ENERGY AUDIT – FINAL REPORT

CHATHAM TOWNSHIP
TANGLEWOOD TREATMENT PLANT

TANGLEWOOD LANE
CHATHAM, NJ 07928

ATTN: Thomas Ciccarone
TOWNSHIP ADMINISTRATOR / CFO

CEG PROJECT NO. 9C09084

CONCORD ENGINEERING GROUP

520 SOUTH BURNT MILL ROAD
VOORHEES, NJ 08043
TELEPHONE: (856) 427-0200
FACSIMILE: (856) 427-6529
WWW.CEG-INC.NET

CONTACT: MICHAEL FISCHETTE, PRESIDENT
EMAIL: mfischette@ceg-inc.net

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I. EXECUTIVE SUMMARY

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

Township of Chatham
Tanglewood Treatment Plant and Office
End of Tanglewood
Chatham, NJ 07928

Municipal Contact Person: Mr. Thomas Ciccarone / Greg LaConte
Facility Contact Person: 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	$146,404
Natural Gas	$ 10,747
Total	$157,151

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 Controls	$1,885	$1,370	1.4	990.2%
ECM #2	Lighting Upgrade - General	$10,201	$3,714	2.7	446.1%
ECM #3	Install LED Exit Signs	$322	$252	1.3	1073.9%
ECM #4	Domestic Water Heater Replacement	$7,420	$161	46.1	-74.0%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	4.60 KW PV System	$41,400	$2,701	15.3	63.1%

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 Controls	0	8,670	0
ECM #2	Lighting Upgrade - General	4.83	12,696	0
ECM #3	Install LED Exit Signs	0	1,594	0
ECM #4	Domestic Water Heater Replacement	0	0	125.5
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION	NATURAL GAS (THERMS)
REM #1	4.60 KW PV System	4.60	5,316	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 Controls
- **ECM #2:** Lighting Upgrade – General
- **ECM #3:** Install LED Exit Signs

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

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

II. INTRODUCTION

The comprehensive energy audit covers the 10,494 square foot Tanglewood Treatment Faciltity, which includes two (2) buildings. The main office building includes the folloing spaces: offices, restrooms, lab on the ground floor, pump rooms, and boiler room. The second building contains the following spaces: ground floor and basement equipment rooms and a ground floor sprinkler closet and boiler 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 Basic General Supply Service (GSG) 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	15.6¢ / kWh
Natural Gas	$1.28 / Therm

Table 3
Electricity Billing Data
Tanglewood Treatment Plant and Office

ELECTRIC USAGE SUMMARY

Utility Provider: JCP&L
Rate: JC_GS3_01F
Meter No: G23561610
Customer ID No: 0801529503 0000736908
Third Party Utility 0
TPS Meter / Acct No: 0

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Jul-08	74,400	117.9	$12,731
Aug-08	75,440	119.5	$12,909
Sep-08	76,720	160.4	$13,079
Oct-08	70,880	114.5	$10,382
Nov-08	73,520	118.2	$10,821
Dec-08	84,240	119.1	$12,726
Jan-09	82,960	113.0	$12,884
Feb-09	85,600	131.4	$13,281
Mar-09	75,200	127.4	$11,504
Apr-09	72,240	116.4	$10,964
May-09	84,800	123.4	$12,789
Jun-09	79,600	118.9	$12,333
Totals	**935,600**	**160.4 Max**	**$146,404**

