LOCAL GOVERNMENT ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT

PREPARED FOR: **CAPE MAY COUNTY MUNICIPAL UTILITY AUTHORITY**
CAPE MAY REGIONAL WASTEWATER TREATMENT FACILITY

ADMINISTRATION BUILDING
545 SUNSET BOULEVARD
CAPE MAY POINT, NJ 08212
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I. EXECUTIVE SUMMARY

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

Cape May County Municipal Utility Authority
- Cape May Regional Waste Water Treatment Facility
- Administration Building
545 Sunset Boulevard
Cape May Point, NJ 08212

Municipal Contact Person: Mr. Charles M. Norkis
Facility Contact Person: Mr. Joshua Palombo

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 this facility are as follows:

Electricity	$ 135,980
Fuel Oil	$ 11,199
Total	$ 147,179

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 ± 20%. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

Table 1
Financial Summary Table

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	General Lighting Replacement	$1,558	$220	7.1	111.7%
ECM #2	Lighting Controls	$1,540	$206	7.5	100.5%
ECM #3	NEMA Premium Efficient pump motor replacement	$581	$23	25.3	-28.7%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	Solar PV 20.47 KW System	$184,230	$12,553	14.7	2.2%
REM #2	100 KW Wind Turbine	$494,523	$16,076	30.8	-35.0%

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

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

Table 2
Estimated Energy Savings Summary Table

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	General Lighting Replacement	0.5	1,400.7	-
ECM #2	Lighting Controls	-	1,385.1	-
ECM #3	NEMA Premium Efficient pump motor replacement	0.1	151.0	-
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	Solar PV 20.47 KW System	20.5	25,007.0	-
REM #2	100 KW Wind Turbine	100.0	114,554.0	-

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. The following Energy Conservation Measures are recommended for the facility:

- **ECM #1:** Lighting Upgrade
- **ECM #2:** Lighting Controls

Although ECM #3 does not provide a payback less than 10 years, it is recommended to proceed with the installation of an efficient pump motor as suggested in ECM #3 (or equal) for the Administration boiler loop pump, since the pump is past its expected lifespan.

In addition to the ECMs, 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 entrance 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.

II. INTRODUCTION

The comprehensive energy audit covers the 5,889 square foot Administration Building, which includes the following spaces: offices, break room, restrooms, locker rooms, Maintenance garage, boiler room, storage, and laboratory.

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

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

Existing building architectural and engineering drawings (where available) are utilized for additional background information. The building envelope, lighting systems, HVAC equipment, and controls information gathered from building drawings allow for a more accurate and detailed review of the building. The information is compared to the energy usage profiles developed from utility data. Through the review of the architectural and engineering drawings a building profile can be defined that documents building age, type, usage, major energy consuming equipment or systems, etc.

The preliminary audit information is gathered in preparation for the site survey. The site survey provides critical information in deciphering where energy is spent and opportunities exist within a facility. The entire site is surveyed to inventory the following to gain an understanding of how each facility operates:

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

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

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

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

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

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

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

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

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

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

The electric usage profile represents the actual electrical usage for the facility. Atlantic City Electric provides electricity to the facility under their Annual General Service rate structure. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. 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 oil usage profile shows the actual oil purchased for the facility. Oil is provided by PEDRONI to the facility. The oil provider measures consumption in gallons. One Gallon of No. 2 oil is equivalent to 140,000 BTUs of energy.

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

Description	Average
Electricity	15.2¢ / kWh
Fuel Oil	$1.66 / Gallon

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: Atlantic City Electric
Rate: Annual General Service
Meter No: 82466301
Customer ID No:
Third Party Utility
TPS Meter / Acct No:

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Jan-09	62,700	110.2	$8,134
Feb-09	62,365	113.1	$8,102
Mar-09	62,965	112.0	$8,210
Apr-09	64,854	138.4	$8,378
May-09	63,462	120.7	$8,238
Jun-09	72,997	139.1	$11,520
Jul-09	78,663	370.5	$14,110
Aug-09	88,739	173.6	$14,976
Sep-09	100,231	413.0	$17,799
Oct-09	83,900	166.5	$12,728
Nov-09	72,059	306.9	$11,067
Dec-09	82,402	300.4	$12,720
Totals	**895,337**	**413.0 Max**	**$135,980**

