}$$

$$Lifetime\ Ma\,\mathrm{int}\,enance\ Savings = \left(Yearly\ Ma\,\mathrm{int}\,enance\ Savings \times ECM\ Lifetime \right)$$

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

Table 3 and Figure 1 represent the electrical usage for the surveyed facility from January-08 to December-08. Jersey Central Power and Light (JCP&L) provides electricity to the facility under the Basic Service Generation (BGS) Rate Schedule. This electric rate has a component for consumption that is measured in kilowatt-hours (kWh). It is calculated by multiplying the wattage of the equipment times the hours that it operates. For example, a 1,000 Watt lamp operating for 5 hours would measure 5,000 Watt-hours. Since one kilowatt is equal to 1,000 Watts, the measured consumption would be 5 kWh. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the most current rate structure available.

Table 4 and Figure 2 show the natural gas energy usage for the surveyed facility from January-08 to December-08. The Ocean Recreation and Senior Center receives natural gas via New Jersey Natural Gas under the Basic Generation Service (BGS) rate. This rate has two component charges that depend on the amount of Therms used per month.

Description	Average
Electricity	16.2¢ / kWh
Natural Gas	$1.553 / Therm

Table 3
Electricity Billing Data

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
1/08	15,760	40.3	$2,433
2/08	20,080	40.3	$3,010
3/08	14,800	38.2	$2,185
4/08	10,960	40.4	$1,708
5/08	5,920	47.1	$1,083
6/08	8,160	38.3	$1,506
7/08	10,400	29.4	$1,938
8/08	8,000	27.3	$1,539
9/08	7,120	23.2	$1,185
10/08	12,880	35.9	$2,051
11/08	18,000	38.2	$2,778
12/08	16,720	37.7	$2,725
Totals	**148,800**	**47.1 Max**	**$24,141**

Figure 1
Electricity Usage Profile

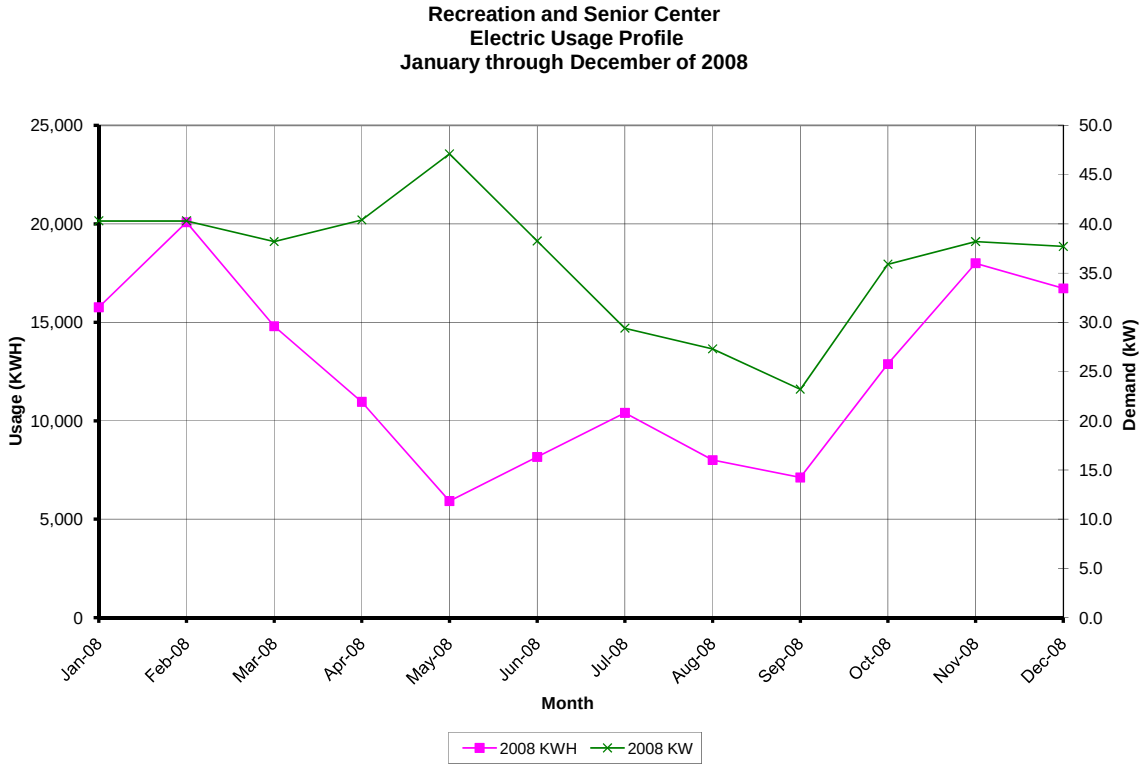
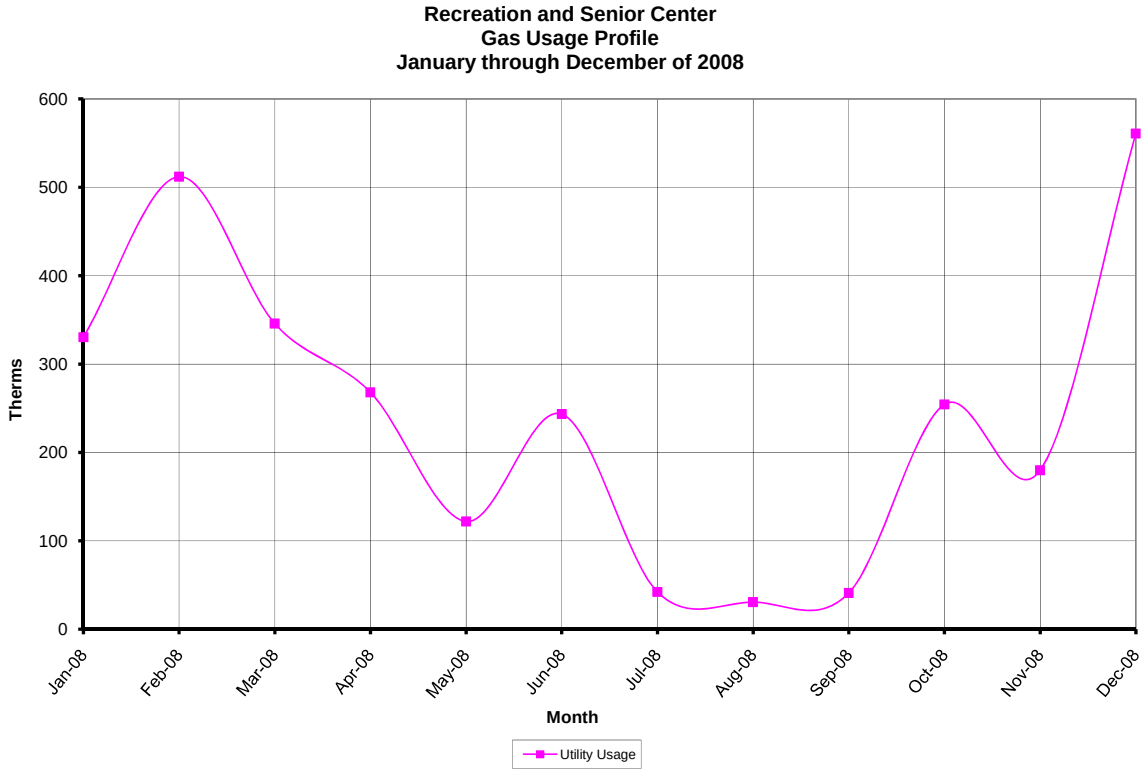


Table 4
Natural Gas Billing Data

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
1/08	330.3	$491
2/08	511.8	$753
3/08	345.8	$513
4/08	268.0	$401
5/08	121.8	$190
6/08	243.4	$366
7/08	42.1	$ 76
8/08	30.6	$ 59
9/08	41.1	$ 74
10/08	254.3	$411
11/08	179.9	$308
12/08	560.7	$907
Totals	**2,929.8**	**$4,551**

