LOCAL GOVERNMENT ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT

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

INFLUENT / SLUDGE PROCESSING BUILDING
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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 Waste Water Treatment Facility
- Influent / Sludge Processing Building
2701 Route 47 South
Rio Grande, NJ 08242

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	$ 452,407
Natural Gas	$ 72,868
Total	$ 525,275

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 Efficiency Pump Motor Replacement	$508	$112	4.5	296.9%
ECM #2	NEMA Premium Efficient 2-Speed Fan Motor Replacement	$7,547	$1,018	7.4	142.8%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	Solar Power 14.26 KW System	$128,340	$8,675	14.8	69.0%

Notes:
A. Cost takes into consideration applicable NJ Smart StartTM incentives.
B. Savings takes into consideration applicable maintenance savings.
C. ECM #1 based on differential cost between standard and premium efficiency motors to highlight the advantage of a premium efficiency motor.

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	NEMA Premium Efficiency Pump Motor Replacement	0.3	756.0	-
ECM #2	NEMA Premium Efficient 2-Speed Fan Motor Replacement	1.2	6,880.0	-
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	Solar Power 14.26 KW System	14.3	17,421.0	-

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 Efficiency Pump Motor Replacement
- **ECM #2:** NEMA Premium Efficient 2-Speed 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. Maintain all weather stripping on entrance doors.
2. Clean all light fixtures to maximize light output.

Renewable Energy Measures (REMs) were also reviewed for implementation at the Wildwood Sludge Process Building. CEG utilized a roof mounted solar array to house a substantial PV system. The recommended 14.26 kW PV system will produce approximately 17,421 kWh of electricity annually and will reduce the WW Sludge Building's electrical consumption from the grid by 0.6%. The system's calculated simple payback of 14.79 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 CMC MUA– Wildwood Sludge Process Building appears to be operating at a below average efficiency level compared to other Energy Star buildings in the "other" category in the region. The 10 hp pump motors do not draw enough to justify the high power density. The 20hp and 25 hp fan motors have a large power demand and the Sludge Processing Building has a small to medium size building area and helps to explain the high power density. These factors are the reasons for the higher than average power usage as noted in the EUI number and the appearance of efficiency less than average. With the implementation of the above recommended measures the CMC MUA will realize further energy savings at the Wildwood Sludge Process Building.

II. INTRODUCTION

The comprehensive energy audit covers the 3,096 square foot Influent / Sludge Processing Building, which includes the following spaces: bar screen area, grit chamber area, control room and grit dewatering area.

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 gas usage profile shows the actual natural gas energy usage for the facility. South Jersey Gas provides natural gas to the facility under the Firm Transportation rate structure. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 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	14.8 ¢ / kWh
Natural Gas	$1.62 / Therm

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: Atlantic City Electric
Rate: Annual General Service
Meter No: 83431486
Customer ID No:
Third Party Utility
TPS Meter / Acct No:

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Jan-08	233,992	411.8	$30,461
Feb-08	134,623	411.4	$30,521
Mar-08	238,895	417.6	$31,187
Apr-08	234,165	542.9	$30,505
May-08	245,441	443.5	$31,803
Jun-08	266,344	504.5	$42,255
Jul-08	368,744	615.4	$43,390
Aug-08	264,138	710.4	$43,237
Sep-08	299,063	1219.2	$52,714
Oct-08	242,797	823.7	$36,873
Nov-08	239,501	937.0	$35,850
Dec-08	294,317	830.4	$43,612
Totals	**3,062,020**	**1219.2 Max**	**$452,407**

