ENERGY AUDIT – FINAL REPORT

CHATHAM TOWNSHIP
CHATHAM GLEN SEWAGE PLANT
RIVER EDGE DRIVE
CHATHAM, NJ 07928

ATTN: Thomas Ciccarone
TOWNSHIP ADMINISTRATOR / CFO

CEG PROJECT NO. 9C09084

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I. EXECUTIVE SUMMARY

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

Township of Chatham
Chatham Glen Sewage Plant
River Edge Drive
Chatham, NJ 07928

Municipal Contact Person: Mr. Thomas Ciccarone / Mr. Greg LaConte
Facility Contact Person: Mr. John Pacelli

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	$ 3,707
Natural Gas	$ 13,240
Total	$ 16,947

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' 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	Lighting Upgrade - Compact Fluorescent	$23	$68	0.3	2250.3%
ECM #2	Lighting Controls	$840	$419	2.0	647.8%
ECM #3	NEMA Efficient Motor Replacement	$18,578	$921	20.2	-25.6%
ECM #4	Fluorescent T12 Replacement	$1,453	$128	11.4	32.1%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	PV System 1.84 KW	$16,560	$1,166	14.2	76.0%

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

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

Table 2
Estimated Energy Savings Summary Table

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	**DESCRIPTION**	**ANNUAL UTILITY REDUCTION**		
		ELECTRIC DEMAND (KW)	**ELECTRIC CONSUMPTION (KWH)**	**NATURAL GAS (THERMS)**
ECM #1	Lighting Upgrade - Compact Fluorescent	0.2	371.3	-
ECM #2	Lighting Controls	0.0	2301.1	-
ECM #3	NEMA Efficient Motor Replacement	0.3	5059.9	-
ECM #4	Fluorescent T12 Replacement	0.1	318.2	-
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	**DESCRIPTION**	**ANNUAL UTILITY REDUCTION**		
		ELECTRIC DEMAND (KW)	**ELECTRIC CONSUMPTION**	**NATURAL GAS (THERMS)**
REM #1	PV System 1.84 KW	1.8	2191.0	-

Concord Engineering Group (CEG) recommends proceeding with the implementation of all ECM's that provide a calculated simple payback at or under ten (10) years. The following Energy Conservation Measures are recommended for the facility:

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

Although ECM # does not provide a payback less than 10 years, it is recommended to proceed with the installation of the NEMA efficient electric motors as suggested in ECM #3 (or equal), since the existing motors are past the expected lifespan.

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

1. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.
2. Maintain all weather stripping on windows and doors.
3. Clean all light fixtures to maximize light output.
4. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

II. INTRODUCTION

The comprehensive energy audit covers the 5,076 square foot Chatham Glen #2 Plant, which includes the following spaces: pump room, toilet room, generator room, process room, screening room, office and storage 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. Jersey Central Power and Light (JCP&L) provides electricity to the facility under their General Service Secondary Three-Phase 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. Public Service Electric and Gas (PSE&G) provides natural gas to the facility under the Large Volume Gas (GSGH) rate structure. Gateway Energy Services Corporation is the third party supplier for this facility. 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	18.2¢ / kWh
Natural Gas	$1.31 / Therm

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY			
Utility Provider:	JCP&L		
Rate:	General Service Secondary - JC_GS1_01F		
Meter No:	G17772939		
Customer ID No:	801529503		
MONTH OF USE	**CONSUMPTION**	**DEMAND**	**TOTAL BILL**
Jul-08	184	6.0	$43
Aug-08	186	3.8	$44
Sep-08	115	4.4	$28
Oct-08	422	5.5	$83
Nov-08	1,135	5.6	$211
Dec-08	2,134	15.4	$391
Jan-09	3,081	15.9	$540
Feb-09	2,996	16.8	$535
Mar-09	2,827	15.7	$496
Apr-09	2,591	15.5	$458
May-09	2,726	15.4	$476
Jun-09	1,950	14.9	$403
Totals	**20,347**	**16.8 Max**	**$3,707**
		AVERAGE DEMAND	**11.2 KW average**
		AVERAGE RATE	**$0.182 $/kWh**