AVERAGE DEMAND 123.3 KW average
AVERAGE RATE $0.156 $/kWh

Figure 1
Electricity Usage Profile

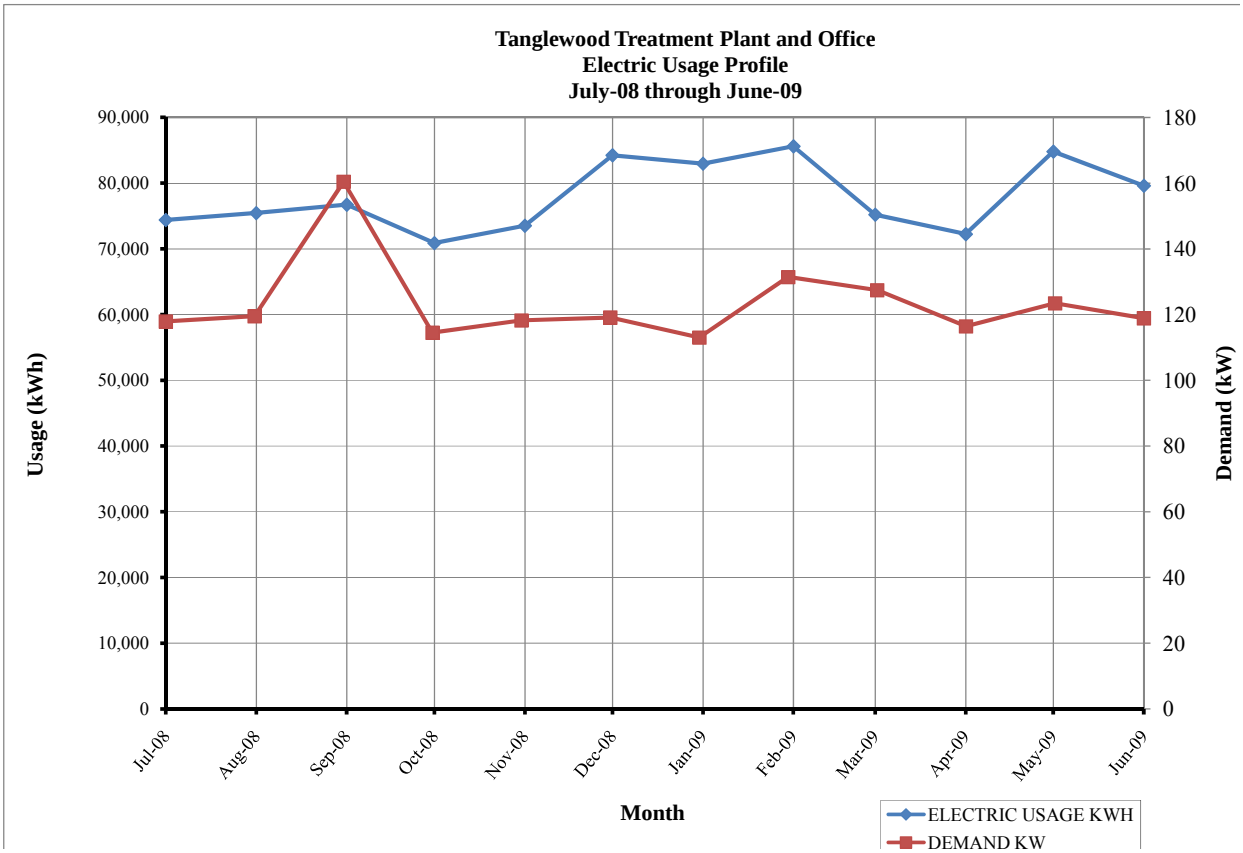


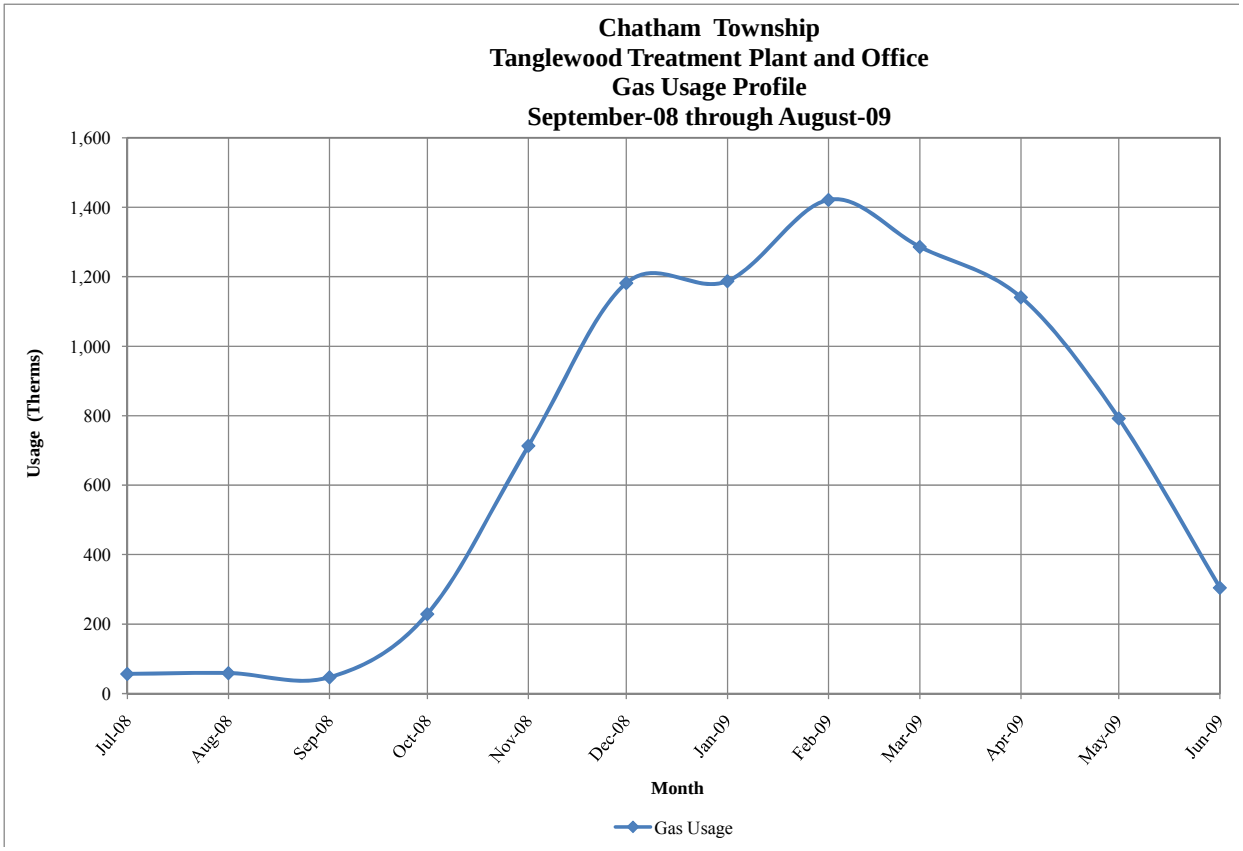
Table 4
Natural Gas Billing Data
Tanglewood Treatment Plant and Office

NATURAL GAS USAGE SUMMARY		
Utility Provider:	PSE&G	
Rate:	GSG	
Meter No:	1464959	2344707
Point of Delivery ID:	PG000010187161404526	
Third Party Utility Provider:	Gateway Energy Services Corp.	
TPS Meter No:	0	

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
Jul-08	56.74	$116.27
Aug-08	59.18	$109.97
Sep-08	47.13	$78.64
Oct-08	229.10	$282.94
Nov-08	713.41	$947.09
Dec-08	1,182.20	$1,543.26
Jan-09	1,187.73	$1,567.32
Feb-09	1,421.71	$1,737.03
Mar-09	1,286.15	$1,407.51
Apr-09	1,141.09	$1,968.30
May-09	792.35	$711.44
Jun-09	304.82	$277.45
TOTALS	**8,421.61**	**$10,747.22**

AVERAGE RATE:	**$1.276**	**$/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
Tanglewood Treatment Plant and Office

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	**BUILDING USE**			**SITE ENERGY**	**SITE-SOURCE RATIO**	**SOURCE ENERGY**
	kWh	**Therms**	**Gallons**	**kBtu**		**kBtu**
ELECTRIC	935600.0			3,194,138	3.340	10,668,422
NATURAL GAS		8421.6		842,161	1.047	881,742
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				4,036,299		11,550,165
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		10,494	SQUARE FEET			
BUILDING SITE EUI		*384.63*	kBtu/SF/YR			
BUILDING SOURCE EUI		*1,100.64*	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**
Tanglewood Treatment	N/A	N/A

The Tanglewood 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 6,894 SF Tanglewood Office No.1 sewage plant is a one story facility with two basement areas. The building is comprised of offices, restrooms and a lab on the ground floor and pump rooms, boiler room and aeration equipment are in the two basement areas. The typical hours of operation for this facility are between 8:00 am and 4:30 pm Monday through Friday and 4 hours Saturday and 4 hours Sunday and 4 hours per legal Holiday. 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 a built-up roof with light color stone covering. The amount of insulation below the roofing is unknown. The building was built in 1966 with no additions since the original construction.