AVERAGE DEMAND 655.6 KW average
AVERAGE RATE $0.148 $/kWh

Figure 1
Electricity Usage Profile

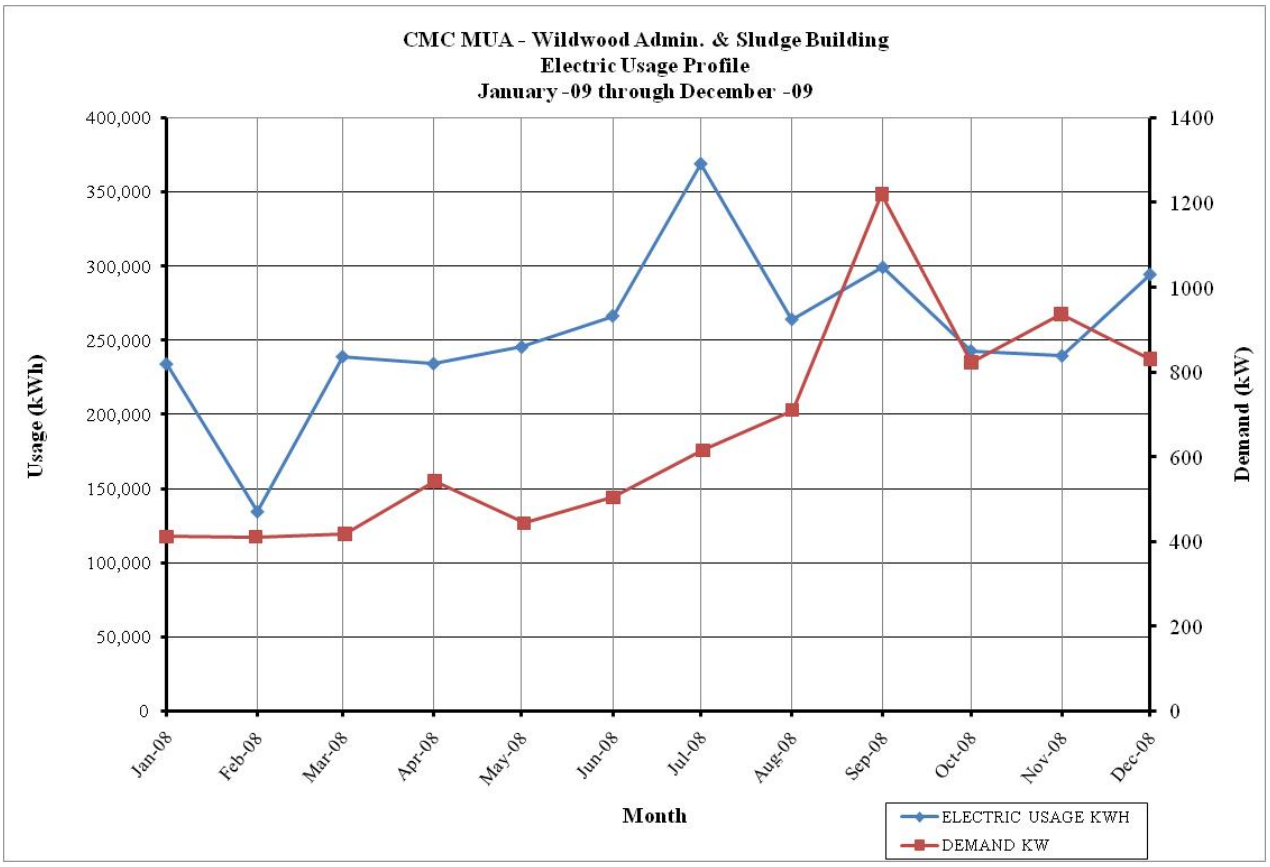
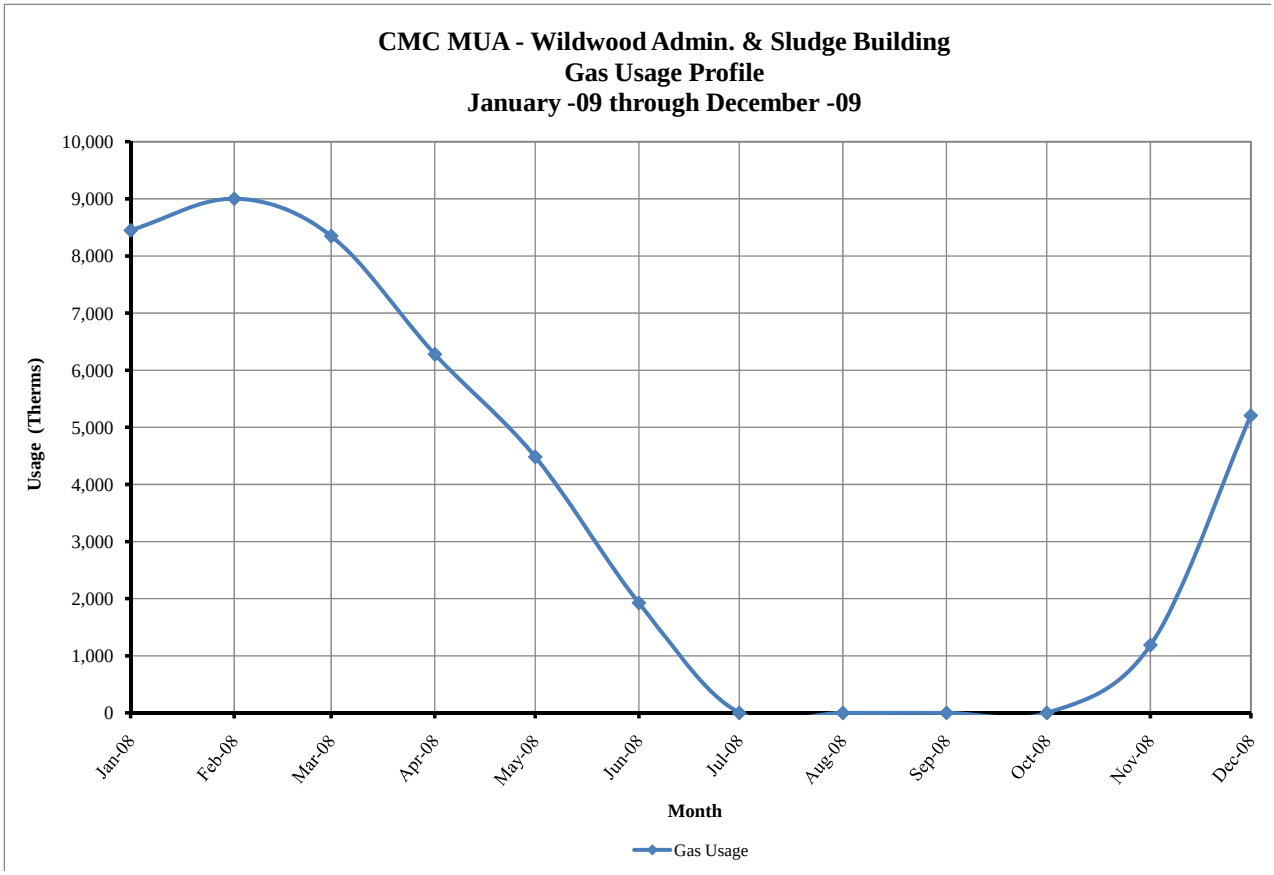