Figure 1
Electricity Usage Profile

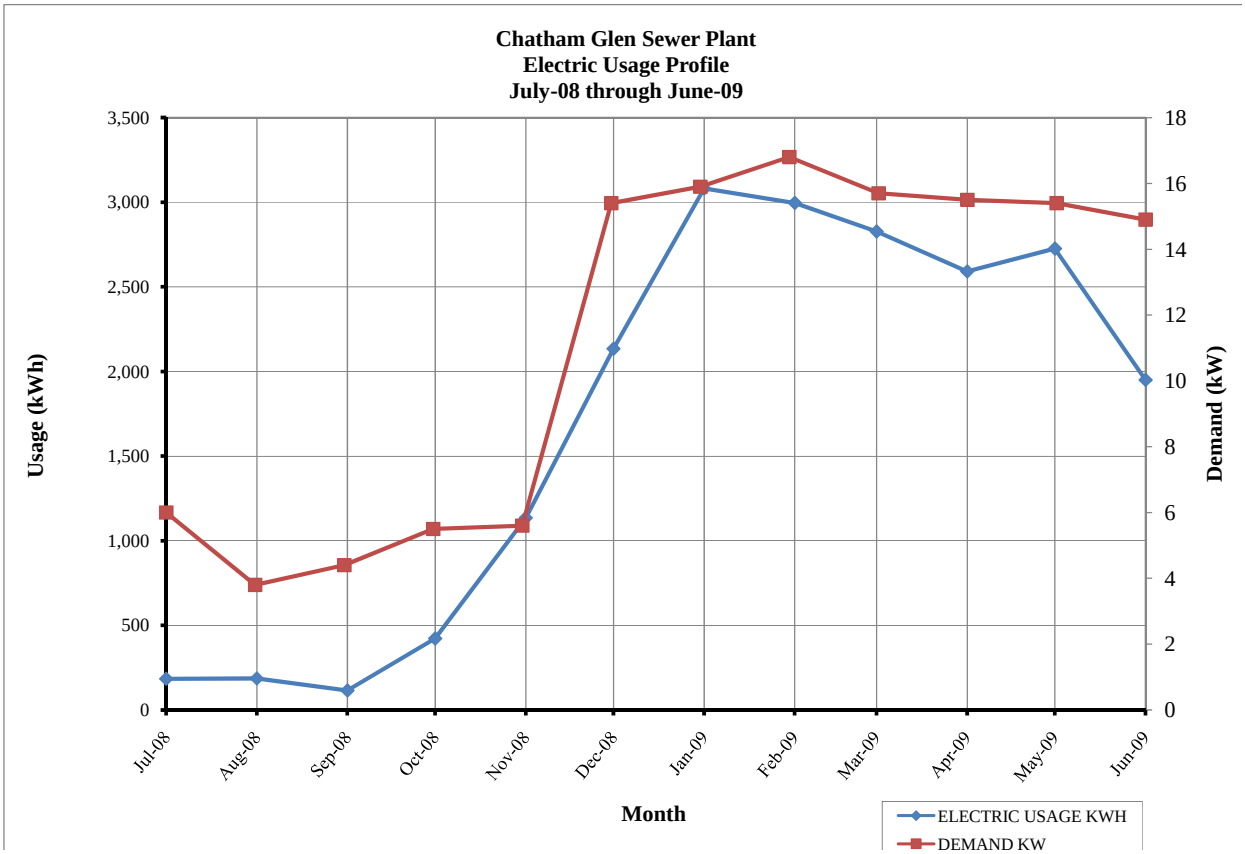
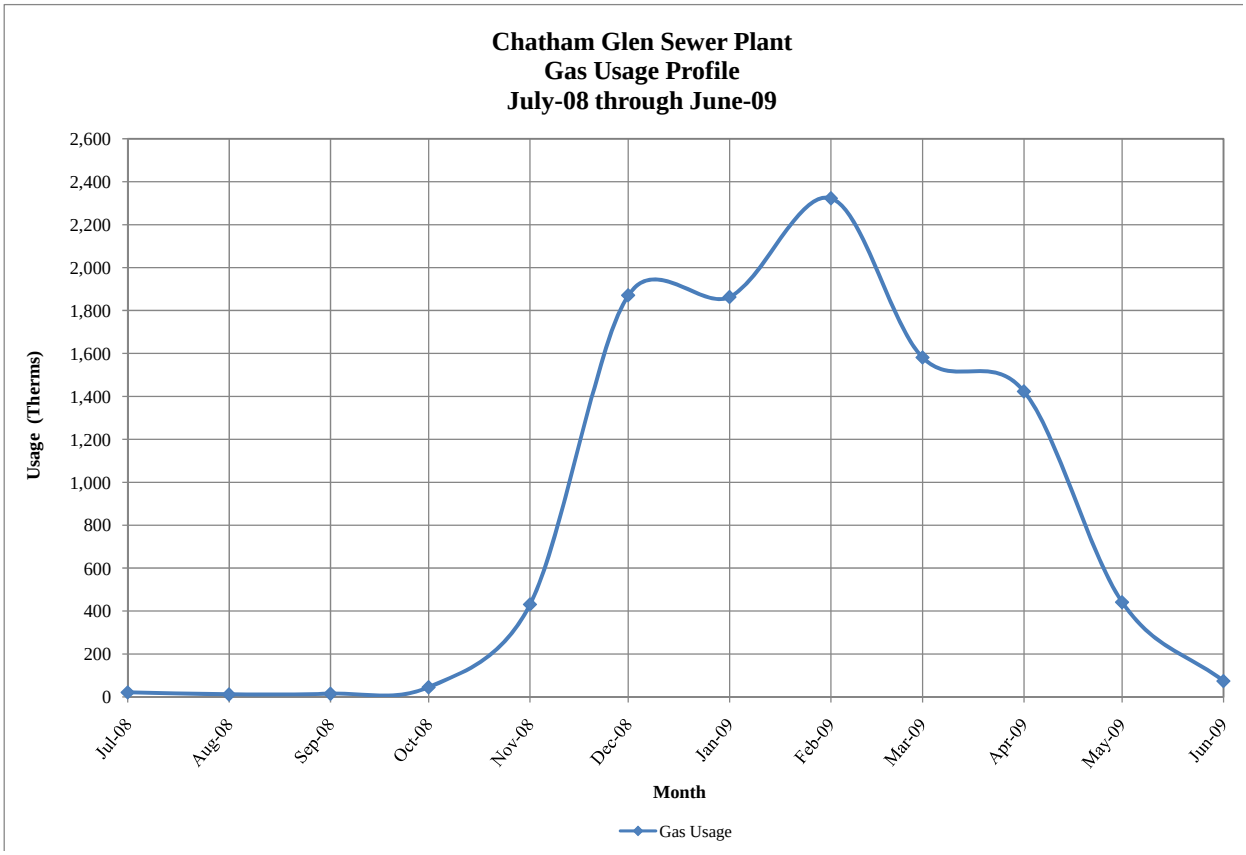