Figure 2
Natural Gas Usage Profile



B. Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's energy utilization per square foot of building. This calculation is completed by converting all utility usage (gas, electric, oil) consumed by a building over a specified time period, typically 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 amongst building of similar type. The EUI for this facility is calculated as follows:

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

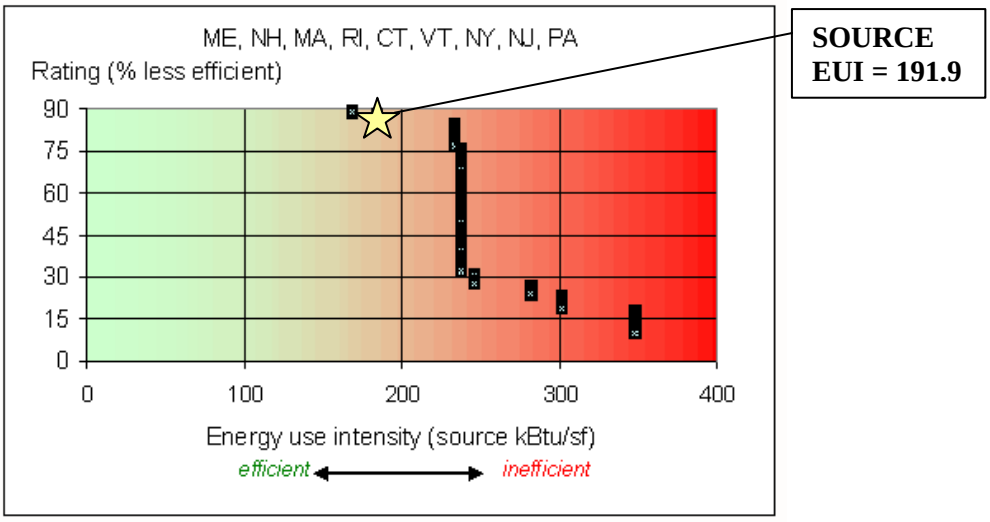
$$Electric = \frac{(148{,}800\ kWh * 1000\,{}^{W}\!/_{kW} * 3.414\,{}^{btu}\!/_{hW})}{(\frac{1000\ {}^{Btu}\!/_{h}}{1\ {}^{kBtu}\!/_{h}})} = \underline{508{,}003.2\ kBtu}$$

$$Gas = \frac{(2{,}929.8\ therms * 100{,}000\,{}^{Btu}\!/_{1\ therm})}{(\frac{1000\ {}^{Btu}\!/_{h}}{1\ {}^{kBtu}\!/_{h}})} = \underline{292{,}980\ kBtu}$$

$$Building\ \ EUI = \frac{(508{,}003.2\ kBtu + 292{,}980\ kBtu)}{10{,}442\ SF} = \frac{800{,}983.2\ kBtu}{10{,}442\ SF}$$

Recreation and Senior Center EUI = <u>76.7 kBtu/SF</u> Site Energy, <u>191.9 kBtu/SF</u> Source Energy

Figure 3
Energy Use Intensity Distributions: Senior Center



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 you to track and assess 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 more emphasis is being placed throughout multiple arenas 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. Therefore, it is vital that local government municipalities assess their energy usage, benchmark this usage utilizing Portfolio Manager, set priorities and goals to lessen their energy usage and move forward with these priorities and goals. Saving energy will in-turn save the environment.

In accordance with the Local Government Energy Audit Program, CEG has created an Energy Star account for the facility in order to allow the municipal access to monitoring their yearly energy usage as it compares to facilities of similar type. The following is the user name and password for this account:

User Name:	oceantwp
Password:	lgeaceg2009
Security Question:	What is your birth city? ocean township

Utilizing the utility bills and other information gathered during the energy audit process, CEG entered the respective data into Portfolio Manager and the following is a summary of the results:

Table 5
ENERGY STAR Performance Rating

FACILITY DESCRIPTION	ENERGY PERFORMANCE RATING	NATIONAL AVERAGE
Recreation / Senior Center	N/A	N/A

An Energy Performance Rating for this facility cannot be calculated because 10% or more of the facility is labeled by an “other” category as defined by the Energy Star Program.

Refer to Appendix D for detailed energy benchmarking report entitled “STATEMENT OF ENERGY PERFORMANCE.”

V. FACILITY DESCRIPTION

The Recreation and Senior Center is a split level building built in the mid-1960's to 70's, with the addition of the senior center in 2003. The total square footage is 10,442 ft^2, and the operating hours for the Recreation Center and the Senior Center are 30 hours and 20 hours per week, respectively. The facility contains two (2) large halls, a basement recreation room, a mechanical room, storage areas, a kitchen, and the senior room.

Heating/cooling System

The Recreation Center is heated by five (5) Amana air to air heat pump units. The evaporator/blower sections are located in the mechanical room adjacent to the large upstairs hall, with their corresponding heat pump air-cooled condensing unit at the low, flat roof on the rear of the building. The heat pump systems are well past their expected service life and appear to be from the initial construction of the facility. The five (5) split systems control five (5) individual zones within the building; the zones are broken down as follows: North Lunch Room, South Lunch Room, Basement, Upper Recreation Room, and Lobby. All the heat pumps in the mechanical room are Amana Air Command units that were manufactured in 1971 and have cooling capacities ranging from 4-5-tons per unit. The heat pump air-cooled condensing units on the roof have corresponding sizes; manufacturer varies from unit to unit.

The Senior Center is heated by a Weil-McLain gas-fired hot water boiler with a heating input of 175 MBH and an output of 133 MBH. Heat is delivered to the space via standard hot water baseboard. The Senior Center is cooled by two (2) Coleman cooling only split systems AC units, each with four (4) ton capacity. These units were installed in 2003 and have an estimated service life of twenty (20) years.

Domestic Hot Water

An A.O. Smith Energy Saver natural gas-fired hot water heater provides hot water to the recreation center. This unit has an input of 32,000 Btu/h input and a recovery rate of 32.8 gallons per hour. The water heater is six (6) years old and has a 30 gallon storage capacity.

An A.O. Smith Power Shot natural gas-fired hot water heater provides hot water to the senior center with a 40 gallon storage capacity and a recovery rate of 48.32 gallons per hour. The water heater was manufactured in 2003.

Lighting

The Recreation and Senior Center are lit by a combination of T8 and T12 light fixtures that vary in number of lamps and fixture size and style. A small number of incandescent lamps were also being utilized in the facility. Refer to Appendix F for a detailed listing of the facilities' lighting.

VI. MAJOR EQUIPMENT LIST

Following the completion of the field survey a detailed equipment list was created. The equipment within this list is considered major energy consuming equipment whose replacement could yield substantial energy savings. In addition, 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 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 Appendix E for a detailed Major Equipment List.

VII. ENERGY CONSERVATION MEASURES

ECM #1: Interior Lighting Upgrade

Description:

New fluorescent lamps and ballasts are available as direct replacements for the existing lamps and ballasts. A simple change from the old to the new can provide substantial savings. A typical drop-ceiling lay in fixture with four, 4-foot lamps (40 Watt lamps) has a total wattage of about 188 Watts. By retrofitting with new lamps, reflector and electronic ballasts the total wattage would be reduced to 91 Watts per fixture and the space light levels and light quality would increase by about 15% and 35%, respectively.

