

BOROUGH OF CAPE MAY POINT

ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT FOR THE MUNICIPAL, MAINTENANCE, AND PUMP HOUSE FACILITIES

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I. EXECUTIVE SUMMARY

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

Borough of Cape May Point
215 Light house Avenue
Cape May Point, NJ 08212

Municipal Contact Person: Carl F. Schopp

This report covers the following three (3) facilities owned by the Borough.

Ref. #	Facility Name	Area (Sqft)	Address
82	Municipal Building	3,512	15 Lighthouse Ave.
83	Maintenance Building	3,500	Lighthouse Ave. & Sunset Blvd.
84	Water Pump Station	900	Sunset Blvd

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

The annual energy costs at these facilities are as follows:

Ref. #	Facility Name	Electricity	Propane	Water	Total
82	Municipal Building	\$4,255	\$1,762	\$213,766	\$219,783
83	Maintenance Building	\$2,923	\$1,084	-	\$4,007
84	Water Pump Station	\$12,402	\$0	-	\$12,402
	Total	\$19,580	\$2,846	\$213,766	\$236,193

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

Table 1

Financial Summary Table

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	DESCRIPTION	NET INSTALLATION COST ^A	ANNUAL SAVINGS ^B	SIMPLE PAYBACK (Yrs)	SIMPLE LIFETIME ROI
82 - ECM #1	Lighting Upgrade	\$1,301	\$797	1.6	818.3%
82 - ECM #2	Lighting Controls Upgrade	\$2,015	\$154	13.1	14.6%
82 - ECM #3	HVAC System Upgrade	\$28,556	\$1,811	15.8	-4.9%
83 - ECM #1	Lighting Upgrade	\$3,500	\$693	5.1	196.8%
83 - ECM #2	Lighting Controls Upgrade	\$250	\$20	12.4	-3.6%
83 - ECM #3	Window Replacement	\$2,400	\$109	22.0	-45.5%
84 - ECM #1	Lighting Upgrade	\$218	\$28	7.9	90.4%
84 - ECM #2	Lighting Controls Upgrade	\$250	\$47	5.3	183.3%
84 - ECM #3	Premium Efficiency Motor Replacement	\$18,138	\$190	95.5	-84.3%
84 - ECM #4	Electric to Gas Unit Heater	\$6,040	\$1,242	4.9	208.4%
ECM #11	Propane to Natural Gas Conversion	\$900	\$1,312	0.7	2086.7%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	DESCRIPTION	NET INSTALLATION COST	ANNUAL SAVINGS	SIMPLE PAYBACK (Yrs)	SIMPLE LIFETIME ROI
REM #1	43.7 KW Roof Solar Array	\$349,600	\$25,812	13.5	84.6%
REM #2	2.4 kW Wind Turbine	\$25,602	\$428	59.8	-74.9%
Notes:		A. Cost takes into consideration applicable NJ Smart Start™ incentives.			
		B. Savings takes into consideration applicable maintenance savings.			

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

Table 2
Estimated Energy Savings Summary Table

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	PROPANE (GAL)
82 - ECM #1	Lighting Upgrade	1.8	3,259.6	0.0
82 - ECM #2	Lighting Controls Upgrade	0.5	841.6	0.0
82 - ECM #3	HVAC System Upgrade	0.0	2,781.0	689.00
83 - ECM #1	Lighting Upgrade	2.6	3,763.0	0.0
83 - ECM #2	Lighting Controls Upgrade	0.1	109.2	0.0
83 - ECM #3	Window Replacement	0.0	30.0	52.0
84 - ECM #1	Lighting Upgrade	10.0	592.8	0.0
84 - ECM #2	Lighting Controls Upgrade	0.4	274.0	0.0
84 - ECM #3	Premium Efficiency Motor Replacement	1.5	1,107.0	0.0
84 - ECM #4	Electric to Gas Unit Heater	0.4	16,306.0	(744.0)
ECM #11	Propane to Natural Gas Conversion	0.0	0.0	(1,450.0)
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	43.7 KW Roof Solar Array	43.7	52463.0	0.0
REM #2	2.4 kW Wind Turbine	2.4	2937.0	0.0

The Energy Conservation Measures (ECMs) identified within the report represents the potential annual savings at the facility. It is recommended to consider all ECMs as part of the Borough's initiative to save energy, reduce emissions, and lower operating costs. Concord Engineering Group (CEG) recommends proceeding with the implementation of all ECM's that provide a calculated simple payback at or under ten (10) years. All of the ECM's presented in this report have been categorized into three groups defined as Short-term (or Fast) Paybacks ranging from 0 to 5 years, Medium-term Paybacks ranging from 5 to 10 years, and Long-term Paybacks of over 10 years to assist the Borough in prioritizing projects.

Short-term Payback Energy Conservation Measures:

The following Energy Conservation Measures (ECMs) identified with a simple payback of 0 to 5 years are considered very cost effective and should be considered a high priority for the Borough. It should be noted that in many cases ECM's lying in this range can be performed utilizing qualified "in house" staff that can further reduce the payback period.

- 82 – ECM #1: Lighting Upgrade
- 84 – ECM #4: Electric to Gas Unit Heater
- ECM #11: Propane to Natural Gas Conversion

While Natural Gas is not currently available at the facility it is expected to be within the next year to two years.

Medium-term Payback Energy Conservation Measures:

The following Energy Conservation Measures (ECMs) identified with a simple payback of 5 to 10 years are considered cost effective and should be considered by the Borough. In many cases these measures can provide significant savings, however the costs to implement are higher, stretching the payback beyond five years.

- 83 – ECM #1: Lighting Upgrade
- 83 – ECM #2: Lighting Controls Upgrade
- 84 – ECM #1 Lighting Upgrade
- 84 – ECM #2: Lighting Controls Upgrade

Long-term Payback Energy Conservation Measures:

The following Energy Conservation Measures (ECMs) identified with a simple payback of over 10 years. The ECMs that have much longer paybacks are considered capital improvement ECMs. These typically have high installation costs that are more difficult to justify based solely on the energy savings associated with the improvement. Despite the long paybacks, these ECMs in many cases provide valuable and much needed infrastructure improvements for the facility. These ECMs include boiler upgrades, HVAC equipment upgrades, etc. It should also be noted that projects under a 15 year payback should be reviewed in the event the Borough wishes to move forward with an Energy Savings Improvement Program where these projects could be included that program.

- 82 - ECM #2: Lighting Controls Upgrade
- 82 – ECM #3: HVAC System Upgrade
- 83 – ECM #3: Window Replacement
- 84 – ECM #3: Premium Efficiency Motor
- REM #1: 43.7 kW Roof Solar Array
- REM #2: 2.4 kW Wind Turbine

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

1. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.
2. Maintain all weather stripping on windows and doors.
3. Clean all light fixtures to maximize light output.
4. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.
5. Verify all thermostats are utilizing setback and scheduling capabilities.
6. The facilities currently have sinks rated at 2.2 gallons per minute. CEG recommends the installation of 0.5 gallons per minute aerators on all sinks. Aerators are a relatively inexpensive item and can install by the Borough's Maintenance personnel.
7. The outdoor showers located at the Municipal Building should be swapped out for 1.5 gallons per minute showerheads or less.

Overall, the Borough facilities appear to be operating at a high efficiency level and taking full advantage of turning off and setting back equipment while unoccupied. With the implementation of the above recommended measures the Borough of Cape May will realize further energy savings at its Municipal, Maintenance, and Pump House Buildings.

II. INTRODUCTION

The comprehensive energy audit covers the following buildings for the Borough of Cape May Point.

Ref. #	Facility Name	Area (Sqft)	Address
82	Municipal Building	3,512	15 Lighthouse Ave.
83	Maintenance Building	3,500	Lighthouse Ave. & Sunset Blvd.
84	Water Pump Station	900	Sunset Blvd

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/ft²/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 costs to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers. The NJ Smart Start Building® program incentives savings (where applicable) are included for the appropriate ECM's and subtracted from the installed cost. Maintenance savings are calculated where applicable and added to the energy savings for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The costs and savings are applied and a simple payback, simple lifetime savings, and simple return on investment are calculated. See below for calculation methods:

ECM Calculation Equations:

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

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

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

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

$$\text{Internal Rate of Return} = \sum_{n=0}^N \left(\frac{\text{Cash Flow of Period}}{(1 + \text{IRR})^n} \right)$$

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

Net Present Value calculations based on Interest Rate of 3%.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

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

The electric usage profile represents the actual electrical usage for the facilities, Atlantic City Electric (ACE) provides electricity to the facilities under their Monthly General Service rate structure. A Third Part Supplier (TPS) has not been contracted. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. 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 historical data received for the facility.

The propane usage profile shows the actual propane consumption for the facility. Propane is provided by South Jersey Propane to the facility. The propane provider measures consumption in gallons. One Gallon of propane is equivalent to 91,600 BTUs of energy.

The Borough is responsible for providing water and sewer services for the entire town. It then bills the residents directly for their water usage on a bi-annual basis. While the Borough does not own and operate its own Water Treatment Facility it receives it via the Cape May County Municipal Utilities Authority.

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

Ref. #	Facility Name	Electric Rate (\$/kWh)	Propane (\$/gal)	Water (\$/1000 gal)
82	Municipal Building	\$0.183	\$1.890	\$6.260
83	Maintenance Building	\$0.184	\$2.100	\$6.260
84	Water Pump Station	\$0.172	N/A	\$6.260

Table 3-A
Electricity Billing Data
Municipal Building

ELECTRIC USAGE SUMMARY			
Utility Provider: Atlantic City Electric			
Rate: Monthly General Service			
Meter No: 105733441			
Account # 1292 4899 9994			
Third Party Utility			
TPS Meter / Acct No:			
MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Nov-09	1,800	5.2	\$330
Dec-09	1,810	4.8	\$281
Jan-10	1,984	5.1	\$310
Feb-10	1,467	5.0	\$232
Mar-10	1,323	3.9	\$205
Apr-10	1,167	3.9	\$183
May-10	1,179	6.0	\$201
Jun-10	1,340	6.1	\$240
Jul-10	2,395	8.9	\$491
Aug-10	3,008	12.0	\$619
Sep-10	3,434	12.0	\$706
Oct-10	2,318	12.0	\$457
Totals	23,225	12.0 Max	\$4,255
AVERAGE DEMAND		7.1 KW average	
AVERAGE RATE		\$0.183 \$/kWh	

Table 3-B
Electricity Billing Data
PW Maintenance Building

ELECTRIC USAGE SUMMARY			
Utility Provider: Atlantic City Electric			
Rate: Monthly General Service			
Meter No: 83221877			
Account # 0343 3269 9999			
Third Party Utility			
TPS Meter / Acct No:			
MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Jan-11	2,980	10.6	\$535
Dec-10	3,131	10.4	\$549
Nov-10	1,204	7.7	\$213
Oct-10	687	8.4	\$124
Sep-10	616	5.0	\$126
Aug-10	876	5.2	\$185
Jul-10	852	5.4	\$180
Jun-10	1,068	5.4	\$224
May-10	969	5.4	\$179
Apr-10	1,023	5.6	\$177
Mar-10	1,065	6.0	\$185
Feb-10	1,414	7.3	\$244
Totals	15,885	10.6 Max	\$2,923
AVERAGE DEMAND		6.9 KW average	
AVERAGE RATE		\$0.184 \$/kWh	

Table 3-C
Electricity Billing Data
Pump House

ELECTRIC USAGE SUMMARY			
Utility Provider: Atlantic City Electric			
Rate: Monthly General Service			
Meter No: 28150294			
Account # 0343 4859 9977			
Third Party Utility Provider:			
TPS Meter / Acct No:			
MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Jan-11	8,679	14.6	\$1,440
Dec-10	9,322	14.0	\$1,491
Nov-10	7,502	12.1	\$1,174
Oct-10	3,799	26.8	\$657
Sep-10	4,001	16.9	\$786
Aug-10	5,619	19.1	\$1,152
Jul-10	4,933	17.7	\$1,012
Jun-10	4,526	19.4	\$929
May-10	3,989	14.2	\$707
Apr-10	4,297	11.4	\$684
Mar-10	6,629	12.1	\$1,018
Feb-10	8,854	14.6	\$1,351
Totals	72,150	26.8 Max	\$12,402
AVERAGE DEMAND		16.1 KW average	
AVERAGE RATE		\$0.172 \$/kWh	