Table 4
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider:	PSE&G	
Rate:	GSGH	
Meter No:	3494838	
Point of Delivery ID:	0	
Third Party Utility Provider:	Gateway Energy Services Corp	
TPS Meter No:	0	
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Jul-08	21.93	$51.03
Aug-08	12.57	$31.60
Sep-08	15.71	$32.94
Oct-08	46.04	$72.15
Nov-08	431.75	$578.94
Dec-08	1,871.26	$2,445.31
Jan-09	1,863.09	$2,540.19
Feb-09	2,322.87	$2,841.35
Mar-09	1,581.60	$1,734.29
Apr-09	1,423.50	$2,435.14
May-09	441.96	$401.02
Jun-09	74.98	$75.93
TOTALS	**10,107.26**	**$13,239.89**
AVERAGE RATE:	**$1.310**	**$/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	20347.0			69,465	3.340	232,012
NATURAL GAS		10107.3		1,010,726	1.047	1,058,230
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				1,080,191		1,290,242
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		5,076	SQUARE FEET			
BUILDING SITE EUI		*212.80*	kBtu/SF/YR			
BUILDING SOURCE EUI		*254.18*	kBtu/SF/YR			

Information regarding a comparison for the Energy Use Index for Sewage plants has not yet been globally coordinated. Therefore CEG has only calculated the kBtu/SF/year for the building.

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: chathamtwp
Password: lgeaceg2009

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

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**
Chatham Glen Plant#2	N/A	N/A

The Chatham Glen Sewage Plant 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 5,076 SF sewage plant is a multi-level facility comprised of a pump room, toilet room, generator room, process room, screening room, office and storage room. This facility operates 24/7 but is typically occupied from 7:30 am-2:00 pm Monday through Friday and 9:00 am-2:00pm Saturday and Sunday for a total of 42.5 hours per week. Exterior walls are block and 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 fair condition and appear to be maintained. Typical windows throughout the facility are double pane, ¼" clear glass with vinyl frames. The roof is wood frame with asphalt shingles. The amount of insulation below the roofing is unknown. The building was built in 1985 with no additions since the original construction.

HVAC Systems

The office area is conditioned by a Freidrich 11,700 BTUH window air conditioning unit and appears to be in good condition. The unit is three years old and in good condition. There are two (2) Dayton, 125 MBH natural gas input unit heaters installed in the process room. The unit heaters are original to the building, are in poor condition and past their ASHRAE useful service life.

Exhaust System

There are two (2) New York Blower supply air fans providing outside air for ventilation. There are two (2) MK Plastics exhaust fans. There are two (2) Dayton exhaust fans in the screening room. The supply and exhaust systems run 24/7. The fans are original to the building, are in fair to poor condition and past their ASHRAE 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 is provided by a 30 gallon A.O. Smith electric hot water heater, capacity of 4500 Watts. The domestic hot water piping insulation appeared to be in fair condition. The water heater is 9 years old and in fair condition.

Lighting

Typical lighting throughout building is fluorescent tube surface fixtures with T-12 lamps and magnetic ballasts, metal halide pendant fixtures, and incandescent lamp fixtures. The parking lot is lit with light poles.

VI. MAJOR EQUIPMENT LIST

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

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

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade - General

Description: General

The lighting in the Chatham Glen Sewer Plant is primarily made up of fluorescent fixtures with T-12 lamps and magnetic ballasts, metal halide pendant fixtures, and incandescent lamp fixtures. The parking lot is lit with light poles.

This ECM includes replacement of all incandescent lamps to compact fluorescent lamps. The energy usage of an incandescent compared to a compact fluorescent approximately 3 to 4 times greater. In addition to the energy savings, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours.

Energy Savings Calculations:

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

NJ Smart Start® Program Incentives are calculated as follows:

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

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$23
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$23
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$68
Total Yearly Savings ($/Yr):	$68
Estimated ECM Lifetime (Yr):	8
Simple Payback	0.3
Simple Lifetime ROI	2250.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$541
Internal Rate of Return (IRR)	294%
Net Present Value (NPV)	$451.32

* ECM#1 Calculations DO NOT include lighting control changes implemented in ECM#2. If ECM#1 and #2 are implemented together the savings will be relatively lower than shown above.

ECM #2: Install Lighting Controls

Description:

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

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

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

Energy Savings Calculations:

From **Investment Grade Lighting Audit Appendix – ECM#2** of this report, we calculated the lighting power density (Watts/ft^2) of the existing plant to be 10,412 Watts / 5,076 SF = 2.05 Watts/SF. The building is only occupied 42.5 hours a week. Ten percent of this value is the resultant energy savings due to installation of occupancy sensors:

Chatham Glen Plant:

10% x 2.05 Watts/SF x 5,076 SF x 2,210 hrs/yr. x 1kW/1000W = 2,300 kWh

Savings = 2,300 kWh x $0.182Wh = $419 / yr

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is $160/unit including material and labor. The SmartStart Buildings® incentive is $20 per control which equates to an installed cost of $140/unit. Total number of rooms to be retrofitted is 6. Total cost to install sensors is $140/ceiling unit x 6 units = $840.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$960
NJ Smart Start Equipment Incentive ($):	$120
Net Installation Cost ($):	$840
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$419
Total Yearly Savings ($/Yr):	$419
Estimated ECM Lifetime (Yr):	15
Simple Payback	2.0
Simple Lifetime ROI	647.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$6,282
Internal Rate of Return (IRR)	50%
Net Present Value (NPV)	$4,159.49

ECM #3: Install NEMA Premium Efficient Motor Explosion Proof

Description:

Replacing the old fan and equipment motors with new efficient motor is a simple change that can provide 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, Explosion Proof 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 1 HP system Blower Motor with the following characteristics:
Existing Motor Efficiency = 82.5%
Annual Hours of Operations = 8760
1 HP = 0.746 Watt
Load Factor = 75%
Cost of electricity = $0.182 / kWh

Existing 1HP 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 1 x 0.75 x 8,760 x 0.182 ÷ 0.825 = $1081 / Year

New NEMA Premium Motor Efficiency = 87.5%

New NEMA Premium Efficiency Motor Operating Cost =
{0.746 x 1 x 0.75 x 8,760 x 0.182} ÷ 0.875 = $119 / Year

Savings = $1081 - $1019 = $62 / Year

Installed Cost of a 1 HP NEMA Premium® Efficiency Explosion Proof Motor = $1,459 minus the SmartStart Building® incentive of 1hp x $50/hp is $1,409.

Simple Payback = $1,409 / $62 = 22.7 Years

kWh saved = $62 / $0.182/kWh = 340 kWh
kW saved = 340 kWh / 8,760 hrs./yr. = 0.04 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	1	XPFC	4-Pole	$1,409	$1,409	$61.79	22.8
1	1	XPFC	4-Pole	$1,409	$1,409	$61.79	22.8
3	2	XPFC	4-Pole	$1,600	$3,199	$136.69	23.4
3	2	XPFC	4-Pole	$1,600	$3,199	$136.69	23.4
3	1	XPFC	4-Pole	$1,600	$1,600	$68.34	23.4
5	4	XPFC	4-Pole	$1,940	$7,762	$455.62	17.0
				Totals:	*$18,578*	*$921*	*20.2*

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

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$19,218
NJ Smart Start Equipment Incentive ($):	$640
Net Installation Cost ($):	$18,578
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$921
Total Yearly Savings ($/Yr):	$921
Estimated ECM Lifetime (Yr):	15
Simple Payback	20.2
Simple Lifetime ROI	-25.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$13,815
Internal Rate of Return (IRR)	-3%
Net Present Value (NPV)	($7,583.16)

ECM #4: Fluorescent T12 Replacement

Description: General

The lighting in the Chatham Glen Sewer Plant is primarily made up of fluorescent fixtures with T-12 lamps and magnetic ballasts, metal halide pendant fixtures, and incandescent lamp fixtures. The parking lot is lit with light poles.

This ECM includes replacement of the existing fixtures containing T12 lamps and magnetic ballasts with fixtures containing T8 lamps and electronic ballasts. The new energy efficient, T8 fixtures will provide adequate lighting and will save the owner on electrical costs due to the better performance of the lamp and ballasts. This ECM will also provide maintenance savings through the reduced number of lamps replaced per year. The expected lamp life of a T8 lamp is approximately 30,000 burn-hours, in comparison to the existing T12 lamps which is approximately 20,000 burn-hours. The facility will need 33% less lamps replaced per year.

This ECM also includes replacement of all incandescent lamps to compact fluorescent lamps. The energy usage of an incandescent compared to a compact fluorescent approximately 3 to 4 times greater. In addition to the energy savings, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours.

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix – ECM#4** outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

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

$$\text{Smart Start®}\ \textit{Incentive} = (\#\ of\ 1-2\ lamp\ \ fixtures \times\ \$\,25) + (\#\ of\ 3-4\ lamp\ \ fixtures \times\ \$\,30)$$
$$\text{Smart Start®}\ \textit{Incentive} = (15 \times\ \$\,25) = \underline{\$}375$$

Replacement and Maintenance Savings are calculated as follows:

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

$$Savings = (10\ lamps\ \ per\ \ year) \times (\$2.00 + \$5.00) = \$70$$

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

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,828
NJ Smart Start Equipment Incentive ($):	$375
Net Installation Cost ($):	$1,453
Maintenance Savings ($/Yr):	$70
Energy Savings ($/Yr):	$58
Total Yearly Savings ($/Yr):	$128
Estimated ECM Lifetime (Yr):	15
Simple Payback	11.4
Simple Lifetime ROI	32.1%
Simple Lifetime Maintenance Savings	$1,050
Simple Lifetime Savings	$1,919
Internal Rate of Return (IRR)	4%
Net Present Value (NPV)	$74.10

* ECM#1 Calculations DO NOT include lighting control changes implemented in ECM#2. If ECM#1 and #2 are implemented together the savings will be relatively lower than shown above.

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 125 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 1.84 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 2,191 KWh annually, reducing the overall utility bill by approximately 10.7% 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.

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

Table 7
Financial Summary – Photovoltaic System

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM			
PAYMENT TYPE	**SIMPLE PAYBACK**	**SIMPLE ROI**	**INTERNAL RATE OF RETURN**
Direct Purchase	14.2 Years	76%	5.6%

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

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

In addition to the Solar Analysis, CEG also conducted a review of the applicability of wind energy for the facility. Wind energy production is another option available through the Renewable Energy Incentive Program. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. Based on CEG's review of the applicability of wind energy for the facility, it was determined that the average wind speed is not adequate, and the kilowatt demand for the building is below the threshold (200 kW) for purchase of a commercial wind turbine. Therefore, wind energy is not a viable option to implement.

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:

This facility is a multi-level facility comprised of a pump room, toilet room, generator room, process room, screening room, office and storage room. This facility operates 24/7 but is typically occupied from 7:30 am-2:00 pm Monday through Friday and 9:00 am-2:00pm Saturday and Sunday for a total of 42.5 hours per week. The building was built in 1985 with no additions since the original construction.