CEG recommends a replacement of the existing fixtures containing T12 lamps and magnetic ballasts with fixtures containing T8 lamps and electronic ballasts. The new energy efficient, T8 fixtures will provide adequate lighting and will save the Owner on electrical costs due to the better performance of the electronic ballasts. In addition to functional cost savings, the fixture replacement will also provide operational cost savings. The operational cost savings will be realized through the lesser number of lamps that will be required to be replaced per year. The expected lamp life of a T8 lamp, approximately 30,000 burn-hours, in comparison to the existing T12 lamps, approximately 20,000 burn-hours, will provide the Owner with fewer lamps to replace per year. Based on the operating hours of this facility, the owner will be changing approximately 33% less lamps per year.

Compact fluorescent lamps (CFL's) were created to be direct replacements for the standard incandescent lamps which are common to table lamps, spot lights, hi-hats, bathroom vanity lighting, etc. The light output of the CFL has been designed to resemble the incandescent lamp. The color rendering index (CRI) of the CFL is much higher than standard fluorescent lighting, and therefore provides a much "truer" light. The CFL is available in a myriad of shapes and sizes depending on the specific application. Typical replacements are: a 13-Watt CFL for a 40-Watt incandescent lamp, a 15-Watt CFL for a 60-Watt incandescent lamp, an 18-Watt CFL for a 75-Watt incandescent lamp, and a 23-Watt CFL for a 100-Watt incandescent lamp.

The CFL is also available for a number of "brightness colors" that is indicated by the Kelvin rating. A 2700K CFL is the "warmest" color available and is closest in color to the incandescent lamp. CFL's are also available in 3000K, 3500K, and 4100K. The 4100K would be the "brightest" or "coolest" output. A CFL can be chosen to screw right into your existing fixtures, or hardwired into your existing fixtures.

This ECM shall replace all T12 fixtures throughout the facility with new T8 fixtures. In addition, this ECM also replaces all incandescent lamps with their compact fluorescent equivalent.

Energy Savings Calculations:

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

NJ Smart Start® Program Incentives are calculated as follows:

From Appendix C, the replacement of a T-12 fixture to a T-5 or T-8 fixture warrants the following incentive: T-5 or T-8 (1-2 lamp) = $25 per fixture; T-5 or T-8 (3-4 lamp) = $30 per fixture.

$$\text{Smart Start®}\ Incentive = (\#\ of\ 1-2\ lamp\ \ fixtures \times\ \$\ 25) + (\#\ of\ 3-4\ lamp\ \ fixtures \times\ \$\ 30)$$

$$\text{Smart Start®}\ Incentive = (7 \times \$\ 25) + (0 \times \$\ 30) = \$175$$

Maintenance Savings are calculated as follows:

$$Maintenance\ Savings = (\#\ of\ \ lamps \times \%\ reduction \times \$\ \ per\ lamp) + Installation\ Labor$$

$$Maintenance\ Savings = (\ 28 \times 33\%\ reduction \times \$\ 2.00) + (\$5 \times 9) = \$64$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$740
NJ Smart Start Equipment Incentive ($):	($175)
Net Installation Cost ($):	*$565*
Annual Maintenance Savings ($ / yr):	*$64*
Annual Energy Savings ($ / yr):	*$283*
Annual Net Savings ($ / yr):	*$347*
Simple Payback (yrs):	*1.6*
Simple Lifetime Return On Investment (%):	*1,152%*
Estimated ECM Lifetime (yr):	*25*
Simple Lifetime Maintenance Savings ($)	*$1,600*
Simple Lifetime Energy Savings ($):	*$7,075*

ECM #2: Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. Many times this is due to the idea that it is better to keep the lights on rather than to continuously switch them on and off. The on/off dilemma was studied and it was found that the best option is to turn the lights off whenever possible. Although this does reduce the lamp life, the energy savings far outweigh the lamp replacement costs. The cutoff for when to turn the lights off is around two minutes. If the lights can be off for only a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is all it would take. Occupancy sensors detect motion and will switch the lights on when the room is occupied. They can either be mounted in place of the current wall switch, or they can be mounted on the ceiling to cover large areas. Lastly, photocells are a lighting control that sense light levels and will turn the lights off when there is adequate daylight. These are mostly used outside, but they are becoming much more popular in energy-efficient office designs as well.

To determine an estimated savings for lighting controls, we used ASHRAE 90.1-2004 (NJ Energy Code). Appendix G of the referenced standard, states that occupancy sensors have a 10% power adjustment factor for daytime occupancies for buildings over 5,000 SF. CEG recommends the installation of dual technology occupancy sensors in all private offices, restrooms, lunch rooms, storage rooms, locker rooms, workshops, etc. (approximately 9,350 SF).

CEG would recommend wall switches for individual rooms, ceiling mount sensors for large office areas or restrooms, and fixture mount box sensors for some applications as manufactured by Sensorswitch or equivalent.

Energy Savings Calculations:

From Appendix F of this report, we calculated the lighting power density (Watts/ft^2) of the existing offices, locker rooms, storage rooms, small shops, etc. to be ±0.93 Watts/SF. Ten percent of this value is the resultant energy savings due to installation of occupancy sensors:

Savings = 10% x 0.93 Watts/SF x 9,350SF x 1,560 hrs/yr. = 1,356 kWh x $0.162/kWh

Savings = $220 per year

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is $160/unit including material and labor.

The SmartStart Buildings® incentive is $20 per control which equates to an installed cost of $140/unit. Total number of rooms to be retrofitted is 9 with a total of 9 sensors required.

Total cost to install sensors is $140/unit x 9 units = $1,260

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,440
NJ Smart Start Equipment Incentive ($):	($180)
Net Installation Cost ($):	*$1,260*
Annual Maintenance Savings ($ / yr):	-
Annual Energy Savings ($ / yr):	*$220*
Annual Net Savings ($ / yr):	*$220*
Simple Payback (yrs):	*5.7*
Simple Lifetime Return On Investment (%):	*162%*
Estimated ECM Lifetime (yr):	*15*
Simple Lifetime Maintenance Savings ($)	-
Simple Lifetime Energy Savings ($):	*$3,300*

ECM #3: Air to Air Heat Pump Upgrade

Description:

Air-conditioning and heating is provided to the recreation center by outdated Amana split system heat pump units, five (5) units in total. The existing heat pumps are inefficient with an estimated Coefficient of Performance (COP) of 3.0 for heating and an estimated Seasonal Energy Efficiency Ratio (SEER) of 9.0 for cooling (manufacture data is not available for these units due to age). The NJ State Energy Code (ASHRAE 90.1-2004) mandates a minimum energy efficiency of 12.0 SEER for units of this type. The existing split system units are aged and have surpassed their service life as outlined in Chapter 36 of the 2007 ASHRAE Applications Handbook. The estimated service life for a heat pump (outdoor unit) is fifteen (15) years; the expected service life for the air handling section (indoor unit) is also fifteen (15) years.

This energy conservation measure will replace the existing split system heat pump units serving the facility; this involves the replacement of the heat pump, A-coil and air handling unit. Calculation is based on the following equipment: Arcoaire heat pump unit, A-coil and condensing unit. The existing units will be replaced with high energy efficient, units with capacities typical of the existing units. Negligible savings for heating will occur for this upgrade.

Cooling Energy Savings Calculations:

Existing Conditioning Characteristics

Rated Capacity = 22 Tons (total tonnage of 5 units)

Heat Pump Unit Efficiency = 9.0 SEER (cooling) / 3.0 COP (heating)

Cooling Season Hrs. of Operation = 1,800 hrs/yr.