The 3,600 SF sludge building at the Tanglewood sewage plant is a one story facility with a basement. The sewage building is comprised of a ground floor and basement equipment rooms and a ground floor sprinkler closet and boiler room. This building operates 24/7 and is only occupied for brief inspections and maintenance. 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 are in fair condition and appear to be maintained. Typical windows throughout the facility are single pane, ¼" clear glass with metal frames. The roof is a built-up roof with light color stone covering. The amount of insulation below the roofing is unknown. The building was built in 1969 with no additions since the original construction.

The maintenance garage is comprised of truck bays, storage area and restroom. The building is a metal frame with insulated roof and wall panels. This building is mostly unoccupied. 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 and aluminum frames with thermal breaks. The roof is a corrugated metal roof. The amount of insulation below the roofing is unknown. The building was built in 1969 with no additions since the original construction

HVAC Systems

The office building is heated by a Burnham model V-905 boiler. The building has perimeter fin tube radiation and cabinet heaters at the entrances. Cooling is achieved with window air conditioners in the offices and the electric room and a ductless split system in the lab. The boilers are in fair condition. The window air conditioners are in fair to poor condition. The ductless split system is in good condition.

The sludge building is heated by a Weil McLain model PFG-6-PIN boiler. There is perimeter radiation an hydronic unit heaters. The furnace room was locked and was not surveyed. Information was provided by plant staff. The natural gas boiler was installed 8 months ago and is in very good condition.

The maintenance garage is heated via natural gas fired unit heaters with local thermostats. The unit heaters appear to be in good condition.

Exhaust System

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

HVAC System Controls

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

Domestic Hot Water

Domestic hot water for the office restrooms is provided by a 50 gallon Vanguard, 75 MBH natural gas input water heater with first hour recovery of 103 gallon per hour. The water heater is approximately 14 years old in appears to be in poor condition and is past it's useful ASHRAE service life. The domestic hot water is circulated throughout the building by a hot water re-circ pump. The circulation pump is controlled by an aqua stat. The domestic hot water piping insulation appeared to be in fair condition.

Domestic hot water for the maintenance garage restroom is provided by a 30 gallon A.O. Smith, 32 MBH natural gas input water heater with first hour recovery of 32.8 gallon per hour. The water heater is approximately 8 years old in appears to be in good condition. The domestic hot water piping insulation appeared to be in good condition.

Lighting

Typical lighting throughout the office building is fluorescent tube surface fixtures with T-12 lamps and magnetic ballasts. There are some incandescent lamps in the basement, bathroom, closet and hallway. The parking lot is lit with light poles and high pressure sodium lamps.

Typical lighting throughout the maintenance garage is fluorescent tube surface and pendant fixtures with T-12 lamps and magnetic ballasts. There are some incandescent lamps in the basement, bathroom, closet and hallway.

The pump house building has fluorescent tube pendant fixtures with T-12 lamps and magnetic ballasts, incandescent lamps vapor tight marine fixture and a compact fluorescent fixture.

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: Dual Technology Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. Many times this is due to the idea that it is better to keep the lights on rather than to continuously switch them on and off. The on/off dilemma was studied and it was found that the best option is to turn the lights off whenever possible. Although this does reduce the lamp life, the energy savings far outweigh the lamp replacement costs. The cutoff for when to turn the lights off is around two minutes. If the lights can be off for only a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is all it would take. Occupancy sensors detect motion/infrared heat 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 interior building designs as well.

Numerous studies by the US Department of Energy have shown that occupancy sensors have an energy savings potential of 20-30% for daytime occupancies. We recommend the installation of dual technology occupancy sensors in all private offices, conference rooms, faculty room, small mechanical rooms, storage rooms, etc.

CEG would recommend wall switches for individual rooms, ceiling mount sensors for larger rooms, office areas, and fixture mount lighting sensors for some applications as manufactured by Sensorswitch, Watt Stopper or equivalent. There are 13 sensors required for this project (approximately 9,000 SF of space).

Energy Savings Calculations:

From the **Investment Grade Lighting Audit Appendix** of this report, we calculated the lighting power density (Watts/ft^2) of the existing offices, conferences rooms, file rooms, copy rooms, storage rooms, equipment rooms, etc. to be 1.287 Watts/SF. Thirty percent of this value is the resultant energy savings due to installation of occupancy sensors:

$$Energy\ Savings = \left(30\% \times\ Watts/SF \times Building\ SF \times Operating\ Hours \times \$/kWh\right)$$

$$Energy\ Savings = \left(30\% \times\ 1.287\ Watts/SF \times 9{,}000\ SF \times 2{,}496 hrs/yr \times \$0.158/kWh\right) = \underline{\$1{,}370\ per\ year}$$

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is $165 / unit including material and labor.

$$Installation\ Cost = (\#\ of\ \ sensors \times\ \ \$\ \ per\ sensor) = (13 \times \$165) = \$2{,}145$$

NJ Smart Start® Program Incentives are calculated as follows:

From **Appendix B**, the incentive for installing a lighting control is $20 per controller.

$$\text{Smart Start®}\ Incentive = (\#\ of\ \ controller \times\ \ \$\ 20) = (13 \times \$\ 20) = \underline{\$}260$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$2,145
NJ Smart Start Equipment Incentive ($):	$260
Net Installation Cost ($):	$1,885
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,370
Total Yearly Savings ($/Yr):	$1,370
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.4
Simple Lifetime ROI	990.2%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$20,550
Internal Rate of Return (IRR)	73%
Net Present Value (NPV)	$14,469.97

ECM #2: Lighting Upgrade – General

Description:

The Tanglewood Treatment Plant and Office are comprised mostly of T-12 and fluorescent fixtures throughout. The facility also includes an array of incandescent fixtures with a few compact fluorescents throughout.

