LOCAL GOVERNMENT ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT

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

LOWER TOWNSHIP PUMPING STATION
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I. EXECUTIVE SUMMARY

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

Cape May County Municipal Utility Authority
Wildwood/Lower Regional Wastewater Treatment Facility
Lower Township Pumping Station
2900 Bayshore Road
Villas, NJ 08251

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	$ 50,710
Total	$ 50,710

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	NEMA Premium Pump Motor Replacement	$9,642	$2,392	4.0	272.2%
ECM #2	NEMA Premium Fan Motor Replacement	$945	$137	6.9	117.5%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	Solar 140.99 KW PV System	$1,268,910	$86,500	14.7	70.4%
REM #2	600 KW Wind Turbine	$4,019,300	$160,000	25.1	-20.4%
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)**
ECM #1	NEMA Premium Pump Motor Replacement	5.2	15,635.0
ECM #2	NEMA Premium Fan Motor Replacement	0.3	894.0
RENEWABLE ENERGY MEASURES (REM's)			
ECM NO.	**DESCRIPTION**	**ANNUAL UTILITY REDUCTION**	
		ELECTRIC DEMAND (KW)	**ELECTRIC CONSUMPTION (KWH)**
REM #1	Solar 140.99 KW PV System	114.2	171,969.0
REM #2	600 KW Wind Turbine	600.0	1,011,564.0

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:** NEMA Premium Pump Motor Replacement
- **ECM #2:** NEMA Premium Fan Motor Replacement

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.

There are a total of five (5) electric unit heaters with fractional horsepower fan motors and electric heating elements that heat both the Pump Room and the Control Room that have surpassed their useful service life as defined by ASHRAE. Replacement of these units would not provide significant energy savings to show a favorable payback based on standard ECM calculation methods. However, because of the age and condition of these units, it would be beneficial both financially and for energy conservation for the Township to replace these unit heaters with newer, more efficient units of equal capacity.

Renewable Energy Measures (REMs) were also reviewed for implementation at the CMC MUA – WW Lower Twp. Pump Station. CEG utilized a ground mounted solar array to house a substantial PV system. The recommended 140.99 kW PV system will produce approximately 171,969 kWh of electricity annually and will reduce the schools electrical consumption from the grid by 51.86%. The system's calculated simple payback of 14.67 years is past the standard 10 year simple payback threshold; however, with alternative funding this payback could be lessened. CEG recommends the Owner review all funding options before deciding to not implement this renewable energy measure.

Overall, the WW Lower Twp. Pump Station appears to be operating at a high efficiency level compared to other buildings in the Energy Star "other" category in the region. With the implementation of the above recommended measures the CMC MUA will realize further energy savings at the WW Lower Twp. Pump Station.

II. INTRODUCTION

The comprehensive energy audit covers the 2,000 square foot Lower Township Pumping Station, which includes the following spaces: restroom, janitor closet, generator room, pump room and electric room.

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

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

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

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

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

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

III. METHOD OF ANALYSIS

Post site visit work includes evaluation of the information gathered, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on HVAC, lighting and building envelope improvements. Data collected is processed using energy engineering calculations to anticipate energy usage for each of the proposed energy conservation measures (ECMs). The actual building's energy usage is entered directly from the utility bills provided by the owner. The anticipated energy usage is compared to the historical data to determine energy savings for the proposed ECMs.

It is pertinent to note, that the savings noted in this report are not additive. The savings for each recommendation is calculated as standalone energy conservation measures. Implementation of more than one ECM may in some cases affect the savings of each ECM. The savings may in some cases be relatively higher if an individual ECM is implemented in lieu of multiple recommended ECMs. For example implementing reduced operating schedules for inefficient lighting will result in a greater relative savings. Implementing reduced operating schedules for newly installed efficient lighting will result in a lower relative savings, because there is less energy to be saved. If multiple ECM's are recommended to be implemented, the combined savings is calculated and identified appropriately.