Table 4
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider:	South Jersey Gas	
Rate:	Firm Transportation	
Meter No:	518218	
Point of Delivery ID:		
Third Party Utility Provider:	Woodruff	
TPS Meter No:		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Jan-08	8,449.32	$13,566.59
Feb-08	9,002.84	$14,588.48
Mar-08	8,348.88	$13,531.95
Apr-08	6,278.79	$10,179.94
May-08	4,483.22	$7,288.41
Jun-08	1,925.10	$3,153.65
Jul-08	0.00	$18.10
Aug-08	0.00	$18.10
Sep-08	0.00	$18.10
Oct-08	0.00	$19.97
Nov-08	1,189.00	$1,962.47
Dec-08	5,206.89	$8,522.10
TOTALS	**44,884.04**	**$72,867.86**
AVERAGE RATE:	**$1.62**	**$/THERM**

Figure 2
Natural Gas 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	3,062,020.0			10,453,736	3.340	34,915,479
NATURAL GAS		44,884.0		4,488,404	1.047	4,699,359
FUEL OIL			-	0	1.010	0
PROPANE			-	0	1.010	0
TOTAL				14,942,140		39,614,838
*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		*645.56*	kBtu/SF/YR			
BUILDING SOURCE EUI		*1,711.52*	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 (Wastewater Treatment and Administration):
  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 620% higher than the baseline building site data. Normalizing the baseline site data for 70% electric, baseline site energy is 130 kBtu/SF and as compared to the national average the energy usage is approximately 496% higher than the baseline building site data. This appears to be high but is understandable since there are 10 hp, 25 hp and larger motors running continuously in the facility for the different processes such as pumping and air scrubbing etc. that is part of required plant operation.

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**
Wildwood Sludge Processing Building	N/A	N/A

An Energy Performance Rating cannot be established for the Wildwood 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 3,096 SF Wildwood Sludge Process Building is a two story facility comprised of a bar screen area, grit chamber area, control room and grit dewatering area.