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 fixtures to compact fluorescent fixtures. 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.

Hours of Operation: 2,496 Hrs per year.

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix** 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) = $10 per fixture; T-5 or T-8 (3-4 lamp) = $20 per fixture.

$$\text{Smart Start®}\ Incentive = (\#\ of\ 1-2\ lamp\ \ fixtures \times\ \$\,10) + (\#\ of\ 3-4\ lamp\ \ fixtures \times\ \$\,20)$$

$$\text{Smart Start®}\ Incentive = (109 \times\ \$\,10) + (0 \times\ \$\,20) = \underline{\$1{,}090}$$

Replacement and Maintenance Savings are calculated as follows:

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

$$Savings = (244\ lamps\ \ per\ \ year) \times (\$2.00 + \$5.00) = \underline{\$1{,}708}$$

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$11,291
NJ Smart Start Equipment Incentive ($):	$1,090
Net Installation Cost ($):	$10,201
Maintenance Savings ($/Yr):	$1,708
Energy Savings ($/Yr):	$2,006
Total Yearly Savings ($/Yr):	$3,714
Estimated ECM Lifetime (Yr):	15
Simple Payback	2.7
Simple Lifetime ROI	446.1%
Simple Lifetime Maintenance Savings	$25,620
Simple Lifetime Savings	$55,710
Internal Rate of Return (IRR)	36%
Net Present Value (NPV)	$34,136.49

ECM #3: Install LED Exit Signs

Description:

LED is an acronym for light-emitting-diode. LED's are small light sources that are readily associated with electronic equipment. LED exit signs have been manufactured in a variety of shapes and sizes. There are also retrofit kits that allow for simply modification of existing exit signs to accommodate LED technology. The benefits of LED technology are substantial. LED exit signs will last for 20-30 years without maintenance. This results in tremendous maintenance savings considering that incandescent or fluorescent lamps need to be replaced at a rate of 1-5 times per year. Lamp costs ($2-$7 each) and labor costs ($4-$10 per lamp) add up rapidly. Additionally, LED exit lights only uses 4 Watts. In comparison, conventional exit signs use 10-40 Watts. It is recommended that samples of the products be installed to confirm that they are compatible with the existing electrical system.

This ECM replaces all exit signs with incandescent lamps with new exit signs containing LED technology.

Energy Savings Calculations:

A detailed Investment Grade Lighting Audit can be found in **Investment Grade Lighting Audit Appendix – ECM#3** that outlines the proposed retrofits, costs, savings, and payback periods.

(30 watts-4 watts) x 1 kW/1000 watts x 8760 hrs/yr x 7 fixtures = 1594 kWh/yr. saved

1594 kWh/yr x $0.158/kWh = $252 / yr. saved

Maintenance savings = 7 fixtures x 1 bulbs/fixture x ($3/bulb + $4/bulb installation) = $49/yr

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, $20/LED Exit sign (≤75kW facility connected load) and $10/LED Exit sign (≥75kW facility connected load).

7 LED Exit signs x $10/ LED Exit sign = $70

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$392
NJ Smart Start Equipment Incentive ($):	$70
Net Installation Cost ($):	$322
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$252
Total Yearly Savings ($/Yr):	$252
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.3
Simple Lifetime ROI	1073.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$3,780
Internal Rate of Return (IRR)	78%
Net Present Value (NPV)	$2,686.36

ECM #4: Domestic Water Heater Replacement

Description:

There are three (1) existing domestic water heaters. The existing Vanguard model GE713 with a 50 gallon tank, 75,000 BTUH input natural gas heater with 80% thermal efficiency and a nameplate recovery rate of 103 gallon per hour.

This energy conservation measure will replace the one (1) existing water heater with a 96% thermal efficient Bradford White model EF-60T-125E-3N gas fired domestic hot water heater having 125 MBH input and 60-gallon storage capacity or equivalent.

Energy Savings Calculations:

Existing Natural Gas DW Heater (WH1)
Rated Capacity = 75 MBH input; 50 gallons storage
Combustion Efficiency = 80%
Age & Radiation Losses = 5%
Thermal Efficiency = 75%

Proposed Natural Gas-Fired, High-Efficiency DW Heater
Rated Capacity = 125 MBH input; 60 gallons storage
Thermal Efficiency = 96%
Radiation Losses = 0.5%
Net Efficiency = 95.5%

Natural Gas Equipment List - Estimated Annual Usage per unit

Manufacturer	Qty.	Model #	Serial #	Input (MBh)	% of Total Input	Estimated Annual Therms
Burnham	1	V-905	7592298	668	61.85%	5,208.92
Weil McLain	1	PFG-6-PIN	7	305	28.24%	2,378.33
VANGUARD	**1**	**GE713**	**VG 1195DO7836**	**75**	**6.94%**	**584.83**
A.O. SMITH	1	FSG 30 216	MH91-0052064-216	32	2.96%	249.53
			Total Input MBH	1,080	1.00	8,421.61
				Total Input Therms	10.8	
				Total Gas Consumption Therms / yr.	8421.61	

Operating Data for Domestic Water Heater

$$\text{Estimated Consumption(WH1)} = \frac{75 MBH input}{1{,}080\ MBH\ bldg\ input}\ x\ 8421.61 Therms/year = 584.83 Therms/year$$

Energy Savings = Old Water Heater Energy Input x ((New Water Heater Efficiency – Old Water Heater) / New Water Heater Efficiency))

Energy Savings = 584.83 Therms x $\frac{(95.5\% - 75\%)}{(95.5\%)}$ = 125.5 Therms

Average Cost of Natural Gas = $1.28/Therm

Yearly Savings = 125.5 Therm x $1.28/ Therm = $161/year

Cost of one (1) Commercial Domestic Water Heater and Installation = $7,670

Smart Start Incentive = $2.00/MBh x 125 /installed MBh = $250.