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

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment 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 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	15.3¢ / kWh

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: Atlantic City Electric
Rate: Annual General
Meter No: 83222043
Customer ID No: 0976 7069 9996
Third Party Utility
TPS Meter / Acct No:

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Jan-09	38,167	101.4	$5,046
Feb-09	36,201	96.1	$4,795
Mar-09	34,725	81.7	$4,560
Apr-09	30,264	93.4	$4,118
May-09	20,592	62.6	$2,972
Jun-09	20,475	76.9	$3,595
Jul-09	22,102	68.4	$3,873
Aug-09	22,555	73.8	$3,916
Sep-09	24,109	148.3	$4,708
Oct-09	17,908	74.8	$3,103
Nov-09	26,069	140.2	$4,191
Dec-09	38,439	134.9	$5,833
Totals	**331,606**	**148.3 Max**	**$50,710**

AVERAGE DEMAND 96.0 KW average
AVERAGE RATE $0.153 $/kWh

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 4
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	331,606.00	-	-	1,132,103	3.340	3,781,224
TOTAL		-	-	1,132,103		3,781,224
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		2,000	SQUARE FEET			
BUILDING SITE EUI		*566.05*	kBtu/SF/YR			
BUILDING SOURCE EUI		*1,890.61*	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 (Sewage Pumping Station):
  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 544% higher than the baseline building site data. Normalizing the building site data for 100% electric, baseline site energy is 185.7 kBtu/SF and as compared to the national average the energy usage is approximately 304.8% higher than the building site data.

B. 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 5
ENERGY STAR Performance Rating

ENERGY STAR PERFORMANCE RATING		
FACILITY DESCRIPTION	**ENERGY PERFORMANCE RATING**	**NATIONAL AVERAGE**
Lower Township Pump Station	N/A	N/A

The Lower Township Pump Station falls under the "other" category which is not applicable for Energy Performance Rating. See the **Statement of Energy Performance Appendix** for the detailed energy summary.

V. FACILITY DESCRIPTION

The 2,000 SF Lower Township Pump Station is a one story facility comprised of a restroom, janitor closet, generator room, pump room and electric room. The facility typically operates 24/7 and is occupied approximately 10 hours a week. Exterior walls are block with brick 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 somewhat maintained. The windows could be re-caulked as part of the facility maintenance. Typical windows throughout the facility are double pane, ¼" clear glass with aluminum frames. Blinds are not utilized through the facility. The majority of the roof is standing seam metal roof system. The amount of insulation below the roofing is unknown. The building was built in 1988 with no additions since the original construction.

HVAC Systems

There is no cooling at this facility. Heat for the facility is provided by five (5) electric unit heaters with capacities ranging from 3 to 7.5 KW. The restroom is heated by a 4 foot, 1000 watt electric baseboard heater. The Janitor closet is heated by a 2 foot, 500 watt electric baseboard heater. The unit heaters and baseboard heaters are twenty two (22) years old, are in fair condition and are two (2) years past their ASHRAE expected useful service life. The electric heaters can be maintained or replaced as needed under building maintenance projects.

There is an emergency generator that was manufactured by Philadelphia Electric Equipment Company that is rated at 500 KVA (400 KW). The generator is twenty two (22) years old and in good to fair condition.

Exhaust System

Ventilation is provided by six (6) exhaust fans ranging from 1/20 hp to 3 hp. The three (3) largest horsepower fans serve the pump room. The smallest is a toilet room exhaust fan. The fans are twenty two (22) years old, are in fair condition and are two (2) years past their ASHRAE expected useful service life.

HVAC System Controls

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

Domestic Hot Water

Domestic hot water for the restroom and Janitor sink is provided by a 6 gallon Bradford White electric hot water heater, capacity of 1500 Watts. The domestic hot water piping insulation appeared to be in good condition. The water heater is twenty two (22) years old, is in fair condition and is ten (10) years past its expected useful service life.

Process Pumps

There are process pumps ranging from 1 hp to 150 hp. The pumps found within the building are: 15 hp wash water pump, 40 hp effluent pump and three (3) 150 hp effluent pumps. Other pumps found onsite are: 1 hp well pump, 5 hp wet well pump, 5 hp wash water pump, two (2) 7.5 hp dilution water pumps and two (2) 20 hp non-potable water pumps. The pumps range from twenty two (22) years old to five years old. The pumps are in good to fair condition and range from twelve (12) years past expected useful service life to having fifteen (15) years of expected useful service life remaining.

Lighting

The Control Room is lit via 1x4 pendant mounted fixtures utilizing T-8 lamps with electronic ballasts. The Pump Room and Generator Room are both lit by 150 W Metal Halide fixtures.