The facility is typically occupied 50 hours a week. Exterior walls are 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 maintained. Typical windows throughout the facility are double pane, ¼" clear glass with aluminum frames. Blinds are not utilized. The roof is a built-up roof with light color stone ballast. 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 are three boilers in the boiler room of which only two (2) are connected to the plant loop. The boiler room is not in the scope of this audit; however, they have been listed in **APPENDIX C- Major Equipment List** for reference.

The Influent / Sludge processing building has no cooling and no heating.

Exhaust System

The building is ventilated by two (2) Spartan Motor model 7-M43842001, 25 / 6.25 hp dual speed and single winding fan motor, exhausting air from the building and through the scrubber. The fans are twenty-two (22) years old, in fair condition and are seven (7) years past its ASHRAE expected useful service life remaining.

HVAC System Controls

The exhaust fan is operated 24/7 continuously.

Domestic Hot Water

There is no domestic hot water in this building.

Process Motors

There are three (3) Grit Chamber (WEG & 01018XP3E215T) 10 hp, 1760 rpm, 90.2% NEMA efficient motors. They are two (2) years old, in good condition and have sixteen (16) years of ASHRAE expected useful service life remaining.

There are three (3) Grit Screw (WEG & 00518XP3E184T) 5 hp motors. Two (2) Motors are two (2) years old with fourteen (14) years of service life remaining. One (1) motor appears to be twenty-two (22) years old, in fair to poor condition and is four (4) years past its ASHRAE expected useful service life.

There is a Bar Screen drive motor that is a Baldor model CM710A (3/4 hp). The motor appears to be twenty-two (22) years old, in fair to poor condition and is four (4) years past its ASHRAE expected useful service life.

There are two (2) Bar Screen gear motors that are Baldor model CM710A (3/4 hp). These motors are twenty-two (22) years old, in fair condition and are four (4) years past its ASHRAE expected useful service life.

There are two (2) Flygt model MP 3068 HT Grinder pump with 2 hp motor. They are twenty-two (22) years old, in fair condition and are four (4) years past its ASHRAE expected useful service life

Lighting

Typical lighting throughout the wet well room is high pressure sodium, pendant mounted explosion proof fixtures. The switch gear room is lit with fluorescent tube lay-in fixtures with T-8 lamps and electronic ballasts.

VI. MAJOR EQUIPMENT LIST

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

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

VII. ENERGY CONSERVATION MEASURES

ECM #1: Install NEMA Premium Efficient Pump Motor

Description:

Replacing old pump motors 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 = 2,600
1 HP = 0.746 Watt
Load Factor = 75%
Cost of electricity = $0.148 / kWh

Existing 5HP 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 2,600 x 0.148] ÷ 0.825 = $522 / Year

New NEMA Premium Motor Efficiency = 86.5%

New NEMA Premium Efficiency Motor Operating Cost =
{0.746 x 2 x 0.75 x 2,600 x 0.148} ÷ 0.865 = $498 / Year

Savings = $522 - $498 = $24 / Year

Installed Cost of a 2 HP NEMA Premium® Efficiency Motor = $908

Installed Cost of a 2 HP same (standard) efficiency motor = $636

The SmartStart Building® incentive of 2hp is $60/TEFC motor.

The cost premium of a premium efficient motor is $908 - $636 = $272

Less the SmartStart Building® incentive $272 - $60 = $212

Simple Payback for efficiency Premium = $212 / $24 = 8.8 Years

kWh saved = $24 / $0.148/kWh = 162.2 kWh (per motor)

kW saved = 162.2 kWh / 2,600 hrs./yr. = 0.06kW (per motor)

The following table outlines the motor replacements efficiencies and savings for this facility:

NEMA Premium Efficient Motor Replacement						
Equipment Tag	**Motor HP**	**Existing Efficiency**	**NEMA Premium Efficiency**	**kW Savings**	**kWh Savings**	**Cost Savings**
-	2	82.5%	86.5%	0.06	163	$24
-	5	87.0%	90.2%	0.11	297	$44
-	5	87.0%	90.2%	0.11	297	$44
Total Savings				**0.3**	**756**	**$112**