The Electric Usage Profile demonstrates a very atypical load shape throughout the year. The profile is atypical because it does not follow the summer (July-September) cooling pattern. In fact there is a little to no usage in the summer. There is however, a sharp rise in consumption beginning in October and continuing to a peak in January, with fairly flat and elevated usage through May, before dropping off again. Air conditioning in the office area is conditioned by a Freidrich 11,700 BTUH window air conditioning unit. There are two (2) New York Blower supply air fans providing outside air for ventilation. There are two (2) MK Plastics exhaust fans. There are two (2) Dayton exhaust fans in the screening room. The supply and exhaust systems run 24/7. Domestic hot water for the restroom is provided by a 30 gallon A.O. Smith electric hot water heater, capacity of 4500 Watts.

This facility is supplied electric Delivery and Supply from Jersey Central Power and Light (JCP&L) on a GSS – 3-phase utility rate classification. A flatter load profile, will allow for more competitive energy prices when shopping for alternative energy suppliers.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical heating load profile. An increase in consumption is observed November through April during the standard heating season. Heating for this facility is supplied by two (2) Dayton, 125 MBH natural gas input unit heaters installed in the process room.

Natural gas delivery-service is provided by Public Service Electric and Gas Company (PSE&G) on a GSGH rate schedule. Commodity service is supplied by Gateway Energy Services, the Third Party Supplier. A consistent load profile is more beneficial when looking at supply options with a Third Party Supplier.

Tariff:

Electricity:

This facility receives electrical service through Jersey Central Power & Light (JCP&L) on a GSS (General Service Secondary – 3 Phase) rate. Service classification GS is available for general service purposes on secondary voltages not included under Service Classifications RS, RT, RGT or GST. This facility's rate is a three phase service at secondary voltages. For electric supply (generation), the customer uses the service of a JCP&L. This facility uses the Delivery Service of the utility (JCP&L). The Delivery Service includes the following charges: Customer Charge, Supplemental Customer Charge, Distribution Charge (kW Demand), kWh Charge, Non-utility Generation Charge, TEFA, SBC, SCC, Standby Fee and RGGI. The Generation Service is provided by JCP&L under BGS (Basic Generation Service). BGS Energy and Reconciliation Charges are provided in Rider BGS-FP (fixed pricing) or BGS-CIEP (Commercial Industrial Energy Pricing). BGS also has a Transmission component to its charge.

Natural Gas:

This facility receives utility service through Public Service Electric and Gas Company (PSE&G). This facility utilizes the Delivery Service (GSGH) from PSE&G while receiving Commodity service from a Third Party Supplier (TPS), Gateway Energy Services. This facility receives natural gas Delivery service through Public Service Electric and Gas Company (PSE&G) on a GSGH (General Service Gas-Heating) rate. The utility tariff rate (GSGH) is for General Service. This is a firm delivery service (higher level of delivery) for general purposes where 1) customer does not qualify for RSG (residential) and 2) customers usage does not exceed 3,000 therms in any month. 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.

The "firm" service described above has a much higher priority of delivery, based on the pipeline capacity. When the pipelines capacity was unbundled (much like the telecom service), it was divided into various levels of service. The "firm" service is the highest priority, and does not get interrupted.

This rate schedule has a Delivery Charge Mechanism which includes: Balancing Charge, Societal Benefits Charge, Realignment Adjustment Charge, Margin Adjustment Charge, RGGI Charge and Customer Account Service Charge. The customer can elect to have the Supply Charge (Commodity Charge) serviced through the utility or by a Third Party Supplier (TPS). In this facility the supplier for the Commodity is Gateway Energy Services. Note: Should the TPS not deliver, the customer may receive service from PSE&G under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service. 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.
Please see CEG recommendations below.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities. Good potential savings can be seen in the electric commodity. The average price per kWh (kilowatt hour) for the Township based on a historical 1-year weighted average price from the utility JCP&L is $.1349 / kWh (this is the fixed "price to compare" when shopping for energy procurement alternatives). The fixed weighted average price per decatherm for natural gas service in the Township, provided by Gateway Energy Services (Third Party Supplier) is $ 8.31 / dth (dth, is the common unit of measure). The natural gas prices are also the "prices to compare".

The "price to compare" is the netted cost of the energy (including other costs), that the customer will use to compare to Third Party Supply sources when shopping for alternative suppliers. For electricity this cost would not include the utility transmission and distribution chargers. For natural gas the cost would not include the utility distribution charges and is said to be delivered to the utilities city-gate.

Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. The Township could see improvement in its energy costs if it were to take advantage of these current market prices quickly, before energy prices increase. Based on electric supply from JCP&L and utilizing the historical consumption data provided (July 2008 through June 2009) and current electric rates, these buildings could see an improvement in its electric costs of up to 27 % and up to $76,000 annually. (Note: Savings were calculated using Average Annual Consumption and a variance to a Fixed Average One-Year commodity contract). CEG recommends aggregating the entire electric load to gain the most optimal energy costs. CEG recommends advisement for alternative sourcing and supply of energy on a "managed approach".

Based on the current alternative market pricing supplied by Gateway Energy Services (TPS-Third Party Supplier), CEG recommends that this pricing is competitive with the wholesale Commodity market, and CEG believes it will behoove the Township to continue with this pricing structure.

CEG recommends scheduling 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 municipality can learn more about the competitive supply process. The Township can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu. They should also 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 Township 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.