AVERAGE DEMAND 205.4 KW average
AVERAGE RATE $0.152 $/kWh

Figure 1
Electricity Usage Profile

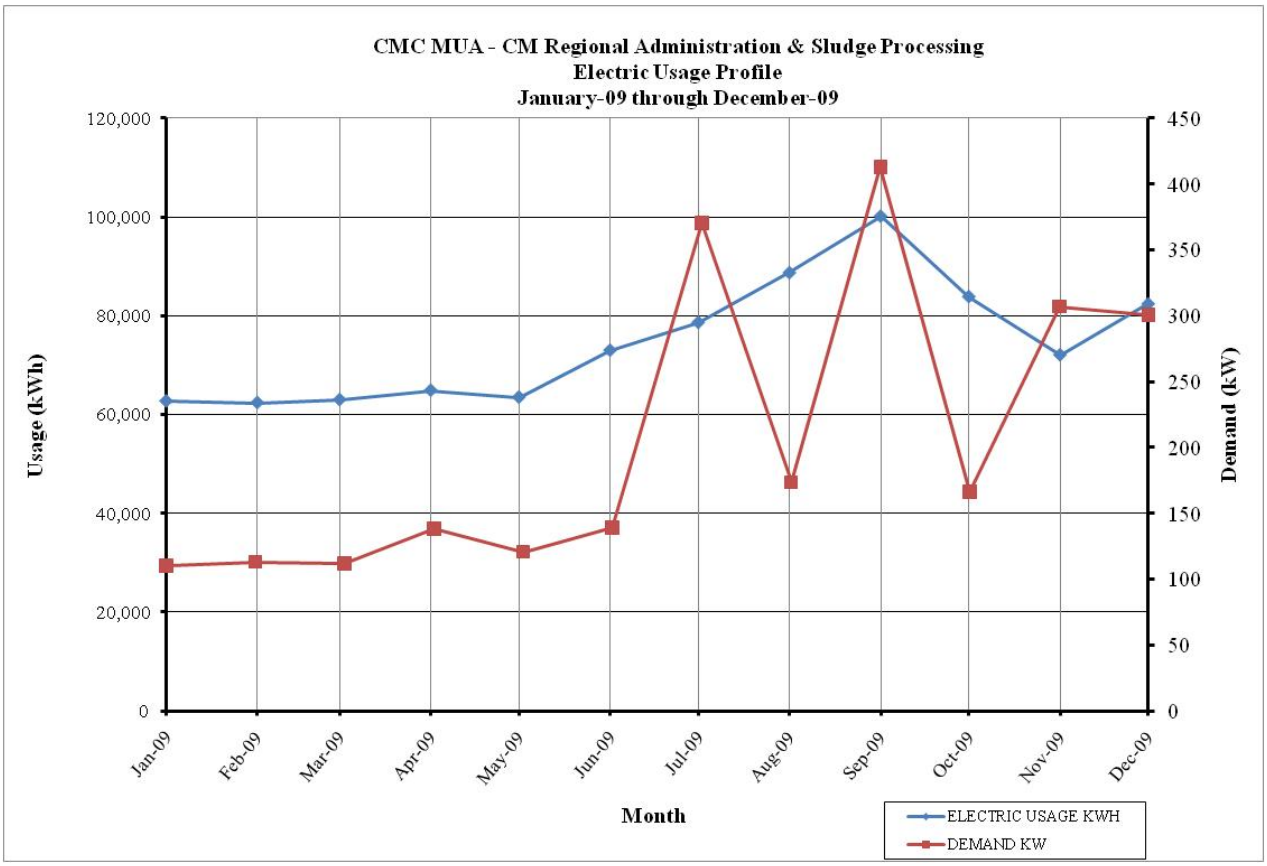
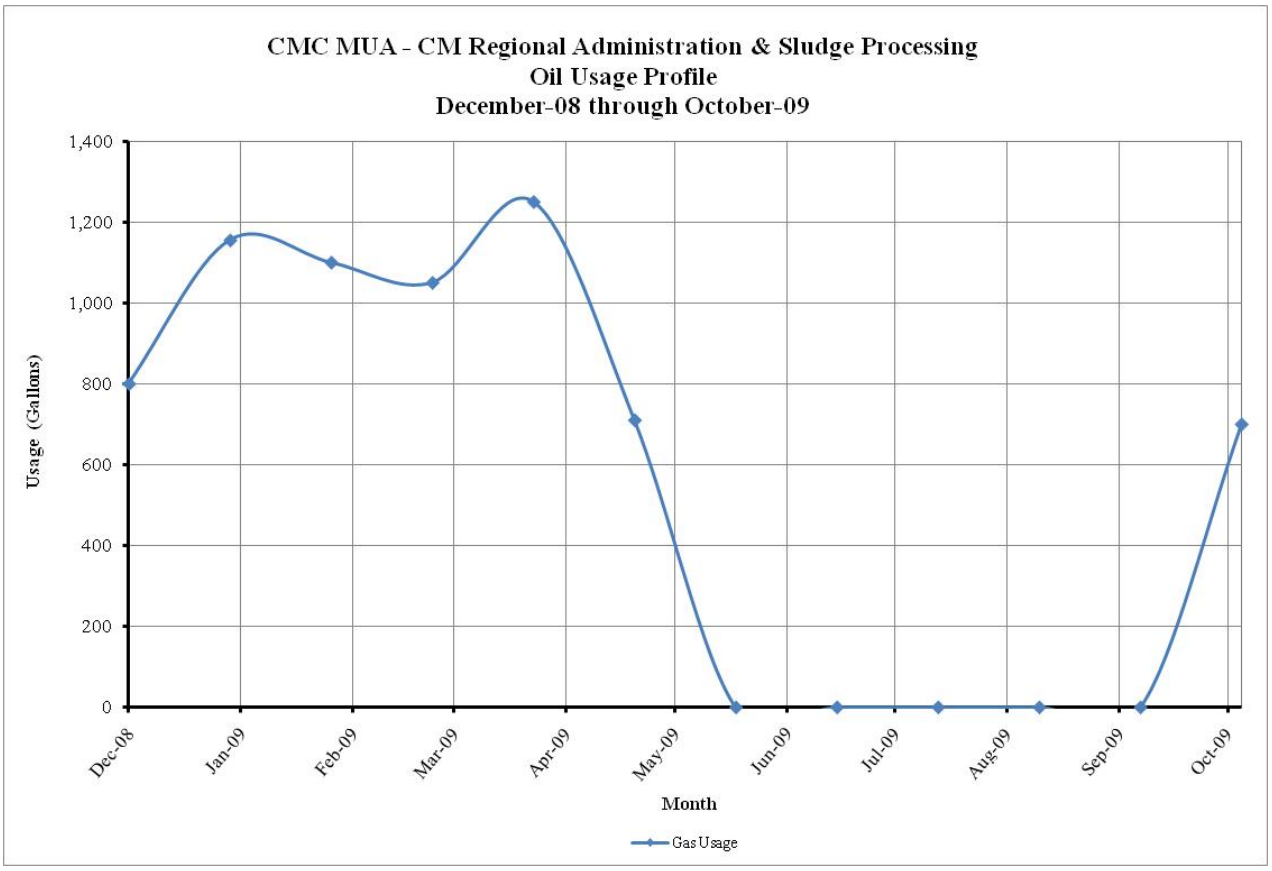


Table 4
Fuel Oil Billing Data

FUEL OIL USAGE SUMMARY		
Utility Provider:	Pedroni	
Rate:	Varies	
Meter No:		
Point of Delivery ID:		
Third Party Utility Provider:		
TPS Meter No:		
MONTH OF USE	**CONSUMPTION (GALLONS)**	**TOTAL BILL**
Dec-08	800.10	$1,448.18
Jan-09	1,155.00	$1,767.15
Jan-09	1,100.00	$1,894.75
Feb-09	1,050.00	$1,522.50
Mar-09	1,250.00	$1,873.75
Apr-09	710.10	$1,105.27
May-09	0.00	$0.00
Jun-09	0.00	$0.00
Jul-09	0.00	$0.00
Aug-09	0.00	$0.00
Sep-09	0.00	$0.00
Oct-09	700.00	$1,586.90
TOTALS	**6,765.20**	**$11,198.50**
AVERAGE RATE:	**$1.66**	**$/Gallon**

Figure 2
Fuel Oil 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:

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

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

Table 5
Facility Energy Use Index (EUI) Calculation

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	**BUILDING USE**			**SITE ENERGY**	**SITE-SOURCE RATIO**	**SOURCE ENERGY**
	kWh	**Therms**	**Gallons**	**kBtu**		**kBtu**
ELECTRIC	895,337.00	-	-	3,056,681	3.340	10,209,313
FUEL OIL	-	-	6,765.20	940,363	1.010	949,766
TOTAL	-	-	-	3,997,043		11,159,079
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		23,146	SQUARE FEET			
BUILDING SITE EUI		*172.69*	kBtu/SF/YR			
BUILDING SOURCE EUI		*482.12*	kBtu/SF/YR			

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:

- Other (Administration and Sludge Processing):
  104 kBtu/SF Site Energy, 213 kBtu/SF Source Energy, 56% electric usage

Based on the information compiled for the studied facility, as compared to the national average the energy usage is approximately 166% higher than the baseline building site data. Normalizing the building site data for 76.5% electric, site energy is 136 kBtu/SF and as compared to the national average the energy usage is approximately 127% higher than the baseline building site data.

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

User Name: capemaymua
Password: lgeaceg2009

Security Question: What city were you born in?
Security Answer: "cape may"

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 6
ENERGY STAR Performance Rating

ENERGY STAR PERFORMANCE RATING		
FACILITY DESCRIPTION	**ENERGY PERFORMANCE RATING**	**NATIONAL AVERAGE**
Cape May Administration Building	N/A	N/A

An Energy Performance Rating cannot be established for the Cape May Regional Area or individual buildings. The Energy Star program does not have enough bin data available to

calculate a campus wide Energy Performance Rating at this time. Also, individual building ratings cannot be established due to the design of the Campus wide electric and gas distribution system. One year of utility data must be entered for each facility, since reliable building energy meters do not exist this approach cannot be taken.

V. FACILITY DESCRIPTION

The 5,889 SF Administration Building is a one story facility comprised of offices, break room, restrooms, locker rooms, Maintenance garage, boiler room, storage, and laboratory. The typical hours of operation for this facility are 60 hours a week. Exterior walls are block construction with minimum insulation typical of the time period. The amount of insulation within the wall is unknown. 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 clad wood frames. 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 concrete plank with rigid insulation board and built up roof. The amount of insulation below the roofing is unknown. The building was built in 1987 with no additions since the original construction.