The motors that are past there useful life and should be replaced are listed in the table above. Considering replacement cost alone would not provide an economical benefit. When considering efficiency upgrades, a comparison of cost difference between the standard efficiency and the premium efficiency motor should be evaluated. The following table outlines the recommended motor replacement plan for this facility based on the cost premium of the efficiency upgrade:

MOTOR REPLACEMENT PLAN							
Motor HP	**QTY**	**ENCL. TYPE**	**No. of POLEs**	**INSTALLED Cost ****	**TOTAL COST**	**TOTAL SAVINGS**	**Simple Payback**
2	1	TEFC	4-Pole	$212	$212	$24.14	8.8
5	1	TEFC	4-Pole	$148	$148	$43.90	3.4
5	1	TEFC	4-Pole	$148	$148	$43.90	3.4
				Totals:	*$508*	*$112*	*4.5*

**** Additional cost of a Premium Efficient motor (compaired to existing efficiency) less the applicable rebate**

This ECM utilizes differential cost in order to show the owner the advantage of replacing an aged, standard efficient motor with a new, premium efficient motor. The owner should review this option prior to rebuilding or replacing all malfunctioning motors.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$688
NJ Smart Start Equipment Incentive ($):	$180
Net Installation Cost ($):	$508
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$112
Total Yearly Savings ($/Yr):	$112
Estimated ECM Lifetime (Yr):	18
Simple Payback	4.5
Simple Lifetime ROI	296.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$2,016
Internal Rate of Return (IRR)	21%
Net Present Value (NPV)	$1,032.39

ECM #2: Install NEMA Premium Efficient Fan Motor

Description:

Replacing old fan motors 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 25/6.25 HP system fan Motor with the following characteristics:
Existing Motor Efficiency = 88.5%/82.5%
Annual Hours of Operations = 7,900
Peak hours (July 4th weekend to Labor Day) =1430
Off-Peak (rest of year) = 6470
1 HP = 0.746 Watt
Load Factor = 75%
Cost of electricity = $0.148 / kWh

Existing 25HP/6.25HP Motor Peak 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 25 x 0.75 x 1,430 x 0.148] ÷ 0.885 = $3,345 / Year

Existing 25HP/6.25HP Motor Off-Peak 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 6.25 x 0.75 x 6,470 x 0.148] ÷ 0.825 = $4,059 / Year

Total Existing 25HP/6.25HP Motor Operating Cost = $3,345 / Year + $4,059 / Year = $7,404

New 25HP/6.25HP NEMA Premium Motor Efficiency = 93% / 91%

New 25HP/6.25HP NEMA Premium Efficiency Motor Peak Operating Cost =

{0.746 x 25 x 0.75 x 1,430 x 0.148} ÷ 0.93 = $3,183 / Year

New 25HP/6.25HP NEMA Premium Efficiency Motor Off-Peak Operating Cost =
{0.746 x 6.25 x 0.75 x 6,470 x 0.148} ÷ 0.91 = $3,680 / Year

Total New 25HP/6.3HP NEMA Premium Efficiency Motor Operating Cost = $3,183 / Year + $3,680 / Year = $6,863

Savings = $7,404 - $6,863 = $541 / Year

Installed Cost of a 25HP/6.3HP HP NEMA Premium® Efficiency Motor = $4,190

The SmartStart Building® incentive of 25hp is $130/TEFC motor.

Less the SmartStart Building® incentive $4,190 - $130 = $4,060

Simple Payback = $4,060 / $541 = 7.5 Years

Peak kWh saved = $379 / $0.148/kWh = 2,560.8 kWh (per motor)

Off-Peak kWh saved = $162 / $0.148/kWh = 1,094.6 kWh (per motor)

Total kWh saved = 2,560.8 kWh + 1,094.6 kWh = 3.655.4 kWh

Peak kW saved = 1094 kWh / 1,430 hrs./yr. = 0.76 kW (per motor)
Off-Peak kW saved = 2,562 kWh / 6,470 hrs./yr. = 0.40 kW (per motor)
Total kW saved = 0.76 kW + 0.40 kW = 1.16 kW

The following table outlines the motor replacements efficiencies and savings for this facility:

NEMA PREMIUM EFFICIENT 2-SPEED MOTOR REPLACEMENT						
Equipment Tag	**Motor HP**	**Existing Efficiency**	**NEMA Premium Efficiency**	**kW Savings**	**kWh Savings**	**Cost Savings**
-	20	85.5%	93.0%	1.06	1,509	$223
-	5	82.5%	89.5%	0.27	1,716	$254
-	25	88.5%	93.0%	0.76	1,094	$162
-	6.25	82.5%	91.0%	0.40	2,562	$379
Total Savings				**2.5**	**6,880**	**$1,018**

The motors that are past there useful life and should be replaced are listed in the table above.