Emergency Generator

The Philadelphia Electric Equipment Company emergency generator is rated at 400 KW, 500 KVA. It has a Cummins engine. The generator has less than 5 KW block heater that cycles to warm the engine block. Attempts to contact the manufacturer failed and we could not confirm the exact heater kW installed. Based on other generators owned by the MUA, the heater would be less than 5 kW. The generator is connected to a 2500 gallon above ground, steel, diesel fuel tank. The generator is not used much. The generator is twenty one (21) years old, in fair condition and is one (1) year past the ASHRAE expected useful service life of reciprocating engines. The generator can be maintained / replaced as needed as a maintenance project. The engine block heater should be maintained as the manufacturer does not offer an alternative as to the fuel source for heating the engine block.

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: NEMA Premium Pump Motor Replacement

Description:

Replacing the old pumps motors with new efficient motors is a simple change that can provide substantial savings.

The existing electric motors equal to or greater than one horsepower range from 78 to 93% efficient. NEMA premium efficient motors have improved efficiency primarily due to better designs with use of better materials to reduce losses. Surprisingly, the electricity used to power a motor represents 95 % of the motor's 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 pump motors in this facility that are greater than or equal to 1 HP. The 150 HP pumps located in the main Pump room would not be replaced, as the existing motor efficiency of 94.5% is only 1% less than the NEMA Premium Motor efficiency rating of 95.8%. The energy savings realized by replacing this motor would not be justified by the high equipment and installation cost of new 150 HP motors.

Energy Savings Calculations:

Existing: A 40 HP pump Motor with the following characteristics:
Existing Motor Efficiency = 81.7%
Annual Hours of Operations = 3000
1 HP = 0.746 KW
Load Factor = 75%
Cost of electricity = $0.153 / kWh

Existing 40 HP Motor Operating Cost =
{0.746 KW/HP x Motor HP x Load Factor x Hours of Operation x Cost of Electricity] ÷ Motor Efficiency
= [0.746 x 40 x 0.75 x 3000 x 0.153] ÷ 0.817 = $12,573 / Year

New NEMA Premium Motor Efficiency = 94.1%

New NEMA Premium Efficiency Motor Operating Cost =
{0.746 x 40 x 0.75 x 3000 x 0.153} ÷ 0.941 = $10,916 / Year

Savings = $12,573 - $10,916 = $1,657 / Year

NEMA PREMIUM EFFICIENT MOTOR REPLACEMENT						
Equipment Tag	**Motor HP**	**Existing Efficiency**	**NEMA Premium Efficiency**	**kW Savings**	**kWh Savings**	**Cost Savings**
P-1	40	81.7%	94.1%	3.61	10,829	$1,657
P-5	15	84.0%	92.8%	0.95	2,842	$435
P-21-4	5	84.0%	90.4%	0.24	707	$108
P-21-8	1	75.0%	85.5%	0.09	275	$42
P-21-9	5	84.0%	90.4%	0.24	707	$108
Wetwell Pump	1	75.0%	85.5%	0.09	275	$42
Total Savings				**5.2**	**15,635.7**	**2,392.3**

Installed Cost of a 40 HP NEMA Premium® Efficiency Motor = $4,780 minus the SmartStart Building® incentive for a 40hp ($162/motor) is $4,618.

Simple Payback = $4,618 /$1,657 = 2.8 Years

kWh saved = $1,657 / $0.153/kWh = 10,829 kWh
kW saved = 10,829 kWh / 3000 hrs./yr. = 3.61 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**
1	2	XPFC	4-Pole	$708	$1,416	$84	16.8
5	2	XPFC	4-Pole	$938	$1,876	$216	8.7
15	1	XPFC	4-Pole	$1,732	$1,732	$435	4.0
40	1	XPFC	4-Pole	$4,618	$4,618	$1,657	2.8
				Totals:	*$9,642*	*$2,392*	*4.0*

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

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$10,106
NJ Smart Start Equipment Incentive ($):	$464
Net Installation Cost ($):	$9,642
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,392
Total Yearly Savings ($/Yr):	$2,392
Estimated ECM Lifetime (Yr):	15
Simple Payback	4.0
Simple Lifetime ROI	272.2%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$35,885
Internal Rate of Return (IRR)	24%
Net Present Value (NPV)	$18,917.12

ECM #2: NEMA Premium Fan Motor Replacement

Description:

This energy conservation measure would replace exhaust fan motors equal to or greater than 1 HP with new NEMA Premium® Efficient Motors. NEMA Premium® is the most efficient motor designation in the marketplace today. Because these units operate 40-80 hours per week, even small increases in efficiency can yield substantial energy and dollar savings.