Figure 1-A
Electricity Usage Profile
Municipal Building

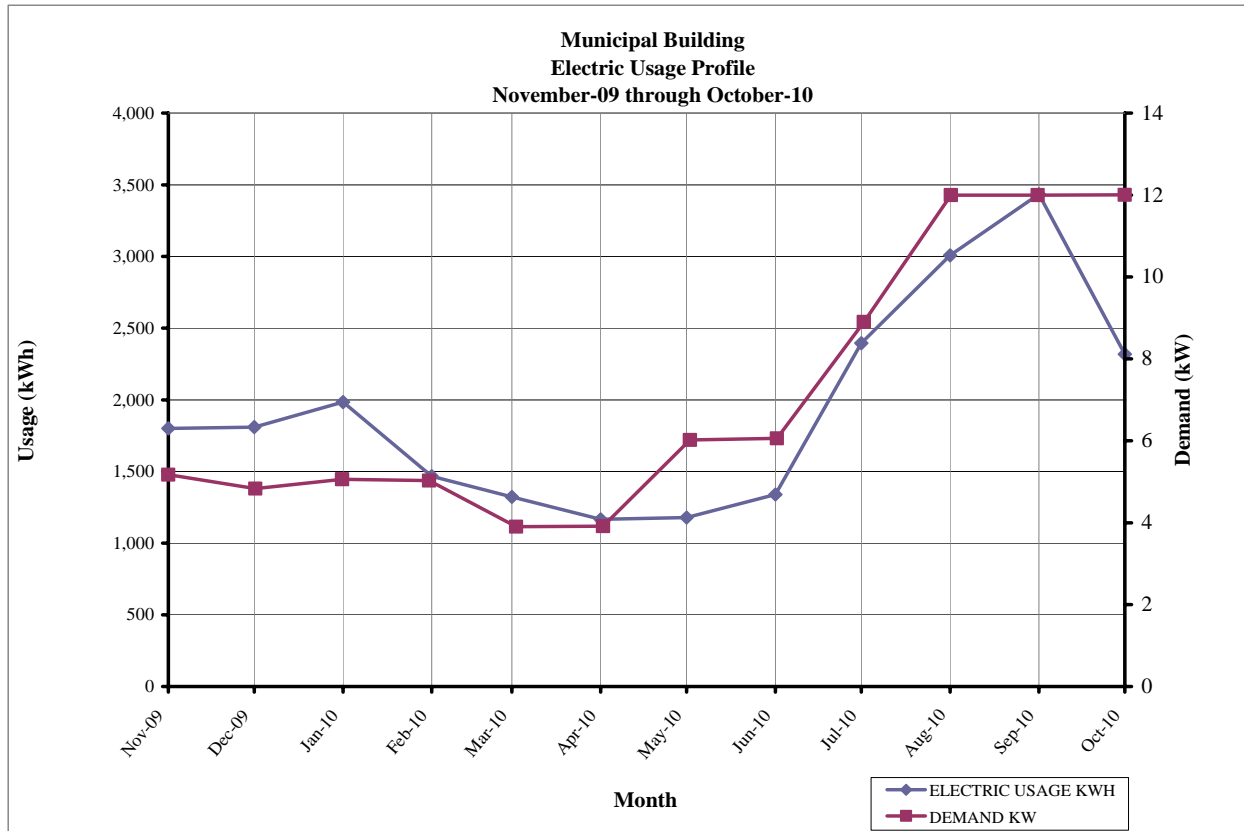


Figure 1-B
Electricity Usage Profile
PW Maintenance Building

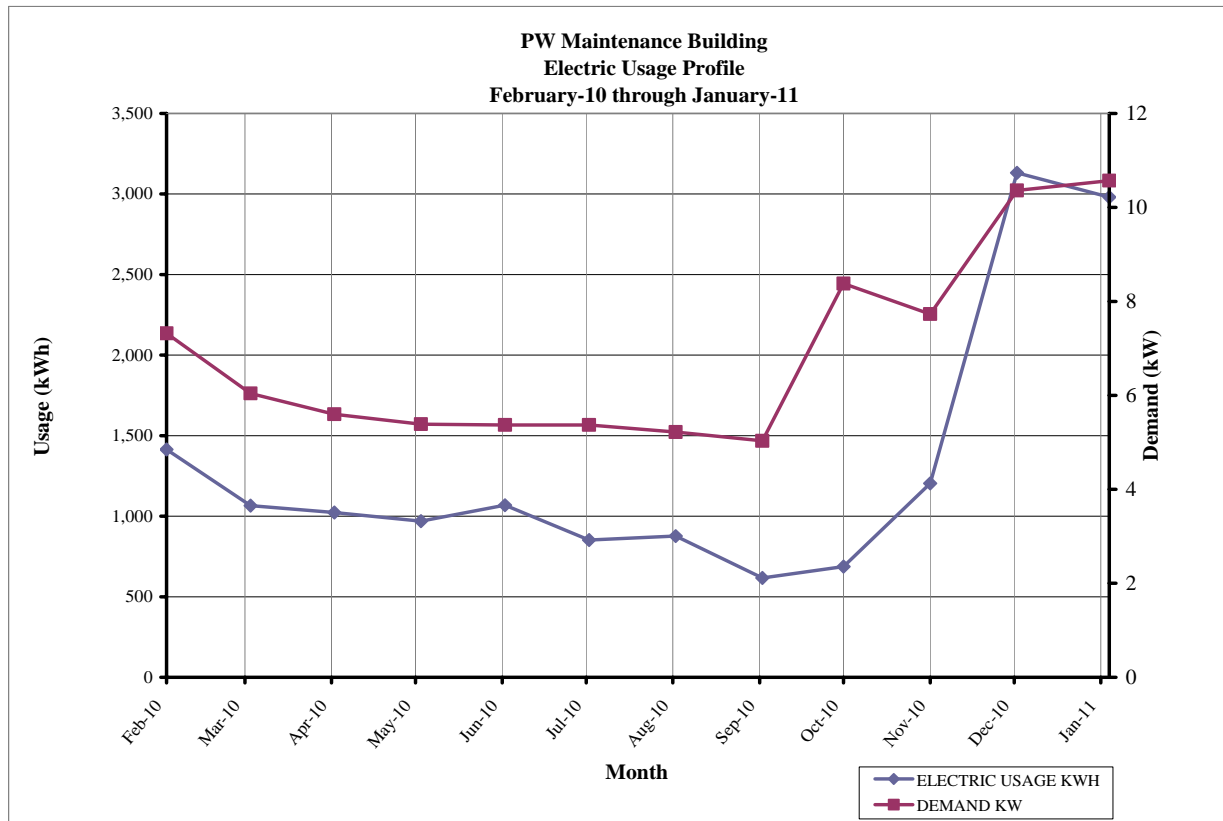


Figure 1-C
Electricity Usage Profile
Pump House

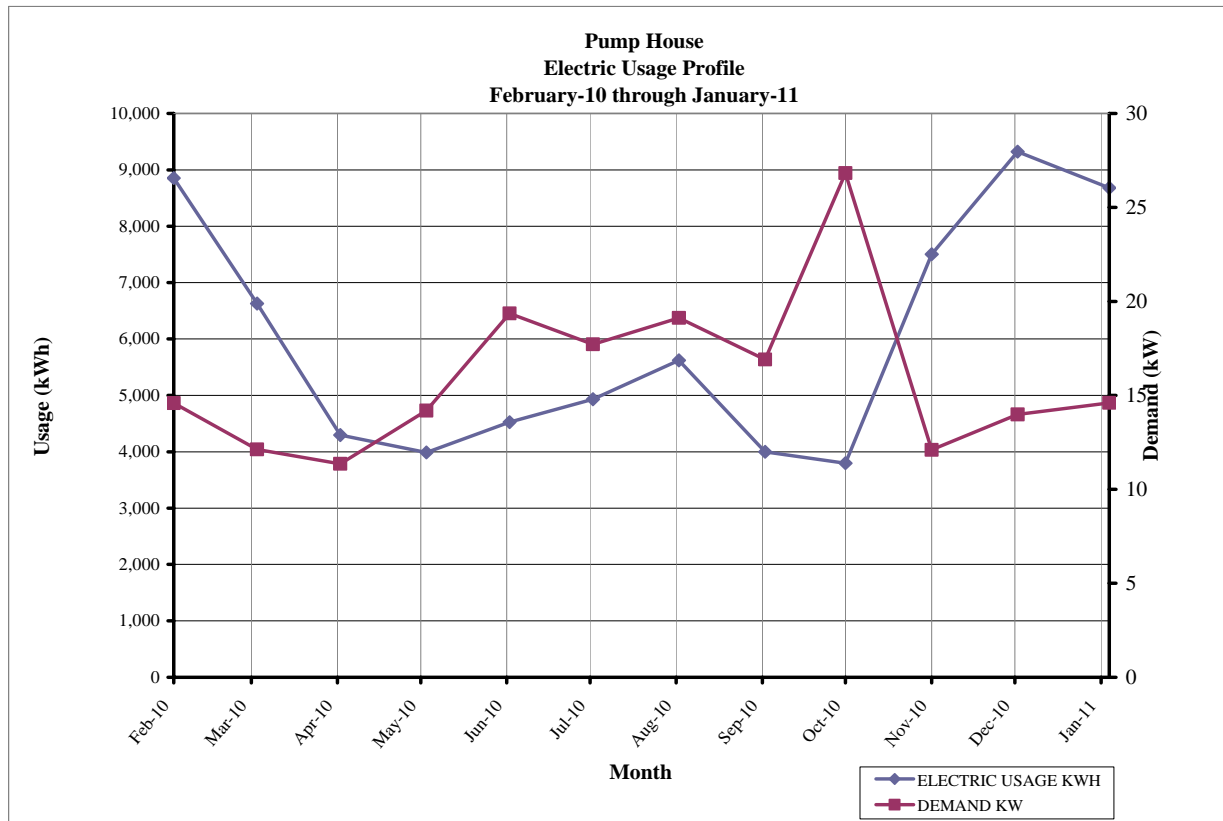


Table 4-A
Propane Billing Data
Municipal Building

PROPANE USAGE SUMMARY		
Utility Provider: South Jersey Propane		
Rate:		
Meter No:		
Point of Delivery ID:		
Third Party Utility Provider:		
TPS Meter No:		
MONTH OF USE	CONSUMPTION (GALLONS)	TOTAL BILL
Dec-09	494.90	\$854.58
Jan-10	82.09	\$160.82
Feb-10	124.47	\$255.47
Mar-10	232.68	\$490.73
Apr-10	0.00	\$0.00
May-10	0.00	\$0.00
Jun-10	0.00	\$0.00
Jul-10	0.00	\$0.00
Aug-10	0.00	\$0.00
Sep-10	0.00	\$0.00
Oct-10	0.00	\$0.00
Nov-10	0.00	\$0.00
TOTALS	934.14	\$1,761.60
AVERAGE RATE:	\$1.89	\$/GAL

Table 4-B
Propane Billing Data
PW Maintenance Building

PROPANE USAGE SUMMARY		
Utility Provider: South Jersey Propane		
Rate:		
Meter No:		
Point of Delivery ID:		
Third Party Utility Provider:		
TPS Meter No:		
MONTH OF USE	CONSUMPTION (GALLONS)	TOTAL BILL
Dec-09	194.30	\$380.63
Jan-10	67.90	\$152.61
Feb-10	88.40	\$198.93
Mar-10	119.19	\$251.37
Apr-10	46.10	\$100.91
May-10	0.00	\$0.00
Jun-10	0.00	\$0.00
Jul-10	0.00	\$0.00
Aug-10	0.00	\$0.00
Sep-10	0.00	\$0.00
Oct-10	0.00	\$0.00
Nov-10	0.00	\$0.00
TOTALS	515.89	\$1,084.45
AVERAGE RATE:	\$2.10	\$/GAL

Figure 2-A
Propane Usage Profile
Municipal Building

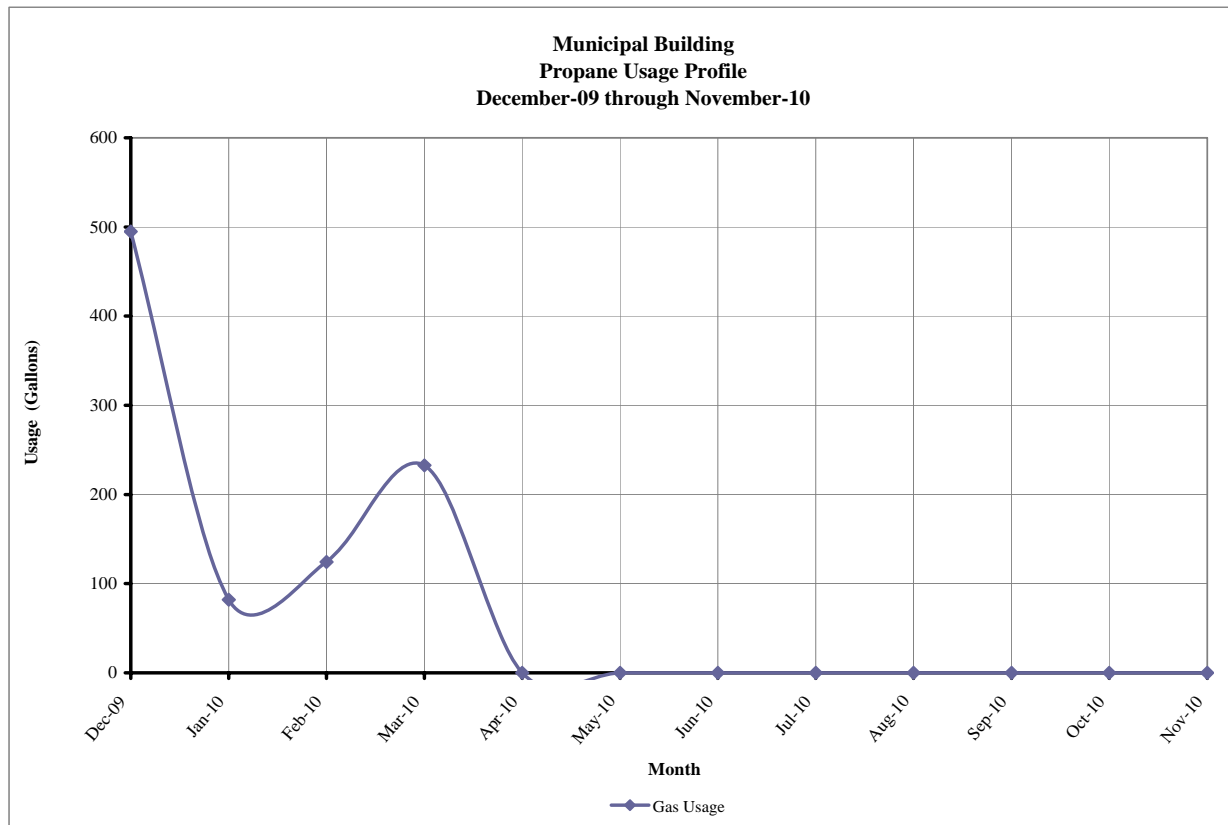
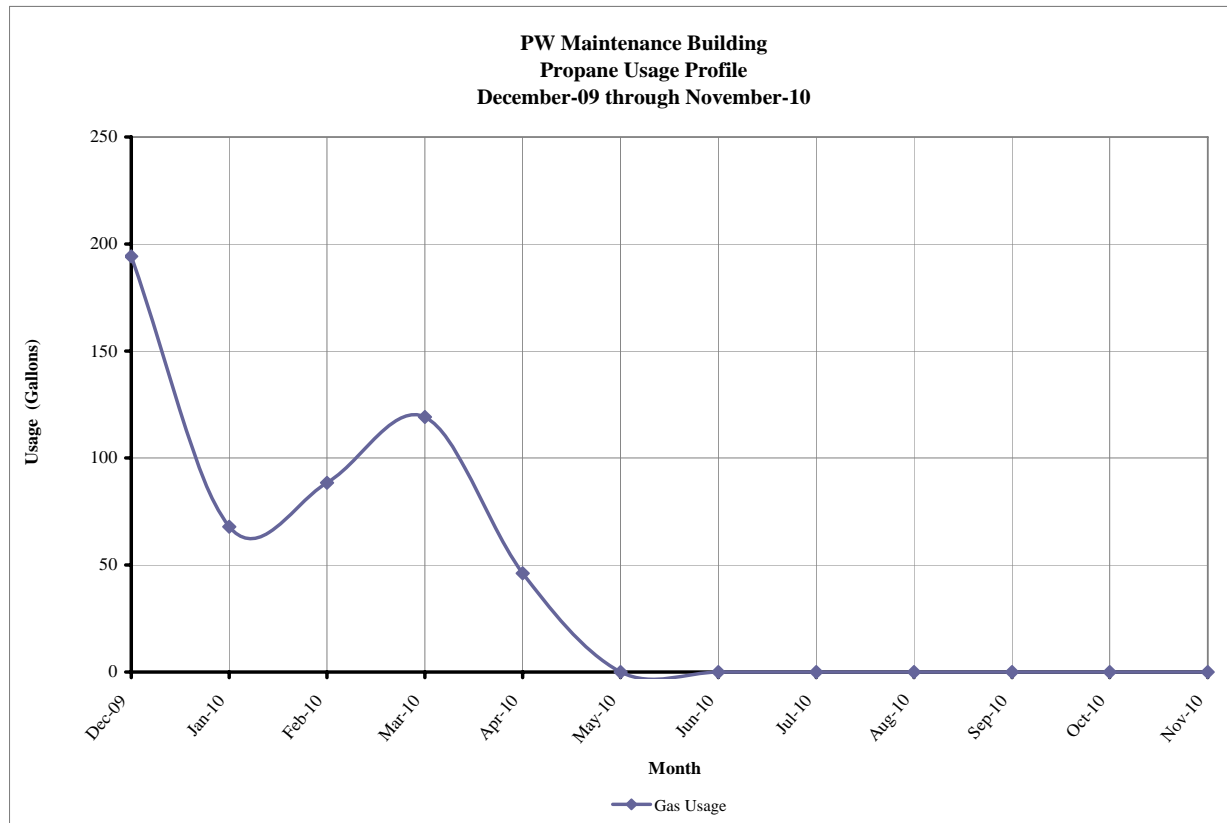


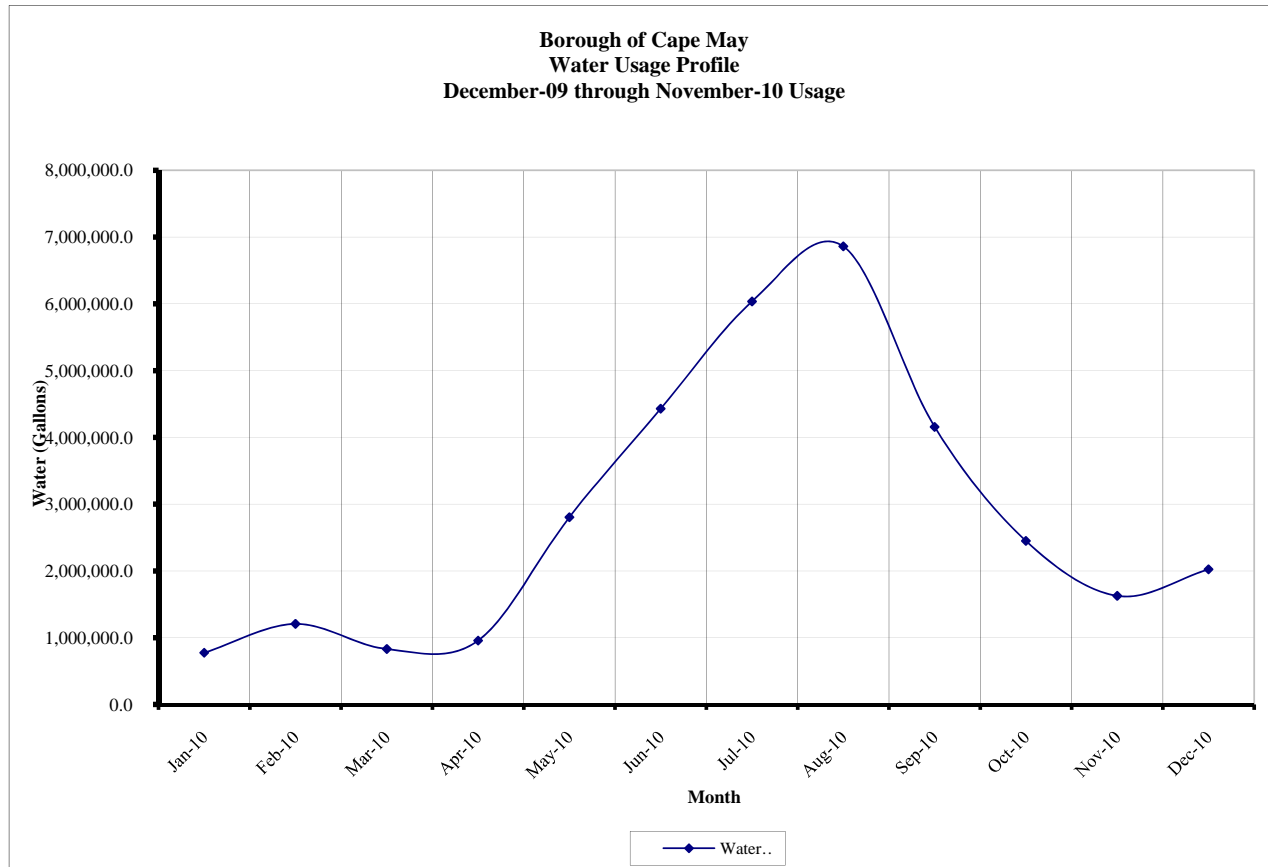
Figure 2-B
Propane Usage Profile
PW Maintenance Building



**Table 5
Water Usage Billing Data**

WATER USAGE SUMMARY		
Utility Provider: Cape May Point Municipal Water		
Rate:		
Meter No:		
Point of Delivery ID:		
Third Party Utility Provider:		
TPS Meter No:		
MONTH OF USE	CONSUMPTION (GALLONS)	TOTAL BILL
Jan-10	774,000.0	\$4,845.24
Feb-10	1,206,000.0	\$7,549.56
Mar-10	830,000.0	\$5,195.80
Apr-10	956,000.0	\$5,984.56
May-10	2,804,000.0	\$17,553.04
Jun-10	4,429,000.0	\$27,725.54
Jul-10	6,035,000.0	\$37,779.10
Aug-10	6,860,000.0	\$42,943.60
Sep-10	4,156,000.0	\$26,016.56
Oct-10	2,449,000.0	\$15,330.74
Nov-10	1,626,000.0	\$10,178.76
Dec-10	2,023,000.0	\$12,663.98
TOTALS	34,148,000.0	\$213,766.48
AVERAGE RATE:	\$6.26	\$/kGAL (1,000 GAL)

Figure 3
Water Usage Profile



B. Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's annual energy utilization per square foot of building. This calculation is completed by converting all utility usage consumed by a building for one year, to British Thermal Units (BTU) and dividing this number by the building square footage. EUI is a good measure of a building's energy use and is utilized regularly for comparison of energy performance for similar building types. The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of Energy maintains a Benchmarking Building Energy Performance Program. The ORNL website determines how a building's energy use compares with similar facilities throughout the U.S. and in a specific region or state.