HVAC Systems

The Administration Building is heated by one (1) Weil McLain water boiler; model BL-486-SW. It has 882 MBH input. The Carlin oil burner model EZ-1 has an input capacity of 6.3 GPH No. 2 oil providing 626.6 MBH boiler output. The boiler is twenty three (23) years old, is in good to fair condition and has twelve (12) years of ASHRAE expected useful service live remaining. The boiler burner is twenty three (23) years old, in fair to poor condition, is eight (8) years past its ASHRAE expected useful service life and should be replaced. There is no redundancy in the heating plant and should be considered when replacing the existing boiler.

The in-line boiler loop pumps are piped in parallel in a lead lag configuration. The pumps are Armstrong model 2D 4360, 2 hp, rated at 65.5 GPM at 50 FT.HD. One pump is four (4) years old, is in good condition and has six (6) years of ASHRAE expected useful service life remaining. The other pump is sixteen (16) years old, in fair to poor condition, is six (6) years past its ASHRAE expected useful service life and should be replaced.

The 2" HWS/R underground lines go from the boiler room to serve the Influent and Effluent buildings.

There are three (3) hot water propeller unit heaters with fractional horse power fan motors in the Maintenance Garage. The unit heaters are twenty three (23) years old, are in good to fair condition and are three (3) years past their ASHRAE expected useful service life.

There is one (1) cabinet unit heater at the Lobby entrance and one (1) cabinet unit heater at the rear corridor exit. The cabinet unit heaters have fractional horse power fan motors.

The heat recovery unit provides ventilation to the Laboratory, restrooms, locker rooms, showers and Mud room. The unit was replaced in 2004. This unit is now a gravity intake hood, hot water heating coil and an exhaust fan. The exhaust fan is a Penn model FX14B, 1 hp, 2100 CFM that runs continuously. The exhaust fan is in very good condition and has nine (9) years of ASHRAE expected useful service life remaining.

There is a Carrier packaged electric cooling roof top unit, model 50HJ-012. The newly installed unit has a nominal 10 Tons of cooling capacity and an efficiency of 11.0 EER. The existing drawings indicate a hot water heating coil.

The work shop has a window air conditioning unit. It is a Electrolux model FAM186R2A with 18.5 MBH of cooling capacity, 10.7 EER and is Energy Star Rated. This unit is one (1) year old and has fourteen years of ASHRAE expected useful service life remaining.

Exhaust System

Air is exhausted from the Laboratory, restrooms, locker rooms, showers and Mud room through the exhaust fan formerly known as the heat recovery unit and it operates continuously.

There is one (1) exhaust fan serving the Maintenance Garage that is a fractional horse power down blast fan that operates less than 200 hours per year. It appears to be original to the building, in fair condition. The fan should be maintained or replaced as needed as a maintenance project.

There is one (1) exhaust fan serving the Work shop and Storage room. The fan has a fractional horse power fan motor and operates approximately 3120 hours per year. The fan appears to be original to the building and in fair condition. The fan should be maintained or replaced as needed as a maintenance project.

There is one (1) exhaust fan serving the Break room and one (1) exhaust fan serving the Janitor's Closet. Both fans are wall mounted fractional horse power fans that operate less than 200 hours per year. They appear to be original to the building and in fair condition. Both fans should be maintained or replaced as needed as a maintenance project.

HVAC System Controls

The HVAC systems within the facility are controlled via local thermostats.

Domestic Hot Water

Domestic hot water for the restrooms, showers and break room is provided by a 50 gallon Bock, model 51E, oil fired hot water heater. The water heater is rated at 1.1 GPH maximum input No.1/No.2 oil (152 MBH) producing 166 GPH recovery at 90 °F rise in temperature. The water heater has a Carlin EZ-1 burner.

There is no domestic hot water circulation pump. The domestic hot water piping appeared to be in good condition.

Lighting

The lighting in the Cape May Administration Building is primarily made up of fluorescent fixtures with T-8 lamps with electronic ballasts. There is a closet with incandescent lighting. The garage, workshop/storage and boiler room areas have metal halide.

VI. MAJOR EQUIPMENT LIST

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

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

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade - General

Description: General

The lighting in the Cape May Administration Building is primarily made up of fluorescent fixtures with T-8 lamps with electronic ballasts. There is a closet with incandescent lighting. The garage, workshop/storage and boiler room areas have metal halide.

This ECM includes replacement of the existing fixtures containing metal halide lamps with fixtures containing T8 lamps and electronic ballasts. The new energy efficient, T8 fixtures will provide adequate lighting and will save the owner on electrical costs due to the better performance of the lamp and ballasts. This ECM will also provide 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 metal halide lamps which is approximately 15,000 burn-hours. The facility will need 50% less lamps replaced per year.

This ECM also includes replacement of all incandescent lamps to compact fluorescent lamps. 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.

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix – ECM#1** outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, the following incentives are warranted:

Replace HID metal halide 175w-249w fixture with new T-5 or T-8 lamps fixture w/electronic ballast = $43 per fixture.

$$\text{Smart Start®}\ Incentive = \left(T5 or T8\ lamp\ \ fixtures \times\ \$\ 43\right)$$
$$\text{Smart Start®}\ Incentive = \left(4 \times\ \$\ 43\right) = \underline{\$172}$$

Replace HID metal halide 100w-174w fixture with new T-5 or T-8 lamps fixture w/electronic ballast = $30 per fixture.

$$\text{Smart Start®}\ Incentive = \left(T5 or T8\ lamp\ \ fixtures \times\ \$\ 30\right)$$
$$\text{Smart Start®}\ Incentive = \left(3 \times\ \$\ 30\right) = \underline{\$90}$$

Total Incentive:

$$\text{Total Smart Start®}\ \textit{Incentive} = \$172 + \$90 = \underline{\$262}$$

Replacement and Maintenance Savings are calculated as follows:

$$\textit{Savings} = (\textit{reduction in lamps replaced per year}) \times (\textit{repacment \$ per lamp} + \textit{Labor \$ per lamp})$$

$$\textit{Savings} = (1\ \textit{lamps per year}) \times (\$2.00 + \$5.00) = \$7$$

From the Smart Start Incentive appendix, there is no incentive for replacing incandescent lamps with compact fluorescent lamps. The incentive is only available if the entire light fixture is replaced. In most cases, the existing fixtures can be re-lamped by the facility's staff to obtain the energy savings without the expense of a new fixture and the involvement of an electrician to install a new fixture.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,820
NJ Smart Start Equipment Incentive ($):	$262
Net Installation Cost ($):	$1,558
Maintenance Savings ($/Yr):	$7
Energy Savings ($/Yr):	$213
Total Yearly Savings ($/Yr):	$220
Estimated ECM Lifetime (Yr):	15
Simple Payback	7.1
Simple Lifetime ROI	111.7%
Simple Lifetime Maintenance Savings	$105
Simple Lifetime Savings	$3,299
Internal Rate of Return (IRR)	11%
Net Present Value (NPV)	$1,067.27

ECM #2: Install Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. There has been a belief that it is better to keep the lights on rather than to continuously switch them on and off. This on/off dilemma was studied, and it was determined that the best option is to turn the lights off whenever possible. Although this practice reduces the lamp life, the energy savings far outweigh the lamp replacement costs.