Average Cost of Electricity = $0.162/kWh

Proposed High-Efficiency Conditioning Characteristics

Rated Capacity = 22 Tons (total tonnage of 5 units)

New Heat Pump Unit Efficiency = 15.0 SEER

$$EnergySavings = \frac{[CoolingTons \times 12{,}000\,Btu/ton]}{[1000W/kW]} \times \left(\frac{1}{SEER_{OLD}} - \frac{1}{SEER_{NEW}} \right) \times Avg.LoadFactor \times Hrs.ofCooling$$

$$EnergySavings = \frac{[22\ CoolingTons \times 12{,}000\,Btu/ton]}{[1000W/kW]} \times \left(\frac{1}{9.0\ SEER_{OLD}} - \frac{1}{15.0\ SEER_{NEW}} \right) \times 0.8 \times 1{,}800\ hours$$

$$= 16{,}896\ kWh/yr$$

Cooling Cost Savings = (16,896 kWh) * $0.162/kWh = $2,740 / Yr.

Equipment Incentives:

Cooling Smart Start Equipment Incentive = ($92/Ton) = (22 Tons x $92) = $2,024

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$74,918
NJ Smart Start Equipment Incentive ($):	($2,024)
Net Installation Cost ($):	$72,894
Annual Maintenance Savings ($ / yr):	-
Annual Energy Savings ($ / yr):	*$2,740*
Annual Net Savings ($ / yr):	*$2,740*
Simple Payback (yrs):	*26.6*
Simple Lifetime Return On Investment (%):	*(25%)*
Estimated ECM Lifetime (yr):	*20*
Simple Lifetime Maintenance Savings ($)	-
Simple Lifetime Energy Savings ($):	*$54,800*

ECM #4: HVAC System Replacement

Description:

This energy conservation measure will replace the existing split system heat pump units serving the recreation center (approximately 8,200 SF) and replace them with DX air cooled condensers and a natural gas fired furnace. This involves the demolition of the existing units, and the installation of five (5) gas furnaces, five (5) evaporator coils and five (5) air cooled condensing units. Calculation is based on the following equipment: Arcoaire condensing, A-coil and gas fired furnace. The existing units will be replaced with high energy efficient, units with capacities typical of the existing units.

Cooling Energy Savings Calculations:

Existing Conditioning Characteristics

Rated Capacity = 22 Tons (total tonnage of 5 units)

Heat Pump Unit Efficiency = 9.0 SEER (cooling) / 3.0 COP (heating)

Cooling Season Hrs. of Operation = 1,800 hrs/yr.

Average Cost of Electricity = $0.162/kWh

Proposed High-Efficiency Conditioning Characteristics

Rated Capacity = 22 Tons (total tonnage of 5 units)

New Condensing Unit Efficiency = 16.0 SEER

New Gas Fired Furnace Efficiency = 95% AFUE

Cooling Energy Savings

$$CoolingEnergySavings = \frac{[CoolingTons \times 12{,}000\,Btu/ton]}{[1000W/kW]} \times \left(\frac{1}{SEER_{OLD}} - \frac{1}{SEER_{NEW}} \right) \times Avg.LoadFactor \times Hrs.ofCooling$$

$$CoolingEnergySavings = \frac{[22\ CoolingTons \times 12{,}000\,Btu/ton]}{[1000W/kW]} \times \left(\frac{1}{9.0\ SEER_{OLD}} - \frac{1}{16.0\ SEER_{NEW}} \right) \times 0.8 \times 1{,}800\ hours$$

$$= 18{,}480\ kWh/yr \times \$0.162/kWh = \underline{\$2{,}995}$$

Natural Gas Energy Savings:

Based on the heating capacity of the existing heat pumps and the use of engineering calculations, the heat loss for the recreation center has been calculated to be approximately 287,000 Btu/h (35 Btu/h per SF, 8,200 SF).

To estimate the amount of energy consumed by the existing heat pumps or gas fired furnace throughout the heating season, the Degree Day method of energy estimating is being utilized. The equation is as follows:

$$Heating \quad EnergyUsed \quad = \frac{H_L \times DD \times Hrs}{\Delta t \times Eff \times V}$$

Where:

H_L = Building Heat Loss, BTU/Hr. (287,000 Btu/h = 84,065 Watts)

HDD = number of Heating Degree Days as Specified Base Temperature (4,888 °F for Newark, NJ)

Hrs = Hours per Day (12 hrs.)

Δt = Design temperature difference, ° F (Warm Air = 70 ° F)

Eff = Efficiency of Energy Utilization (Heat Pump = 3.0 (300%), Gas Furnace = 95%)

V = Heating value of fuel, BTU/Therm (Natural Gas = 100,000 Btu = 1 Therm, Electric = 3,414 Btu/h = 1 kW)

Estimated Energy Consumption – Heating:

$$HeatpumpEnergyUsed = \frac{(84.065\ kW) \times (4{,}888°F) \times 12\ h}{70°F \times 300\% \times (1\ kW / 3{,}414\ BTu/h)} = 80{,}162{,}616\ BTu/h = 23{,}480\ \text{kWh}$$

$$GasFurnaceEnergyUsed = \frac{(287{,}000\ Btu/h) \times (4{,}888°F) \times 12}{70°F \times 95\% \times (100{,}000\ Btu/h/1\ Therm)} = 2{,}531\ Therms$$

Heat Pump Operation Cost = 23,480 kWh x $0.162/kWh = $3,804

Gas Furnace Operation Cost = 2,531 Therms x $1.53/Therm = $3,872

Cost Difference = $3,872 - $3,804 = ($68) Savings Loss

Total Energy Savings = Cooling Savings + Heating Loss

= $2,995 + ($68) = $2,927 per year

Equipment Incentives:

Cooling Smart Start Equipment Incentive = ($92/Ton) = (22 Tons x $92) = $2,024

Heating Smart Start Equipment Incentive = ($400/Unit) = (5 Units x $400) = $2,000

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$57,171
NJ Smart Start Equipment Incentive ($):	($4,024)
Net Installation Cost ($):	$53,147
Annual Maintenance Savings ($ / yr):	-
Annual Energy Savings ($ / yr):	*$2,927*
Annual Net Savings ($ / yr):	*$2,927*
Simple Payback (yrs):	*18.2*
Simple Lifetime Return On Investment (%):	*10%*
Estimated ECM Lifetime (yr):	*20*
Simple Lifetime Maintenance Savings ($)	-
Simple Lifetime Energy Savings ($):	*$58,580*

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. CEG has assessed the feasibility of installing renewable energy technologies for Ocean Township and has concluded that there is potential for solar energy production.

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which will be 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 $350, this value was used in our financial calculations. This equates to $0.35 per kWh generated.

CEG has reviewed the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 1,058 S.F. can be utilized for a PV system on the facility. A depiction of the area utilized is shown in Appendix G. Using this square footage it was determined that a system size of 16.6 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 25,843 KWh annually, reducing the overall utility bill by 17% percent. A detailed financial analysis can be found in Appendix G. This analysis illustrates the payback of the system over a 25 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 Sun Power SPR-230 panel. This panel has a "DC" rated full load output of 230 watts, and has a total panel conversion efficiency of 18%. Although panels rated at higher wattages are available through Sun Power 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 proposed solar array 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.

CEG has reviewed financing options for the owner. Two options were studied and they are as follows: Self-financed and direct purchase without finance. Self-finance was calculated with 95% of the total project cost financed at a 7% interest rate over 25 years. Direct purchase involves the local government paying for 100% of the total project cost upfront. Both of these calculations include a utility inflation rate as well as the degradation of the solar panels over time. Based on our calculations the following are the payback periods for the respective method of payment:

PAYMENT TYPE	SIMPLE PAYBACK	INTERNAL RATE OF RETURN
Self-Finance	11.3 Years	12.3%
Direct Purchase	11.3 Years	8.0%

The resultant Internal Rate of Return indicates that if the Owner was able to "self-finance" the solar project, the project would be slightly more beneficial to the Owner. However, if the Owner was able to work out a Power Purchase Agreement with a third-party and agree upon a decent base energy rate for kilowatt hour production, the "direct purchase" option could also, prove to be a beneficial route.