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$7,670
NJ Smart Start Equipment Incentive ($):	$250
Net Installation Cost ($):	$7,420
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$161
Total Yearly Savings ($/Yr):	$161
Estimated ECM Lifetime (Yr):	12
Simple Payback	46.1
Simple Lifetime ROI	-74.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$1,932
Internal Rate of Return (IRR)	-16%
Net Present Value (NPV)	($5,817.41)

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 325 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 4.60 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 5,316 KWh annually, reducing the overall utility bill by approximately .56% percent. A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix**. This analysis illustrates the payback of the system over a 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	15.33 Years	63.1%	4.8%

*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:

The 6,894 SF Tanglewood Office No.1 sewage plant is a one story facility with two basement areas. The building is comprised of offices, restrooms and a lab on the ground floor and pump rooms, boiler room and aeration equipment are in the two basement areas. The typical hours of operation for this facility are between 8:00 am and 4:30 pm Monday through Friday and 4 hours Saturday and 4 hours Sunday and 4 hours per legal Holiday. The building was built in 1966 with no additions since the original construction.

The Electric Usage Profile demonstrates a very flat or consistent load shape throughout the year. The profile is expected as this facility office No. 1 sewage plant operates Monday through Friday but also on weekends and legal Holiday's thus demonstrating a consistent load pattern. Furthermore, the sludge building operates 24/7 and is only occupied for brief inspections and maintenance, complimenting the flat load profile. The building was built in 1969 with no additions since the original construction.

The maintenance garage is comprised of truck bays, storage area and restroom. The building was constructed in 1969 with no additions since the original construction

Cooling is achieved with window air conditioners in the offices and the electric room and a ductless split system in the lab.

This facility is supplied electric Delivery and Supply from Jersey Central Power and Light (JCP&L) on a GSS single 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 December through July during the standard heating season (the season is a bit longer than is typical, for example June, July and August). The usage in September, October and November is basically non-existent. The heating shape is consistent with heating. The office building is heated by a Burnham model V-905 boiler. The building has perimeter fin

tube radiation and cabinet heaters at the entrances. The sludge building is heated by a Weil McLain model PFG-6-PIN boiler. Perimeter radiation and hydronic unit heaters are present. The maintenance garage is heated via natural gas fired unit heaters with local thermostats.

Domestic hot water for the office restrooms is provided by a 50 gallon Vanguard, 75 MBH natural gas input water heater with first hour recovery of 103 gallon per hour. The domestic hot water is circulated throughout the building by a hot water re-circ pump. The circulation pump is controlled by an aqua stat.

Domestic hot water for the maintenance garage restroom is provided by a 30 gallon A.O. Smith, 32 MBH natural gas input water heater with first hour recovery of 32.8 gallon per hour.
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) 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.

E. Confirm that outside air economizers on the rooftop units are functioning properly to take advantage of free cooling and avoid excess outside air during occupied periods.

In addition to the recommendations above, implementing Retro-Commissioning would be beneficial for this facility. Retro-Commissioning is a means to verify your current equipment is operating at its designed efficiency, capacity, airflow, and overall performance. Retro-Commissioning provides valuable insight into systems or components not performing correctly or efficiently. The commissioning process defines the original system design parameters and recommends revisions to the current system operating characteristics.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Tanglewood Treatment Plant

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (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 #1	Lighting Controls	$2,145	$0	$260	$1,885	$1,370	$0	$1,370	15	$20,550	$0	990.2%	1.4	72.66%	$14,469.97
ECM #2	Lighting Upgrade - General	$11,291	$0	$1,090	$10,201	$2,006	$1,708	$3,714	15	$55,710	$25,620	446.1%	2.7	36.05%	$34,136.49
ECM #3	Install LED Exit Signs	$392	$0	$70	$322	$252	$0	$252	15	$3,780	$0	1073.9%	1.3	78.25%	$2,686.36
ECM #4	Domestic Water Heater Replacement	$7,670	$0	$250	$7,420	$161	$0	$161	12	$1,932	$0	-74.0%	46.1	-16.37%	($5,817.41)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	4.60 KW PV System	$41,400	$0	$0	$41,400	$840	$1,861	$2,701	25	$67,525	$46,525	63.1%	15.3	4.18%	$5,632.91

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
Tanglewood

Building ID: 1830958
For 12-month Period Ending: June 30, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: February 04, 2010

Facility
Tanglewood
Tanglewood Lane
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: 1966
Gross Floor Area (ft²): 10,494

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	3,169,884
Natural Gas (kBtu)[4]	842,232
Total Energy (kBtu)	4,012,116

Energy Intensity[5]

Site (kBtu/ft²/yr)	382
Source (kBtu/ft²/yr)	1093

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	528

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	413%
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	Tanglewood	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	Tanglewood Lane, 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		☐
Tanglewood Treatment Plant (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	10,494 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	3(Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	56Hours(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	6(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: Tanglewood 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	73,040.00
05/01/2009	05/31/2009	84,800.00
04/01/2009	04/30/2009	72,240.00
03/01/2009	03/31/2009	75,200.00
02/01/2009	02/28/2009	85,600.00
01/01/2009	01/31/2009	82,960.00
12/01/2008	12/31/2008	84,240.00
11/01/2008	11/30/2008	73,520.00
10/01/2008	10/31/2008	70,880.00
09/01/2008	09/30/2008	76,720.00
08/01/2008	08/31/2008	75,440.00
07/01/2008	07/31/2008	74,400.00
Tanglewood Electric Consumption (kWh (thousand Watt-hours))		**929,040.00**
Tanglewood Electric Consumption (kBtu (thousand Btu))		**3,169,884.48**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**3,169,884.48**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