Lighting controls are available in many forms. Lighting controls can be as simplistic as an additional switch. Timeclocks are often used which allow the user to set an on/off schedule. Timeclocks range from a dial clock with on/off indicators to a small box the size of a thermostat with user programs for on/off schedule in digital format. Occupancy sensors detect motion and will switch the lights on when the room is occupied. They can either be mounted in place of the current wall switch, or they can be mounted on the ceiling to cover large areas. Lastly, photocells are a lighting control that sense light levels and will turn the lights off when there is adequate daylight. These are mostly used outside, but they are becoming much more popular in energy-efficient office designs as well.

To determine an estimated savings for lighting controls, we used ASHRAE 90.1-2004 (NJ Energy Code). Appendix G states that occupancy sensors have a 10% power adjustment factor for daytime occupancies for buildings over 5,000 SF. CEG recommends the installation of dual technology occupancy sensors in all private offices, restrooms, Electrical Shop, Lab, Garage, lunch room, training room, control room, Workshop/Storage room, locker room, etc.

Energy Savings Calculations:

From **Investment Grade Lighting Audit Appendix – ECM#2** of this report, we calculated the lighting power density (Watts/ft^2) of the existing Administration building to be 5,208 Watts / 5,889 SF = 0.884 Watts/SF. The hallways of the building is a 24/7 facility while the majority of the building is only occupied 60 hours a week and other areas are only a few hours a day. Ten percent of this value is the resultant energy savings due to installation of occupancy sensors:

Administration Building:

10% x 0.884 Watts/SF x 5,889 SF x 2,600 hrs/yr. x 1kW/1000W = 1,354 kWh

Savings = 1,354 kWh x $0.152 kWh = $206 / yr

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is $160/unit including material and labor. The SmartStart Buildings® incentive is $20 per control which equates to an installed cost of $140/unit. Total number of rooms to be retrofitted is 11. Total cost to install sensors is $140/ceiling unit x 11 units = $1,540.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,760
NJ Smart Start Equipment Incentive ($):	$220
Net Installation Cost ($):	$1,540
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$206
Total Yearly Savings ($/Yr):	$206
Estimated ECM Lifetime (Yr):	15
Simple Payback	7.5
Simple Lifetime ROI	100.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$3,087
Internal Rate of Return (IRR)	10%
Net Present Value (NPV)	$917.07

ECM #3: Install NEMA Premium Efficient Pump Motor

Description:

Replacing the old system booster pump motor with new efficient motor is a simple change that can provide substantial savings.

Existing electric motors equal to or greater than one horsepower ranged from 78 to 93% efficient. 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 40-80 hours per week, even small increases in efficiency can yield substantial energy and dollar savings.

This energy conservation measure would replace all motors equal to or greater than 1 HP with NEMA Premium® Efficient Motors. NEMA Premium® is the most efficient motor designation in the marketplace today. Using MotorMaster+, Version 4, the energy & cost savings were calculated for the fan/pump motors in this facility that are greater than or equal to 1 HP.

Energy Savings Calculations:

Existing: A 2 HP system circulation pump Motor with the following characteristics:
Existing Motor Efficiency = 82.5%
Annual Hours of Operations = 2,416
1 HP = 0.746 Watt
Load Factor = 75%
Cost of electricity = $0.152 / kWh

Existing 2HP Motor Operating Cost =
{0.746 Watt/HP x Motor HP x Load Factor x Hours of Operation x Cost of Electricity] ÷ Motor Efficiency
= [0.746 x 2 x 0.75 x 2,416 x 0.152] ÷ 0.825 = $498 / Year

New NEMA Premium Motor Efficiency = 86.5%

New NEMA Premium Efficiency Motor Operating Cost =
{0.746 x 2 x 0.75 x 2,416 x 0.152} ÷ 0.865 = $475 / Year

Savings = $498 - $475 = $23 / Year

Installed Cost of a 2 HP NEMA Premium® Efficiency Motor = $635 minus the SmartStart Building® incentive of 2hp x $54/motor is $581.

Simple Payback = $581 / $23 = 25.3 Years

kWh saved = $23 / $0.152/kWh = 151 kWh

kW saved = 151 kWh / 2,416 hrs./yr. = 0.06 kW

The following table outlines the motor replacement plan for this facility:

MOTOR REPLACEMENT PLAN							
Motor HP	**QTY**	**ENCL. TYPE**	**No. of POLEs**	**INSTALLED Cost ****	**TOTAL COST**	**TOTAL SAVINGS**	**Simple Payback**
2	1	ODP	4-Pole	$581	$581	$23.03	25.2
				Totals:	*$581*	*$23*	*25.2*

**** Net Cost after the SmartStart Buildings® incentive is applied.**

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$635
NJ Smart Start Equipment Incentive ($):	$54
Net Installation Cost ($):	$581
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$23
Total Yearly Savings ($/Yr):	$23
Estimated ECM Lifetime (Yr):	18
Simple Payback	25.3
Simple Lifetime ROI	-28.7%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$414
Internal Rate of Return (IRR)	-3%
Net Present Value (NPV)	($264.67)

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 energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which will be mounted on all south and southwestern facades of the building. Flat roof, as well as sloped areas can be utilized; flat areas will have the panels turned to an optimum solar absorbing angle. (A structural survey of the roof would be necessary before the installation of PV panels is considered). The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit is around $350, this value was used in our financial calculations. This equates to $0.35 per kWh generated.

CEG has reviewed the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 1440 S.F. can be utilized for a PV system. 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 20.47 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 25,007 KWh annually, reducing the overall utility bill by approximately 2.8% 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 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

The proposed photovoltaic array layout is designed based on the specifications for the Sun Power SPR-230 panel. This panel has a "DC" rated full load output of 230 watts, and has a total panel conversion efficiency of 18%. Although panels rated at higher wattages are available through Sun Power and other various manufacturers, in general most manufacturers who produce commercially available solar panels produce a similar panel in the 200 to 250 watt range. This provides more manufacturer options to the public entity if they wish to pursue the proposed solar recommendation without losing significant system capacity.

The 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 CMC MUA – Cape May Administration Building 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 7
Financial Summary – Photovoltaic System

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM			
PAYMENT TYPE	**SIMPLE PAYBACK**	**SIMPLE ROI**	**INTERNAL RATE OF RETURN**
Direct Purchase	14.68 Years	6.8%	5.2%

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

Given the large amount of capital required by the CMC MUA – Cape May Administration Building to invest in a solar system through a Direct Purchase CEG does not recommend the CMC MUA – Cape May Administration Building pursue this route. It would be more advantageous for the CMC MUA – Cape May Administration Building to solicit Power Purchase

Agreement (PPA) Providers who will own, operate, and maintain the system for a period of 15 years. During this time the PPA Provider would sell all of the electric generated by Solar Arrays to the CMC MUA – Cape May Administration Building at a reduced rate compared to their existing electric rate.