Wind energy production is another option available through the Renewable Energy Incentive Program. Small wind turbines can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. CEG has reviewed the applicability of wind energy for facility and has determined it is not a viable option. The facilities electrical demand is not large enough to justify the installation of a wind turbine.

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 Section IV, Figures 1 and 2 included within this report to reference the respective electricity and natural gas usage load profile for Jan 2008 through Dec 2008.

Electricity:

Section IV, Figure 1 demonstrates an atypical cooling profile (May-September). The load profile is relatively flat, sensing there is little summertime load. The cooling is supplied by (5) split systems which may be the reason for a flat load. There is a fairly sizable increase in the winter (November-March) load consumption. Base-load shaping is important because a flat consumption profile will yield more competitive pricing when shopping for alternative energy solutions.

Natural Gas:

Section IV, Figure 2 demonstrates a typical heating load (November –March), and complimentary cooling load (April –October). Consequently there is a clear separation between summer and winter loads consistent with the manner in which energy is traded on the New York Mercantile Exchange. There are some anomalies in the load shape with spikes in June and October. But the winter load is strong (November –March) as expected with heating loads. Heating loads carry a much higher average cost because of the higher demand for natural gas during the winter season. This facility utilizes natural gas to supply energy to its heating systems.

Tariff Analysis:

Electricity:

This facility receives electrical service through Jersey Central Power & Light (JCP&L) on a GSS (General Service Secondary) rate. Service classification GS is available for general service purposes on secondary voltages not included under Service Classifications RS, RT, RGT or GST. This is a single or three phase service at secondary voltages. For electric supply (generation), the customer will use the utilities Basic Generation Service (BGS) or a Third Party Supplier (TPS). If they use the utility BGS then they will pay according to the BGS default service. The Delivery Service includes the following charges: Customer Charge, Supplemental Customer Charge, Distribution Charge (kW Demand), kWh Charge, Non-utility Generation Charge, TEFA, SBC, SCC, Standby Fee and RGGI.

Natural Gas:

The Recreation and Senior Centers receive natural gas service through New Jersey Natural Gas on a BGS (Basis Generation Service) rate class, when not receiving commodity by a Third Party Supplier. The utility tariff rate (LVG) is for firm delivery service for general purposes. Customers may either purchase gas supply from a Third Party (TPS) of from Public Services Basic Gas Supply Service default service as detailed in the rate schedule.

This rate schedules have a Delivery Charge Mechanism which includes: Balancing Charge, Societal Benefits Charge, Realignment Adjustment Charge, Margin Adjustment Charge, RGGI Charge and Customer Account Service Charge. The customer can elect to have the Supply Charge (Commodity Charge) serviced through the utility or by a Third Party Supplier (TPS). It is pertinent to note, should the TPS not deliver, the customer may receive service from PSE&G under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service.

Imbalances occur when Third Party Suppliers are used to supply natural gas, full-delivery is not made, and when a new supplier is contracted or the customer returns to the utility. It is important when utilizing a Third Party Supplier, that an experienced regional supplier is used. Otherwise, imbalances can occur, jeopardizing economics and scheduling.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities within The Township of Ocean. CEG's observations are seen in both commodities. The average price per kWh (kilowatt hour) for all buildings is $.134/kWh (kWh is the common unit of electric measure). The average price per decatherm for natural gas is $11.52/dth (dth is the common unit of measure). Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. Ocean Township could realize significant savings if it were to take advantage of these current market prices quickly, before energy increases. Based on last year's historical consumption (January –December 2008) and current fixed electric rates, the Township could see an improvement of 20%. (Note: Savings were calculated using Ocean Townships Average Annual Consumption of 1,382,755 kWh and an Average fixed one-year commodity contract). CEG recommends aggregating the entire electric load to gain the most optimal energy costs. CEG recommends advisement for alternative sourcing and supply of energy on a "managed approach".

CEG's other recommendation coincides with the natural gas cost. CEG recognized that the Township could also see improvement in its natural gas costs by a factor of over 20%. And CEG recommends further advisement on these prices. The Township should consider procuring energy (natural gas) on its own. CEG recommends alternative sourcing strategies through energy advisement.

CEG recommends that the town schedule a meeting with their current utility providers to review their utility charges and current tariff structures for electricity and natural gas. This meeting would provide insight regarding alternative procurement options that are currently available. Through its

meeting with the Local Distribution Company (LDC), the town will learn more about the competitive supply process. The utility can provide a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu, and should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the data to manage ongoing demand-side management projects. Furthermore, CEG recommends special attention to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with their utility representative. In addition, Ocean Township should also ask the utility representative about alternative billing options. Some utilities allow for consolidated billing options when utilizing the service of a Third Party Supplier.

Finally, if Ocean frequently changes its supplier for energy (natural gas), it needs to closely monitor balancing, particularly when the contract is close to termination.

X. INSTALLATION FUNDING OPTIONS

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

i. *Energy Savings Improvement Program (ESIP)* – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and par 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.

ii. *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.

iii. *Power Purchase Agreement* – Public Law 2008, Chapter 3 authorizes contractor of up to fifteen (15) years for 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.

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.

XI. ADDITIONAL RECOMMENDATIONS

The following recommendations include no cost/low cost measures, Operation & Maintenance (O&M) items, and water conservation measures with attractive paybacks. These measures are not eligible for the Smart Start Buildings incentives from the office of Clean Energy but save energy none the less.

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. Use cog-belts instead of v-belts on all belt-driven fans, etc. These can reduce electrical consumption of the motor by 2-5%.

D. Provide more frequent air filter changes to decrease overall fan horsepower requirements and maintain better IAQ.

E. Recalibrate existing sensors serving spaces.

F. Clean all light fixtures to maximize light output.

Electric Cost Summary

Jersey Centrel Power and Light (Rate - BGS)

Recreation and Senior

615 West Park Ave, Ocean NJ, 07712

2008

Account # 10 00 13 4493 4 1

Meter # G28073894

Month	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	**Total**	
Billing Days	31	28	31	30	31	30	31	31	30	31	30	31	365	
KWH	15,760	20,080	14,800	10,960	5,920	8,160	10,400	8,000	7,120	12,880	18,000	16,720	148,800	
KW	40.3	40.3	38.2	40.4	47.1	38.3	29.4	27.3	23.2	35.9	38.2	37.7	47.1	Max
Monthly Load Factor	53%	74%	52%	38%	17%	30%	48%	39%	43%	48%	65%	60%	47%	
Electric Delivery, $	$714	$824	$572	$510	$312	$396	$460	$399	$301	$455	$542	$646	$6,130	
Delivery $/kwh	$0.045	$0.041	$0.039	$0.047	$0.053	$0.049	$0.044	$0.050	$0.042	$0.035	$0.030	$0.039	$0.041	
Electric Supply, $	$1,719	$2,185	$1,614	$1,198	$771	$1,110	$1,479	$1,140	$884	$1,596	$2,236	$2,078	$18,011	
Supply $/kwh	$0.109	$0.109	$0.109	$0.109	$0.130	$0.136	$0.142	$0.143	$0.124	$0.124	$0.124	$0.124	$0.121	
Total Cost, $	$2,433	$3,010	$2,185	$1,708	$1,083	$1,506	$1,938	$1,539	$1,185	$2,051	$2,778	$2,725	$24,141	
$/KWH	$0.154	$0.150	$0.148	$0.156	$0.183	$0.185	$0.186	$0.192	$0.166	$0.159	$0.154	$0.163	**$0.162**	

Estimated utility information. Utility bill not provided by owner.