Energy Savings Calculations:

Existing: EF-1 has a fan motor with the following characteristics:

Existing Motor Efficiency = 83.2%
Existing motor HP = 3.0 HP
Annual Hours of Operations = 2,600 (Average)
1 HP = 0.746 Watt
Load Factor = 75%
Cost of electricity = $0.153 / kWh

Existing EF 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 3.0 x 0.75 x 2,600 x 0.153] ÷ 0.832 = $802 / Year

New NEMA Premium Motor Efficiency = 89.7%

New EF NEMA Premium Efficiency Motor Operating Cost =
{0.746 x 1.5 x 0.75 x 2,600 x 0.153} ÷ 0.897 = $744 / Year

Savings = $802 - $744 = $58 / Year

NEMA PREMIUM EFFICIENT MOTOR REPLACEMENT					
MOTOR HP	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**	**KW SAVINGS**	**KWH SAVINGS**	**COST SAVINGS**
3	83.2%	89.7%	0.15	380	$58
2	80.9%	86.9%	0.10	248	$38
1 1/2	78.1%	86.3%	0.10	265	$41
			0.3	**894**	**$137**

Installed Cost of a 3.0 HP NEMA Premium® Efficiency Motors = $400
The SmartStart Building® incentive of a 3.0 hp motor x $54/motor is $54

Net installed Cost = $400 - $54 = $346.
Simple Payback = $346 /$58 = 5.9 Years

kWh saved = $58.15 / $0.153/kWh = 380 kWh
kW saved = 380 kWh / 2600 hrs./yr. = 0.15 kW

The following table outlines the NEMA Premium® Efficiency Motor replacement energy savings for this facility:

MOTOR REPLACEMENT PLAN							
MOTOR HP	**QTY**	**ENCL. TYPE**	**NO. OF POLES**	**INSTALLED COST ****	**TOTAL COST**	**TOTAL SAVINGS**	**SIMPLE PAYBACK**
3	1	ODP	4-Pole	$346	$346	$58.15	5.9
2	1	ODP	4-Pole	$305	$305	$37.99	8.0
1 1/2	1	ODP	4-Pole	$294	$294	$40.62	7.2
				Totals:	*$945*	*$137*	*6.9*

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,098
NJ Smart Start Equipment Incentive ($):	$153
Net Installation Cost ($):	$945
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$137
Total Yearly Savings ($/Yr):	$137
Estimated ECM Lifetime (Yr):	15
Simple Payback	6.9
Simple Lifetime ROI	117.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$2,055
Internal Rate of Return (IRR)	12%
Net Present Value (NPV)	$690.50

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, ground area, 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 on the building 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 and the ground area near-by being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A ground area of 10,000 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 140.99 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 171,969 KWh annually, reducing the overall utility bill by approximately 51.86% 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 ground 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 – WW Lower Twp. Pump Station 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 6
Financial Summary – Photovoltaic System

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM			
PAYMENT TYPE	**SIMPLE PAYBACK**	**SIMPLE ROI**	**INTERNAL RATE OF RETURN**
Direct Purchase	14.67 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 – WW Lower Twp. Pump Station to invest in a solar system through a Direct Purchase CEG does not recommend the CMC MUA – WW Lower Twp. Pump Station pursue this route. It would be more advantageous for the CMC MUA – WW Lower Twp. Pump Station 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 – WW Lower Twp. Pump Station 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 5.38 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 600 kilowatt Fuhrlander Wind Turbine with a 75 meter hub height at the facility would be able to produce approximately 1,011,564 kWh for just one turbine. Although the power generation from one turbine is substantial, the turbine installation itself has an expected payback of over 15 years, being priced at approximately$4,000,000 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 ($):	$4,562,500
NJ Smart Start Equipment Incentive ($):	$543,200
Net Installation Cost ($):	$4,019,300
Maintenance Savings ($):	($15,000)
REC Revenue ($/Yr):	$25,289
Energy Savings ($/Yr):	$149,711
Total Yearly Savings ($/Yr):	$160,001
Estimated ECM Lifetime (Yr):	20
Simple Payback	25.12
Lifetime Energy Savings	$2,994,229

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 Profile included within this report to reference the electricity usage load profile.