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

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

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

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

Table 6-A
Facility Energy Use Index (EUI) Calculation
Municipal Building

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE RATIO	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu		kBtu
ELECTRIC	23,225.0			79,290	3.340	264,829
PROPANE			934.1	85,315	1.010	86,168
TOTAL				164,605		350,997
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA	3,512 SQUARE FEET					
BUILDING SITE EUI	46.87 kBtu/SF/YR					
BUILDING SOURCE EUI	99.94 kBtu/SF/YR					

Table 6-B
Facility Energy Use Index (EUI) Calculation
PW Maintenance Building

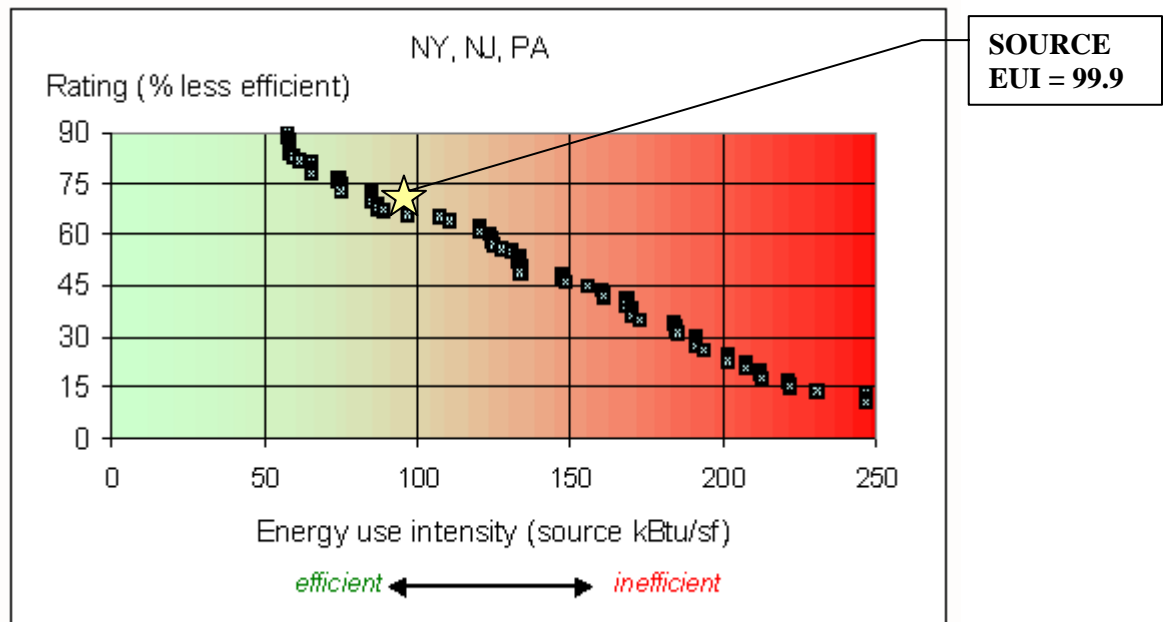
ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE RATIO	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu		kBtu
ELECTRIC	15,885.0			54,231	3.340	181,133
PROPANE			515.9	47,116	1.010	47,587
TOTAL				101,348		228,720
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA	3,500 SQUARE FEET					
BUILDING SITE EUI	28.96 kBtu/SF/YR					
BUILDING SOURCE EUI	65.35 kBtu/SF/YR					

Table 6-C
Facility Energy Use Index (EUI) Calculation
Pump House

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE RATIO	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu		kBtu
ELECTRIC	72,150.0			246,320	3.340	822,709
TOTAL				246,320		822,709
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA	900 SQUARE FEET					
BUILDING SITE EUI	273.69 kBtu/SF/YR					
BUILDING SOURCE EUI	914.12 kBtu/SF/YR					

Figure 3 below depicts a national EUI grading for the source use of *Office Buildings*.

Figure 4
Source Energy Use Intensity Distributions: Office Buildings



As a comparison, data has been gathered by the US Department of Energy (DOE) for various facilities cataloguing the standard site and source energy utilization. This data has been published in the 2003 Commercial Building Energy Consumption Survey and is noted as follows for facilities of this type:

- Service (Vehicle Repair):
77 kBtu/SF Site Energy, 150 kBtu/SF Source Energy.

C. EPA Energy Benchmarking System

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

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

In accordance with the Local Government Energy Audit Program, CEG has created an ENERGY STAR account for the municipality to access and monitoring the facility’s yearly energy usage as it compares to facilities of similar type. The login page for the account can be accessed at the following web address; the username and password are also listed below:

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

[Redacted Username and Password]

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

**Table 7
ENERGY STAR Performance Rating**

ENERGY STAR PERFORMANCE RATING			
Ref. #	Facility Description	Energy Performance Rating	National Average
82	Municipal Building	N/A	50
83	Maintenance Building	N/A	N/A
84	Water Pump Station	N/A	N/A

Refer to **Statement of Energy Performance Appendix** for the detailed energy summary.

The facilities owned by the Borough are unable to be rated within energy due to the Municipal Building being less than the necessary 5,000 square feet, and the Maintenance and Pump Station being categorized as “Other” that cannot be rated.

V. FACILITY DESCRIPTION

#82 Municipal Building

The 3,512 SF Municipal Building is a one story building comprised of office space, beach patrol attached garage, restrooms, conference room, and small lobby area. The typical hours of operation for this facility are between 8:00 am and 4:30 pm. Exterior walls are brick construction and stucco with typical lay-in insulation within the walls. The specific R value for the insulation is unknown however appears to more than adequately insulate the building. The windows throughout the facility are in good condition and appear to be maintained. Typical windows throughout the facility are double pane, ¼" clear glass with vinyl frames. Blinds are utilized throughout the facility per occupant comfort. The blinds are valuable because they help to reduce heat loss in the winter and reduce solar heat in the summer. The roof is a standard A-frame shingle roof with insulation located in the attic space that is likely rated at R-30. The building was built in 1995 with no additions since the original construction.

HVAC Systems

The facility is heating and cooled via two split system indoor/outdoor air handling units equipped with propane fired furnaces and outdoor condensing units. The furnaces are rated at approximately 75,000 Btu/h and have an efficiency of 78%. The condensing units are rated at three and 4 tons of cooling each with an efficiency level of 10 SEER.

The lobby vestibule is heated via a ceiling hung electric cabinet heater rated at

Exhaust System

Air is exhausted from the toilet rooms through the roof exhausters. The toilet room exhaust fan is operated based on the facility occupancy schedule.

HVAC System Controls

The HVAC systems within the facility are controlled via individual wall mounted thermostats with 7-day program setback capability.

Domestic Hot Water

Domestic hot water for the restrooms and office lounge is provided by a 75 gallon Bradford White propane fired hot water heater, capacity of 75,000 Btu/h. The domestic hot water is circulated throughout the building by a hot water re-circ pump.

Lighting

Typical lighting throughout building is fluorescent tube lay-in fixtures with T-8 lamps and electronic ballasts. Storage rooms and closets lit with compact fluorescent lamps. Building exterior perimeter lighting is a mixture of high pressure sodium and incandescent fixtures.

#83 Maintenance Building

The 3,500 SF Maintenance Building is a one story building comprised of office, break room area, restroom, garage, and maintenance shop. The typical hours of operation for this facility are between 7:00 am and 3:00 pm, but the building is only intermittently occupied by staff throughout the day. The exterior walls are metal construction with wallboard insulation. There are two windows located in the office and break room constructed with aluminum framing and quarter inch plexi-glass single pane. Blinds are utilized through the facility per occupant comfort. The blinds are valuable because they help to reduce heat loss in the winter and reduce solar heat in the summer. The roof is a standing seam metal roof with insulation located beneath. The building was built in 1997 with no additions since the original construction.

HVAC Systems

The facility is heating only with a propane fired 20,000 Btu/h wall mounted heater in the break room, an additional electric oil filled baseboard strip in the office, and the garage area is heated by a ceiling hung propane fired 143,750 Btu/h unit heater.

Exhaust System

The garage area had sidewall exhaust fans that operate off wall switches.

HVAC System Controls

The HVAC systems in the office and break room are all controlled via on board set point controls, and the unit heaters have programmable thermostats.

Domestic Hot Water

Domestic hot water for the restrooms is supplied by a under the sink Whirlpool 1.5 kilowatt 12 gallons hot water heater.

Lighting

Typical lighting throughout building is fluorescent tube pendant mount fixtures with T-12 lamps and magnetic ballasts. The restroom is light with a 100 watt incandescent medium base screw in.

#84 Water Pump Station

The 900 SF Pump Station is a one story building comprised of a pump room. The building is always in operation to pump water however it is only occupied a few minutes a day to verify operating condition and when maintenance is required. The exterior walls are brick construction with concrete block wall on the interior. There are no windows in the facility. The roof is a standing A-Frame roof with shingles and insulation located in the attic space above the drop ceiling. The building was built in 1994 with no additions since the original construction.

HVAC Systems

The facility is heating only with two (2) electric unit heaters rated at 5,000 watts each.

HVAC System Controls

The HVAC system is controlled via on board controls on the unit heaters.

Domestic Hot Water

There is not domestic hot water system for this facility.

Lighting

Typical lighting throughout building is fluorescent tube surface mount fixtures with T-12 lamps and magnetic ballasts.

VI. MAJOR EQUIPMENT LIST

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

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

VII. ENERGY CONSERVATION MEASURES

Municipal Building

82 - ECM #1: Lighting Upgrade

Description:

There are still a large amount of T-12 fixtures throughout the Municipal Building. Improved fluorescent lamps and ballasts are available as direct replacements for the existing lamps and ballasts. A simple retrofit of the existing fixture can provide substantial savings. For example, a conventional drop-ceiling lay in fixture with four, 4-foot lamps (34 Watt lamps with magnetic ballast) has a total wattage of 144 Watts per fixture. By using T-8 lamps and electronic ballasts, the total wattage would be reduced to 86 Watts. The light levels would increase by about 15% and the light quality would increase by 35%.

Some of the remaining interior lighting at the Borough of Cape May Point Municipal building is provided with fluorescent fixtures with older generation, 700 series 32W T8 lamps and electronic ballasts. Although 700 series T8 lamps are considered fairly efficient, further energy savings can be achieved by replacing the existing T8 lamps with new generation, 800 series 28W T8 lamps without compromising light output. CEG recommends, re-lamping all of the fixtures with 28W T8 lamps.

This ECM includes retrofitting each of the existing T-12 fluorescent lamp and magnetic ballast fixtures with T-8 lamps and high-power electronic ballasts. High efficiency electronic ballasts reduce overall wattage while maintaining the existing lumen levels of the various rooms. This ECM also includes re-lamping of the existing fluorescent fixtures with 800 series, 28W T8 lamps. Additionally, the retrofit of all older fluorescent fixtures with T8 or T5 fluorescent fixtures with electronic ballasts in the building would prove to be more energy efficient. The new, energy efficient T8 fixtures will provide adequate lighting and will save on electrical costs due to better performance of the lamp and ballasts. This ECM also includes maintenance savings through the reduced number of lamps replaced per year. The expected lamp life of a T8 lamp is approximately 30,000 burn-hours, in comparison to the existing T12 lamps which is approximately 20,000 burn-hours. The facility will need approximately 33% less lamps replaced per year for each one for one fixture replaced.

The ECM also includes replacement of any incandescent lamps with compact fluorescent lamps. Compact fluorescent lamps (CFL's) were designed 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 60-Watt incandescent lamp, an 18-Watt CFL for a 75-Watt incandescent lamp, and a 26-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. Where the existing fixture is controlled by a dimmer switch, the CFL bulb must be compatible with a dimmer switch. In some locations the bulb replacement will need to be tested to make sure the larger base of the CFL will fit into the existing fixture. The energy usage of an incandescent compared to a compact fluorescent approximately 3 to 4 times greater. In addition to the energy savings, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours. However, the maintenance savings due to reduced lamp replacement is offset by the higher cost of the CFL’s compared to the incandescent lamps.

Energy Savings Calculations:

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

Rebates and Incentives:

From the **NJ Smart Start Incentive Appendix**, the retrofit of a T-12 fixture to a T-5 or T-8 fixture or the retrofit of existing 32 watt T-8 system to reduced wattage (28w/25w 4') warrants the following incentive: \$10 per fixture.

$$\text{SmartStart}^{\circledR} \text{ Incentive} = (\# \text{ of } 1-4 \text{ lamp fixtures} \times \$10) = 29 \times \$10 = \$290$$

From the **NJ Smart Start Incentive Appendix**, the retrofit of an existing incandescent fixture to a screw-in PAR38 or 30 Compact Fluorescent Lamp with aluminum reflector warrants the following incentive: \$7 per lamp.

$$\text{SmartStart}^{\circledR} \text{ Incentive} = (\# \text{ of } \textit{Incandescent to PAR38/30} \times \$7) = 9 \times \$7 = \$63$$

Energy Savings Summary:

82 - ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$1,654
NJ Smart Start Equipment Incentive (\$):	\$353
Net Installation Cost (\$):	\$1,301
Maintenance Savings (\$/Yr):	\$200
Energy Savings (\$/Yr):	\$597
Total Yearly Savings (\$/Yr):	\$797
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.6
Simple Lifetime ROI	818.3%
Simple Lifetime Maintenance Savings	\$3,000
Simple Lifetime Savings	\$11,948
Internal Rate of Return (IRR)	61%
Net Present Value (NPV)	\$8,207.68

82 - ECM #2: Lighting Controls Upgrade – Occupancy Sensors

Description:

Some of the lights in the Cape May Point Municipal building are left on unnecessarily. In many cases the lights are left on because of the inconvenience to manually switch lights off when a room is left or on when a room is first occupied. This is common in rooms that are occupied for only short periods and only a few times per day. In some instances lights are left on due to the misconception that it is better to keep the lights on rather than to continuously switch lights on and off. Although increased switching reduces lamp life, the energy savings outweigh the lamp replacement costs. The payback timeframe for when to turn the lights off is approximately two minutes. If the lights are expected to be off for at least a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is adequate to provide reduced lighting levels when full light output is not needed. Occupancy sensors detect motion and will switch the lights on when the room is occupied. Occupancy sensors can either be mounted in place of a current wall switch, or on the ceiling to cover large areas.

The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings is based on the “Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways,” document posted for public use April 2005. The study has found that commercial buildings have the potential to achieve significant energy savings through the use of building controls. The average energy savings are as follows based on the report:

- Occupancy Sensors for Lighting Control 20% - 28% energy savings.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 20% of the total light energy controlled by occupancy sensors and daylight sensors (The majority of the savings is expected to be after school hours when rooms are left with lights on)

This ECM includes installation of ceiling or switch mount sensors for individual offices, bathrooms, and conference rooms. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent. The **Investment Grade Lighting Audit Appendix** of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by the applicable percent savings for each area that includes lighting controls.