Summary of Natural Gas Cost

New Jersey Natural Gas (Rate - BGS)

Recreation and Senior

615 West Park Ave, Ocean NJ, 07712

2008

Account # 22-0008-1249-13

Meter # 00719733

Month	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	**Total**
Billing Days	31	28	31	30	31	30	31	31	30	31	30	31	365
Therms (Burner Tip)	330.3	511.8	345.8	268.0	121.8	243.4	42.1	30.6	41.1	254.3	179.9	560.7	2,929.8
Total Distribution Cost	$330	$512	$345	$268	$122	$243	$42	$31	$41	$356	$283	$882	3,454
Cost per Therm	$0.999	$0.999	$0.999	$0.999	$0.999	$0.999	$0.999	$0.999	$0.999	$1.398	$1.574	$1.573	$1.179
Total Commodity Cost	$161	$241	$168	$134	$69	$123	$34	$29	$33	$56	$25	$25	1,097
Cost per Therm	$0.49	$0.47	$0.49	$0.50	$0.57	$0.50	$0.80	$0.94	$0.81	$0.22	$0.14	$0.04	$0.37
Total Cost	$491	$753	$513	$401	$191	$366	$76	$59	$74	$411	$308	$907	$4,551
Cost per Therm	$1.487	$1.471	$1.485	$1.497	$1.565	$1.504	$1.800	$1.935	$1.808	$1.617	$1.713	$1.618	**$1.553**

CONSTRUCTION COST AND REBATES

CONCORD ENGINEERING GROUP

Recreation and Senior Center

ECM 1 Interior Lighting Upgrade

	Qty	Unit Cost $	Material $	Labor $	Total $
Lighting Fixture Replacement	LS	$740	$0	$0	$740
Total Cost			$0	$0	$740
Utility Incentive - NJ Smart Start					($175)
Total Cost Less Incentive					$565

ECM 2 LIGHTING CONTROLS

	Qty	Unit Cost $	Material $	Labor $	Total $
Dual - Technology Sensor	9	$160	$720	$720	$1,440
Total Cost			$720	$720	$1,440
Utility Incentive - NJ Smart Start					($180)
Total Cost Less Incentive					$1,260

ECM 3 Air to Air Heat Pump Upgrade

	Qty	Unit Cost $	Material $	Labor $	Total $
4-Ton Arcoaire Heat Pump	3	$9,518	$6,345	$3,173	$28,553
5-Ton Arcoaire Heat Pump	2	$10,509	$7,006	$3,503	$21,018
4-Ton A-Coil	3	$1,107	$738	$369	$3,321
5-Ton A-Coil	2	$1,269	$846	$423	$2,538
4-Ton Air Handling Unit	3	$3,732	$2,488	$1,244	$11,196
5-Ton Air Handling Unit	2	$4,146	$2,764	$1,382	$8,292
Total Cost			$20,187	$10,094	$74,918
Utility Incentive - NJ Smart Start					($2,024)
Total Cost Less Incentive					$72,894

ECM 4 HVAC System Replacement

	Qty	Unit Cost $	Material $	Labor $	Total $
4-Ton Arcoaire Condensing Unit	3	$6,954	$4,636	$2,318	$20,862
5-Ton Arcoaire Condensing Unit	2	$7,815	$5,210	$2,605	$15,630
4-Ton A-Coil	3	$1,107	$738	$369	$3,321
5-Ton A-Coil	2	$1,269	$846	$423	$2,538
Natural Gas Furnace	5	$2,964	$1,976	$988	$14,820
Total Cost			$13,406	$6,703	$57,171
Utility Incentive - NJ Smart Start					($4,024)
Total Cost Less Incentive					$53,147

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 as of January, 2009:

Electric Chillers

Water-Cooled Chillers	$12 - $170 per ton
Air-Cooled Chillers	$8 - $52 per ton

Gas Cooling

Gas Absorption Chillers	$185 - $400 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 - $93 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

Ground Source Heat Pumps

Closed Loop & Open Loop	$370 per ton

Gas Heating

Gas Fired Boilers < 300 MBH	$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	$300 - $400 per unit

Variable Frequency Drives

Variable Air Volume	$65 - $155 per hp
Chilled-Water Pumps	$60 per hp
Compressors	$5,250 to $12,500 per drive

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons	$50 per unit
Gas-Fired Water Heaters >50 gallons	$1.00 - $2.00 per MBH
Gas-Fired Booster Water Heaters	$17 - $35 per MBH

Premium Motors

Three-Phase Motors	$45 - $700 per motor

Prescriptive Lighting

T-5 and T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 - $30 per fixture, (depending on quantity)
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start	$25 per fixture
LED Exit Signs	$10 - $20 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $284 per fixture

Lighting Controls – Occupancy Sensors

Wall Mounted	$20 per control
Remote Mounted	$35 per control
Daylight Dimmers	$25 per fixture
Occupancy Controlled hi-low Fluorescent Controls	$25 per fixture controlled

Lighting Controls – HID or Fluorescent Hi-Bay Controls

Occupancy hi-low	$75 per fixture controlled
Daylight Dimming	$75 per fixture controlled

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2004 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive

STATEMENT OF ENERGY PERFORMANCE
Recreation and Senior Center

Building ID: 1774935
For 12-month Period Ending: December 31, 2008[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: August 11, 2009

Facility
Recreation and Senior Center
615 West Park Ave
Ocean, NJ 07712

Facility Owner
Township of Ocean
399 Monmouth Rd.
Oakhurst, NJ 07755

Primary Contact for this Facility
Andrew Brannen
399 Monmouth Rd.
Oakhurst, NJ 07755

Year Built: 1960
Gross Floor Area (ft²): 10,442

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

Site Energy Use Summary[3]

Natural Gas (kBtu)[4]	302,980
Electricity (kBtu)	507,706
Total Energy (kBtu)	810,686

Energy Intensity[5]

Site (kBtu/ft²/yr)	78
Source (kBtu/ft²/yr)	193

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	93

Electric Distribution Utility
Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	65
National Average Source EUI	136
% Difference from National Average Source EUI	42%
Building Type	Recreation

Stamp of Certifying Professional

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

Meets Industry Standards[6] **for Indoor Environmental Conditions:**

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

Certifying Professional
Raymond Johnson
520 S. Burnt Mill Rd
Voorhees, NJ 08043

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

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.
NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Recreation and Senior Center	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Recreation	Is this an accurate description of the space in question?		☐
Location	615 West Park Ave, Ocean, NJ 07712	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐
Recreation & Senior Center (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	10,442 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Number of PCs	0 (Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	30 Hours(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	1 (Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Jersey Central Power & Lt Co

Fuel Type: Electricity

Meter: Rec and Sr. Electric (kWh (thousand Watt-hours))
Space(s): Entire Facility

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
12/01/2008	12/31/2008	16,720.00
11/01/2008	11/30/2008	18,000.00
10/01/2008	10/31/2008	12,880.00
09/01/2008	09/30/2008	7,120.00
08/01/2008	08/31/2008	8,000.00
07/01/2008	07/31/2008	10,400.00
06/01/2008	06/30/2008	8,160.00
05/01/2008	05/31/2008	5,920.00
04/01/2008	04/30/2008	10,960.00
03/01/2008	03/31/2008	14,800.00
02/01/2008	02/29/2008	20,080.00
01/01/2008	01/31/2008	15,760.00
Rec and Sr. Electric Consumption (kWh (thousand Watt-hours))		**148,800.00**
Rec and Sr. Electric Consumption (kBtu)		**507,705.60**
Total Electricity Consumption (kBtu)		**507,705.60**
Is this the total Electricity consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

Meter: Rec and Sr Gas (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
12/01/2008	12/31/2008	560.70
11/01/2008	11/30/2008	179.90
10/01/2008	10/31/2008	254.30
09/01/2008	09/30/2008	41.10
08/01/2008	08/31/2008	30.60
07/01/2008	07/31/2008	42.10
06/01/2008	06/30/2008	343.40
05/01/2008	05/31/2008	121.80
04/01/2008	04/30/2008	268.00

03/01/2008	03/31/2008	345.80
02/01/2008	02/29/2008	511.80
01/01/2008	01/31/2008	330.30
Rec and Sr Gas Consumption (therms)		**3,029.80**
Rec and Sr Gas Consumption (kBtu)		**302,980.00**
Total Natural Gas Consumption (kBtu)		**302,980.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

Additional Fuels	
Do the fuel consumption totals shown above represent the total energy use of this building? Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.	☐

Certifying Professional

(When applying for the ENERGY STAR, this must be the same PE that signed and stamped the SEP.)