Electricity:

The Electric Usage Profile shows increased usage in the winter months between December and March. The usage is fairly steady for the remainder of the year. This profile is somewhat a-typical since the vacation season and high tourist volume does not coincide with the highest usage months. The winter season represents the highest consumption. The baseline electric use for the facility is a result of the pumps housed in the building. This is the primary function of the facility; however increase electric load in the winter can be attributed to the electric resistance heat in the heating season. The electric demand is at its peak in the month of September. The higher demand for pumping energy in the summer is counter balanced by the higher demand for electric heat in the winter; therefore the overall demand profile for the facility is fairly steady except for months that experience simultaneous pump and electric heat use. The facility pumps run based on water treatment needs and as a result the full load operation is extremely short. This results in a low load factor rating of approximately 26%. 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 26% 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.

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. However because of the extremely low load factor and high demand relative to the overall usage, the demand charges play a more significant role in the overall electric costs.

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 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). 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%.*

v. *Direct Install Program* – The New Jersey Clean Energy's Direct Install Program is a state funded program that targets small commercial and industrial facilities with peak demand of less than 200 kW. This turnkey program is aimed at providing owners a seamless, comprehensive process for analysis, equipment replacement and financial incentives to reduce consumption, lower utility costs and improve profitability. The program covers up to 80% 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.

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

CMC MUA Wildwood Lower Township Pump Station

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	NEMA Premium Pump Motor Replacement	$10,106	$0	$464	$9,642	$2,392	$0	$2,392	15	$35,885	$0	272.2%	4.0	23.80%	$18,917.12
ECM #2	NEMA Premium Fan Motor Replacement	$1,098	$0	$153	$945	$137	$0	$137	15	$2,055	$0	117.5%	6.9	11.76%	$690.50
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	Solar 140.99 KW PV System	$1,268,910	$0	$0	$1,268,910	$26,311	$60,189	$86,500	25	$2,162,500	$1,504,725	70.4%	14.7	4.60%	$237,327.28
REM #2	600 KW Wind Turbine	$4,562,500	$0	$543,200	$4,019,300	$149,711	$10,289	$160,000	20	$3,200,000	$205,780	-20.4%	25.1	23732727.53%	$0.00

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* .

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, 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%

STATEMENT OF ENERGY PERFORMANCE
WW LOWER TOWNSHIP PS

Building ID: 2261749
For 12-month Period Ending: December 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: March 31, 2010

Facility
WW LOWER TOWNSHIP PS
2900 Bayshore Road
Villas, NJ 08251

Facility Owner
Cape May MUA
1523 Route 9 North
Swainton, NJ 08210

Primary Contact for this Facility
Josh Palombo
1523 Route 9 North
Swainton, NJ 08210

Year Built: 1988
Gross Floor Area (ft²): 2,000

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	1,131,440
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	1,131,440

Energy Intensity[5]

Site (kBtu/ft²/yr)	566
Source (kBtu/ft²/yr)	1890

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	172

Electric Distribution Utility
Pepco - Atlantic City Electric Co

National Average Comparison

National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	787%
Building Type	Other

Stamp of Certifying Professional

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

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

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

Certifying Professional
Michael Fischette
520 South Burnt Mill Road
Voorhees, NJ 08043

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

ENERGY STAR® Data Checklist for Commercial Buildings

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

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

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	WW LOWER TOWNSHIP PS	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Other	Is this an accurate description of the space in question?		☐
Location	2900 Bayshore Road, Villas, NJ 08251	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐
LOWER TOWNSHIP PS (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	2,000 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Number of PCs	0(Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	10Hours(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	15(Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Pepco - Atlantic City Electric Co

Fuel Type: Electricity		
Meter: Electric (kWh (thousand Watt-hours)) **Space(s):** Entire Facility **Generation Method:** Grid Purchase		
Start Date	**End Date**	**Energy Use (kWh (thousand Watt-hours))**
12/01/2009	12/31/2009	38,439.00
11/01/2009	11/30/2009	26,069.00
10/01/2009	10/31/2009	17,908.00
09/01/2009	09/30/2009	24,109.00
08/01/2009	08/31/2009	22,555.00
07/01/2009	07/31/2009	22,102.00
06/01/2009	06/30/2009	20,475.00
05/01/2009	05/31/2009	20,592.00
04/01/2009	04/30/2009	30,264.00
03/01/2009	03/31/2009	34,725.00
02/01/2009	02/28/2009	36,201.00
01/01/2009	01/31/2009	38,167.00
Electric Consumption (kWh (thousand Watt-hours))		**331,606.00**
Electric Consumption (kBtu (thousand Btu))		**1,131,439.67**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**1,131,439.67**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