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; with an average annual wind speed of 5.30 meters per second at 30 meter height, it is sufficient enough to reach the cut in speed for most commercial sized wind turbines of 3.5 meters per second. The installation of 100 kilowatt Northwind Wind Turbine with a 37 meter hub height at the facility would be able to produce approximately 114,554 kWh for just one turbine. Although the power generation from one turbine is substantial, the turbine installation itself has an expected payback of over 30 years, being priced at approximately$500,000 installed. In addition upfront costs for permitting, further wind studies, environmental impact studies, and bird and bat studies could cost the MUA in upwards of half million dollars, without a guarantee that wind turbine will get approval for construction given the wetlands location of the plant. Based on our calculations the following is the payback period:

Table 8
Financial Summary – Wind Turbine System

REM #2 - WINDTURBINES	
Installation Cost ($):	$595,000
NJ Smart Start Equipment Incentive ($):	$100,477
Net Installation Cost ($):	$494,523
Maintenance Savings ($):	($4,200)
REC Revenue ($/Yr):	$2,864
Energy Savings ($/Yr):	$17,412
Total Yearly Savings ($/Yr):	$16,076
Estimated ECM Lifetime (Yr):	20
Simple Payback	30.76
Lifetime Energy Savings	$348,245

For further wind analysis refer to the **Wind Analysis Calculation Appendix.**

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 Electric Usage Profile shows increased usage in the cooling season between months July through October and relatively flat baseline usage in the heating season. The increase in the cooling season is relatively small compared to the base-line electric usage representing a high baseline usage. This is somewhat typical for an administration building with non electric heat, however this service is provided for multiple buildings which make comparisons to typical load profiles more difficult. The cooling season represents a typical load profile with increase usage from the building air conditioning systems. The electric demand is at its peak in the month of September representing the largest electric draw in the cooling season. The buildings connected to this service include the administration building as well as process buildings and pump stations. The load factor rating for this service is approximately 25%. Load factor is the total usage divided by the demand times the total hours (KWH/KW*8760). This means that the full load electric draw for the facility is only used for 25% of the time. A higher load factor (rating of 50% or higher) along with a flat load profile will allow for more competitive energy prices when shopping for alternative suppliers.

#2 Heating Oil:

The Heating Oil Usage Profile demonstrates a very typical (heat load) profile. The summer months zero consumption (complimenting the cooling electric load), July through November. There is an increase in consumption December through May. The primary use of the heating oil is the oil fired boiler. Heating oil is purchased based on market driven pricing and delivered on an as needed bases. This utility is unlike natural gas and electric utilities where time of use and load profiling has a more significant role.

Tariff Analysis:

Electricity:

This facility receives electrical service through Atlantic City Electric on their Annual General Service (AGS-Secondary) rate. This service classification is available for general service purposes on secondary voltages. This facility's rate is a three phase service at secondary voltages. For electric supply (generation), the customer has the option to purchase energy

through the utility's Generation Charge or a Third Party Supplier (TPS). This facility utilizes the generation service provide through Atlantic City Electric (BGS), Therefore, they will pay according to the default service. The Delivery Service includes the following charges: Customer Charge, Distribution Charge (kW Demand), Reactive Demand Charge (kvar Demand, over 1/3 kW), Distribution Charge kWh, Non-utility Generation Charge, Societal benefits Charge kWh, Regulatory Assets Recovery Charge kWh, Transition Bond Charge kWh, Market Transition Charge Tax kWh, System Control Charge kWh, CIEP Standby Fee kWh, Transmission Demand Charge kW, Reliability Must Run Transmission Surcharge kWh, Transmission Enhancement Charge kWh, Basic Generation Service Charge kWh, Regional Greenhouse Gas Initiative Recovery Charge kWh, Infrastructure Investment Surcharge.

The Demand charges are based on a ratchet demand rate of 80% of the highest demand set in the months of June through September. The usage charges are based on a stepped rate structure. The demand charges for this rate structure are far less than the usage charges on a typical basis making this rate structure less dependent on demand versus usage. The steps for the usage charges are very small increments of change which result in fairly steady costs per kWh per month despite the changes in electrical usage and demand.

#2 Heating Oil:

This facility receives deliveries for #2 heating oil on an as needed basis. The cost per gallon is determined based on the market driven costs. These utilities do not include tariffs and rate structures.

Natural gas is a utility similar to electric which includes delivery and supply charges based on a rate structure and utility tariff. If the county were to consider the addition of natural gas to this facility, the County should review the following: Customers of natural gas service may either purchase gas supply from a Third Party (TPS) or from Public Services Basic Gas Supply Service default service as detailed in the utility rate schedule. Different service rates are available and should be considered for the facility prior to beginning a contract.

When considering a third party supplier for natural gas it is important to understand the costs associated with imbalances. Most natural gas rate schedules have a balancing charge included in their rate structure. Should the TPS not deliver, the customer may receive service from the default delivery utility under their Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service. Should the TPS un-deliver to the utility on behalf of the client, the utility will automatically supply this default service to the client. Imbalances occur when Third Party Suppliers are used to supply natural gas, full-delivery is not made, and when a new supplier is contracted or the customer returns to the utility. It is important when utilizing a Third Party Supplier, that an experienced regional supplier is used. Otherwise, imbalances can occur, jeopardizing economics and scheduling.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities within the County. Based on the latest electric utility bill, the average price per kWh (kilowatt hour) for the building based on 1-year historical average price is $0.1226/kWh based on the utility information provided (this is the average "price to compare" if the client intends to shop for energy). The average price per gallon of #2 oil is $ 1.66 / gallon. Energy commodities are among the most volatile of all commodities, however at this point and time, energy is relatively competitive. The County should consider procuring energy through alternative supply sources to shop for the most competitive prices.

CEG also recommends that the County schedule a meeting with the current utility providers to review their utility charges and current tariff structures for electricity. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), the County can learn more about the competitive supply process. Cape May County can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu. The County should consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the information for ongoing demand-side management projects. The County should ask the utility representative about alternative billing options, such as consolidated billing when utilizing the service of a Third Party Supplier. This could be performed with the aid of an "energy advisor".

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 par for the costs using the value of energy savings that result from the improvements. The "Energy Savings Improvement Program (ESIP)" law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources.

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

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

iv. *Pay For Performance – The New Jersey Smart Start Pay for Performance program includes incentives based on savings resulted from implemented ECMs. The program is available for all buildings with average demand loads above 200 KW. The facility's participation in the program is assisted by an approved program partner. An "Energy Reduction Plan" is created with the facility and approved partner to shown at least 15% reduction in the building's current energy use. Multiple energy conservation measures implemented together are applicable toward the total savings of at least 15%. No more than 50% of the total energy savings can result from lighting upgrades / changes.*

Total incentive is capped at 50% of the project cost. The program savings is broken down into three benchmarks; Energy Reduction Plan, Project

Implementation, and Measurement and Verification. Each step provides additional incentives as the energy reduction project continues. The benchmark incentives are as follows:

1. *Energy Reduction Plan – Upon completion of an energy reduction plan by an approved program partner, the incentive will grant $0.10 per square foot between $5,000 and $50,000, and not to exceed 50% of the facility's annual energy expense. (Benchmark #1 is not provided in addition to the local government energy audit program incentive.)*

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

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

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.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Cape May Administration Building

ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM #1	General Lighting Replacement	$1,820	$0	$262	$1,558	$213	$7	$220	15	$3,299	$105	111.7%	7.1	11.27%	$1,067.27
ECM #2	Lighting Controls	$1,760	$0	$220	$1,540	$206	$0	$206	15	$3,087	$0	100.5%	7.5	10.29%	$917.07
ECM #3	NEMA Premium Efficient pump motor replacement	$635	$0	$54	$581	$23	$0	$23	18	$414	$0	-28.7%	25.3	-3.35%	($264.67)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	Solar PV 20.47 KW System	$184,230	$0	$0	$184,230	$3,801	$8,752	$12,553	15	$188,295	$131,280	2.2%	14.7	0.27%	($34,373.10)
REM #2	100 KW Wind Turbine	$595,000	$0	$100,477	$494,523	$17,412	($1,336)	$16,076	20	$321,520	-$26,720	-35.0%	30.8	-3.79%	($255,352.71)

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* .