2-SPEED MOTOR REPLACEMENT PLAN							
Motor HP	**QTY**	**ENCL.TYPE**	**No. of POLEs**	**INSTALLED Cost ***	**TOTAL COST**	**TOTAL SAVINGS**	**Simple Payback**
20 / 5	1	TEFC	4-Pole	$3,487	$3,487	$477.33	7.3
25 / 6.25	1	TEFC	4-Pole	$4,060	$4,060	$540.97	7.5
				Totals:	*$7,547*	*$1,018*	*7.4*

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

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$7,802
NJ Smart Start Equipment Incentive ($):	$255
Net Installation Cost ($):	$7,547
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,018
Total Yearly Savings ($/Yr):	$1,018
Estimated ECM Lifetime (Yr):	18
Simple Payback	7.4
Simple Lifetime ROI	142.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$18,324
Internal Rate of Return (IRR)	12%
Net Present Value (NPV)	$6,454.08

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 1000 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 14.26 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 17,421 KWh annually, reducing the overall utility bill by approximately 0.57% 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 – WW Sludge Process 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	14.79 Years	6.8%	5.1%

*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 Sludge Process Building to invest in a solar system through a Direct Purchase CEG does not recommend the CMC MUA – WW Sludge Process Building pursue this route. It would be more advantageous for the CMC MUA – WW Sludge Process 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 – WW Sludge Process Building at a reduced rate compared to their existing electric rate.

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 based on each building (meter) basis. Cash incentives are available per kWh of electric usage.

CEG has reviewed the July 9, 2008 "Pre-Feasibility Study for the Development of Wind Energy: Wildwood Regional Wastewater Treatment Facility" by DNV Global Energy Concepts Inc. The study concluded hub height wind speed is "poor to fair" and would be economically challenging due to installation costs. The study sites limitations such as: low wind speed, site space and setback limitations and expected FAA height restrictions. The study cites concerns due to turbine location in the wetlands buffer and transition areas that include: habitat suitable for threatened and endangered species, and cites a "high likelihood" for communications interference with the on-site communications tower.

Based on CEG's review of the applicability of wind energy for the facility, it was determined that wind energy is not a viable option to implement due to inadequate average wind speed, site limitations, expected height restrictions, communication concerns and biological concerns.

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 June and September due to the air conditioning load. This load profile is typical for an administration building with gas heat; however this facility is feed from an electrical service that combines other buildings and process loads which makes it difficult to compare load profiles. The cooling season represents a typical load profile with increase usage from the administration building air conditioning systems. The electric demand is at its peak in the month of July representing the largest electric draw in the cooling season. The hours of operation of the sludge processing building are based on demand for water treatment. The administration building has operating hours typical for an office building. As a result the majority of the "full load hours" is spread over a relatively short period of time (occupied hours). This results in a poor load factor rating of approximately 29%. 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 29% 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.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical natural gas (heat load) profile. The summer months demonstrate very low consumption (complimenting the cooling electric load), May through September. There is an increase in consumption December through May. Gas fired furnaces in the admin building as well as a gas fired boiler in the sludge processing building is responsible for the majority of the natural gas load. A base-load shaping (flat) will secure more competitive energy prices when procuring through an alternative energy source.

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.

Natural Gas:

This facility receives natural gas service through South Jersey Gas Company on its General Service Gas rate, "Firm Transportation". This is a firm delivery service (higher level of delivery) for general purposes where 1) customer does not qualify for any other rate schedule. Customers may either purchase gas supply from a Third Party (TPS) or from Public Services Basic Gas Supply Service default service as detailed in the rate schedule. This service has a much higher priority of delivery, based on the pipeline capacity. The "firm" service is the highest priority, and does not get interrupted.