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

On-Site Solar and Wind Energy	
Do the fuel consumption totals shown above include all on-site solar and/or wind power located at your facility? Please confirm that no on-site solar or wind installations have been omitted from this list. All on-site systems must be reported.	☐

Certifying Professional

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

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

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

Facility
WW LOWER TOWNSHIP PS
2900 Bayshore Road
Villas, NJ 08251

Facility Owner
Cape May MUA
1523 Route 9 North
Swainton, NJ 08210

Primary Contact for this Facility
Josh Palombo
1523 Route 9 North
Swainton, NJ 08210

General Information

WW LOWER TOWNSHIP PS	
Gross Floor Area Excluding Parking: (ft^2)	2,000
Year Built	1988
For 12-month Evaluation Period Ending Date:	December 31, 2009

Facility Space Use Summary

LOWER TOWNSHIP PS	
Space Type	Other - Other
Gross Floor Area(ft^2)	2,000
Number of PCs[o]	0
Weekly operating hours[o]	10
Workers on Main Shift[o]	15

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 12/31/2009)	**Baseline** (Ending Date 12/31/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft^2)	566	566	0	N/A	104
Source (kBtu/ft^2)	1890	1890	0	N/A	213
Energy Cost					
$/year	$ 50,710.00	$ 50,710.00	N/A	N/A	$ 9,322.35
$/$ft^2$/year	$ 25.36	$ 25.36	N/A	N/A	$ 4.66
Greenhouse Gas Emissions					
$MtCO_2e$/year	172	172	0	N/A	32
$kgCO_2e/ft^2$/year	86	86	0	N/A	16

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

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

"CMC MUA - Wildwood Lower Township Pump Station"

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
P-1	Pump Room	Pump Room	Marathon	1	VJ 404TTDS7411AN	19-00674-8/17	40	885	-	-	404HPV	460/3	2005	20	15	81.7% NEMA Eff., AFD
P-2	Pump Room	Pump Room	Marathon	1	VJ 445TTDS6092AN W	19-00676-8/15-03	150	1190	-	-	445HPV	460/3	1988	20	(-2)	94.5% NEMA Eff., Pump s/n K3T2-059725-2, AFD
P-3	Pump Room	Pump Room	Marathon	1	VJ 445TTDS6092AN W	-	150	1190	-	-	445HPV	460/3	1988	20	(-2)	94.5% NEMA Eff., Pump s/n K3T2-059725-2, AFD (OUT FOR REPAIR)
P-4	Pump Room	Pump Room	Marathon	1	VJ 445TTDS6092AN W	19-00675-8/15-01	150	1190	-	-	445HPV	460/3	1988	20	(-2)	94.5% NEMA Eff., Pump s/n K3T2-059725-2, AFD
P-5	Pump Room	Pump Room	Marathon	1	254TTDR8306AN W	11-91767-8/7	15	3250	-	-	254HPV	460/3	1988	20	(-2)	84.0% NEMA Eff., Fairbank Morris s/n K3T2-059728-0
P-21-4	Wash water	Wash water	-	1	-	-	5	-	-	-	-	-	1988	10	(-12)	Inaccessable
P-21-8	Wash water	Wash water	-	1	-	-	1	-	-	-	-	-	1988	10	(-12)	Inaccessable
P-21-9	Wetwell	Wetwell	-	1	-	-	5	-	-	-	-	-	1988	10	(-12)	Inaccessable
-	Wetwell	Wetwell	-	1	-	-	1	-	-	-	-	-	1988	10	(-12)	Inaccessable

Domestic Hot Water Heater

Tag	Location	Area Served	Manufacturer	Qty	Model #	Serial #	Input	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
-	Janitor Closet	Restroom	Bradford White	1	M6U5S-1	ED 687816B	1.5 KW	-	6	-	Electric	1988	12	(-10)	

Exhaust Fans

Tag	Location	Area Served	Manufacturer	Qty	Model #	Serial #	Motor HP	RPM	CFM	ESP	Volts / Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
EF-1	Pump Room	Pump Room	-	1	-	-	3	-	-	-	480/3	-	1988	15	(-7)	Inaccessable
EF-2	Pump Room	Pump Room	-	1	-	-	2	-	-	-	480/3	-	1988	15	(-7)	Inaccessable
EF-3	Pump Room	Pump Room	-	1	-	-	1.5	-	-	-	480/3	-	1988	15	(-7)	Inaccessable