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

Chatham Glen Sewage Plant

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	Lighting Upgrade - Compact Fluorescent	$23	$0	$0	$23	$68	$0	$68	8	$541	$0	2250.3%	0.3	293.78%	$451.32
ECM #2	Lighting Controls	$960	$0	$120	$840	$419	$0	$419	15	$6,282	$0	647.8%	2.0	49.74%	$4,159.49
ECM #3	NEMA Efficient Motor Replacement	$19,218	$0	$640	$18,578	$921	$0	$921	15	$13,815	$0	-25.6%	20.2	-3.49%	($7,583.16)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	PV System 1.84 KW	$16,560	$0	$0	$16,560	$399	$767	$1,166	25	$29,150	$19,175	76.0%	14.2	4.92%	$3,743.73

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 January, 2009:

Electric Chillers

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

Gas Cooling

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

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	$73 - $93 per ton
Air-to-Air Heat Pumps	$73 - $92 per ton
Water-Source Heat Pumps	$81 per ton
Packaged Terminal AC & HP	$65 per ton
Central DX AC Systems	$40- $72 per ton
Dual Enthalpy Economizer Controls	$250

Ground Source Heat Pumps

Closed Loop & Open Loop	$370 per ton

Gas Heating

Gas Fired Boilers < 300 MBH	$300 per unit
Gas Fired Boilers ≥ 300 - 1500 MBH	$1.75 per MBH
Gas Fired Boilers ≥1500 - ≤ 4000 MBH	$1.00 per MBH
Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	$300 - $400 per unit

Variable Frequency Drives

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

Natural Gas Water Heating

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

Premium Motors

Three-Phase Motors	$45 - $700 per motor

Prescriptive Lighting

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

Lighting Controls – Occupancy Sensors

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

Lighting Controls – HID or Fluorescent Hi-Bay Controls

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

Other Equipment Incentives

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

STATEMENT OF ENERGY PERFORMANCE
Chatham Glen Sewerage Plant

Building ID: 1830948
For 12-month Period Ending: June 30, 2009[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: February 04, 2010

Facility
Chatham Glen Sewerage Plant
Rever Edge Drive
Chatham, NJ 07928

Facility Owner
Chatham Township
58 Meyersville Road
Chatham, NJ 07928

Primary Contact for this Facility
Greg La Conte
58 Meyersville Road
Chatham, NJ 07928

Year Built: 1985
Gross Floor Area (ft²): 5,076

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	69,424
Natural Gas (kBtu)[4]	1,016,688
Total Energy (kBtu)	1,086,112

Energy Intensity[5]

Site (kBtu/ft²/yr)	214
Source (kBtu/ft²/yr)	255

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	65

Electric Distribution Utility
FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	20%
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	Chatham Glen Sewerage Plant	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	Rever Edge Drive, Chatham, NJ 07928	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		☐
Chatham Glen Sewage Plant (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	5,076 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	1(Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	44Hours(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	2(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: FirstEnergy - Jersey Central Power & Lt Co

Fuel Type: Electricity

Meter: Glen Sewage Electric (kWh (thousand Watt-hours))
Space(s): Entire Facility
Generation Method: Grid Purchase

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
06/01/2009	06/30/2009	1,950.00
05/01/2009	05/31/2009	2,726.00
04/01/2009	04/30/2009	2,591.00
03/01/2009	03/31/2009	2,827.00
02/01/2009	02/28/2009	2,996.00
01/01/2009	01/31/2009	3,081.00
12/01/2008	12/31/2008	2,134.00
11/01/2008	11/30/2008	1,135.00
10/01/2008	10/31/2008	422.00
09/01/2008	09/30/2008	115.00
08/01/2008	08/31/2008	186.00
07/01/2008	07/31/2008	184.00
Glen Sewage Electric Consumption (kWh (thousand Watt-hours))		**20,347.00**
Glen Sewage Electric Consumption (kBtu (thousand Btu))		**69,423.96**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**69,423.96**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

Meter: Glen Sewerage Gas (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
06/01/2009	06/30/2009	74.98
05/01/2009	05/31/2009	441.96
04/01/2009	04/30/2009	1,423.50
03/01/2009	03/31/2009	1,581.60
02/01/2009	02/28/2009	2,322.87
01/01/2009	01/31/2009	1,922.71
12/01/2008	12/31/2008	1,871.26
11/01/2008	11/30/2008	431.75
10/01/2008	10/31/2008	46.04
09/01/2008	09/30/2008	15.71

08/01/2008	08/31/2008	12.57
07/01/2008	07/31/2008	21.93
Glen Sewerage Gas Consumption (therms)		**10,166.88**
Glen Sewerage Gas Consumption (kBtu (thousand Btu))		**1,016,688.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**1,016,688.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

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

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
Chatham Glen Sewerage Plant
Rever Edge Drive
Chatham, NJ 07928

Facility Owner
Chatham Township
58 Meyersville Road
Chatham, NJ 07928

Primary Contact for this Facility
Greg La Conte
58 Meyersville Road
Chatham, NJ 07928

General Information

Chatham Glen Sewerage Plant	
Gross Floor Area Excluding Parking: (ft^2)	5,076
Year Built	1985
For 12-month Evaluation Period Ending Date:	June 30, 2009

Facility Space Use Summary

Chatham Glen Sewage Plant	
Space Type	Other - Other
Gross Floor Area(ft^2)	5,076
Number of PCs[o]	1
Weekly operating hours[o]	44
Workers on Main Shift[o]	2