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
Recreation and Senior Center
615 West Park Ave
Ocean, NJ 07712

Facility Owner
Township of Ocean
399 Monmouth Rd.
Oakhurst, NJ 07755

Primary Contact for this Facility
Andrew Brannen
399 Monmouth Rd.
Oakhurst, NJ 07755

General Information

Recreation and Senior Center	
Gross Floor Area Excluding Parking: (ft^2)	10,442
Year Built	1960
For 12-month Evaluation Period Ending Date:	December 31, 2008

Facility Space Use Summary

Recreation & Senior Center	
Space Type	Other - Recreation
Gross Floor Area(ft^2)	10,442
Number of PCs[o]	0
Weekly operating hours[o]	30
Workers on Main Shift[o]	1

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 12/31/2008)	**Baseline** (Ending Date 12/31/2008)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft^2)	78	78	0	N/A	65
Source (kBtu/ft^2)	193	193	0	N/A	136
Energy Cost					
$/year	$ 28,695.00	$ 28,695.00	N/A	N/A	$ 24,023.38
$/$ft^2$/year	$ 2.75	$ 2.75	N/A	N/A	$ 2.30
Greenhouse Gas Emissions					
$MtCO_2e$/year	93	93	0	N/A	78
$kgCO_2e/ft^2$/year	9	9	0	N/A	8

More than 50% of your building is defined as Recreation. This building is currently ineligible for a rating. Please note the National Average column represents the CBECS national average data for Recreation. This building uses X% less energy per square foot than the CBECS national average for Recreation.

Notes:
o - This attribute is optional.
d - A default value has been supplied by Portfolio Manager.

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Recreation and Senior Center"

Boiler

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life
Rear Mech. Room	Senior Center	Weil McLain	1	GV-6	4	175	133	87	Natural Gas	6	35	29

Domestic Hot Water Heater

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Input (MBh)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life
Rec. Center	Rec Center	Ao Smith	1	FSG 30 248	MK02-2001801-248	32	32.8	30	-	Natural Gas	8	12	4
Rear Mech. Room	Senior Center	Ao Smith	1	FPSH40270	MK030000972	46	48.32	40	-	Natural Gas	6	12	6

Air Handling Units

Location	Area Served	Manufacturer	Qty	Unit Tag	Model #	Serial #	Cooling Coil	Cooling Capacity	Heating Type	Heating Input (MBh)	Fan HP	Fuel	Volts	Phase	Hz	Approx. Age	ASHRAE Service Life	Remaining Life
Heat Pump Room	Lobby	Amana	1	#1	BBH4825M-B	SC71000335	DX R-22	4 Ton	Heat Pump	45.6	1/3	Electric	-	1	60	38	15	-23
Heat Pump Room	Upper Rec Room	Amana	1	#2	BBH4825M-B	SC71000308	DX R-22	4 Ton	Heat Pump	45.6	1/3	Electric	-	1	60	38	15	-23
Heat Pump Room	Basement	Amana	1	#3	BBH4825M-B	SC71000302	DX R-22	4 Ton	Heat Pump	45.6	1/3	Electric	-	1	60	38	15	-23
Heat Pump Room	Lunch Room North	Amana	1	#4	BBH6025M-B	SB71300183	DX R-22	5 Ton	Heat Pump	57	1/2	Electric	-	1	60	38	15	-23
Heat Pump Room	Lunch Room South	Amana	1	#5	BBH6025M-B	-	DX R-22	5 Ton	Heat Pump	57	1/2	Electric		1	60	38	15	-23
Rear Mech. Room	Senior Center	Coleman	2	AHU #1	F2FP060H06B	XAMS021875	DX R-22	4 Ton	Cooling Only	N/A	3/4	Electric	208-230	3	60	6	15	9
				AHU #2		XFMS153934												

Heat Pumps

Location	Area Served	Manufacturer	Qty.	Unit Tag	Model #	Serial #	Cooling Capacity	Cooling Efficiency	Heating Input (MBh)	COP	Refrigerant	Volts	Phase	Hz	Approx. Age	ASHRAE Service Life	Remaining Life
Rear Roof	Lobby	Heil	1	#1	NCHH048AHAAOT	-	4 Ton	9.0 SEER	45.6	3.0	R-22	208-230	3	60	20	15	-5
Rear Roof	Upper Rec Room	Heritage	1	#2	GC0048A300A3	R251NXJHF	4 Ton	9.0 SEER	45.6	3.0	R-22	230	3	60	9	15	6
Rear Roof	Basement	Whirlpool	1	#3	PSS201-520	RC68100163	4 Ton	9.0 SEER	45.6	3.0	R-22	208-230	3	60	20	15	-5
Rear Roof	Lunch Room North	Comercial Comfort	1	#4	CHC060HAA	L01136G245	6 Ton	9.0 SEER	57	3.0	R-22	230	3	60	20	15	-5
Rear Roof	Lunch Room South	Heil	1	#5	PSS201-880	HA72016056	6 Ton	9.0 SEER	57	3.0	R-22	208-230	3	60	20	15	-5

Notes: Heating capacity not available in field, capacity shown based on closet manufacturers data.

Condensing Units

Location	Area Served	Manufacturer	Qty.	Unit Tag	Model #	Serial #	Cooling Capacity	Cooling Eff. (SEER)	Refrigerant	Volts	Phase	Hz	Approx. Age	ASHRAE Service Life	Remaining Life
Exterior Rear Mech	Senior Center	Coleman	1	CU-1 (AHU-1)	HABA - T048SA	WKMM060587	4 Ton	10.0	R-22	230	3	60	6	20	14
Exterior Rear Mech	Senior Center	Coleman	1	CU-2 (AHU-2)	HABA - T048SA	WKMM024108	4 Ton	10.0	R-22	230	3	60	6	20	14

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C09048
Project: Ocean Twp.
Address: 615 West Park Ave.
City: Ocean, NJ 07712
Building SF: 10,442

"Recreation and Senior Center"