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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, 2010:

Electric Chillers

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

Energy Efficiency must comply with ASHRAE 90.1-2004

Gas Cooling

Gas Absorption Chillers	$185 - $400 per ton
Gas Engine-Driven Chillers	Calculated through custom measure path)

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	$73 - $93 per ton
Air-to-Air Heat Pumps	$73 - $92 per ton
Water-Source Heat Pumps	$81 per ton
Packaged Terminal AC & HP	$65 per ton
Central DX AC Systems	$40- $72 per ton
Dual Enthalpy Economizer Controls	$250
Occupancy Controlled Thermostat (Hospitality & Institutional Facility)	$75 per thermostat

Energy Efficiency must comply with ASHRAE 90.1-2004

Ground Source Heat Pumps

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

Energy Efficiency must comply with ASHRAE 90.1-2004

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%

Variable Frequency Drives

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

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons	$50 per unit
Gas-Fired Water Heaters > 50 gallons	$1.00 - $2.00 per MBH
Gas-Fired Booster Water Heaters	$17 - $35 per MBH
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	$15 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 (1-2 lamps) $30 per fixture (3-4 lamps)
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	$25 per fixture
LED Exit Signs	$10 - $20 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $284 per fixture
HID ≥ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	$50 per fixture
HID ≥ 100w Replacement with new HID ≥ 100w	$70 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 90.1-2004 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%

MAJOR EQUIPMENT LIST

Concord Engineering Group

Cape May Point Administration Building

Boiler

Tag	Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
-	Boiler room	Ad Min Bldg	Weil-McLain	1	BL-486-SW	BL496W	882	720	82	NG/No.2	16	35	19	NJ000054184H

Burner

Tag	Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
-	Boiler Room	Ad Min Bldg - BOILER	Carlin	1	AR-858382	-	882	82	Diesel No.2	16	21	2	
-	Boiler Room	Ad Min Bldg-WATER HEATER	Carlin	1	EZ-1	-	152	82	Diesel No.2	16	21	2	

Boiler - Pumps

Tag	Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	RPM	GPM	Ft. Hd	Frame Size	Volts / Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
-	Boiler Room	Ad Min Bldg	Armstrong	1	2D4360	556667	2	1800	65.5	50	145JM	208-230/460	4	10	6	
-	Boiler Room	Ad Min Bldg	Armstrong	1	MVK145TTDR764	50141	2	1735	65.5	50	145JM	208-230/460	16	10	(-6)	

Domestic Hot Water Heater

Tag	Location	Area Served	Manufacturer	Qty	Model #	Serial #	Input (MBh)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
-	Boiler Room	Ad Min Bldg	Bock	1	51E	05081470T	152	166	50	91.5	Diesel No.2	2	12	10	

Rooftop Units

Tag	Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Heating Coil	Cooling Capacity (MBH)	Capacity (Btu/h)	Fan HP	Fan RPM	Volts / Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
-	Roof	Ad Min Bldg	Carrier	1	50HJ-012---G71	1209G50619	-	120	120	-	1760	460/3	9.8	1	15	14	

Window AC Units

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity - DX BTU/H	Heating Capacity - HW	Fan HP	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
-	Ad min Building	Electrolux	1	FAM186R2A	-	18000	-	-	230/208	1	7.9/8.6	1	15	14	

NOTE: IF AN ITEM IS LEFT BLANK, THE INFORMATION IS EITHER NOT AVAILABLE OR NOT APPLICABLE FOR THIS PIECE OF EQUIPMENT.

Investment Grade Lighting Audit

CEG Job #: 9C09168
Project: CMC MUA – Cape May Administration Building
Address: Address
Address
Building SF: 5,889

"CMC MUA – Cape May Administration Building"

KWH COST: $0.152

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
227.22	Entry	3200	13	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.75	2,412.8	$366.75	13	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Reception	2600	3	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Parabolic Lens	104	0.31	811.2	$123.30	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Electrical Shop	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Parabolic Lens	104	0.62	1,622.4	$246.60	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Lab	2600	3	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Parabolic Lens	104	0.31	811.2	$123.30	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
736	Garage	2600	4	1	175w MH, Pendant Mnt., Prismatic Lens	210	0.84	2,184.0	$331.97	4	6	2x4, 6 Lamp, 32w T8, Elect. Ballast, w/Wire Guard - Lo Bay	168	0.67	1747.2	$265.57	$220.00	$880.00	0.17	436.8	$66.39	13.25
221.16	Garage Storage	2600	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Acrylic Lens	58	0.06	150.8	$22.92	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
734	Workshop/ Storage	2600	2	1	150w MH Lo Bay - Prismatic Lens	188	0.38	977.6	$148.60	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, w/Wire Guard - Lo Bay	120	0.24	624	$94.85	$220.00	$440.00	0.14	353.6	$53.75	8.19
734	Boiler Room	2600	1	1	150w MH Lo Bay - Prismatic Lens	188	0.19	488.8	$74.30	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, w/Wire Guard - Lo Bay	120	0.12	312	$47.42	$220.00	$220.00	0.07	176.8	$26.87	8.19
601	Exits	8760	4	2	(2) 7w CFL Exit Sign	16	0.06	560.6	$85.22	4	1	LED Exit Sign	5	0.02	175.2	$26.63	$65.00	$260.00	0.04	385.44	$58.59	4.44
226.15	Locker Room	2600	13	2	6"x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., White Diffuser	58	0.75	1,960.4	$297.98	13	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
226.45		2600	1	2	6"x4, 2 Lamp, 32w T8, Elect. Ballast, Wall Mnt., White Diffuser	58	0.06	150.8	$22.92	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.11	Women's Restroom	2600	3	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Clear Acrylic Lens	58	0.17	452.4	$68.76	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
226.45		2600	1	2	6"x4, 2 Lamp, 32w T8, Elect. Ballast, Wall Mnt., White Diffuser	58	0.06	150.8	$22.92	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.11	Men's Restroom	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Clear Acrylic Lens	58	0.23	603.2	$91.69	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
226.45		2600	1	2	6"x4, 2 Lamp, 32w T8, Elect. Ballast, Wall Mnt., White Diffuser	58	0.06	150.8	$22.92	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

242.21	Office	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.42	1,081.6	$164.40	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Control Room	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.42	1,081.6	$164.40	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21		2600	4	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	58	0.23	603.2	$91.69	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
613	Closet	650	1	1	"Keyless" Socket, 100w A19 Lamp	100	0.10	65.0	$9.88	1	1	(1) 26w CFL Lamp	26	0.03	16.9	$2.57	$20.00	$20.00	0.07	48.1	$7.31	2.74
242.21	Lunch Room	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.42	1,081.6	$164.40	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Training Room	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.42	1,081.6	$164.40	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		81	52			6.86	18,482.4	$2,809.33	81	16			1.078	2875.3	$437.05		$1,820.00	0.49	1400.7	$212.91	8.55