Energy Savings Calculations:

$$\text{Energy Savings} = (\% \text{ Savings} \times \text{Controlled Light Energy (kWh/Yr)})$$

$$\text{Savings.} = \text{Energy Savings (kWh)} \times \text{Ave Elec Cost} \left(\frac{\$}{\text{kWh}} \right)$$

Cost and Incentives:

Installation cost per dual-technology sensors (Basis: Sensor switch or equivalent) are as follows:

Dual Technology Occupancy Sensor - Remote Mount	\$160 per installation
Dual Technology Occupancy Sensor - Switch Mount	\$75 per installation

Cost includes material and labor.

From the **NJ Smart Start[®] Program Incentives Appendix**, the installation of a lighting control device warrants the following incentive:

Occupancy Sensor Fixture Mounted (existing facility only) = \$20 per sensor
 Occupancy Sensor Remote Mounted (existing facility only) = \$35 per sensor

Smart Start[®] Incentive = (# of wall mount × \$ 20) + (# of ceiling mount × \$35)
 Smart Start[®] Incentive = (3 wall mount × \$ 20) + (10 ceiling mount × \$35) = \$410

Energy Savings Summary:

82 - ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$2,425
NJ Smart Start Equipment Incentive (\$):	\$410
Net Installation Cost (\$):	\$2,015
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$154
Total Yearly Savings (\$/Yr):	\$154
Estimated ECM Lifetime (Yr):	15
Simple Payback	13.1
Simple Lifetime ROI	14.6%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$2,310
Internal Rate of Return (IRR)	2%
Net Present Value (NPV)	(\$176.56)

82 - ECM #3: HVAC System Replacement

Description:

The Municipal Building HVAC system is current near the end of its useful life expectancy and could be replaced with a newer much more efficient system. The system currently utilized two propane fired furnaces coupled with outdoor condensing units to serve the building. Each unit is controlled via a centrally located thermostat.

This ECM proposed replacing both systems with a hybrid heat pump system. This system would utilize two stages of heating, the heat pump would handle the first stage of heating down to an outdoor air temperature of approximately 40 degrees Fahrenheit, and then the system would go into its second stage of heating being provided by a gas furnace. System specifications are based on the installation of a Lennox XP21 heat pump units and SL98UH high efficiency natural gas fired furnace that can also be utilized with propane.

Energy Savings Calculations:

Cooling savings were calculated based equivalent full load hours for a standard cooling system compared with that of a heat pump unit utilizing the following equation.

$$\text{Electric Usage} = \frac{\text{Cooling (Tons)} \times 12,000 \left(\frac{\text{Btu}}{\text{Ton hr}} \right)}{1000 \left(\frac{\text{W}}{\text{kW}} \right)} \times \left(\frac{1}{\text{SEER}} \right) \times \text{Equivalent Full Load Hrs.}$$

Heating savings were calculated based on the existing heating requirements of the building utilizing the previous year's propane bills and removing the portion of the bill associated with domestic hot water heating. Stage 1 heat pump heating usage was calculated based on the percentage of Heating Degree Days from 45 to 65 degrees Fahrenheit, and stage 2 furnace heating usage was calculation based on the percentage of Heating Degree Days below 45 degrees Fahrenheit. The following equations were utilized in calculation these savings.

$$\text{Heating Usage Stage One} = \frac{\% \text{HDD}(45 \text{ to } 65 \text{ F}) \times \text{Heating Load (kBtu)}}{1000 \left(\frac{\text{Btu}}{\text{kBtu}} \right)} \times \left(\frac{1}{\text{HSPF}} \right) \times \left(\frac{1}{1000} \frac{\text{Wh}}{\text{kWh}} \right)$$

$$\text{Heating Usage Stage Two} = \frac{\% \text{HDD}(45 \text{ F}) \times \text{Heating Load (kBtu)}}{1000 \left(\frac{\text{Btu}}{\text{kBtu}} \right)} \times \left(\frac{1}{\text{Efficiency}} \right) \times \left(\frac{1}{91,600} \frac{\text{Btu}}{\text{gal}} \right)$$

HVAC SYSTEM CONV TO HP W/ GAS FURNACE CALCULATION			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
<i>HEATING SAVINGS CALCULATION</i>			
Building Heating Usage (kbtu)	78,567		
Existing Heating System Efficiency	80%		
Building Heat Load (kBtu)	62,854	62,854	
Heating Degree Days (65 F)	4,328	4,328	
Percent HDD less than 45 F	N/A	24%	
Percent HDD between 45 F to 65 F	N/A	76%	
Heating Stage 1 [Heat Pump] (kBtu)	N/A	47,852	
Heating Stage 2 [Gas Furnace] (kBtu)	N/A	15,002	
Electric Usage (kWh)	0	4,933	
Propane Usage (Gallons)	858	169	
<i>COOLING SAVINGS CALCULATION</i>			
Cooling Equivalent Full Load Hours	1,131	381	
Electric Usage (kWh)	9,500	1,787	
Electric Cost (\$/kWh)	0.18	0.18	
Propane Cost (\$/Gal)	1.89	1.89	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Electric Usage (kWh)	9,500	6,720	2,781
Propane Usage (Gallons)	858	169	689
Energy Cost (\$)	\$3,360	\$1,549	\$1,811
COMMENTS:	HP Operation Above 45 F for Heating, Below 45 F Gas Furnace; HDD(45F) 1033		

Currently South Jersey Gas is extending natural gas service to the Borough in the coming year. As a result ECM savings that effect propane usage have also been reviewed based on natural gas being available. The following table projects potential savings with natural gas service at the building using a natural gas cost of \$1.1553 per therm. (Current rate information on SJG GSG and BGSS tariffs)

SAVINGS ADJUSTMENT FOR NATURAL GAS		
ECM Results	Usage	Cost (\$)
Existing Propane (gal)	858	\$1,622
Proposed Natural Gas (therm)	155	<u>\$179</u>
Adjusted Savings		\$1,443
Electric Savings (kWh)	689	<u>\$124</u>
New Total Savings		\$1,567

Energy Savings Summary:

82 - ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$29,800
NJ Smart Start Equipment Incentive (\$):	\$1,244
Net Installation Cost (\$):	\$28,556
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$1,811
Total Yearly Savings (\$/Yr):	\$1,811
Estimated ECM Lifetime (Yr):	15
Simple Payback	15.8
Simple Lifetime ROI	-4.9%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$27,165
Internal Rate of Return (IRR)	-1%
Net Present Value (NPV)	(\$6,936.40)

Maintenance Building

83 - ECM #1: Lighting Upgrade

Description:

There are still T-12 fixtures throughout the Maintenance Building. Improved fluorescent lamps and ballasts are available as direct replacements for the existing lamps and ballasts. A simple retrofit of the existing fixture can provide substantial savings. For example, a conventional drop-ceiling lay in fixture with four, 4-foot lamps (34 Watt lamps with magnetic ballast) has a total wattage of 144 Watts per fixture. By using T-8 lamps and electronic ballasts, the total wattage would be reduced to 86 Watts. The light levels would increase by about 15% and the light quality would increase by 35%.

The lighting with in the Maintenance building is older T12 technology with Magnetic Ballasts. Upgrading these fixtures to T8 28 watt lamps and high efficiency electronic ballasts can provide substantial savings. This ECM replaced all T12 with new T8 fluorescent fixtures.

Energy Savings Calculations:

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

Rebates and Incentives:

From the **NJ Smart Start Incentive Appendix**, the retrofit of a T-12 fixture to a T-5 or T-8 fixture or the retrofit of existing 32 watt T-8 system to reduced wattage (28w/25w 4') warrants the following incentive: \$10 per fixture.

$$\text{SmartStart}^{\circledR} \text{ Incentive} = (\# \text{ of } 1 - 4 \text{ lamp fixtures} \times \$10) = 22 \times \$10 = \$220$$

Energy Savings Summary:

83 - ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$3,720
NJ Smart Start Equipment Incentive (\$):	\$220
Net Installation Cost (\$):	\$3,500
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$693
Total Yearly Savings (\$/Yr):	\$693
Estimated ECM Lifetime (Yr):	15
Simple Payback	5.1
Simple Lifetime ROI	196.8%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$10,388
Internal Rate of Return (IRR)	18%
Net Present Value (NPV)	\$4,767.62

83 - ECM #2: Lighting Controls Upgrade – Occupancy Sensors

Description:

Some of the lights in the Maintenance Building are left on unnecessarily. In many cases the lights are left on because of the inconvenience to manually switch lights off when a room is left or on when a room is first occupied. This is common in rooms that are occupied for only short periods and only a few times per day. In some instances lights are left on due to the misconception that it is better to keep the lights on rather than to continuously switch lights on and off. Although increased switching reduces lamp life, the energy savings outweigh the lamp replacement costs. The payback timeframe for when to turn the lights off is approximately two minutes. If the lights are expected to be off for at least a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is adequate to provide reduced lighting levels when full light output is not needed. Occupancy sensors detect motion and will switch the lights on when the room is occupied. Occupancy sensors can either be mounted in place of a current wall switch, or on the ceiling to cover large areas.

This ECM includes installation of ceiling or switch mount sensors for Break-room and office. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent. The **Investment Grade Lighting Audit Appendix** of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by the applicable percent savings for each area that includes lighting controls.

Energy Savings Calculations:

Energy Savings = (% Savings × Controlled Light Energy (kWh/Yr))

Savings. = Energy Savings (kWh) × Ave Elec Cost $\left(\frac{\$}{\text{kWh}}\right)$

Cost and Incentives:

Installation cost per dual-technology sensors (Basis: Sensor switch or equivalent) are as follows:

Dual Technology Occupancy Sensor - Remote Mount	\$160 per installation
Dual Technology Occupancy Sensor - Switch Mount	\$75 per installation

Cost includes material and labor.

From the **NJ Smart Start[®] Program Incentives Appendix**, the installation of a lighting control device warrants the following incentive:

Occupancy Sensor Fixture Mounted (existing facility only) = \$20 per sensor
 Occupancy Sensor Remote Mounted (existing facility only) = \$35 per sensor

Smart Start® Incentive = (# of wall mount × \$ 20)+(#of ceiling mount×\$35)
 Smart Start® Incentive = (0 wall mount × \$ 20)+(2 ceiling mount ×\$35)=\$70

Energy Savings Summary:

83 - ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$320
NJ Smart Start Equipment Incentive (\$):	\$70
Net Installation Cost (\$):	\$250
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$20
Total Yearly Savings (\$/Yr):	\$20
Estimated ECM Lifetime (Yr):	12
Simple Payback	12.4
Simple Lifetime ROI	-3.6%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$241
Internal Rate of Return (IRR)	-1%
Net Present Value (NPV)	(\$50.02)

83 - ECM #3: Window Replacement

Description:

The two windows located in the office and break room area are aluminum framed with clear plexiglass. The windows transmit a substantial amount of solar gain which is reduced using shades and are sealed as best as possible to prevent air leakage.

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

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

The basis for this ECM is Anderson Windows at \$80 per SF of window installed. Below is a list of areas with older and inefficient windows:

WINDOW REPLACEMENT SUMMARY			
ECM INPUTS	NUMBER OF WINDOWS	SIZE	AREA
Office & Break Room	2	5'x3'	30
TOTAL	2	-	30

Energy Savings Calculations:

$$\text{Infiltration} \left(\frac{\text{Ft}^3}{\text{Min.}} \right) = \text{Window Area} (\text{Ft}^2) \times \text{Estimated Infiltration per SF of Window} \left(\frac{\text{CFM}}{\text{Ft}^2} \right)$$

$$\text{Heat Load} \left(\frac{\text{Btu}}{\text{Hr.}} \right) = 1.1 \times \text{Infiltration} \left(\frac{\text{Ft}^3}{\text{Min.}} \right) \times \text{Design Temperature Difference} (^\circ\text{F})$$

$$\text{Cooling Load (Ton)} = \text{Infiltration} \left(\frac{\text{Ft}^3}{\text{Min.}} \right) \times \frac{1 \text{ Ton Cooling}}{400 \left(\frac{\text{Ft}^3}{\text{Min.}} \right)}$$

$$\text{Heating Leakage Energy (Therms)} = \frac{\text{Heat Load} \left(\frac{\text{Btu}}{\text{Hr.}} \right) \times \text{HDD}(\text{Day } ^\circ\text{F}) \times 24 \left(\frac{\text{Hr.}}{\text{Day}} \right) \times (0.60)}{65(^{\circ}\text{F}) \times \text{Fuel Heat Value} \left(\frac{\text{Btu}}{\text{Therms}} \right) \times \text{Heating Efficiency}(\%)}$$

$$\text{Cooling Leakage Energy (kWh)} = \frac{\text{Cooling Load}(\text{Ton}) \times \left(\frac{12,000 \text{ Btu}}{\text{Ton Hr.}} \right) \times \text{Full Load Cooling Hours}}{\frac{1000 \text{ W.h}}{\text{kWh}} \times \text{Cooling Efficiency (EER)}}$$

$$\text{Conductive Energy (Therms)} = \frac{\text{U - Value} \times \text{Area}(\text{Ft}^2) \times \text{HDD}(\text{Day } ^\circ\text{F}) \times 24 \left(\frac{\text{Hr.}}{\text{Day}} \right) \times (0.60)}{65(^{\circ}\text{F}) \times \text{Fuel Heat Value} \left(\frac{\text{Btu}}{\text{Therms}} \right) \times \text{Heating Efficiency}(\%)}$$

$$\text{Heating Energy Cost} = \text{Total Heating Energy}(\text{Therms}) \times \text{Ave Fuel Cost} \left(\frac{\$}{\text{Therms}} \right)$$

$$\text{Cooling Energy Cost} = \text{Total Cooling Energy}(\text{kWh}) \times \text{Ave Fuel Cost} \left(\frac{\$}{\text{kWh}} \right)$$

Estimated cost for replacing the inefficient windows at the Maintenance building is \$2,400.

WINDOW REPLACEMENT CALCULATIONS			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
Description:	Existing Single Pane Windows	Double Pane Low-E Windows	-
Window (SF)	30	30	-
U-Value (BTU/HR/SF*°F)	1.25	0.45	0.80
Estimated Infiltration, CFM per SF Window	3	2	-
Total Infiltration, CFM	90	60	30
Heating System Efficiency (%)	75%	75%	-
Heating Degree Days (HDD)	4,328	4,328	-
Design Day Temp Diff (°F)	65	65	-
Heating Hrs Per Day (Hrs)	24	24	-
Full Load Cooling Hours	300	300	-
Average Cooling Efficiency, EER	9.0	9.0	-
Gas Cost (\$/Therm)	2.10	2.10	-
Electric Cost (\$/kWh)	0.184	0.184	-
Gas Heat Value (BTU/Gal)	91,600	91,600	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Heat Load (BTU/Hr)	6,435	4,290	2,145
Leakage Energy (Gal)	90	60	30
Conductive Energy (Gal)	34	12	22
Total Heating Energy (Gal)	124	72	52
Cooling Load (Ton)	0	0	0
Cooling Demand (kW)	0.1	0.1	0.0
Total Cooling Energy (kWh)	90	60	30
Gas Energy Cost (\$)	\$260	\$151	\$109
Electric Energy Cost (\$)	\$17	\$11	\$6
Comments:	1. Proposed window U-value Based on ASHRAE 90.1 - 2007		

Energy Savings Summary:

83 - ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$2,400
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$2,400
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$109
Total Yearly Savings (\$/Yr):	\$109
Estimated ECM Lifetime (Yr):	12
Simple Payback	22.0
Simple Lifetime ROI	-45.5%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	\$1,308
Internal Rate of Return (IRR)	-8%
Net Present Value (NPV)	(\$1,315.01)

Pump Station Building

84 - ECM #1: Lighting Upgrade

Description:

There are still a small amount of T-12 fixtures throughout the Pump House. Improved fluorescent lamps and ballasts are available as direct replacements for the existing lamps and ballasts. A simple retrofit of the existing fixture can provide substantial savings. For example, a conventional drop-ceiling lay in fixture with four, 4-foot lamps (34 Watt lamps with magnetic ballast) has a total wattage of 144 Watts per fixture. By using T-8 lamps and electronic ballasts, the total wattage would be reduced to 86 Watts. The light levels would increase by about 15% and the light quality would increase by 35%.

This ECM includes retrofitting each of the existing T-12 fluorescent lamp and magnetic ballast fixtures with T-8 lamps and high-power electronic ballasts. High efficiency electronic ballasts reduce overall wattage while maintaining the existing lumen levels of the various rooms. This ECM also includes re-lamping of the existing fluorescent fixtures with 800 series, 28W T8 lamps.