Meter: Tanglewood Gas (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
06/01/2009	06/30/2009	304.82
05/01/2009	05/31/2009	792.35
04/01/2009	04/30/2009	1,141.09
03/01/2009	03/31/2009	1,286.15
02/01/2009	02/28/2009	1,421.71
01/01/2009	01/31/2009	1,187.73
12/01/2008	12/31/2008	1,182.20
11/01/2008	11/30/2008	713.41
10/01/2008	10/31/2008	229.10
09/01/2008	09/30/2008	47.13

08/01/2008	08/31/2008	59.89
07/01/2008	07/31/2008	56.74
Tanglewood Gas Consumption (therms)		**8,422.32**
Tanglewood Gas Consumption (kBtu (thousand Btu))		**842,232.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**842,232.00**
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
Tanglewood
Tanglewood Lane
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

Tanglewood	
Gross Floor Area Excluding Parking: (ft^2)	10,494
Year Built	1966
For 12-month Evaluation Period Ending Date:	June 30, 2009

Facility Space Use Summary

Tanglewood Treatment Plant	
Space Type	Other - Other
Gross Floor Area(ft^2)	10,494
Number of PCs[o]	3
Weekly operating hours[o]	56
Workers on Main Shift[o]	6

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)	382	382	0	N/A	104
Source (kBtu/ft^2)	1093	1093	0	N/A	213
Energy Cost					
$/year	$ 156,301.60	$ 156,301.60	N/A	N/A	$ 42,517.70
$/$ft^2$/year	$ 14.89	$ 14.89	N/A	N/A	$ 4.05
Greenhouse Gas Emissions					
$MtCO_2e$/year	528	528	0	N/A	144
$kgCO_2e/ft^2$/year	50	50	0	N/A	14

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 Twp. Tanglewood plant

Boiler

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Shop Bldg.	Shop Bldg.	Burnham	1	V-905	7592298	668	534	80	NG	34	35	1	Reg #: 92 1589 H
Office Bunt.	Office	Weil McLain	1	PFG-6-PIN	7	305	247	81	NG	34	35	1	Motor: L1446876

Boiler - Burner

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Office Bunt.	Burnham Boiler	Power Flame	1	BCJR15A-10	119199330	714 MAX		NG	34	20	-14	Invoice# 93890

Boiler - Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	RPM	GPM	Ft. Hd	Frame Size	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
LAB	Lab#1	Bell & Gossett	4	M10532	-	1/4	1725	-	-	-	-	-	10	10	0	Rebate available for 1hp and larger.

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
Office Bunt.	OFFICE	VANGUARD	1	GE713	VG 1195DO7836	75	103	50	80	NG	14	12	-2	
GARAGE	GARAGE	A.O. SMITH	1	FSG 30 216	MH91-0052064-216	32	32.8	30	80	NG	8	12	4	

Process - Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	RPM	GPM	Ft. Hd	Frame Size	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Office Bunt.		Crane	2	1.562A-100P12B	T1203487	10	3500	150	122	-	-	3	3	10	7	88.5% EFF.
Office Bunt.		Crane	2	2.562A-20P146	T1206407	2	-	130	30	-	-	3		10	10	84% Eff., E143 / 5T
Office Bunt.		Cornell	1	4NNDH-F16	1413598.25	10	1755	-	-	215T	-	-		10	10	91% Eff., V04-T3020057-GT-2
Office Bunt.		Cornell	1	4NNDH-F16	1413588.25	10	1755	-	-	215T	-	-		10	10	91% Eff., V04-T3020057-GT-3
Office Bunt.		Fairbank Morse	1	-	K3W1-071028-1	-	-	-	-	-	-	-		10	10	
Office Bunt.		Fairbank Morse	1	5720	K2K1029669	12.25	-	1500	1.5	-	-	-		10	10	
Office Bunt.		INGERSOLL DRESSER	1	SMP2000	IMP DI 40	-	-	-	-	-	-	-		10	10	1 1/4 x 5
Office Bunt.		STARITE	1	JHF3-51H	001H07W0001	1.5	3450	-	-	-	208-230/460	3	2	10	8	
Office Bunt.		STARITE	1	JHF3-51H	001H07W0002	1.5	3450	-	-	-	208-230/460	3	2	10	8	
	PLANT	GORATOR	1	-	5354B-2	7.5	1760	-	-	-	208-230/460	3		10	10	GE Motor M/N 5K4254B2L S/N FB310496
		US ELECTRICAL	1	6-1352-00	266	5	-	-	-	215T	-	-		10	10	
		US ELECTRICAL	1	4003931	-	7.5	-	-	-	-	-	-		10	10	
		ITT MARLOW	1	G45877U03U0090027F	-	5	1165	-	-	215T	230/460	-		10	10	85.5% Eff.

Split Systems and AC Condensers

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity	Eff.	Refrigerant	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
LAB	LAB	SANYO	1	KS1852 / C1852	144624 / 85221342487000	18000	-	R-22	230	1	-	7	15	8	

Air Compressor

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	Pressure	Capacity	Volts	Phase	FLA	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Office Bunt.		COLTEC INDUSTRIES QUINCY	1	OSB25WNW32SQ	955308	25	-	-	-	-	-	14	15	1	AO SMITH MOTOR 91.7% EFF
Office Bunt.		QUINCY	1	5K215AB2B5	NMY150	10	-	-	200-230/460	-	-	14	15	1	GE MOTOR- 87.5%EFF.
GARAGE	GARAGE	GAST	1	58CD-11T	993	3/4	-	-	-	-	-	14	15	1	REBATE FOR 1 HP OR MORE

Motors

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Motor HP	RPM	Volts	Phase	Amps	Approx. Age	ASHRAE Service	Remaining Life	Notes
Office Bunt.	Aerator blower	Marathon Electric	2	XF254TTFP7265AA-W	-	5	1760	460	3	-		15	15	82.5% Eff.
Office Bunt.		Reliance	1	P18C4531L	-	-	1160	-	3	-		15	15	86% Eff.
Office Bunt.		Reliance	1	XT	IMAF570212- - G1 PS	20	1185	460	3	-		15	15	
Office Bunt.		Reliance	1	XT	-	37.5	885	460	3	-		15	15	
Office Bunt.		DAYTON	1	3N735	E371E92V056R133M	10	1750	-	-	-		15	15	88.5%EFF.