DATE: 8/14/2009
KWH COST: $0.162

EXISTING LIGHTING											PROPOSED LIGHTING								SAVINGS			
Line No.		Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost		No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
1		HP Room	3	100 W Incandescent	1560	100	0.30	468	$75.82		3	Install 23 Watt Compact Fluorescent Lamp	23	0.07	107.64	$17.44	$8.00	$24.00	0.23	360.36	58.37832	0.41
2		Upstairs Hall	23	2' x 2' 2-L U-tube T-8, Prism Lens, Electronic Ballast	1560	73	1.68	2619.24	$424.32		0	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
3		Corridor	4	2' x 2' 2-L U-tube T-8, Prism Lens, Electronic Ballast	1560	73	0.29	455.52	$73.79		0	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
4			3	2' x 4' 4-Lamp T-8, Prism Lens, Electronic Ballast	1560	109	0.33	510.12	$82.64		0	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
5		Basement Rec Room	15	4' 2-Lamp T-8, Prism Lens, Electronic Ballast, Below Ceiling Mount	1560	58	0.87	1357.2	$219.87		0	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
6		Basement Storage	7	4' 4-Lamp T-12, Prism Lens, Magnetic Ballast	1560	160	1.12	1747.2	$283.05		7	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.39	600.6	$97.30	$100.00	$700.00	0.74	1146.6	185.7492	3.77
7		Restrooms	8	2' x 2' 2-L U-tube T-8, Prism Lens, Electronic Ballast	1560	73	0.58	911.04	$147.59		0	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
8		1st Floor Hall	35	2' x 2' 2-L U-tube T-8, Prism Lens, Electronic Ballast	1560	73	2.56	3985.8	$645.70		0	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
9		Electrical Room	2	100 W Incandescent	1560	100	0.20	312	$50.54		2	Install 23 Watt Compact Fluorescent Lamp	23	0.05	71.76	$11.63	$8.00	$16.00	0.15	240.24	38.91888	0.41
10		1st Hall Kitchen	10	2' x 2' 2-L U-tube T-8, Prism Lens, Electronic Ballast	1560	73	0.73	1138.8	$184.49		0	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
11		Card Room	17	2' x 4' 2-Lamp T-8, Prism Lens, Electronic Ballast	1040	58	0.99	1025.44	$166.12		0	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
12		Boiler Room	2	4' 2-Lamp T-8, Prism Lens, Electronic Ballast, Below Ceiling	1040	58	0.12	120.64	$19.54		0	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	0	0.00
		Totals	129				9.76	14651	$2,373.46		12			0.50	780	$126.36		$740.00	1.12	1747.2	$283.05	2.61

Project Name: LGEA Solar PV Project - Recreation and Senior Center
Location: Oakhurst, NJ
Description: Photovoltaic System 95% Financing - 20 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 20 year
Total Construction Cost	$149,040
Annual kWh Production	25,843
Annual Energy Cost Reduction	$4,187
Annual SREC Revenue	$9,045
First Cost Premium	**$149,040**
Simple Payback:	**11.26** Years

Life Cycle Cost Analysis

Analysis Period (years): 25
Financing Term (mths): 240
Average Energy Cost ($/kWh) **$0.162**
Financing Rate: 7.00%
Financing %: 95%
Maintenance Escalation Rate: 3.0%
Energy Cost Escalation Rate: 3.0%
SREC Value ($/kWh) $0.350

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	$7,452	0	0	0	$0	0	0	(7,452)	0
1	$0	25,843	$4,187	$0	$9,045	$9,804	$3,368	$59	($7,393)
2	$0	25,713	$4,312	$0	$9,000	$9,561	$3,612	$139	($7,254)
3	$0	25,585	$4,441	$0	$8,955	$9,300	$3,873	$223	($7,031)
4	$0	25,457	$4,575	$0	$8,910	$9,020	$4,153	$312	($6,719)
5	$0	25,330	$4,712	$261	$8,865	$8,720	$4,453	$144	($6,575)
6	$0	25,203	$4,853	$260	$8,821	$8,398	$4,775	$242	($6,333)
7	$0	25,077	$4,999	$258	$8,777	$8,053	$5,120	$345	($5,989)
8	$0	24,952	$5,149	$257	$8,733	$7,682	$5,490	$452	($5,536)
9	$0	24,827	$5,303	$256	$8,689	$7,286	$5,887	$564	($4,972)
10	$0	24,703	$5,462	$254	$8,646	$6,860	$6,313	$681	($4,291)
11	$0	24,579	$5,626	$253	$8,603	$6,404	$6,769	$803	($3,488)
12	$0	24,456	$5,795	$252	$8,560	$5,914	$7,259	$930	($2,558)
13	$0	24,334	$5,969	$251	$8,517	$5,390	$7,783	$1,062	($1,495)
14	$0	24,212	$6,148	$249	$8,474	$4,827	$8,346	$1,200	($295)
15	$0	24,091	$6,332	$248	$8,432	$4,224	$8,949	$1,344	$1,049
16	$0	23,971	$6,522	$247	$8,390	$3,577	$9,596	$1,493	$2,541
17	$0	23,851	$6,718	$246	$8,348	$2,883	$10,290	$1,648	$4,189
18	$0	23,732	$6,920	$244	$8,306	$2,139	$11,034	$1,809	$5,997
19	$0	23,613	$7,127	$243	$8,265	$1,341	$11,831	$1,976	$7,973
20	$0	23,495	$7,341	$242	$8,223	$486	$12,687	$2,150	$10,123
21	$0	23,378	$7,561	$241	$8,182	$412	$11,663	$3,428	$13,550
22	$0	23,261	$7,788	$240	$8,141	$282	$9,597	$5,810	$19,360
23	$0	23,144	$8,022	$238	$8,101	$0	$0	$15,884	$35,244
24	$0	23,029	$8,262	$237	$8,060	$0	$0	$16,085	$51,330
25	$0	22,913	$8,510	$236	$8,020	$0	$0	$16,294	$67,624
	Totals:	493,023	$112,493	$4,021	$172,558	$121,867	$141,588	$162,848	$149,049
					Net Present Value (NPV)			**$9,679**	
					Internal Rate of Return (IRR)			**12.3%**	

Project Name: LGEA Solar PV Project - Recreation and Senior Center
Location: Oakhurst, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$149,040
Annual kWh Production	25,843
Annual Energy Cost Reduction	$4,187
Annual SREC Revenue	$9,045
First Cost Premium	**$149,040**
Simple Payback:	**11.26** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.162**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Cumulative Cash Flow
0	$149,040	0	0	0	$0	(149,040)	0
1	$0	25,843	$4,187	$0	$9,045	$13,231	($135,809)
2	$0	25,713	$4,312	$0	$9,000	$13,312	($122,497)
3	$0	25,585	$4,441	$0	$8,955	$13,396	($109,101)
4	$0	25,457	$4,575	$0	$8,910	$13,485	($95,616)
5	$0	25,330	$4,712	$261	$8,865	$13,316	($82,300)
6	$0	25,203	$4,853	$260	$8,821	$13,415	($68,885)
7	$0	25,077	$4,999	$258	$8,777	$13,518	($55,367)
8	$0	24,952	$5,149	$257	$8,733	$13,625	($41,742)
9	$0	24,827	$5,303	$256	$8,689	$13,737	($28,005)
10	$0	24,703	$5,462	$254	$8,646	$13,854	($14,151)
11	$0	24,579	$5,626	$253	$8,603	$13,976	($175)
12	$0	24,456	$5,795	$252	$8,560	$14,103	$13,928
13	$0	24,334	$5,969	$251	$8,517	$14,235	$28,163
14	$0	24,212	$6,148	$249	$8,474	$14,373	$42,536
15	$0	24,091	$6,332	$248	$8,432	$14,516	$57,052
16	$0	23,971	$6,522	$247	$8,390	$14,665	$71,717
17	$0	23,851	$6,718	$246	$8,348	$14,820	$86,538
18	$0	23,732	$6,920	$244	$8,306	$14,981	$101,519
19	$0	23,613	$7,127	$243	$8,265	$15,149	$116,668
20	$0	23,495	$7,341	$242	$8,223	$15,322	$131,990
21	$1	23,378	$7,561	$241	$8,182	$15,503	$147,493
22	$2	23,261	$7,788	$240	$8,141	$15,690	$163,182
23	$3	23,144	$8,022	$238	$8,101	$15,884	$179,066
24	$4	23,029	$8,262	$237	$8,060	$16,085	$195,151
25	$5	22,913	$8,510	$236	$8,020	$16,294	$211,445
	Totals:	493,023	$112,493	$4,021	$172,558	$360,485	$281,030
				Net Present Value (NPV)		**$211,470**	
				Internal Rate of Return (IRR)		**8.0%**	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Recreation and Senior Center	1058	Sunpower SPR230	72	14.7	1,059	16.6	25,843	2,376	15.64

.= Proposed PV Layout

Notes:

1. Estimated kWH based on 4.68 hours full output per day per 365 day year. Actual kWH will vary day to day.