This rate schedule has a Delivery Charge Mechanism which includes: Basic Gas Supply Service Charge, Capital Investment Recovery Charge, Transportation Initiation Charge, Societal Benefits Charge, Temperature Adjustment Charge, Balancing Service Charge, Economic Development Rate Charge, Conservation Incentive Program Charge, and Energy Efficiency Tracker Charge. The customer can elect to have the Supply Charge (Commodity Charge) serviced through the utility or by a Third Party Supplier (TPS). Note: If the facility should choose to utilize a third party supplier (TPS) and the TPS not deliver, the customer may receive service from South Jersey Gas under 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 decatherm for natural gas is $ 11.89 / dth 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 and natural gas. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), the 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. Furthermore, special attention should be given to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with the utility representative. The County should ask the utility representative about alternative billing options, such as consolidated billing when utilizing the service of a Third Party Supplier. Finally, if the supplier for energy (natural gas) is changed, closely monitor balancing, particularly when the contract is close to termination. 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 that were audited as part of the NJ Clean Energy's Local Government Energy Audit Program. 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. Maintain all weather stripping on windows and doors.

B. Clean all light fixtures to maximize light output.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Wildwood Sludge Process 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	NEMA Premium Efficiency Pump Motor Replacement	$688	$0	$180	$508	$112	$0	$112	18	$2,016	$0	296.9%	4.5	21.37%	$1,032.39
ECM #2	NEMA Premium Efficient 2-Speed Fan Motor Replacement	$7,802	$0	$255	$7,547	$1,018	$0	$1,018	18	$18,324	$0	142.8%	7.4	11.63%	$6,454.08
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	Solar Power 14.26 KW System	$128,340	$0	$0	$128,340	$2,578	$6,097	$8,675	25	$216,875	$152,425	69.0%	14.8	4.52%	$22,719.06

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* .
4) ECM #1 based on differential cost between standard and premium efficiency motors to highlight the advantage of a premium efficiency motor.

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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

Wildwood Sludge Process Building

Boiler

Tag	Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
-	Sludge Building Boiler Room	Campus	Weil McClain	3	ABL-688-WS	142198	1703	1358	80	NG	1987/88	35	21	(2) are lead/Lag and (1) is not connected to system to remain under 100 Boiler HF

Boiler - Burner

Tag	Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
-	Sludge Building Boiler Room	Campus	Power Flame	3	CR2-G-15	99363999	2200	80	NG	1993	18	1	(2) are lead/Lag and (1) is not connected to system to remain under 100 Boiler HF

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
-	Sludge Building Boiler Room	Campus	Bell & Gossett	2	1531	C039041-01-070	5	1800	215	60	1531	480/3	4	10	6	
-	Sludge Building Boiler Room	Campus	Bell & Gossett	1	1531	-	3	1800	105	55	1531	480/3	4	10	6	

Process - 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
-	Influent Building	Grit Chamber	WEG	1	01018XP3E215T	-	10	1760	-	-	215T	460	2008	18	16	90.2% NEMA Eff.
-	Influent Building	Grit Chamber	WEG	1	01018XP3E215T	-	10	1760	-	-	215T	460	2008	18	16	90.2% NEMA Eff.
-	Influent Building	Grit Chamber	WEG	1	01018XP3E215T	-	10	1760	-	-	215T	460	2008	18	16	90.2% NEMA Eff.
-	Influent Building	Grit Screw	WEG	1	00518XP3E184T	-	5	1760	-	-	184T	460	22	18	(-4)	80% Nema Eff.
-	Influent Building	Grit Screw	WEG	2	00518XP3E184T	-	5	1760	-	-	184T	460	4	18	14	87.5% NEMA Eff.
-	Influent Building	Bar Screen conveyor	Baldor	1	CM710A	-	3/4	1800	-	-	56C	460	22	18	(-4)	Explosion Proof
-	Influent Building	Bar Screen Gear Drive	Baldor	2	CM710A	-	3/4	1800	-	-	56C	460	22	18	(-4)	Explosion Proof, 20 min/hour on lead/lag
-	Influent Building	Sump Pump	Flygt	2	MP 3068 HT	-	2	3315	-	-	-	460	22	18	(-4)	

Exhaust Fans

Tag	Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	RPM	NEMA Eff.	Frame Size	Volts / Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
-	East Side of Sludge Process Building	Influent Scrubber Fan	-	1	-	-	20/5	1745/870	88.5% / 82.5%	284T	480/3	22	15	(-7)	
-	West Side of Sludge Process Building	BFP Scrubber Fan	Spartan Motor	1	7-M43847001	-	25/6.25	1745/860	88.5% / 82.5%	284T	480/3	22	15	(-7)	