Energy Savings Calculations:

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

Rebates and Incentives:

From the **NJ Smart Start Incentive Appendix**, the retrofit of a T-12 fixture to a T-5 or T-8 fixture or the retrofit of existing 32 watt T-8 system to reduced wattage (28w/25w 4') warrants the following incentive: \$10 per fixture.

$$\text{SmartStart}^{\circledR} \text{ Incentive} = (\# \text{ of } 1-4 \text{ lamp fixtures} \times \$10) = 20 \times \$10 = \$200$$

Energy Savings Summary:

84 - ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$248
NJ Smart Start Equipment Incentive (\$):	\$30
Net Installation Cost (\$):	\$218
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$28
Total Yearly Savings (\$/Yr):	\$28
Estimated ECM Lifetime (Yr):	15
Simple Payback	7.9
Simple Lifetime ROI	90.4%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$415
Internal Rate of Return (IRR)	9%
Net Present Value (NPV)	\$112.32

84 - ECM #2: Lighting Controls Upgrade – Occupancy Sensors

Description:

In general the lighting at the Pump House is shut down by maintenance staff when leaving the building, however there is occasion the lights are left on for long periods of time accidentally. In some instances lights are left on due to the misconception that it is better to keep the lights on rather than to continuously switch lights on and off. Although increased switching reduces lamp life, the energy savings outweigh the lamp replacement costs. The payback timeframe for when to turn the lights off is approximately two minutes. If the lights are expected to be off for at least a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is adequate to provide reduced lighting levels when full light output is not needed. Occupancy sensors detect motion and will switch the lights on when the room is occupied. Occupancy sensors can either be mounted in place of a current wall switch, or on the ceiling to cover large areas.

This ECM includes installation of ceiling or switch mount sensors for the main pump room. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent. The **Investment Grade Lighting Audit Appendix** of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by the applicable percent savings for each area that includes lighting controls.

Energy Savings Calculations:

Energy Savings = (% Savings × Controlled Light Energy (kWh/Yr))

Savings. = Energy Savings (kWh) × Ave Elec Cost $\left(\frac{\$}{\text{kWh}}\right)$

Cost and Incentives:

Installation cost per dual-technology sensors (Basis: Sensor switch or equivalent) are as follows:

Dual Technology Occupancy Sensor - Remote Mount	\$160 per installation
Dual Technology Occupancy Sensor - Switch Mount	\$75 per installation

Cost includes material and labor.

From the **NJ Smart Start[®] Program Incentives Appendix**, the installation of a lighting control device warrants the following incentive:

Occupancy Sensor Fixture Mounted (existing facility only) = \$20 per sensor

Occupancy Sensor Remote Mounted (existing facility only) = \$35 per sensor

Smart Start® Incentive = (# of wall mount × \$ 20)+(#of ceiling mount ×\$35)

Smart Start® Incentive = (0 wall mount × \$ 20)+(2 ceiling mount ×\$35) = \$70

Energy Savings Summary:

84 - ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$320
NJ Smart Start Equipment Incentive (\$):	\$70
Net Installation Cost (\$):	\$250
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$47
Total Yearly Savings (\$/Yr):	\$47
Estimated ECM Lifetime (Yr):	15
Simple Payback	5.3
Simple Lifetime ROI	183.3%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$708
Internal Rate of Return (IRR)	17%
Net Present Value (NPV)	\$313.71

84 - ECM #3: Install NEMA Premium® Efficiency Motors

Description:

The improved efficiency of the NEMA Premium® efficient motors is primarily due to better designs with use of better materials to reduce losses. Surprisingly, the electricity used to power a motor represents 95 % of its total lifetime operating cost. Because many motors operate continuously 24 hours a day, even small increases in efficiency can yield substantial energy and dollar savings.

The electric motors driving the hot water pumps are candidates for replacing with premium efficiency motors. These standard efficiency motors run considerable amount of time over a year.

This energy conservation measure replaces existing electric motors over 5 HP or more with NEMA Premium® efficiency motors. NEMA Premium® is the most efficient motor designation in the marketplace today.

IMPLEMENTATION SUMMARY					
EQMT ID	FUNCTION	MOTOR HP	HOURS OF OPERATION	EXISTING EFFICIENCY	NEMA PREMIUM EFFICIENCY
P-1	Hot Water Pump	20	1,100	91.7%	93.0%
P-2	Hot Water Pump	20	1,100	91.7%	93.0%
P-3	Hot Water Pump	50	600	91.7%	94.5%

Energy Savings Calculations:

$$\text{Electric usage, kWh} = \frac{\text{HP} \times \text{LF} \times 0.746 \times \text{Hours of Operation}}{\text{Motor Efficiency}}$$

where, HP = Motor Nameplate Horsepower Rating

LF = Load Factor

Motor Efficiency = Motor Nameplate Efficiency

$$\text{Electric Usage Savings, kWh} = \text{Electric Usage}_{\text{Existing}} - \text{Electric Usage}_{\text{Proposed}}$$

$$\text{Electric Usage Savings, kWh} = \text{Electric Usage}_{\text{Existing}} - \text{Electric Usage}_{\text{Proposed}}$$

$$\text{Electric cost savings} = \text{Electric Usage Savings} \times \text{Electric Rate} \left(\frac{\$}{\text{kWh}} \right)$$

The calculations were carried out and the results are tabulated in the table below:

PREMIUM EFFICIENCY MOTOR CALCULATIONS							
EQMT ID	MOTOR HP	LOAD FACTOR	EXISTING EFFICIENCY	NEMA PREMIUM EFFICIENCY	POWER SAVINGS kW	ENERGY SAVINGS kWh	COST SAVINGS
P-1	20	90%	91.7%	93.0%	0.20	226	\$39
P-2	20	90%	91.7%	93.0%	0.20	226	\$39
P-3	50	90%	91.7%	94.5%	1.08	654	\$113
TOTAL					1.5	1,107	\$190

Equipment Cost and Incentives

Below is a summary of SmartStart Building® incentives for premium efficiency motors:

INCENTIVES	
HORSE POWER	NJ SMART START INCENTIVE
5	\$60
7.5	\$90
10	\$100
15	\$115
20	\$125
25	\$130
30	\$150
40	\$180
50	\$220

The following table outlines the summary of motor replacement costs and incentives:

MOTOR REPLACEMENT SUMMARY						
EQMT ID	MOTOR POWER HP	INSTALLED COST	SMART START INCENTIVE	NET COST	TOTAL SAVINGS	SIMPLE PAYBACK
P-1	20	\$4,635	\$125	\$4,510	\$39	115.8
P-2	20	\$4,635	\$125	\$4,510	\$39	115.8
P-3	50	\$9,338	\$220	\$9,158	\$113	81.4
TOTAL	Totals:	\$18,608	\$470	\$18,178	\$190	95.5

Energy Savings Summary:

84 - ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$18,608
NJ Smart Start Equipment Incentive (\$):	\$470
Net Installation Cost (\$):	\$18,138
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$190
Total Yearly Savings (\$/Yr):	\$190
Estimated ECM Lifetime (Yr):	15
Simple Payback	95.5
Simple Lifetime ROI	-84.3%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$2,850
Internal Rate of Return (IRR)	-17%
Net Present Value (NPV)	(\$15,869.79)

84 - ECM #4: Electric to Gas Unit Heater Replacement

Description:

The existing pump house is heated by two 5 kilowatt electric unit heaters with propeller fans. These units operate all winter long in order to keep the water pumps from freezing. Given the large amount of run time hours these units have it is recommended they be converted gas fired units with either liquid propane or natural gas.

This ECM would replace the two electric unit heaters with two new 30,000 Btu/h gas fired units with all associated venting a piping for the new units.

Energy Savings Calculations:

$$\text{Building Heat Usage (mmBtu)} = \frac{0.8 \times \text{Heater Size} \times \text{HDD} \times 24 \frac{\text{Hr}}{\text{Day}}}{(65 - 13) \times 1,000,000 \frac{\text{Btu}}{\text{mmBtu}}}$$

$$\text{Energy Usage (Fuel Units)} = \frac{\text{Building Heat Usage}}{\% \text{ Efficiency} * \text{Fuel Heat Value}}$$

GAS UNIT HEATER CALCULATIONS			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
ECM INPUTS	Electric Unit Heater	Gas Unit Heater	
Quantity	2	2	
Total Heater Size (Btu/h)	34,120	60,000	
Heating Degree Days (65F)	4,328	4,328	
Building Heat Usage (MMBTUs)	55	55	
Electric Usage (kWh)	16,306	0	
Propane Usage (Gallons)	0	744	
Efficiency (%)	98%	80%	-18%
Fuel Heat Value (BTU/Fuel Unit)	3,412	91,600	
Electric Cost (\$/kWh)	0.17	0.17	
Propane Cost (\$/Gal)	2.10	2.10	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Electric Usage (kWh)	16,306	0	16,306
Propane Usage (Gallons)	0	744	-744
Energy Cost (\$)	\$2,805	\$1,563	\$1,242
COMMENTS:			

Currently South Jersey Gas is extending natural gas service to the Borough in the coming year. As a result ECM savings that effect propane usage have also been reviewed based on natural gas being available. The following table projects potential savings with natural gas service at the building using a natural gas cost of \$1.1553 per therm. (Current rate information on SJG GSG and BGSS tariffs)

SAVINGS ADJUSTMENT FOR NATURAL GAS		
ECM Results	Usage	Cost (\$)
Existing Propane (gal)	0	\$0
Proposed Natural Gas (therm)	682	\$787
Adjusted Savings		(\$787)
Electric Savings (kWh)	16306	\$2,935
New Total Savings		\$2,148

Energy Savings Summary:

84 - ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$6,040
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$6,040
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$1,242
Total Yearly Savings (\$/Yr):	\$1,242
Estimated ECM Lifetime (Yr):	15
Simple Payback	4.9
Simple Lifetime ROI	208.4%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$18,630
Internal Rate of Return (IRR)	19%
Net Present Value (NPV)	\$8,786.92

ECM #11: Propane to Natural Gas Conversion All Buildings

Description:

To date South Jersey Gas is currently in the process of providing Natural Gas service to the Borough and its residents. The Borough currently operates many of its system on propane that is delivered on an as needed basis to storage tanks located at each building. While still an efficient way to heat propane is much more expensive per Btu than natural gas. The switchover would require gas pipe be run to each of the Borough's buildings and a gas meter installed. In many cases the existing pipe can be reused for natural gas, however each propane/gas piece of equipment would require a nozzle change out to accept the Natural Gas. Assuming the utility pays for the meter and gas piping from the main to the building the Borough would only be required to pay for the equipment alterations and any account set fees and deposits, which are determined when the account is setup.

Energy Savings Calculations:

The current Propane pricing from previously bills was compared to the current pricing for Natural Gas using SJG General Service Gas and Basic Gas Supply Service tariffs

PROPANE TO NATURAL GAS CONVERSION					
BUILDING	PROPANE		NATURAL GAS		SAVINGS
	Usage (Gal)	Cost (\$)	Usage (therm)	Cost (\$)	
Municipal Building	934.1	\$1,762	855.6	\$989	
Maintenance Building	515.9	\$1,084	472.6	\$546	
TOTAL	1450	\$2,846	1328.2	\$1,534	\$1,312

Energy Savings Summary:

ECM #11 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$900
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$900
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$1,312
Total Yearly Savings (\$/Yr):	\$1,312
Estimated ECM Lifetime (Yr):	15
Simple Payback	0.7
Simple Lifetime ROI	2086.7%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$19,680
Internal Rate of Return (IRR)	146%
Net Present Value (NPV)	\$14,762.57

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 measures (REM) for the municipality utilizing renewable technologies and concluded that there is potential for solar energy generation. The solar photovoltaic system calculation summary will be concluded as **REM#1** within this report.

Solar Generation

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which are mounted on all south and southwestern facades of the building. Flat roof, as well as sloped areas can be utilized; flat areas will have the panels turned to an optimum solar absorbing angle. (A structural survey of the roof would be necessary before the installation of PV panels is considered). The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit is around \$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 1032 S.F. can be utilized for a PV system at the Municipal Building and Maintenance Building. A depiction of the area utilized is shown in **Renewable / Distributed Energy Measures Calculation Appendix**. Using this square footage it was determined that a system size of 14.95 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 17,354 KWh annually, reducing the overall utility bill by approximately 56% percent. A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix**. This analysis illustrates the payback of the system over a 15 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

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

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

Direct purchase involves the Borough paying for 100% of the total project cost upfront via one of the methods noted in the Installation Funding Options section below. Calculations include a utility inflation rate as well as the degradation of the solar panels over time. Based on our calculations the following is the payback period:

**Table 8
Financial Summary – Photovoltaic System**

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM		
PAYMENT TYPE	SIMPLE PAYBACK, Yrs.	INTERNAL RATE OF RETURN
Direct Purchase	9.70	6.59%

*The solar energy measure is shown for reference in the executive summary Renewable Energy Measure (REM) table

Given the relatively small size to the system that can be installed here and the less than ten year simple payback it is recommended the Borough look into self financing the project. The small size of the system is restrictive for a Power Purchase Agreement and would likely result in little to no interest. It may be advantageous for the Borough to looking into Clean Energy financing

provided by Banks for these types of projects or soliciting for developer to design, install, and finance for the Borough.

Wind Generation

In addition to the Solar Analysis, CEG also conducted a review of the applicability of wind energy for the facility. Wind energy production is another option available through the Renewable Energy Incentive Program. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. Based on CEG's review of the applicability of wind energy for the facility, it was determined that based on 30 meter wind maps an average wind speed of 7.0 meters per second is available making wind a potential option for the Borough. Based on the current 26 kW peak load and available land space, CEG recommends a 2.4 kilowatt Sky Stream Turbine at a hub height of 30 feet. Based on our estimates the turbine could potentially produce 2,937 kilowatt-hours of electric annually. In addition electrical savings the district can receive Renewable Energy Certificates (REC) for wind energy production, with a current market price of approximately \$25 per megawatt-hour or production. The following table summarized the benefits and costs for the installation of the turbine.

Table 9
Summary – Wind Turbine

REM #2 - WINDTURBINES	
Installation Cost (\$):	\$35,000
NJ Smart Start Equipment Incentive (\$):	\$9,398
Net Installation Cost (\$):	\$25,602
Maintenance Savings (\$):	(\$150)
REC Revenue (\$/Yr):	\$73
Energy Savings (\$/Yr):	\$505
Total Yearly Savings (\$/Yr):	\$429
Estimated ECM Lifetime (Yr):	25
Simple Payback	59.74
Lifetime Energy Savings	\$12,628

It should be noted the NJ Office of Clean Energy Offers incentives for performing Feasibility Studies for up to 50% of the study costs, with maximums based on expected project size in kilowatts. It should be noted that the turbine specified can be easily installed and taken down in the event of severe weather.

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

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

Electricity:

The electricity usage profile demonstrates a steady year long load profile for facilities that have occupancy during the summer months.

The historical usage profile is beneficial and will allow for more competitive energy prices when shopping for alternative suppliers mainly due to the relatively flat load profile. Third Party Supplier (TPS) electric commodity contracts that offer's a firm, fixed price for 100% of the facilities electric requirements and are lower than the Atlantic City Electric's (AECO) BGS-FP default rate are recommended.

Propane:

The Propane profile demonstrates that peak usage occurs during the heating season for the facilities with minimal usage occurring the remaining part of the year.

The historical usage profile is beneficial as it provides information to the propane supplier on expected times of delivery and overall demand throughout the year. The propane pricing structure is currently based on delivery date pricing.

Tariff Analysis:

Electricity:

The facilities receive electrical service through Atlantic City Electric (AECO) on MGS (Monthly General Service). The facilities have not currently contracted a Third Party Supplier (TPS) to provide electric commodity service on a fixed price and purchases through AECO BGS-FP rate structure. For electric supply (generation) service, the client has a choice to either use AECO's default service rate BGS-FP or contract with a Third Party Supplier (TPS) to supply electric.

Each year since 2002, the four New Jersey Electric Distribution Companies (EDCs) - Public Service Gas & Electric Company (PSE&G), Atlantic City Electric Company (ACE), Jersey Central Power & Light Company (JCP&L), and Rockland Electric Company (RECO) - have

procured several billion dollars of electric supply to serve their Basic Generation Service (BGS) customers through a statewide auction process held in February.

BGS refers to the service of customers who are not served by a third party supplier or competitive retailer. This service is sometimes known as Standard Offer Service, Default Service, or Provider of Last Resort Service.

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

The utility, Atlantic City Electric will continue to be responsible for maintaining the existing network of wires, pipes and poles that make up the delivery system, which will serve all consumers, regardless of whom they choose to purchase their electricity or natural gas from. AECO's delivery service rate includes the following charges: Customer Service Charge, Distribution Charge, Market Transition, Transition Bond Charge, Non Utility Generation Charge, Societal Benefits Charge (SBC), Infrastructure Investment Charge, System Control Charge, Regulatory Assets Recovery Charge, and Regional Greenhouse Gas Initiative Charge.

Propane:

Propane pricing from South Jersey Propane is currently based on delivery date pricing. The propane market generally follows closely with the petroleum market, which can cause prices to fluctuate throughout the year.