Unit Heaters

Tag	Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Heating Type	Heating Capacity (KW)	CFM	RPM / HP	VOLTAGE	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
UH-1	Pump Room	Pump Room		1	-	-	Electric	7.5	650	-	480/3	1988	13	(-9)	
UH-2	Pump Room	Pump Room		1	-	-	Electric	7.5	650	-	480/3	1988	13	(-9)	
UH-3	Pump Room	Pump Room		1	-	-	Electric	7.5	650	-	480/3	1988	13	(-9)	
UH-4	Generator Room	Generator Room	Berko	1	-	-	Electric	3	350	-	480/3	1988	13	(-9)	
UH-5	Generator Room	Generator Room	Berko	1	-	-	Electric	3	350	-	480/3	1988	13	(-9)	

Emergency Generator

Tag	Location	Area Served	Manufacturer	Qty.	Model #	Serial #	KW	KVA	Volts / Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
-	Generator room	Pump Station	Philadelphia	1	D400S-63C	GS-7807	400	500	277/480/3	1988	25	3	Jaket Htr: 20amp 480v

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 #: **Insert CEG Job Number Here**
Project: **Project Name** **"Lower Township WW PS"** **KWH COST:** **$0.153**
Address: **Address**
Address
Building SF: 2,000

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
221.31	Control Room	100	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	58	0.23	23.2	$3.55	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
733	Pump Room	100	3	1	150w MH	188	0.56	56.4	$8.63	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
733	Generator Room	100	3	1	150w MH	188	0.56	56.4	$8.63	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		10	4			1.36	136.0	$20.81	10	0			0	0	$0.00		$0.00	0.00	0.0	$0.00	#DIV/0!

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

Project Name: LGEA Solar PV Project - Lower Township Pump Station
Location: Villas, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$1,268,910
Annual kWh Production	171,969
Annual Energy Cost Reduction	$26,311
Annual SREC Revenue	$60,189
First Cost Premium	**$1,268,910**
Simple Payback:	**14.67** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.153**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$1,268,910	0	0	0	$0	(1,268,910)	0
1	$0	171,969	$26,311	$0	$60,189	$86,500	($1,182,410)
2	$0	171,109	$27,101	$0	$59,888	$86,989	($1,095,421)
3	$0	170,254	$27,914	$0	$59,589	$87,502	($1,007,918)
4	$0	169,402	$28,751	$0	$59,291	$88,042	($919,877)
5	$0	168,555	$29,614	$1,736	$58,994	$86,872	($833,005)
6	$0	167,713	$30,502	$1,727	$58,699	$87,474	($745,531)
7	$0	166,874	$31,417	$1,719	$58,406	$88,104	($657,427)
8	$0	166,040	$32,360	$1,710	$58,114	$88,763	($568,664)
9	$0	165,209	$33,330	$1,702	$57,823	$89,452	($479,212)
10	$0	164,383	$34,330	$1,693	$57,534	$90,171	($389,040)
11	$0	163,561	$35,360	$1,685	$57,247	$90,922	($298,118)
12	$0	162,744	$36,421	$1,676	$56,960	$91,705	($206,413)
13	$0	161,930	$37,514	$1,668	$56,675	$92,521	($113,892)
14	$0	161,120	$38,639	$1,660	$56,392	$93,372	($20,521)
15	$0	160,315	$39,798	$1,651	$56,110	$94,257	$73,736
16	$0	159,513	$40,992	$1,643	$55,830	$95,179	$168,915
17	$0	158,716	$42,222	$1,635	$55,550	$96,138	$265,052
18	$0	157,922	$43,488	$1,627	$55,273	$97,135	$362,187
19	$0	157,132	$44,793	$1,618	$54,996	$98,171	$460,358
20	$0	156,347	$46,137	$1,610	$54,721	$99,248	$559,606
21	$1	155,565	$47,521	$1,602	$54,448	$100,366	$659,972
22	$2	154,787	$48,947	$1,594	$54,175	$101,528	$761,500
23	$3	154,013	$50,415	$1,586	$53,905	$102,733	$864,234
24	$4	153,243	$51,928	$1,578	$53,635	$103,984	$968,218
25	$5	152,477	$53,485	$1,571	$53,367	$105,282	$1,073,500
	Totals:	4,050,893	$959,289	$34,692	$1,417,813	$2,342,410	($2,300,169)
				Net Present Value (NPV)			**$1,073,525**
				Internal Rate of Return (IRR)			**5.2%**