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 06/30/2009)	**Baseline** (Ending Date 06/30/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft^2)	214	214	0	N/A	104
Source (kBtu/ft^2)	255	255	0	N/A	213
Energy Cost					
$/year	$ 15,863.75	$ 15,863.75	N/A	N/A	$ 7,710.57
$/$ft^2$/year	$ 3.13	$ 3.13	N/A	N/A	$ 1.52
Greenhouse Gas Emissions					
$MtCO_2e$/year	65	65	0	N/A	32
$kgCO_2e/ft^2$/year	13	13	0	N/A	6

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

Chatham Glen Sewage Plant #2

Domestic Hot Water Heater

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Input (MBh)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
		A.O. SMITH	1	EES 80 920	P/N: EES 80 M202172006	4500 WATT	81	80	80	ELECTRIC	9	12	3	

Fans

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	CFM	ESP (IN. W.G.)	HP	Volts	Phase	Amps	FRPM	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
		New York Blowers	1	RFE 315		300	4	1	208/230/460	3		2015	24	15	(-9)	Explosion Proof
		New York Blowers	1	RFE 400	Y 7057-110	1000	6	1	208/230/460	3		1910	24	15	(-9)	86.5% Eff., Explosion Proof
		Dayton	2					3	208-230/460	3			24	15	(-9)	86.5% Eff., Explosion Proof
		MK Plastics	2	AXCL 2225	12897-3	4000	1	3	208	3		1341	24	15	(-9)	

Air Compressor

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	Pressure	Capacity	Volts	Phase	FLA	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
		GAST	1	1HAB-44-M100X	2Z867	1/6		Free Air Flow @ 100 psi 0.38 CFM, Free Air Flow @ 20 psi 1.00 CFM, Free Air Flow @ 30 psi 0.85 CFM				24	20	(-4)	High Efficiency Motor Rebate 1hp and larger

Window Air Conditioning Units

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity - DX	Heating Capacity - HW	EER	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
		Freidrich	1	US12B30A		11,700 / 11,400		9.4	230 / 208	1	6.0 / 6.4	2006	15	12	

Motors

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Motor HP	RPM	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
	Aerator Digester	Marathon Electric	1	1NV 184TTDH.026AAX		5	1745	230/460			15	10	(-5)	87.5% Eff.
	Surge Tank Aerator	Marathon Electric	1	4VK182TTDB026AA	E718	3	1760	208-230/460	3	8.8-8.2/4.1	12	10	(-2)	86.5% Eff.
		Hydromatic	2	S4F		3					2000	10	1	
	Clear wells		4			5	1750	240			2002	10	2	
		A.O. SMITH	1	E300	BXO5	7.5	1745	230/460	3	19.4 / 9.7	2002	10	3	88.5% Eff.
		Reliance	1	P2153029		5	1160	230/460	3	14/7	2002	10	2	87.5% Eff.
	Submersible pump	Flygt	2	TP111CLHTEC60034-1 IP68/20MI	3102.180-037065	5	1745	460	3	6.8	2002	10	3	Submersible Pump
	Skum Pump		1		3085.181	5					24	10	(-14)	
		Reliance	1	P1806575G-NK			1710	230/460	3		2002	10	2	Frame: 184TC
		Reliance	1	30338394-NK	G79187-10-1	5	830				22	10	(-12)	
		A.O. SMITH	1	E100	P/N: 7-349220-01	1	1745	200-230/460		3.4-3.0/1.5	2001	10	2	82.5%Eff. , Frame: X143T
		BALDOR	1	EM3116T	F010015363	1	1740	230/460	3		2001	10	2	85.5%Eff., P/N: 35L405T865
		SUTORBILT	1	GAALBPA 2LI	S121776	5	5275	460	3		2002	20	13	Premium Eff. TEFC
		BALDOR	1	PC2200	10182	3		460	3	4.8	2000	10	9	ORDER# 28693
		DAYTON	1	3KV81A	K98	5	1165				11	10	(-1)	73.1 %EFF., Frame 215T

CEG Job #: 9C09084
Project: Chatham Glen Sewage Plant — **Chatham Township** — **KWH COST:** $0.182
Address: River Edge Drive
Chatham, NJ 07928
Building SF: 5,076