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

CEG Job #: 9C09168
Project: CMC MUA – Cape May Administration Building
Address: Address
Address
Building SF: 5889

"CMC MUA – Cape May Administration Building"

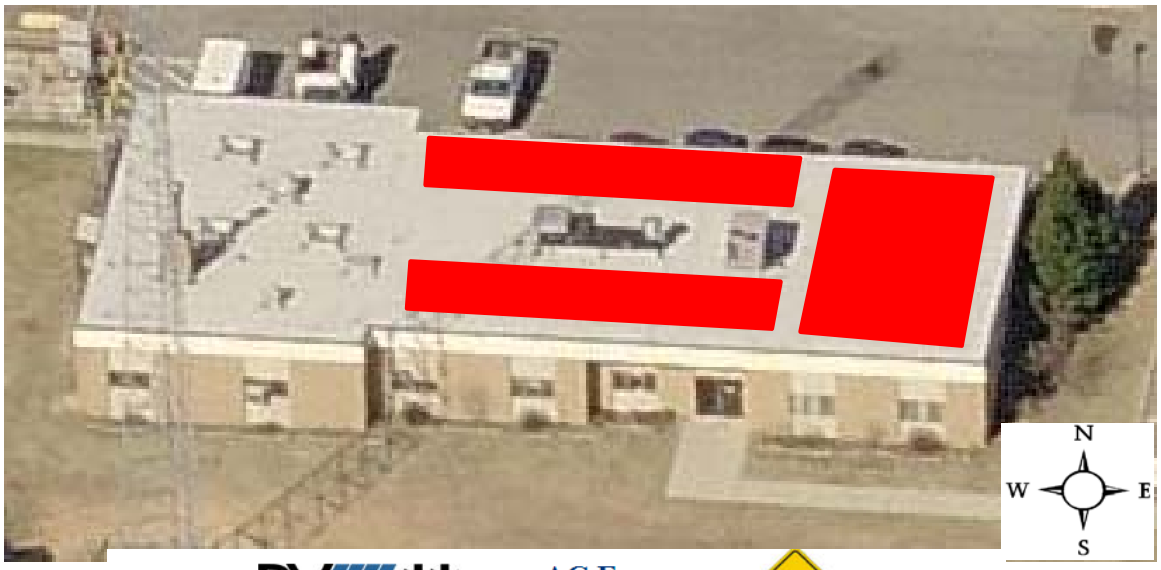
KWH COST: **$0.152**

ECM #2: Lighting Controls

EXISTING LIGHTINC										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. Cont.	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
227.2	Entry	3200	13	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.75	2,412.8	$366.75	13	0	No Change	58	0.75	0%	2412.8	$366.75	$160.00	$0.00	0.00	0	$0.00	0.00
242.2	Reception	2600	3	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Parabolic Lens	104	0.31	811.2	$123.30	3	0	No Change	104	0.31	0%	811.2	$123.30	$160.00	$0.00	0.00	0	$0.00	0.00
242.2	Electrical Shop	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Parabolic Lens	104	0.62	1,622.4	$246.60	6	1	Dual Technology Occupancy Sensor	104	0.62	10%	1460.16	$221.94	$160.00	$160.00	0.00	162.24	$24.66	6.49
242.2	Lab	2600	3	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Parabolic Lens	104	0.31	811.2	$123.30	3	1	Dual Technology Occupancy Sensor	104	0.31	10%	730.08	$110.97	$160.00	$160.00	0.00	81.12	$12.33	12.98
736	Garage	2600	4	1	175w MH, Pendant Mnt., Prismatic Lens	210	0.84	2,184.0	$331.97	4	1	Dual Technology Occupancy Sensor	210	0.84	10%	1965.6	$298.77	$160.00	$160.00	0.00	218.4	$33.20	4.82
221.2	Garage Storage	2600	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Acrylic Lens	58	0.06	150.8	$22.92	1	0	No Change	58	0.06	0%	150.8	$22.92	$160.00	$0.00	0.00	0	$0.00	0.00
734	Workshop/ Storage	2600	2	1	150w MH Lo Bay - Prismatic Lens	188	0.38	977.6	$148.60	2	1	Dual Technology Occupancy Sensor	188	0.38	10%	879.84	$133.74	$160.00	$160.00	0.00	97.76	$14.86	10.77
734	Boiler Room	2600	1	1	150w MH Lo Bay - Prismatic Lens	188	0.19	488.8	$74.30	1	0	No Change	188	0.19	0%	488.8	$74.30	$160.00	$0.00	0.00	0	$0.00	0.00
601	Exits	8760	4	2	(2) 7w CFL Exit Sign	16	0.06	560.6	$85.22	4	0	No Change	16	0.06	0%	560.64	$85.22	$160.00	$0.00	0.00	0	$0.00	0.00
226.2	Locker Room	2600	13	2	6"x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., White Diffuser	58	0.75	1,960.4	$297.98	13	1	Dual Technology Occupancy Sensor	58	0.75	10%	1764.36	$268.18	$160.00	$160.00	0.00	196.04	$29.80	5.37
226.5		2600	1	2	6"x4, 2 Lamp, 32w T8, Elect. Ballast, Wall Mnt., White Diffuser	58	0.06	150.8	$22.92	1	0	No Change	58	0.06	0%	150.8	$22.92	$160.00	$0.00	0.00	0	$0.00	0.00

222.1	Women's Restroom	2600	3	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Clear Acrylic Lens	58	0.17	452.4	$68.76	3	1	Dual Technology Occupancy Sensor	58	0.17	10%	407.16	$61.89	$160.00	$160.00	0.00	45.24	$6.88	23.27
226.5		2600	1	2	6"x4, 2 Lamp, 32w T8, Elect. Ballast, Wall Mnt., White Diffuser	58	0.06	150.8	$22.92	1	0	No Change	58	0.06	0%	150.8	$22.92	$160.00	$0.00	0.00	0	$0.00	0.00
222.1	Men's Restroom	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Clear Acrylic Lens	58	0.23	603.2	$91.69	4	1	Dual Technology Occupancy Sensor	58	0.23	10%	542.88	$82.52	$160.00	$160.00	0.00	60.32	$9.17	17.45
226.5		2600	1	2	6"x4, 2 Lamp, 32w T8, Elect. Ballast, Wall Mnt., White Diffuser	58	0.06	150.8	$22.92	1	0	No Change	58	0.06	0%	150.8	$22.92	$160.00	$0.00	0.00	0	$0.00	0.00
242.2	Office	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.42	1,081.6	$164.40	4	1	Dual Technology Occupancy Sensor	104	0.42	10%	973.44	$147.96	$160.00	$160.00	0.00	108.16	$16.44	9.73
242.2	Control Room	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.42	1,081.6	$164.40	4	1	Dual Technology Occupancy Sensor	104	0.42	10%	973.44	$147.96	$160.00	$160.00	0.00	108.16	$16.44	6.25
222.2		2600	4	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	58	0.23	603.2	$91.69	4	0		58	0.23	10%	542.88	$82.52	$160.00	$0.00	0.00	60.32	$9.17	0.00
613	Closet	650	1	1	"Keyless" Socket, 100w A19 Lamp	100	0.10	65.0	$9.88	1	0	No Change	100	0.10	0%	65	$9.88	$160.00	$0.00	0.00	0	$0.00	0.00
242.2	Lunch Room	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.42	1,081.6	$164.40	4	1	Dual Technology Occupancy Sensor	104	0.42	10%	973.44	$147.96	$160.00	$160.00	0.00	108.16	$16.44	9.73
242.2	Training Room	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.42	1,081.6	$164.40	4	1	Dual Technology Occupancy Sensor	104	0.42	10%	973.44	$147.96	$160.00	$160.00	0.00	108.16	$16.44	9.73
	Totals		81	52			6.86	18,482.4	$2,809.33	81	11			6.858		$17,128.36	$2,603.51		1760.00	0.0	1,354.08	$205.82	8.55