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
Lower Township Pump Station	10000	Sunpower SPR230	613	14.7	9,014	140.99	171,969	20,229	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:	141.0 kW
DC to AC Derate Factor:	0.810
AC Rating:	114.2 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	190.0°
Energy Specifications	
Cost of Electricity:	0.2 ¢/kWh

Results			
Month	Solar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	2.57	9117	13.95
2	3.32	10795	16.52
3	4.30	15073	23.06
4	5.20	17208	26.33
5	5.85	19662	30.08
6	6.13	19119	29.25
7	6.06	19315	29.55
8	5.53	17726	27.12
9	4.84	15239	23.32
10	3.75	12425	19.01
11	2.64	8675	13.27
12	2.22	7613	11.65
Year	4.37	171969	263.11

.= Proposed PV Layout

Notes:

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

REM #2 - WINDTURBINES	
Installation Cost ($):	$4,562,500
NJ Smart Start Equipment Incentive ($):	$543,200
Net Installation Cost ($):	$4,019,300
Maintenance Savings ($):	($15,000)
REC Revenue ($/Yr):	$25,289
Energy Savings ($/Yr):	$149,711
Total Yearly Savings ($/Yr):	$160,001
Estimated ECM Lifetime (Yr):	20
Simple Payback	25.12
Lifetime Energy Savings	$2,994,229

x1 Fuhrlander 600kW Turbine

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
Wildwood/Lower Regional- Lower Twp Pu	6.173	1,011,564	$149,711	$15,000	$25,289	$160,001	$4,562,500	$543,200	$4,019,300	25.12

Wind REC	$0.0250			
Electric Cost	$0.1480			
Wind Shear Exponent				
alpha	0.150			
Wind Data Height (m)	30		ft	0.3048 m per ft
Hub height (m)	75		ft	
Avg. Wind Speed	5.380	m/s		
Avg. Speed Adjust.	6.173	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	984,000	$492,000.00
				$543,200.00

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	
Vm (m/s)	Power (kWe)
0.00	0.00
1.00	0.00
2.00	0.00
3.00	7.00
4.00	26.00
5.00	61.00
6.00	115.00
7.00	190.00
8.00	289.00
9.00	410.00
10.00	519.00
11.00	593.00
12.00	604.00
13.00	615.00
14.00	613.00
15.00	568.00
16.00	600.00

Avg Speed
Power Rating

127.9504817

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

Furhlander 1500 kW Turbine - 80 m Hub

Power Curve Data	
Speed (mps	Power (kW)
0	0
1	0
2	0
3	0
4	33.7
5	98.5
6	192.9
7	329.3
8	507
9	738.8
10	1020.7
11	1334.4
12	1500
13	1500
14	1500
15	1500
16	1500
17	1500
18	1500
19	1500
20	1500
21	1500
22	1500
23	1500
24	1500
25	1500
26+	0

Furhlander 600 kW Turbine - 75 m Hub

Power Curve Data	
Speed (mps	Power (kW)*
0	0
1	0
2	0
3	7
4	26
5	61
6	115
7	190
8	289
9	410
10	519
11	593
12	604
13	615
14	613
15	568
16	600
17	600
18	600
19	600
20	600
21	0
22	0
23	0
24	0
25	0
26+	0

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

FUHRLANDER

Description	Qty	$/Unit	Material Cost	Labor Cost	Total
FL 1500 kW	1		$0	$0	$0
Misc Costs	1		$0	$0	$0
Crane	1		$0	$0	$0
Sub-Total			$0	$0	$0

FUHRLANDER

Description	Qty	$/Unit	Material Cost	Labor Cost	Total
FL 600 kW	1	$1,850,000	$1,850,000	$1,387,500	$3,237,500
Misc Costs	1	$1,200,000	$1,200,000	$0	$1,200,000
Crane	1	$125,000	$125,000	$0	$125,000
Sub-Total			$3,175,000	$1,387,500	$4,562,500

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

	Qty	$/Unit	Total Cost
Annual Maintenance	3	$4,200	$12,600

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

	Qty	$/Unit	Total Cost
Annual Maintenance	1		$0

	Qty	$/Unit	Total Cost
Annual Maintenance	1	$15,000	$15,000