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 - WW Influent / Sludge Processing Building
Address: 2701 Route 47 South
Rio Grande, NJ 08242
Building SF: 3,096

"WW Influent / Sludge Processing Building"

KWH COST: $0.148

Investment Grade Lighting Audit

EXISTING LIGHTING										PROPOSED LIGHTING										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
	Well Room	1000	19	1	150w HPS Pendant Mnt., Explosionproof	188	3.57	3,572.0	$528.66	19	1	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.36	Switch Gear Room	1000	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Clear Acrylic Lens	58	0.12	116.0	$17.17	2	2	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
	Exits	8760	3	1	Led Exit	5	0.02	131.4	$19.45	3	1	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		24	4			3.70	3,819.4	$565.27	24	4			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 - Wildwood Sludge Processing Building**
Location: **Rio Grande, NJ**
Description: **Photovoltaic System - Direct Purchase**

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$128,340
Annual kWh Production	17,421
Annual Energy Cost Reduction	$2,578
Annual SREC Revenue	$6,097
First Cost Premium	**$128,340**
Simple Payback:	**14.79** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.148**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$128,340	0	0	0	$0	(128,340)	0
1	$0	17,421	$2,578	$0	$6,097	$8,676	($119,664)
2	$0	17,334	$2,656	$0	$6,067	$8,723	($110,942)
3	$0	17,247	$2,735	$0	$6,037	$8,772	($102,170)
4	$0	17,161	$2,817	$0	$6,006	$8,824	($93,346)
5	$0	17,075	$2,902	$176	$5,976	$8,702	($84,644)
6	$0	16,990	$2,989	$175	$5,946	$8,760	($75,883)
7	$0	16,905	$3,079	$174	$5,917	$8,821	($67,062)
8	$0	16,820	$3,171	$173	$5,887	$8,885	($58,177)
9	$0	16,736	$3,266	$172	$5,858	$8,951	($49,226)
10	$0	16,653	$3,364	$172	$5,828	$9,021	($40,205)
11	$0	16,569	$3,465	$171	$5,799	$9,094	($31,111)
12	$0	16,486	$3,569	$170	$5,770	$9,169	($21,942)
13	$0	16,404	$3,676	$169	$5,741	$9,248	($12,693)
14	$0	16,322	$3,786	$168	$5,713	$9,331	($3,363)
15	$0	16,240	$3,900	$167	$5,684	$9,417	$6,054
16	$0	16,159	$4,017	$166	$5,656	$9,506	$15,560
17	$0	16,078	$4,137	$166	$5,627	$9,599	$25,160
18	$0	15,998	$4,262	$165	$5,599	$9,696	$34,856
19	$0	15,918	$4,389	$164	$5,571	$9,797	$44,652
20	$0	15,838	$4,521	$163	$5,543	$9,901	$54,554
21	$1	15,759	$4,657	$162	$5,516	$10,010	$64,564
22	$2	15,680	$4,796	$162	$5,488	$10,123	$74,687
23	$3	15,602	$4,940	$161	$5,461	$10,240	$84,927
24	$4	15,524	$5,089	$160	$5,433	$10,362	$95,289
25	$5	15,446	$5,241	$159	$5,406	$10,488	$105,778
	Totals:	410,368	$94,003	$3,514	$143,629	$234,118	($264,348)
				Net Present Value (NPV)		**$105,803**	
				Internal Rate of Return (IRR)		**5.1%**	

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
Wildwood Sludge Building	1000	Sunpower SPR230	62	14.7	912	14.26	17,421	2,046	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:	14.3 kW
DC to AC Derate Factor:	0.810
AC Rating:	11.6 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	926	103.71
2	3.33	1094	122.53
3	4.31	1528	171.14
4	5.20	1740	194.88
5	5.85	1987	222.54
6	6.14	1934	216.61
7	6.06	1954	218.85
8	5.54	1796	201.15
9	4.85	1544	172.93
10	3.76	1261	141.23
11	2.65	883	98.90
12	2.23	774	86.69
Year	4.38	17421	1951.15

.= Proposed PV Layout

Notes:

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