Natural Gas:

The facilities currently do not receive natural gas distribution service through South Jersey Gas, however it is the future plan of the Borough once service is available to convert, as a result information in this section was left for future reference. At that time the Borough buildings will be likely placed under a General Service (GS) rate structure, and if do not contract with a third party will purchase commodity through SJG BGSS tariff.

South Jersey Gas provides basic gas supply service (BGSS) to customers who choose not to shop from a Third Party Supplier (TPS) for natural gas commodity. The option is essential to protect the reliability of service to consumers as well as protecting consumers if a third party supplier defaults or fails to provide commodity service. Please refer to the link below for a recap of natural gas BGSS charges from South Jersey Gas for rate schedule GSG.

<http://www.southjerseygas.com/108/tariff/bgssrates.pdf>

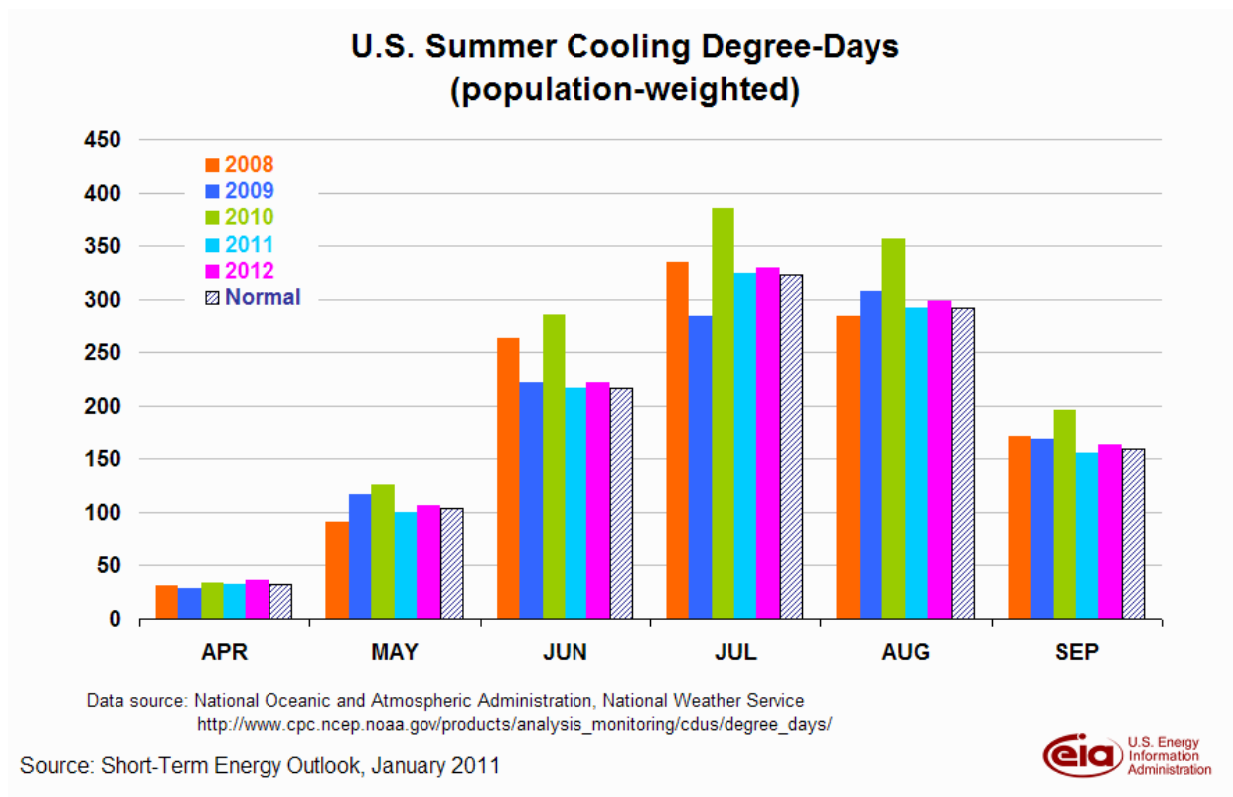
The utility, South Jersey Gas is responsible for maintaining the existing network of wires, pipes and poles that make up the delivery system, which will serve all consumers, regardless of whom they choose to purchase their electricity or natural gas from. South Jersey Gas's delivery service

rate includes the following charges: Customer Service Charge, Distribution Charge, & Societal Benefits Charge (SBC).

Electric and Natural Gas Commodities Market Overview:

Current electricity and natural gas market pricing has remained relatively stable over the last year. Commodity pricing in 2008 marked historical highs in both natural gas and electricity commodity. Commodity pricing commencing spring of 2009 continuing through 2010, has decreased dramatically over 2008 historic highs and continues to be favorable for locking in long term (2-5 year) contracts with 3rd Party Supplier’s for both natural gas and electricity supply requirements.

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



Short Term Energy Outlook - US Energy Information Administration (1/11/2011):

U.S. Natural Gas Prices. The Henry Hub spot price averaged \$4.25 per MMBtu during December, an increase of about 54 cents from November's price of \$3.71 per MMBtu. EIA expects the higher forecast production during the first half of 2011 compared with the same period last year, combined with a decline in consumption, to moderate natural gas spot prices. The projected spot price falls to a low of \$3.73 per MMBtu in June then rises to \$4.61 in December, averaging \$4.02 per MMBtu for all of 2011, which is \$0.37 per MMBtu lower than the 2010 average and \$0.31 per MMBtu lower than in last month's *Outlook*. In 2012, the spot price rises to an average of \$4.50 per MMBtu.

Uncertainty over future natural gas prices is slightly lower this year compared with last year at this time. Natural gas futures for March 2011 delivery (for the 5-day period ending January 6) averaged \$4.39 per MMBtu, and the average implied volatility over the same period was 43 percent. This produced lower and upper bounds for the 95-percent confidence interval for March 2011 contracts of \$3.21 per MMBtu and \$6.02 per MMBtu, respectively. At this time last year, the natural gas March 2010 futures contract averaged \$5.73 per MMBtu and implied volatility averaged 57 percent. The corresponding lower and upper limits of the 95-percent confidence interval were \$3.88 per MMBtu and \$8.47 per MMBtu.

U.S. Electricity Retail Prices. EIA expects the U.S. retail price for electricity distributed to the residential sector during 2010 to average 11.6 cents per kilowatt-hour, about the same level as in 2009. EIA expects the U.S. residential price to increase only slightly over the forecast period--by 0.6 percent in 2011 and by 1.0 percent in 2012.

Recommendations:

1. CEG recommends the Borough pursue aggregating their existing buildings and soliciting for a third party supplier for electricity and potentially natural gas in the future. As the Borough is a small user it is also recommended they review options for shared services with neighboring Municipalities in order to aggregate their supplies together as an attempt to achieve some economies of scale.
2. CEG also recommends that the Borough further investigate shopping its Propane purchasing or perhaps contracting with a provider at a fixed price for the year if an available option.
3. CEG recommends that the Borough consider utilizing a third party utility billing-auditing service to further analyze historical utility invoices such as water, sewer, natural gas and electric for incorrect billings and rate tariff optimization services. This service can be based on a shared savings model with no cost to the Borough. The service could provide refunds on potential incorrect billings that may have been passed through by the utilities and paid by the Borough.

X. INSTALLATION FUNDING OPTIONS

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

- i. *Energy Savings Improvement Program (ESIP)* – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and pay for the costs using the value of energy savings that result from the improvements. The “Energy Savings Improvement Program (ESIP)” law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources.
- 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.
- iv. *Direct Install Program* – The New Jersey Clean Energy’s Direct Install Program is a state funded program that targets small commercial and industrial facilities with peak demand of less than 100 kW. This turnkey program is aimed at providing owners a seamless, comprehensive process for analysis, equipment replacement and financial incentives to reduce consumption, lower utility costs and improve profitability. The program covers up to 60% of the cost for eligible upgrades including lighting, lighting controls, refrigeration, HVAC, motors, variable speed drives, natural gas and food service. Participating contractors (refer to www.njcleanenergy.com) conduct energy assessments in addition to your standard local government energy audit and install the cost-effective measures.

- v. *Energy Efficiency and Conservation Block Grants* – The EECGB rebate provides supplemental funding up to \$20,000 for counties and local government entities to implement energy conservation measures. The EECGB funding is provided through the American Recovery and Reinvestment Act (ARRA). The local government must be among the eligible local government entities listed on the NJ Clean Energy website as follows - <http://njcleanenergy.com/commercial-industrial/programs/eecbg-eligible-entities>. This program is limited to municipalities and counties that have not already received grants directly through the US department of Energy.

This incentive is provided in addition to the other NJ Clean Energy program funding. This program's incentive is considered the entity's capital and therefore can be applied to the LGEA program's requirements to implement the recommended energy conservation measures totaling at least 25% of the energy audit cost. Additional requirements of this program are as follows:

1. The entity must utilize additional funding through one or more of the NJ Clean Energy programs such as Smart Start, Direct Install, and Pay for Performance.
2. The EECBG funding in combination with other NJ Clean Energy programs may not exceed the total cost of the energy conservation measures being implemented.
3. Envelope measures are applicable only if recommended by the LGEA energy audit and if the energy audit was completed within the past 12 months.
4. New construction and previously installed measures are not eligible for the EECBG rebate.
5. Energy conservation measures eligible for the EECBG must fall within the list of approved energy conservation measures. The complete list of eligible measures and other program requirements are included in the "EECBG Complete Application Package." The application package is available on the NJ Clean Energy website - <http://njcleanenergy.com/commercial-industrial/programs/energy-efficiency-and-conservation-block-grants>.

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. Clean all light fixtures to maximize light output.
- D. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.
- E. The facilities currently have sinks rated at 2.2 gallons per minute. CEG recommends the installation of 0.5 gallons per minute aerators on all sinks. Aerators are a relatively inexpensive item and can install by the Borough's Maintenance personnel.
- F. The outdoor showers located at the Municipal Building should be swapped out for a 1.5 gallons per minute shower or less.

XII. ENERGY AUDIT ASSUMPTIONS

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

- A. Cost Estimates noted within this report are based on industry accepted costing data such as RS MeansTM Cost Data, contractor pricing and engineering estimates. All cost estimates for this level of auditing are +/- 20%. Prevailing wage rates for the specified region has been utilized to calculate installation costs. The cost estimates indicated within this audit should be utilized by the owner for prioritizing further project development post the energy audit. Project development would include investment grade auditing and detailed engineering.
- B. Energy savings noted within this audit are calculated utilizing industry standard procedures and accepted engineering assumptions. For this level of auditing, energy savings are not guaranteed.
- C. Information gathering for each facility is strongly based on interviews with operations personnel. Information dependent on verbal feedback is used for calculation assumptions including but not limited to the following:
 - a. operating hours
 - b. equipment type
 - c. control strategies
 - d. scheduling
- D. Information contained within the major equipment list is based on the existing owner documentation where available (drawings, O&M manuals, etc.). If existing owner documentation is not available, catalog information is utilized to populate the required information.
- E. Equipment incentives and energy credits are based on current pricing and status of rebate programs. Rebate availability is dependent on the individual program funding and applicability.
- F. Equipment (HVAC, Plumbing, Electrical, & Lighting) noted within an ECM recommendation is strictly noted as a **basis for calculation** of energy savings. The owner should use this equipment information as a benchmark when pursuing further investment grade project development and detailed engineering for specific energy conservation measures.

Utility bill annual averages are utilized for calculation of all energy costs unless otherwise noted. Accuracy of the utility energy usage and costs are based on the information provided. Utility information including usage and costs is estimated where incomplete data is provided.

APPENDIX A

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Cape May Point - Municipal, Maintenance, and Pump House Buildings

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^N \frac{C_n}{(1 + IRR)^n}$	$\sum_{n=0}^N \frac{C_n}{(1 + DR)^n}$
		(\$)	(\$)	(\$)	(\$)	(\$/Yr)	(\$/Yr)	(\$/Yr)		(Yr)	(\$)	(\$)	(%)	(Yr)	(\$)
82 - ECM #1	Lighting Upgrade	\$1,323	\$331	\$353	\$1,301	\$597	\$200	\$797	15	\$11,948	\$3,000	818.3%	1.6	61.18%	\$8,207.68
82 - ECM #2	Lighting Controls Upgrade	\$1,940	\$485	\$410	\$2,015	\$154	\$0	\$154	15	\$2,310	\$0	14.6%	13.1	1.76%	(\$176.56)
82 - ECM #3	HVAC System Upgrade	\$15,600	\$14,200	\$1,244	\$28,556	\$1,811	\$0	\$1,811	15	\$27,165	\$0	-4.9%	15.8	-0.62%	(\$6,936.40)
83 - ECM #1	Lighting Upgrade	\$3,720	\$0	\$220	\$3,500	\$693	\$0	\$693	15	\$10,388	\$0	196.8%	5.1	9.39%	\$112.32
83 - ECM #2	Lighting Controls Upgrade	\$256	\$64	\$70	\$250	\$47	\$0	\$47	12	\$567	\$0	126.7%	5.3	17.12%	\$313.71
83 - ECM #3	Window Replacement	\$2,400	\$0	\$0	\$2,400	\$115	\$0	\$115	12	\$1,380	\$0	-42.5%	20.9	18.17%	\$4,767.62
84 - ECM #1	Lighting Upgrade	\$248	\$0	\$30	\$218	\$28	\$0	\$28	15	\$415	\$0	90.4%	7.9	15.56%	\$220.03
84 - ECM #2	Lighting Controls Upgrade	\$320	\$0	\$70	\$250	\$47	\$0	\$47	15	\$708	\$0	183.3%	5.3	-7.63%	(\$1,255.29)
84 - ECM #3	Premium Efficiency Motor Replacement	\$14,886	\$3,722	\$470	\$18,138	\$388	\$0	\$388	15	\$5,820	\$0	-67.9%	46.7	-11.71%	(\$13,506.08)
84 - ECM #4	Electric to Gas Unit Heater	\$3,000	\$3,040	\$0	\$6,040	\$1,242	\$0	\$1,242	15	\$18,630	\$0	208.4%	4.9	19.06%	\$8,786.92
ECM #11	Propane to Natural Gas Conversion	\$600	\$300	\$0	\$900	\$1,312	\$0	\$1,312	15	\$19,680	\$0	2086.7%	0.7	145.78%	\$14,762.57
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	43.7 KW Roof Solar Array	\$349,600	\$0	\$0	\$349,600	\$7,450	\$18,362	\$25,812	25	\$645,300	\$459,050	84.6%	13.5	5.40%	\$99,868.17
REM #2	2.4 kW Wind Turbine	\$35,000	\$0	\$9,398	\$25,602	\$505	(\$77)	\$428	15	\$6,420	-\$1,155	-74.9%	59.8	-13.78%	(\$20,492.56)

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

APPENDIX B



Concord Engineering Group, Inc.