Window Air Conditioning Units

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity (BTUH)	Heating Capacity - HW	EER	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
1ST FL OFFICE	OFFICE	KENMORE	1	253 8786991	JK94222441	9,000	N/A	10.5	115	1	-	15	15	0	R-22
1ST FL OFFICE	OFFICE	KENMORE	1	253 8740655	JK00206001	6000	N/A	9.4	115	1	-	9	15	6	
1ST FL OFFICE	OFFICE	KENMORE	1	253 8780991	JK94224830	9000	N/A	10.5	115	1	-	15	15	0	
1ST ELECTRIC RM	ELEC RM	FRIEDRICH	1	KM18L30-B	LGGJ005219	17800/17600	-	10	230/208	1	-	2007	15	13	

CEG Job #: **9C09084**
Project: **Township of Chatham** **"Tanglewood Sewage Plant"** **KWH COST:** **$0.158**
Address: **Tanglewood Lane**
Chatham, NJ 07928
Building SF: 10,494

ECM #1: Lighting Upgrade - General

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	Basement	2496	22	2	4 Foot, 2-Lamp, T12, Magnetic Ballast, Surface Mounted, Industrial	80	1.76	4,393.0	$694.09	22	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	1.21	3020.16	$477.19	$100.00	$2,200.00	0.55	1372.8	$216.90	10.14
2		2496	2	2	4 Foot, 2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.16	399.4	$63.10	2	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.11	274.56	$43.38	$100.00	$200.00	0.05	124.8	$19.72	10.14
9		2496	1	0	1-Lamp Incandescents	100	0.10	249.6	$39.44	1	0	26 W CFL Lamp	26	0.03	64.896	$10.25	$5.75	$5.75	0.07	184.704	$29.18	0.20
9	Handicap Bathroom	2496	4	0	1-Lamp Incandescents	100	0.40	998.4	$157.75	4	0	26 W CFL Lamp	26	0.10	259.584	$41.01	$5.75	$23.00	0.30	738.816	$116.73	0.20
9	Closet	2496	1	0	1-Lamp Incandescents	100	0.10	249.6	$39.44	1	0	26 W CFL Lamp	26	0.03	64.896	$10.25	$5.75	$5.75	0.07	184.704	$29.18	0.20
2	Bathroom	2496	3	2	4 Foot, 2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.24	599.0	$94.65	3	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.17	411.84	$65.07	$100.00	$300.00	0.08	187.2	$29.58	10.14
9		2496	1	0	1-Lamp Incandescents	100	0.10	249.6	$39.44	1	0	26 W CFL Lamp	26	0.03	64.896	$10.25	$5.75	$5.75	0.07	184.704	$29.18	0.20
2	Hallway 1	2496	6	2	4 Foot, 2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.48	1,198.1	$189.30	6	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.33	823.68	$130.14	$100.00	$600.00	0.15	374.4	$59.16	10.14
3	Electric Room	2496	4	2	4 Foot, 2-Lamp, T12, Magnetic Ballast, Recessed, Prismatic Lens	80	0.32	798.7	$126.20	4	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.22	549.12	$86.76	$100.00	$400.00	0.10	249.6	$39.44	10.14
4		2496	5	2	4 Foot, 2-Lamp, T12, Magnetic Ballast, Pendant, Industrial	80	0.40	998.4	$157.75	5	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.28	686.4	$108.45	$100.00	$500.00	0.13	312	$49.30	10.14
3	Office	2496	4	2	4 Foot, 2-Lamp, T12, Magnetic Ballast, Recessed, Prismatic	80	0.32	798.7	$126.20	4	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.22	549.12	$86.76	$100.00	$400.00	0.10	249.6	$39.44	10.14
2	Lab	2496	8	2	4 Foot, 2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.64	1,597.4	$252.40	8	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.44	1098.24	$173.52	$100.00	$800.00	0.20	499.2	$78.87	10.14
3	Break Room	2496	5	2	4 Foot, 2-Lamp, T12, Magnetic Ballast, Recessed, Prismatic Lens	80	0.40	998.4	$157.75	5	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.28	686.4	$108.45	$100.00	$500.00	0.13	312	$49.30	10.14
3	Hallway 2	2496	2	2	4 Foot, 2-Lamp, T12, Magnetic Ballast, Recessed, Prismatic Lens	80	0.16	399.4	$63.10	2	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.11	274.56	$43.38	$100.00	$200.00	0.05	124.8	$19.72	10.14
10		2496	6	0	1-Lamp Incandescents	150	0.90	2,246.4	$354.93	6	0	40 W CFL Lamp	40	0.24	599.04	$94.65	$9.78	$58.68	0.66	1647.36	$260.28	0.23