ECM #1: Lighting Upgrade - Compact Fluorescent

EXISTING LIGHTINC										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
1	Pump Room	2210	6	1	1-Lamp Metal Halides	400	2.40	5,304.0	$965.33	6	1	No Change	400	2.40	5304	$965.33	$0.00	$0.00	0.00	0	$0.00	0.00
2		2210	1	1	1 Lamp Incandescents	60	0.06	132.6	$24.13	1	1	18 W CFL Lamp	18	0.02	39.78	$7.24	$5.75	$5.75	0.04	92.82	$16.89	0.34
3		2210	7	2	2'x4' 2-Lamp T-12 Surface Mounted, Prism Lens, Magnetic Ballast	68	0.48	1,052.0	$191.46	7	2	No Change	68	0.48	1051.96	$191.46	$0.00	$0.00	0.00	0	$0.00	0.00
4	Restroom	2210	1	1	2' 1-Lamp T-12 wall Mtd. Vanity	20	0.02	44.2	$8.04	1	1	No Change	20	0.02	44.2	$8.04	$0.00	$0.00	0.00	0	$0.00	0.00
3	Generator Room	2210	4	2	2'x4' 2-Lamp T-12 Surface Mounted, Prism Lens, Magnetic Ballast	68	0.27	601.1	$109.40	4	2	No Change	68	0.27	601.12	$109.40	$0.00	$0.00	0.00	0	$0.00	0.00
1	Process Room	2210	12	1	1-Lamp Metal Halides	400	4.80	10,608.0	$1,930.66	12	1	No Change	400	4.80	10608	$1,930.66	$0.00	$0.00	0.00	0	$0.00	0.00
2		2210	2	1	1 Lamp Incandescents	60	0.12	265.2	$48.27	2	1	18 W CFL Lamp	18	0.04	79.56	$14.48	$5.75	$11.50	0.08	185.64	$33.79	0.34
1	Upstairs	2210	5	1	1-Lamp Metal Halides	400	2.00	4,420.0	$804.44	5	1	No Change	400	2.00	4420	$804.44	$0.00	$0.00	0.00	0	$0.00	0.00
2		2210	1	1	1 Lamp Incandescents	60	0.06	132.6	$24.13	1	1	18 W CFL Lamp	18	0.02	39.78	$7.24	$5.75	$5.75	0.04	92.82	$16.89	0.34
3	Office	2210	3	2	2'x4' 2-Lamp T-12 Surface Mounted, Prism Lens, Magnetic Ballast	68	0.20	450.8	$82.05	3	2	No Change	68	0.20	450.84	$82.05	$0.00	$0.00	0.00	0	$0.00	0.00
5	outside	2210	4	1	Outdoor 1-Lamp Metal Halides	400	1.60	3,536.0	$643.55	4	1	No Change	400	1.60	3536	$643.55	$0.00	$0.00	0.00	0	$0.00	0.00
6	Throughout	8760	4	0	Exit Sign - LED	4	0.02	140.2	$25.51	4	0	No Change	4	0.02	140.16	$25.51	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals	2210	50	14			12.03	26,686.7	$4,856.98	50	14			11.86	26315.4	$4,789.40		$23.00	0.17	371.3	$67.57	0.34

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

Project Name: LGEA Solar PV Project - Chatham Glen Sewage Plant
Location: Chatham, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$16,560
Annual kWh Production	2,191
Annual Energy Cost Reduction	$399
Annual SREC Revenue	$767
First Cost Premium	**$16,560**
Simple Payback:	**14.21** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.182**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$16,560	0	0	0	$0	(16,560)	0
1	$0	2,191	$399	$0	$767	$1,166	($15,394)
2	$0	2,180	$411	$0	$763	$1,174	($14,221)
3	$0	2,169	$423	$0	$759	$1,182	($13,038)
4	$0	2,158	$436	$0	$755	$1,191	($11,847)
5	$0	2,148	$449	$22	$752	$1,178	($10,669)
6	$0	2,137	$462	$22	$748	$1,188	($9,481)
7	$0	2,126	$476	$22	$744	$1,198	($8,282)
8	$0	2,115	$490	$22	$740	$1,209	($7,073)
9	$0	2,105	$505	$22	$737	$1,220	($5,853)
10	$0	2,094	$520	$22	$733	$1,232	($4,621)
11	$0	2,084	$536	$21	$729	$1,244	($3,378)
12	$0	2,073	$552	$21	$726	$1,256	($2,121)
13	$0	2,063	$569	$21	$722	$1,269	($852)
14	$0	2,053	$586	$21	$718	$1,283	$431
15	$0	2,043	$603	$21	$715	$1,297	$1,728
16	$0	2,032	$621	$21	$711	$1,312	$3,040
17	$0	2,022	$640	$21	$708	$1,327	$4,366
18	$0	2,012	$659	$21	$704	$1,343	$5,709
19	$0	2,002	$679	$21	$701	$1,359	$7,068
20	$0	1,992	$699	$21	$697	$1,376	$8,444
21	$1	1,982	$720	$20	$694	$1,393	$9,837
22	$2	1,972	$742	$20	$690	$1,412	$11,249
23	$3	1,962	$764	$20	$687	$1,431	$12,680
24	$4	1,952	$787	$20	$683	$1,450	$14,130
25	$5	1,943	$811	$20	$680	$1,471	$15,600
Totals:		41,800	$10,715	$341	$14,630	$32,160	$25,004
				Net Present Value (NPV)		**$15,625**	
				Internal Rate of Return (IRR)		**5.6%**	

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
Chatham Glen	125	Sunpower SPR230	8	14.7	118	1.84	2,191	264	15.64

.= Proposed PV Layout

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

PVWatts * * * AC Energy & Cost Savings

Cautions for Interpreting the Results

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	1.8 kW
DC to AC Derate Factor:	0.810
AC Rating:	1.5 kW
Array Type:	Fixed Tilt
Array Tilt:	15.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	11.2 ¢/kWh

Results			
Month	Solar Radiation (kWh/m^2/day)	AC Energy (kWh)	Energy Value ($)
1	2.59	121	13.55
2	3.36	143	16.02
3	4.22	194	21.73
4	4.90	210	23.52
5	5.71	247	27.66
6	5.92	240	26.88
7	5.76	239	26.77
8	5.44	224	25.09
9	4.79	197	22.06
10	3.81	166	18.59
11	2.52	109	12.21
12	2.19	100	11.20
Year	4.27	2191	245.39

Output Hourly Performance Data * Output Results as Text

About the Hourly Performance Data — Saving Text from a Browser

Run PVWATTS v.1 for another US location or an International location
Run PVWATTS v.2 (US only)

Please send questions and comments regarding PVWATTS to Webmaster

Disclaimer and copyright notice

Return to RReDC home page (*http://rredc.nrel.gov*)

PVWatts * * * AC Energy & Cost Savings

Cautions for Interpreting the Results

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
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DC Rating:	1.8 kW
DC to AC Derate Factor:	0.810
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Array Type:	Fixed Tilt
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Cost of Electricity:	11.2 ¢/kWh

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