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

SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of February 15, 2011:

Electric Chillers

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

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Cooling

Gas Absorption Chillers	\$185 - \$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 - \$92 per ton
Air-to-Air Heat Pumps	\$73 - \$92 per ton
Water-Source Heat Pumps	\$81 per ton
Packaged Terminal AC & HP	\$65 per ton
Central DX AC Systems	\$40- \$72 per ton
Dual Enthalpy Economizer Controls	\$250
Occupancy Controlled Thermostat (Hospitality & Institutional Facility)	\$75 per thermostat

Energy Efficiency must comply with ASHRAE 90.1-2007

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, AFUE ≥ 92%

Ground Source Heat Pumps

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

Energy Efficiency must comply with ASHRAE 90.1-2007

Variable Frequency Drives

Variable Air Volume	\$65 - \$155 per hp
Chilled-Water Pumps	\$60 per VFD rated hp
Compressors	\$5,250 to \$12,500 per drive
Cooling Towers \geq 10 hp	\$60 per VFD rated hp

Natural Gas Water Heating

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

Prescriptive Lighting

Retro fit of T12 to T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	\$10 per fixture (1-4 lamps)
Replacement of T12 with new T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	\$25 per fixture (1-4 lamps)
Replacement of incandescent with screw-in PAR 38 or PAR 30 (CFL) bulb	\$7 per bulb
T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	\$10 per fixture
Hard-Wired Compact Fluorescent	\$25 - \$30 per fixture
Metal Halide w/Pulse Start Including Parking Lot	\$25 per fixture
T-5 and T-8 High Bay Fixtures	\$16 - \$200 per fixture
HID \geq 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	\$50 per fixture
HID \geq 100w Replacement with new HID \geq 100w	\$70 per fixture

Prescriptive Lighting - LED

LED New Exit Sign Fixture Existing Facility < 75 kw Existing Facility > 75 kw	\$20 per fixture \$10 per fixture
LED Display Case Lighting	\$30 per display case
LED Shelf-Mtd. Display & Task Lights	\$15 per linear foot
LED Portable Desk Lamp	\$20 per fixture
LED Wall-wash Lights	\$30 per fixture
LED Recessed Down Lights	\$35 per fixture
LED Outdoor Pole/Arm-Mounted Area and Roadway Luminaries	\$175 per fixture
LED Outdoor Pole/Arm-Mounted Decorative Luminaries	\$175 per fixture
LED Outdoor Wall-Mounted Area Luminaries	\$100 per fixture
LED Parking Garage Luminaries	\$100 per fixture
LED Track or Mono-Point Directional Lighting Fixtures	\$50 per fixture
LED High-Bay and Low-Bay Fixtures for Commercial & Industrial Bldgs.	\$150 per fixture
LED High-Bay-Aisle Lighting	\$150 per fixture
LED Bollard Fixtures	\$50 per fixture
LED Linear Panels (2x2 Troffers only)	\$100 per fixture
LED Fuel Pump Canopy	\$100 per fixture
LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	\$42 per 5 foot \$65 per 6 foot

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
Daylight Dimming - office	\$50 per fixture controlled

Premium Motors

Three-Phase Motors	\$45 - \$700 per motor
Fractional HP Motors Electronic Communicated Motors (replacing shaded pole motors in refrigerator/freezer cases)	\$40 per electronic communicated motor

Other Equipment Incentives

Performance Lighting	\$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2007 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive
Custom Measures	\$0.16 KWh and \$1.60/Therm of 1st year savings, or a buy down to a 1 year payback on estimated savings. Minimum required savings of 75,000 KWh or 1,500 Therms and a IRR of at least 10%.
Multi Measures Bonus	15%

APPENDIX C

MAJOR EQUIPMENT LIST

Concord Engineering Group Cape May Point - Public Works Garage

Unit Heaters

Tag			
Unit Type	Gas Fired Unit Heater	Unit Heater	
Qty	1	1	
Location	Garage	Office	
Area Served	Garage	Office	
Manufacturer	ADP	Kozy-World	
Model #	SEP-145A-5	KWP210	
Serial #	5606J18987	4047466	
Heating Type	Propane/ LP	Propane/ LP	
Heating Capacity (MBH)	145	20	
CFM	1900 CFM	-	
RPM/HP	1075 RPM / 1/8 HP	-	
GPM	N/A	N/A	
Approx Age			
Ashrae Service Life	20	20	
Remaining Life	20	20	
Comments			

MAJOR EQUIPMENT LIST

Concord Engineering Group

Cape May Point - Public Works Garage

Domestic Water Heaters

Tag	DHW-1		
Unit Type	Elec HWH		
Qty	1		
Location	Bathroom		
Area Served	Sink/Bathroom		
Manufacturer	Whirlpool		
Model #	EIF12US015V		
Serial #	0800129		
Size (Gallons)	12		
Input Capacity (MBH/KW)	1.5 kW		
Recovery (Gal/Hr)	-		
Efficiency %	-		
Fuel	Electric		
Approx Age	3		
ASHRAE Service Life	12		
Remaining Life	9		
Comments			

MAJOR EQUIPMENT LIST

Concord Engineering Group
Cape May Point - Municipal Building

Rooftop / AC Units

Tag	AH-1	AH-1	
Unit Type	CU/Furnace Unit	CU/Furnace Unit	
Qty	1	1	
Location	Indoor/Outdoor	Indoor/Outdoor	
Area Served	Left Side of Building	Right Side of Building	
Manufacturer	Lennox	Lennox	
Model #	HS21-411-1P / G26Q3-75-1	HS-21-511-1P / G26Q4/5-75-1	
Serial #	5896C10125 / 5895L20550	5895L35324 / 5896A14370	
Cooling Type	DX	DX	
Cooling Capacity (Tons)	3.00	3.00	
Cooling Efficiency (SEER/EER)	10 SEER	10 SEER	
Heating Type	Gas Furnace	Gas Furnace	
Heating Input (MBH)	75000	75000	
Efficiency	78%	78%	
Fuel	Propane	Propane	
Approx Age	15	15	
ASHRAE Service Life	15	15	
Remaining Life	0	0	
Comments			

MAJOR EQUIPMENT LIST

Concord Engineering Group
Cape May Point - Municipal Building

Domestic Water Heaters

Tag	HWH-1		
Unit Type	Boiler		
Qty	1		
Location	Closet		
Area Served	Building		
Manufacturer	Bradford & White		
Model #	MI75S5CX6		
Serial #	KH1899049		
Size (Gallons)	75		
Input Capacity (MBH/KW)	75 MBH		
Recovery (Gal/Hr)	68.3		
Efficiency %	80%		
Fuel	Propane		
Approx Age	11		
ASHRAE Service Life	12		
Remaining Life	1		
Comments			

MAJOR EQUIPMENT LIST

Concord Engineering Group

Cape May Point - Pump Station

Pumps

Tag	P-1	P-2	
Unit Type	Water Pump	Water Pump	
Qty	2	1	
Location	Pump House	Pump House	
Area Served			
Manufacturer	Siemens	Siemens	
Model #	RG7ESD	RGZVSD	
Serial #	TL49256-4YK60	1LA03264SD23	
Horse Power	20 HP	50 HP	
Flow			
Motor Info			
Electrical Power	230/460/3/60		
RPM	1755 RPM	1765 RPM	
Motor Efficiency %	91.7%	91.7%	
Approx Age			
ASHRAE Service Life	18	18	20
Remaining Life			
Comments			

MAJOR EQUIPMENT LIST

Concord Engineering Group

Cape May Point - Pump Station

Unit Heaters

Tag	UH-1, 2		
Unit Type	Electric Unit Heater		
Qty	2		
Location	Pump House		
Area Served	Pump House		
Manufacturer	Q Mark		
Model #	MUH0541		
Serial #	1108		
Heating Type	Electric		
Heating Capacity (MBH)	5 KW		
CFM	-		
RPM/HP	-		
GPM	N/A		
Approx Age			
Ashrae Service Life	20		
Remaining Life	20		
Comments			

APPENDIX D

Investment Grade Lighting Audit

CEG Job #: 9C10102

Project: Cape May Point LGEA

Address: 15 Lighthouse Avenue

Cap May Point, NJ

Building SF: 3,512

Municipal Building

KWH COST: \$0.183

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING					PROPOSED LIGHTING								SAVINGS									
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly \$ Savings	Yearly Simple Payback
1	Construction Office	1820	6	4	4 Lamp 32 W T8 2x4 Recessed Prismatic	109	0.65	1,190.3	\$217.82	6	4	Relamp - Sylvania Lamp FO28/841/SS/ECO	98	0.59	1070.16	\$195.84	\$28.00	\$168.00	0.07	120.12	\$21.98	7.64
1	File Room	1820	1	4	4 Lamp 32 W T8 2x4 Recessed Prismatic	109	0.11	198.4	\$36.30	1	4	Relamp - Sylvania Lamp FO28/841/SS/ECO	98	0.10	178.36	\$32.64	\$28.00	\$28.00	0.01	20.02	\$3.66	7.64
1	Clerk Administrator	1820	2	4	4 Lamp 32 W T8 2x4 Recessed Prismatic	109	0.22	396.8	\$72.61	2	4	Relamp - Sylvania Lamp FO28/841/SS/ECO	98	0.20	356.72	\$65.28	\$28.00	\$56.00	0.02	40.04	\$7.33	7.64
2		1820	1	1	100 W Recessed Can Flood Lamp	100	0.10	182.0	\$33.31	1	1	26w R40 CFL Lamp	26	0.03	47.32	\$8.66	\$20.00	\$20.00	0.07	134.68	\$24.65	0.81
4	Treasurer/CFO Office	1820	4	1	65 W PAR30 Recessed Flood	65	0.26	473.2	\$86.60	4	1	23w PAR38 Energy Star Rated Floodlight Lamp	23	0.09	167.44	\$30.64	\$22.00	\$88.00	0.17	305.76	\$55.95	1.57
3		1820	1	1	25 W CFL Desk Lamp	25	0.03	45.5	\$8.33	1	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
4	Hallway	1820	4	1	65 W PAR30 Recessed Flood	65	0.26	473.2	\$86.60	4	1	23w PAR38 Energy Star Rated Floodlight Lamp	23	0.09	167.44	\$30.64	\$22.00	\$88.00	0.17	305.76	\$55.95	1.57
5		1820	4	1	13 W Recessed CFL	13	0.05	94.6	\$17.32	4	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
2	Conference Room	1820	6	1	100 W Recessed Can Flood Lamp	100	0.60	1,092.0	\$199.84	6	1	26w R40 CFL Lamp	26	0.16	283.92	\$51.96	\$20.00	\$120.00	0.44	808.08	\$147.88	0.81
6		1820	2	1	75 W Incandescent Med Base Side Wall Fixture	75	0.15	273.0	\$49.96	2	1	Energy Star Rated, Dimmable 26w CFL Lamp	26	0.05	94.64	\$17.32	\$20.00	\$40.00	0.10	178.36	\$32.64	1.23
1	Tax Collector	1820	1	4	4 Lamp 32 W T8 2x4 Recessed Prismatic	109	0.11	198.4	\$36.30	1	4	Relamp - Sylvania Lamp FO28/841/SS/ECO	98	0.10	178.36	\$32.64	\$28.00	\$28.00	0.01	20.02	\$3.66	7.64
3		1820	1	1	25 W CFL Desk Lamp	25	0.03	45.5	\$8.33	1	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
7	Garage "Life Guard"	1820	2	2	2 Lamp T12 34 Watt 1x4 Surface Mount Wrap	80	0.16	291.2	\$53.29	2	2	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.12	211.12	\$38.63	\$100.00	\$200.00	0.04	80.08	\$14.65	13.65
9		1820	1	2	2 Lamp T8 32 Watt Surface Mount Wrap	58	0.06	105.6	\$19.32	1	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.05	91	\$16.65	\$14.00	\$14.00	0.01	14.56	\$2.66	5.25
8	Life guard Bathroom	1820	1	1	1 Lamp T12 1x2 Side Wall Wrap	25	0.03	45.5	\$8.33	1	1	1 28w T8, 4' Channel	25	0.03	45.5	\$8.33	\$120.00	\$120.00	0.00	0	\$0.00	0.00
9	Storage Room	1820	1	2	2 Lamp T8 32 Watt Surface Mount Wrap	58	0.06	105.6	\$19.32	1	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.05	91	\$16.65	\$14.00	\$14.00	0.01	14.56	\$2.66	5.25
9	Captain's Office	1820	1	2	2 Lamp T8 32 Watt Surface Mount Wrap	58	0.06	105.6	\$19.32	1	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.05	91	\$16.65	\$14.00	\$14.00	0.01	14.56	\$2.66	5.25
10	Hallway Cont'd	1820	4	2	2 Lamp T8 1x4 32 Watt Recessed Prismatic	58	0.23	422.2	\$77.27	4	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.20	364	\$66.61	\$14.00	\$56.00	0.03	58.24	\$10.66	5.25
4		1820	1	1	65 W PAR30 Recessed Flood	65	0.07	118.3	\$21.65	1	1	23w PAR38 Energy Star Rated Floodlight Lamp	23	0.02	41.86	\$7.66	\$22.00	\$22.00	0.04	76.44	\$13.99	1.57
11		1820	3	1	26 Watt Recessed CFL	26	0.08	142.0	\$25.98	3	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
1	Beach Office	1820	2	4	4 Lamp 32 W T8 2x4 Recessed Prismatic	109	0.22	396.8	\$72.61	2	4	Relamp - Sylvania Lamp FO28/841/SS/ECO	98	0.20	356.72	\$65.28	\$28.00	\$56.00	0.02	40.04	\$7.33	7.64
8	Mech Closet	1820	1	1	1 Lamp T12 1x2 Side Wall Wrap	25	0.03	45.5	\$8.33	1	1	1 28w T8, 4' Channel	25	0.03	45.5	\$8.33	\$120.00	\$120.00	0.00	0	\$0.00	0.00
9	Men's Toilet	1820	1	2	2 Lamp T8 32 Watt Surface Mount Wrap	58	0.06	105.6	\$19.32	1	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.05	91	\$16.65	\$14.00	\$14.00	0.01	14.56	\$2.66	5.25
9	Wome's Toilet	1820	1	2	2 Lamp T8 32 Watt Surface Mount Wrap	58	0.06	105.6	\$19.32	1	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.05	91	\$16.65	\$14.00	\$14.00	0.01	14.56	\$2.66	5.25
1	Public Safety Office	1820	2	4	4 Lamp 32 W T8 2x4 Recessed Prismatic	109	0.22	396.8	\$72.61	2	4	Relamp - Sylvania Lamp FO28/841/SS/ECO	98	0.20	356.72	\$65.28	\$28.00	\$56.00	0.02	40.04	\$7.33	7.64

Investment Grade Lighting Audit

EXISTING LIGHTING					PROPOSED LIGHTING								SAVINGS									
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly \$ Savings	Yearly Simple Payback
1	Com. Revenue & Finance	1820	1	4	4 Lamp 32 W T8 2x4 Recessed Prismatic	109	0.11	198.4	\$36.30	1	4	Relamp - Sylvania Lamp FO28/841/SS/ECO	98	0.10			\$28.00	\$28.00	0.01	0	\$0.00	0.00
3		1820	1	1	25 W CFL Desk Lamp	25	0.03	45.5	\$8.33	1	0	No Change	0	0.00			\$0.00	\$0.00	0.00	0	\$0.00	0.00
1	Mayor Office	1820	2	4	4 Lamp 32 W T8 2x4 Recessed Prismatic	109	0.22	396.8	\$72.61	2	4	Relamp - Sylvania Lamp FO28/841/SS/ECO	98	0.20	356.72	\$65.28	\$28.00	\$56.00	0.02	40.04	\$7.33	7.64
10		1820	1	2	2 Lamp T8 1x4 32 Watt Recessed Prismatic	58	0.06	105.6	\$19.32	1	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.05	91	\$16.65	\$14.00	\$14.00	0.01	14.56	\$2.66	5.25
3		1820	1	1	25 W CFL Desk Lamp	25	0.03	45.5	\$8.33	1	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
5	Vestibule	1820	2	1	13 W Recessed CFL	13	0.03	47.3	\$8.66	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
12	Exterior	1820	3	1	70 W HPS Side Down Light	94	0.28	513.2	\$93.92	3	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
13		1820	3	1	40 Watt Incandescent Screw In	40	0.12	218.4	\$39.97	3	1	(1) 26w CFL Lamp	13	0.04	70.98	\$12.99	\$20.00	\$60.00	0.08	147.42	\$26.98	2.22
14		1820	8	1	65 Watt Incandescent Recessed	65	0.52	946.4	\$173.19	8	1	(1) 26w CFL Lamp	13	0.10	189.28	\$34.64	\$20.00	\$160.00	0.42	757.12	\$138.55	1.15
Totals			76	66			5.26	9,565.9	\$1,750.56	76	58			2.92	5128.76	\$938.56		\$1,654.00	1.80	3259.6	\$596.51	2.77

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.
2. Lamp totals only include T-12 tube replacment calculations