5		2496	1	2	2 Foot, 2-Lamp, U-Tube, Magnetic Ballast, Recessed, Prismatic Lens	70	0.07	174.7	$27.61	1	2	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast, Architectural surface or Recessed static METALUX 2AC 217 UNV EB81	34	0.03	84.864	$13.41	$204.00	$204.00	0.04	89.856	$14.20	14.37
3	Office	2496	4	2	4 Foot, 2-Lamp, T12, Magnetic Ballast, Recessed, Prismatic Lens	80	0.32	798.7	$126.20	4	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.22	549.12	$86.76	$100.00	$400.00	0.10	249.6	$39.44	10.14
3	Mens	2496	2	2	4 Foot, 2-Lamp, T12, Magnetic Ballast, Recessed, Prismatic Lens	80	0.16	399.4	$63.10	2	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.11	274.56	$43.38	$100.00	$200.00	0.05	124.8	$19.72	10.14
2	Basement 2	2496	15	2	4 Foot, 2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	1.20	2,995.2	$473.24	15	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.83	2059.2	$325.35	$100.00	$1,500.00	0.38	936	$147.89	10.14
4	Garage	2912	6	2	4 Foot, 2-Lamp, T12, Magnetic Ballast, Pendant, Industrial	80	0.48	1,397.8	$220.85	6	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.33	960.96	$151.83	$100.00	$600.00	0.15	436.8	$69.01	8.69
6		2912	3	2	4 Foot, 2-Lamp, T12, Magnetic Ballast, Wall Mount, Industrial	80	0.24	698.9	$110.42	3	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.17	480.48	$75.92	$100.00	$300.00	0.08	218.4	$34.51	8.69
7		2912	11	2	4 Foot, 2-Lamp, T12, Magnetic Ballast, Pendant, Prismatic Lens	80	0.88	2,562.6	$404.88	11	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.61	1761.76	$278.36	$100.00	$1,100.00	0.28	800.8	$126.53	8.69
8	Bathroom	2912	1	1	3 Foot, 1-Lamp, T12, Magnetic Ballast, Wall Mount Vanity Fixture	47	0.05	136.9	$21.62	1	0	3' - 1-Lamp 25W T-8 Prismatic Lens / Elect Ballast; Metalux M/N SNF125	23	0.02	66.976	$10.58	$119.00	$119.00	0.02	69.888	$11.04	10.78
4	Outside Pump House	2912	6	2	4 Foot, 2-Lamp, T12, Magnetic Ballast, Pendant, Industrial	80	0.48	1,397.8	$220.85	6	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.33	960.96	$151.83	$100.00	$600.00	0.15	436.8	$69.01	8.69
11		2912	1	0	1-Lamp Compact Flourescent	26	0.03	75.7	$11.96	1	0	No Change	26	0.03	75.712	$11.96	$0.00	$0.00	0.00	0	$0.00	0.00
9	Closet	2912	1	0	1-Lamp Incandescents	100	0.10	291.2	$46.01	1	0	26 W CFL Lamp	26	0.03	75.712	$11.96	$5.75	$5.75	0.07	215.488	$34.05	0.17
9	Basement	2912	11	0	1-Lamp Incandescents	100	1.10	3,203.2	$506.11	11	0	26 W CFL Lamp	26	0.29	832.832	$131.59	$5.75	$63.25	0.81	2370.368	$374.52	0.17
	Totals		136	37			11.58	30,306.0	$4,788.35	136	36			6.757	17610.53	$2,782.46		$11,290.93	4.83	12695.5	$2,005.89	5.63

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 - Tanglewood Treatment Plant
Location: Chatham, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$41,400
Annual kWh Production	5,316
Annual Energy Cost Reduction	$840
Annual SREC Revenue	$1,861
First Cost Premium	**$41,400**
Simple Payback:	**15.33** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.158**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$41,400	0	0	0	$0	(41,400)	0
1	$0	5,316	$840	$0	$1,861	$2,701	($38,699)
2	$0	5,289	$865	$0	$1,851	$2,716	($35,983)
3	$0	5,263	$891	$0	$1,842	$2,733	($33,250)
4	$0	5,237	$918	$0	$1,833	$2,751	($30,499)
5	$0	5,210	$945	$54	$1,824	$2,715	($27,784)
6	$0	5,184	$974	$53	$1,815	$2,735	($25,049)
7	$0	5,159	$1,003	$53	$1,805	$2,755	($22,294)
8	$0	5,133	$1,033	$53	$1,796	$2,777	($19,517)
9	$0	5,107	$1,064	$53	$1,787	$2,799	($16,718)
10	$0	5,082	$1,096	$52	$1,779	$2,822	($13,896)
11	$0	5,056	$1,129	$52	$1,770	$2,846	($11,050)
12	$0	5,031	$1,163	$52	$1,761	$2,872	($8,178)
13	$0	5,006	$1,198	$52	$1,752	$2,898	($5,280)
14	$0	4,981	$1,233	$51	$1,743	$2,925	($2,355)
15	$0	4,956	$1,270	$51	$1,735	$2,954	$599
16	$0	4,931	$1,309	$51	$1,726	$2,984	$3,583
17	$0	4,906	$1,348	$51	$1,717	$3,015	$6,597
18	$0	4,882	$1,388	$50	$1,709	$3,047	$9,644
19	$0	4,857	$1,430	$50	$1,700	$3,080	$12,724
20	$0	4,833	$1,473	$50	$1,692	$3,115	$15,838
21	$1	4,809	$1,517	$50	$1,683	$3,151	$18,989
22	$2	4,785	$1,563	$49	$1,675	$3,188	$22,177
23	$3	4,761	$1,609	$49	$1,666	$3,227	$25,404
24	$4	4,737	$1,658	$49	$1,658	$3,267	$28,670
25	$5	4,713	$1,707	$49	$1,650	$3,309	$31,979
	Totals:	101,418	$22,569	$827	$35,496	$73,379	$57,238
				Net Present Value (NPV)		**$32,004**	
				Internal Rate of Return (IRR)		**4.8%**	

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
Tanglewood Treatment Plant	325	Sunpower SPR230	20	14.7	294	4.60	5,316	660	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:	4.6 kW
DC to AC Derate Factor:	0.810
AC Rating:	3.7 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	0.2 ¢/kWh

Results			
Month	Solar Radiation (kWh/m^2/day)	AC Energy (kWh)	Energy Value ($)
1	2.39	276	0.43
2	3.17	335	0.52
3	4.07	468	0.73
4	4.83	519	0.81
5	5.70	617	0.96
6	5.94	603	0.94
7	5.77	598	0.93
8	5.38	554	0.86
9	4.65	477	0.74
10	3.61	393	0.61
11	2.35	250	0.39
12	2.01	225	0.35
Year	4.16	5316	8.29

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)

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