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW_{DC}	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Cape May Regional Admin Building	1440	Sunpower SPR230	89	14.7	1,309	20.47	25,007	2,937	15.64



PVWatts

AC Energy & Cost Savings

Cautions for Interpreting the Results

Station Identification	
City:	Atlantic_City
State:	New_Jersey
Latitude:	39.45° N
Longitude:	74.57° W
Elevation:	20 m
PV System Specifications	
DC Rating:	20.5 kW
DC to AC Derate Factor:	0.810
AC Rating:	16.6 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	11.2 ¢/kWh

Results			
Month	Solar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	2.58	1330	148.96
2	3.33	1570	175.84
3	4.31	2193	245.62
4	5.20	2498	279.78
5	5.85	2853	319.54
6	6.14	2777	311.02
7	6.06	2805	314.16
8	5.54	2578	288.74
9	4.85	2216	248.19
10	3.76	1810	202.72
11	2.65	1268	142.02
12	2.23	1110	124.32
Year	4.38	25007	2800.78

.= Proposed PV Layout

Notes:

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

REM #2 - WINDTURBINES	
Installation Cost ($):	$595,000
NJ Smart Start Equipment Incentive ($):	$100,477
Net Installation Cost ($):	$494,523
Maintenance Savings ($):	($4,200)
REC Revenue ($/Yr):	$2,864
Energy Savings ($/Yr):	$17,412
Total Yearly Savings ($/Yr):	$16,076
Estimated ECM Lifetime (Yr):	20
Simple Payback	30.76
Lifetime Energy Savings	$348,245

AVERAGE WIND SPEED IS TOO LOW

Location/Building	Average Wind Speed, m/s	Turbine #1 Generation, kWh	Electric Cost Offset	Annual Maint Cost	Wind REC Revenue	Total Annual Savings	Project Cost	Incentive	Net Project Cost	Simple Payback
Cape May Regional- Facility Administratio	5.469	114,554	$17,412	$4,200	$2,864	$16,076	$595,000	$100,477	$494,523	30.76

Wind REC	$0.0250			
Electric Cost	$0.1520			
Wind Shear Exponent				
alpha	0.150			
Wind Data Height (m)	30		ft	0.3048 m per ft
Hub height (m)	37		ft	
Avg. Wind Speed	5.300	m/s		
Avg. Speed Adjust.	5.469	m/s		
Hours per Year	8,760			
Turbine Availability	95%			
Adj. Hours per Year	8,322			
Electrical Losses	5%			

Wind Systems
Production Rebate Amount

Feasibility Study 50% of project costs up to $50,000				Incentive
1-16,000	$3.20	per kWh	16,000	$51,200.00
16,000-1,000,000	$0.50	per kWh	98,554	$49,277.11
				$100,477.11

POWER CURVE OF TURBINE BEING PROPSED TO COMPUTER kWe RATING BASED ON WIND SPEED

Northwind NW100 - 100 kW Turbine - 37 m Hub Height

Power Curve Data		Avg Speed
Vm (m/s)	Power (kWe)	Power Rating
1.00	(0.50)	
1.50	(0.55)	
2.00	(0.60)	
2.50	(0.65)	
3.00	(0.70)	
3.50	1.50	
4.00	3.70	
4.50	7.10	
5.00	10.50	
5.50	14.75	14.48971306
6.00	19.00	
6.50	24.20	
7.00	29.40	
7.50	35.20	
8.00	41.00	
8.50	47.65	
9.00	54.30	
9.50	60.55	
10.00	66.80	

Northwind NW100 - 100 kW Turbine - 37 m Hub Height

Power Curve Data	
Vm (m/s)	Power (kWe)
1.00	(0.50)
1.50	(0.55)
2.00	(0.60)
2.50	(0.65)
3.00	(0.70)
3.50	1.50
4.00	3.70
4.50	7.10
5.00	10.50
5.50	14.75
6.00	19.00
6.50	24.20
7.00	29.40
7.50	35.20
8.00	41.00
8.50	47.65
9.00	54.30
9.50	60.55
10.00	66.80
10.50	72.25
11.00	77.70
11.50	82.05
12.00	86.40
12.50	89.60
13.00	92.80
13.50	95.05
14.00	97.30
14.50	98.65
15.00	100.00
15.50	100.40
16.00	100.80
16.50	100.70
17.00	100.60
17.50	100.20
18.00	99.80
18.50	99.60
19.00	99.40
19.50	99.00
20.00	98.60
20.50	98.20
21.00	97.80
21.50	97.55
22.00	97.30
22.50	97.30
23.00	97.30
23.50	97.65
24.00	98.00
24.50	98.85
25.00	99.70

SkyStream - 2.4 kW - 30 ft Hub Height

Power Curve Data	
Vm (m/s)	Power (kWe)
0.00	0.00
3.50	0.08
5.00	0.20
6.00	0.40
7.50	0.80
10.00	2.00
12.50	2.40
15.00	2.40
18.50	2.00
23.00	2.00
25.00	1.80

Gale Vertical Axis Turbine

Power Curve Data	
Vm (m/s)	Power (kWe)
0.00	0.00
3.00	0.15
4.00	0.25
5.00	0.35
6.00	0.50
7.00	0.75
8.00	1.10
9.00	1.55
10.00	2.30
11.00	3.10
12.00	4.00
13.00	4.30
14.00	4.25
15.00	4.20
16.00	4.20
17.00	4.20
18.00	4.20
19.00	4.20
20.00	4.20

SKYSTREAM

Description	Qty	$/Unit	Material Cost	Labor Cost	Total
Skystream 3.7	1	$20,000	$20,000	$10,000	$30,000
Misc Costs	1	$10,000	$10,000	$0	$10,000
Crane	1	$0	$0	$0	$0
Total			$30,000	$10,000	$40,000

NORTHWIND

Description	Qty	$/Unit	Material Cost	Labor Cost	Total
Northwind 100 Turbine w/ T	1	$330,000	$330,000	$165,000	$495,000
Misc Costs	1	$50,000	$50,000	$0	$50,000
Crane	1	$50,000	$50,000	$0	$50,000
Sub-Total			$430,000	$165,000	$595,000

GALE

Description	Qty	$/Unit	Material Cost	Labor Cost	Total
Gale Vertical Axis	1	$28,496	$28,496	$14,248	$42,744
Misc Costs	1	$20,000	$20,000	$0	$20,000
Crane	1	$8,000	$8,000	$0	$8,000
Sub-Total			$56,496	$14,248	$70,744

	Qty	$/Unit	Total Cost
Annual Maintenance	1	$60	$60

	Qty	$/Unit	Total Cost
Annual Maintenance	1	$4,200	$4,200

	Qty	$/Unit	Total Cost
Annual Maintenance	1	$60	$60