Investment Grade Lighting Audit

CEG Job #: 9C10102

Project: Cape May Point LGEA

Municipal Building

KWH COST: \$0.183

Address: 15 Lighthouse Avenue

Cap May Point, NJ

Building SF: 3512

ECM #2: Lighting Controls

EXISTING LIGHTING					PROPOSED LIGHTING CONTROLS							SAVINGS											
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr	Yearly \$ Cost	No. Fixts	No. Lamps	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr	Yearly \$ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly \$ Savings	Yearly Simple Payback
0	0	0	0	0	0	0	0	0	0	0	0		0	0.00	0%	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
1	Construction Office	1820	6	4	4 Lamp 32 W T8 2x4 Recessed Prismatic	109	0.65	1190.28	\$217.82	6	1	Dual Technology Occupancy Sensor - Remote Mnt.	109	0.52	20%	952.224	\$174.26	\$160.00	\$160.00	0.13	238.056	\$43.56	3.67
1	File Room	1820	1	4	4 Lamp 32 W T8 2x4 Recessed Prismatic	109	0.11	198.38	\$36.30	1	1	Dual Technology Occupancy Sensor - Switch Mnt.	109	0.09	20%	158.704	\$29.04	\$75.00	\$75.00	0.02	39.676	\$7.26	10.33
1	Clerk Administrator	1820	2	4	4 Lamp 32 W T8 2x4 Recessed Prismatic	109	0.22	396.76	\$72.61	2	1	Dual Technology Occupancy Sensor - Remote Mnt.	109	0.17	20%	317.408	\$58.09	\$160.00	\$160.00	0.04	79.352	\$14.52	11.02
2		1820	1	1	100 W Recessed Can Flood Lamp	100	0.10	182	\$33.31	1	0	No Change	100	0.10	0%	182	\$33.31	\$75.00	\$75.00	0.00	0	\$0.00	0.00
4	Treasurer/CFO Office	1820	4	1	65 W PAR30 Recessed Flood	65	0.26	473.2	\$86.60	4	1	Dual Technology Occupancy Sensor - Remote Mnt.	65	0.21	20%	378.56	\$69.28	\$160.00	\$160.00	0.05	94.64	\$17.32	9.24
3		1820	1	1	25 W CFL Desk Lamp	25	0.03	45.5	\$8.33	1	0	No Change	25	0.03	0%	45.5	\$8.33	\$0.00	\$0.00	0.00	0	\$0.00	0.00
4	Hallway	1820	4	1	65 W PAR30 Recessed Flood	65	0.26	473.2	\$86.60	4	0	No Change	65	0.26	0%	473.2	\$86.60	\$0.00	\$0.00	0.00	0	\$0.00	0.00
5		1820	4	1	13 W Recessed CFL	13	0.05	94.64	\$17.32	4	0	No Change	13	0.05	0%	94.64	\$17.32	\$75.00	\$75.00	0.00	0	\$0.00	0.00
2	Conference Room	1820	6	1	100 W Recessed Can Flood Lamp	100	0.60	1092	\$199.84	6	0	No Change	100	0.60	0%	1092	\$199.84	\$75.00	\$75.00	0.00	0	\$0.00	0.00
6		1820	2	1	75 W Incandescent Med Base Side Wall Fixture	75	0.15	273	\$49.96	2	0	No Change	75	0.15	0%	273	\$49.96	\$75.00	\$150.00	0.00	0	\$0.00	0.00
1	Tax Collector	1820	1	4	4 Lamp 32 W T8 2x4 Recessed Prismatic	109	0.11	198.38	\$36.30	1	1	Dual Technology Occupancy Sensor - Remote Mnt.	109	0.09	20%	158.704	\$29.04	\$160.00	\$160.00	0.02	39.676	\$7.26	22.04
3		1820	1	1	25 W CFL Desk Lamp	25	0.03	45.5	\$8.33	1	0	No Change	25	0.03	0%	45.5	\$8.33	\$0.00	\$0.00	0.00	0	\$0.00	0.00
7	Garage "Life Guard"	1820	2	2	2 Lamp T12 34 Watt 1x4 Surface Mount Wrap	80	0.16	291.2	\$53.29	2	0	No Change	80	0.16	0%	291.2	\$53.29	\$0.00	\$0.00	0.00	0	\$0.00	0.00
9		1820	1	2	2 Lamp T8 32 Watt Surface Mount Wrap	58	0.06	105.56	\$19.32	1	0	No Change	58	0.06	0%	105.56	\$19.32	\$0.00	\$0.00	0.00	0	\$0.00	0.00
8	Life guard Bathroom	1820	1	1	1 Lamp T12 1x2 Side Wall Wrap	25	0.03	45.5	\$8.33	1	0	No Change	25	0.03	0%	45.5	\$8.33	\$75.00	\$75.00	0.00	0	\$0.00	0.00

Investment Grade Lighting Audit

EXISTING LIGHTING					PROPOSED LIGHTING CONTROLS								SAVINGS										
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	No. Fixts	No. Lamps	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly \$ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly \$ Savings	Yearly Simple Payback
9	Storage Room	1820	1	2	2 Lamp T8 32 Watt Surface Mount Wrap	58	0.06	105.56	\$19.32	1	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.05	20%	84.448	\$15.45	\$75.00	\$75.00	0.01	21.112	\$3.86	19.41
9	Captain's Office	1820	1	2	2 Lamp T8 32 Watt Surface Mount Wrap	58	0.06	105.56	\$19.32	1	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.05	20%	84.448	\$15.45	\$160.00	\$160.00	0.01	21.112	\$3.86	41.41
10	Hallway Cont'd	1820	4	2	2 Lamp T8 1x4 32 Watt Recessed Prismatic	58	0.23	422.24	\$77.27	4	0	No Change	58	0.23	0%	422.24	\$77.27	\$0.00	\$0.00	0.00	0	\$0.00	0.00
4		1820	1	1	65 W PAR30 Recessed Flood	65	0.07	118.3	\$21.65	1	0	No Change	65	0.07	0%	118.3	\$21.65	\$75.00	\$75.00	0.00	0	\$0.00	0.00
11		1820	3	1	26 Watt Recessed CFL	26	0.08	141.96	\$25.98	3	0	No Change	26	0.08	0%	141.96	\$25.98	\$75.00	\$75.00	0.00	0	\$0.00	0.00
1	Beach Office	1820	2	4	4 Lamp 32 W T8 2x4 Recessed Prismatic	109	0.22	396.76	\$72.61	2	1	Dual Technology Occupancy Sensor - Remote Mnt.	109	0.17	20%	317.408	\$58.09	\$160.00	\$160.00	0.04	79.352	\$14.52	11.02
8	Mech Closet	1820	1	1	1 Lamp T12 1x2 Side Wall Wrap	25	0.03	45.5	\$8.33	1	1	Dual Technology Occupancy Sensor - Switch Mnt.	25	0.02	20%	36.4	\$6.66	\$75.00	\$75.00	0.01	9.1	\$1.67	45.04
9	Men's Toilet	1820	1	2	2 Lamp T8 32 Watt Surface Mount Wrap	58	0.06	105.56	\$19.32	1	0	No Change	58	0.06	0%	105.56	\$19.32	\$0.00	\$0.00	0.00	0	\$0.00	0.00
9	Wome's Toilet	1820	1	2	2 Lamp T8 32 Watt Surface Mount Wrap	58	0.06	105.56	\$19.32	1	0	No Change	58	0.06	0%	105.56	\$19.32	\$0.00	\$0.00	0.00	0	\$0.00	0.00
1	Public Safety Office	1820	2	4	4 Lamp 32 W T8 2x4 Recessed Prismatic	109	0.22	396.76	\$72.61	2	1	Dual Technology Occupancy Sensor - Remote Mnt.	109	0.17	20%	317.408	\$58.09	\$160.00	\$160.00	0.04	79.352	\$14.52	11.02
1	Com. Revenue & Finance	1820	1	4	4 Lamp 32 W T8 2x4 Recessed Prismatic	109	0.11	198.38	\$36.30	1	1	Dual Technology Occupancy Sensor - Remote Mnt.	109	0.09	20%	158.704	\$29.04	\$160.00	\$160.00	0.02	39.676	\$7.26	22.04
3		1820	1	1	25 W CFL Desk Lamp	25	0.03	45.5	\$8.33	1	0	No Change	25	0.03	0%	45.5	\$8.33	\$0.00	\$0.00	0.00	0	\$0.00	0.00
1	Mayor Office	1820	2	4	4 Lamp 32 W T8 2x4 Recessed Prismatic	109	0.22	396.76	\$72.61	2	1	Dual Technology Occupancy Sensor - Remote Mnt.	109	0.17	20%	317.408	\$58.09	\$160.00	\$160.00	0.04	79.352	\$14.52	11.02
10		1820	1	2	2 Lamp T8 1x4 32 Watt Recessed Prismatic	58	0.06	105.56	\$19.32	1	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.05	20%	84.448	\$15.45	\$160.00	\$160.00	0.01	21.112	\$3.86	41.41
3		1820	1	1	25 W CFL Desk Lamp	25	0.03	45.5	\$8.33	1	0	No Change	25	0.03	0%	45.5	\$8.33	\$75.00	\$0.00	0.00	0	\$0.00	0.00
5	Vestibule	1820	2	1	13 W Recessed CFL	13	0.03	47.32	\$8.66	2	0	No Change	13	0.03	0%	47.32	\$8.66	\$75.00	\$0.00	0.00	0	\$0.00	0.00
12	Exterior	1820	3	1	70 W HPS Side Down Light	94	0.28	513.24	\$93.92	3	0	No Change	94	0.28	0%	513.24	\$93.92	\$0.00	\$0.00	0.00	0	\$0.00	0.00
13		1820	3	1	40 Watt Incandescent Screw In	40	0.12	218.4	\$39.97	3	0	No Change	40	0.12	0%	218.4	\$39.97	\$75.00	\$0.00	0.00	0	\$0.00	0.00

Investment Grade Lighting Audit

EXISTING LIGHTING					PROPOSED LIGHTING CONTROLS								SAVINGS										
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	No. Fixts	No. Lamps	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly \$ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly \$ Savings	Yearly Simple Payback
14		1820	8	1	65 Watt Incandescent Recessed	65	0.52	946.4	\$173.19	8	0	No Change	65	0.52	0%	946.4	\$173.19	\$0.00	\$0.00	0.00	0	\$0.00	0.00
Totals				76	66		5.26	9,565.9	\$1,750.56	76	13			4,7936		8724.352	\$1,596.56		\$2,425.00	0.46	841.6	\$154.01	15.75

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.
2. Lamp totals only include T-12 tube replacment calculations

Investment Grade Lighting Audit

CEG Job #: 9C10102

Project: Cape May Point LGEA

Maintenance Building

KWH COST: \$0.184

Address: Lighthouse Avenue & Sunset Blvd

Cap May Point, NJ

Building SF: 3,500

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING					PROPOSED LIGHTING								SAVINGS									
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly \$ Savings	Yearly Simple Payback
21	Office	1500	1	4	4 Lamp T12 Pendant Mount Prismatic	204	0.20	306.0	\$56.30	1	3	Replace to 3-Lamp T8 with Electronic Ballast	83	0.08	124.5	\$22.91	\$175.00	\$175.00	0.12	181.5	\$33.40	5.24
7	Break Area	1500	2	2	2 Lamp T12 34 Watt 1x4 Pendant Mount	80	0.16	240.0	\$44.16	2	2	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.12	174	\$32.02	\$100.00	\$200.00	0.04	66	\$12.14	16.47
21	Garage	1500	19	4	4 Lamp T12 Pendant Mount Prismatic	204	3.88	5,814.0	\$1,069.78	19	3	Replace to 3-Lamp T8 with Electronic Ballast	83	1.58	2365.5	\$435.25	\$175.00	\$3,325.00	2.30	3448.5	\$634.52	5.24
14	Bathroom	780	1	1	100 Watt Incandescent Recessed	100	0.10	78.0	\$14.35	1	1	(1) 26w CFL Lamp	13	0.01	10.14	\$1.87	\$20.00	\$20.00	0.09	67.86	\$12.49	1.60
Totals				23	11		4.34	6,438.0	\$1,184.59	23	9			1.79	2674.14	\$492.04		\$3,720.00	2.55	3763.9	\$692.55	5.37

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.
2. Lamp totals only include T-12 tube replacment calculations

Investment Grade Lighting Audit

CEG Job #: 9C10102

Project: Cape May Point LGEA

Maintenance Building

KWH COST: \$0.184

Address: Lighthouse Avenue & Sunset Blvd
Cap May Point, NJ

Building SF: 3500

ECM #2: Lighting Controls

EXISTING LIGHTING					PROPOSED LIGHTING CONTROLS							SAVINGS											
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	No. Fixts	No. Lamps	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly \$ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly \$ Savings	Yearly Simple Payback
21	Office	1500	1	4	4 Lamp T12 Pendant Mount Prismatic	204	0.20	306	\$56.30	1	1	Dual Technology Occupancy Sensor - Remote Mnt.	204	0.16	20%	244.8	\$45.04	\$160.00	\$160.00	0.04	61.2	\$11.26	14.21
7	Break Area	1500	2	2	2 Lamp T12 34 Watt 1x4 Pendant Mount	80	0.16	240	\$44.16	2	1	Dual Technology Occupancy Sensor - Remote Mnt.	80	0.13	20%	192	\$35.33	\$75.00	\$75.00	0.03	48	\$8.83	8.49
21	Garage	1500	19	4	4 Lamp T12 Pendant Mount Prismatic	204	3.88	5814	\$1,069.78	19	0	No Change	204	3.88	0%	5814	#####	\$160.00	\$160.00	0.00	0	\$0.00	0.00
14	Bathroom	780	1	1	100 Watt Incandescent Recessed	100	0.10	78	\$14.35	1	0	No Change	100	0.10	0%	78	\$14.35	\$75.00	\$75.00	0.00	0	\$0.00	0.00
Totals				23	11		4.34	6,438.0	\$1,184.59	23	2			4.2672		6328.8	\$1,164.50		\$470.00	0.07	109.2	\$20.09	23.39

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.
2. Lamp totals only include T-12 tube replacment calculations

Investment Grade Lighting Audit

CEG Job #: 9C10102

Project: Cape May Point LGEA

Pump Station

KWH COST: \$0.172

Address: Sunset Boulevard

Cap May Point, NJ

Building SF: 900

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING					PROPOSED LIGHTING							SAVINGS										
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly \$ Savings	Yearly Simple Payback
17	Pump Station	780	20	2	2x4, 2-Lamp, 40w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	88	1.76	1,372.8	\$236.12	20	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	1.00	780	\$134.16	\$80.00	\$1,600.00	0.76	592.8	\$101.96	15.69
Totals			20	2			1.76	1,372.8	\$236.12	20	2			1.00	780	\$134.16		\$1,600.00	0.76	592.8	\$101.96	15.69

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.
2. Lamp totals only include T-12 tube replacement calculations

Investment Grade Lighting Audit

CEG Job #: 9C10102

Project: Cape May Point LGEA

Pump Station

KWH COST: \$0.172

Address: Sunset Boulevard

Cap May Point, NJ

Building SF: 900

ECM #2: Lighting Controls

EXISTING LIGHTING					PROPOSED LIGHTING CONTROLS							SAVINGS											
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	No. Fixts	No. Lamps	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly \$ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly \$ Savings	Yearly Simple Payback
17	Pump Station	780	20	2	2x4, 2-Lamp, 40w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	88	1.76	1372.8	\$236.12	20	2	Dual Technology Occupancy Sensor - Remote Mnt.	88	1.41	20%	1098.24	\$188.90	\$160.00	\$320.00	0.35	274.56	\$47.22	6.78
Totals			20	2			1.76	1,372.8	\$236.12	20	2			1.408		1098.24	\$188.90		\$320.00	0.35	274.6	\$47.22	6.78

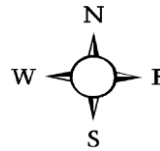
NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.


2. Lamp totals only include T-12 tube replacment calculations

APPENDIX E

Project Name: LGEA Solar PV Project							
Location: Cape May Point., NJ							
Description: Photovoltaic System - Direct Purchase							
Simple Payback Analysis							
	Photovoltaic System - Direct Purchase						
Total Construction Cost	\$89,700						
Annual kWh Production	17,354						
Annual Energy Cost Reduction	\$3,176						
Annual SREC Revenue	\$6,074						
First Cost Premium	\$89,700						
Simple Payback:	9.70 Years						
Life Cycle Cost Analysis							
Analysis Period (years):	15			Financing %:	0%		
Financing Term (mths):	0			Maintenance Escalation Rate:	3.0%		
Average Energy Cost (\$/kWh)	\$0.183			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	\$89,700	0	0	0	\$0	(89,700)	0
1	\$0	17,354	\$3,176	\$0	\$6,074	\$9,250	(\$80,450)
2	\$0	17,267	\$3,271	\$0	\$6,044	\$9,315	(\$71,136)
3	\$0	17,181	\$3,369	\$0	\$6,013	\$9,382	(\$61,753)
4	\$0	17,095	\$3,470	\$0	\$5,983	\$9,454	(\$52,300)
5	\$0	17,010	\$3,574	\$175	\$5,953	\$9,353	(\$42,947)
6	\$0	16,924	\$3,682	\$174	\$5,924	\$9,431	(\$33,516)
7	\$0	16,840	\$3,792	\$173	\$5,894	\$9,513	(\$24,004)
8	\$0	16,756	\$3,906	\$173	\$5,864	\$9,598	(\$14,406)
9	\$0	16,672	\$4,023	\$172	\$5,835	\$9,686	(\$4,720)
10	\$0	16,589	\$4,144	\$171	\$5,806	\$9,779	\$5,059
11	\$0	16,506	\$4,268	\$170	\$5,777	\$9,875	\$14,934
12	\$0	16,423	\$4,396	\$169	\$5,748	\$9,975	\$24,909
13	\$0	16,341	\$4,528	\$168	\$5,719	\$10,079	\$34,988
14	\$0	16,259	\$4,664	\$167	\$5,691	\$10,187	\$45,175
15	\$0	16,178	\$4,804	\$167	\$5,662	\$10,299	\$55,474
Totals:		251,394	\$59,066	\$1,880	\$87,988	\$55,474	(\$204,693)
Net Present Value (NPV)						\$55,489	
Internal Rate of Return (IRR)						6.6%	

Building	Available Area (sqft.)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW _{DC}	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Municipal	432	Sunpower SPR230	25	14.7	368	5.75	7,048	825	15.64
Maintenance	600	Sunpower SPR230	40	14.7	588	9.20	10,306	1,320	15.64
Total	1032	Sunpower SPR230	65			14.95	17,354		



 = Proposed PV Layout

Notes:

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