



# **ENERGY AUDIT – FINAL REPORT**

**CHATHAM TOWNSHIP  
CHATHAM MUNICIPAL BUILDING  
58 MEYERSVILLE ROAD  
CHATHAM, NJ 07928**

**ATTN: Thomas Ciccarone  
TOWNSHIP ADMINISTRATOR / CFO**

**CEG PROJECT No. 9C09084**

## **CONCORD ENGINEERING GROUP**



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**Table of Contents**

I. EXECUTIVE SUMMARY ..... 3

II. INTRODUCTION ..... 7

III. METHOD OF ANALYSIS..... 8

IV. HISTORIC ENERGY CONSUMPTION/COST..... 10

    A. ENERGY USAGE / TARIFFS ..... 10

    B. ENERGY USE INDEX (EUI)..... 15

    C. EPA ENERGY BENCHMARKING SYSTEM..... 17

V. FACILITY DESCRIPTION ..... 18

VI. MAJOR EQUIPMENT LIST ..... 20

VII. ENERGY CONSERVATION MEASURES..... 21

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES ..... 27

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY ..... 30

X. INSTALLATION FUNDING OPTIONS..... 33

XI. ADDITIONAL RECOMMENDATIONS ..... 34

Appendix A – ECM Cost & Savings Breakdown

Appendix B – New Jersey Smart Start® Program Incentives

Appendix C – Portfolio Manager “Statement of Energy Performance”

Appendix D – Major Equipment List

Appendix E – Investment Grade Lighting Audit

Appendix F – Renewable / Distributed Energy Measures Calculations

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## I. EXECUTIVE SUMMARY

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

Township of Chatham  
Municipal Building  
58 Meyersville Road  
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	\$ 84,991
Natural Gas	\$29,240
Total	\$114,231

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  $\pm 20\%$ . 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**

<b>ENERGY CONSERVATION MEASURES (ECM's)</b>					
<b>ECM NO.</b>	<b>DESCRIPTION</b>	<b>NET INSTALLATION COST<sup>A</sup></b>	<b>ANNUAL SAVINGS<sup>B</sup></b>	<b>SIMPLE PAYBACK (Yrs)</b>	<b>SIMPLE LIFETIME ROI</b>
ECM #1	Lighting Controls	\$6,670	\$4,063	1.6	813.7%
ECM #2	Lighting Upgrade - General	\$62,270	\$49,936	1.2	1102.9%
ECM #3	Premium Efficient Motor Replacement	\$1,458	\$195	7.5	140.7%
<b>RENEWABLE ENERGY MEASURES (REM's)</b>					
<b>ECM NO.</b>	<b>DESCRIPTION</b>	<b>NET INSTALLATION COST</b>	<b>ANNUAL SAVINGS</b>	<b>SIMPLE PAYBACK (Yrs)</b>	<b>SIMPLE LIFETIME ROI</b>
REM #1	73.37 KW PV System	\$660,330	\$44,172	14.9	67.2%

**Notes:** A. Cost takes into consideration applicable NJ Smart Start™ 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**

<b>ENERGY CONSERVATION MEASURES (ECM's)</b>				
<b>ECM NO.</b>	<b>DESCRIPTION</b>	<b>ANNUAL UTILITY REDUCTION</b>		
		<b>ELECTRIC DEMAND (KW)</b>	<b>ELECTRIC CONSUMPTION (KWH)</b>	<b>NATURAL GAS (THERMS)</b>
ECM #1	Lighting Controls	0.0	23760.0	0.0
ECM #2	Lighting Upgrade - General	48.5	195825.0	0.0
ECM #3	Premium Efficient Motor Replacement	0.3	1138.0	0.0
<b>RENEWABLE ENERGY MEASURES (REM's)</b>				
<b>ECM NO.</b>	<b>DESCRIPTION</b>	<b>ANNUAL UTILITY REDUCTION</b>		
		<b>ELECTRIC DEMAND (KW)</b>	<b>ELECTRIC CONSUMPTION</b>	<b>NATURAL GAS (THERMS)</b>
REM #1	73.37 KW PV System	73.37	84,783	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:** Premium Efficient Motor Replacement

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

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

## II. INTRODUCTION

The comprehensive energy audit covers the 37,994 square foot Municipal Building, which includes the following spaces: mechanical room, offices, conference room, court room, rest rooms and closets.

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<sup>2</sup>/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:

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

$$\text{Simple Lifetime Savings} = (\text{Yearly Savings} \times \text{ECM Lifetime})$$

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

$$\text{Lifetime Maintenance Savings} = (\text{Yearly Maintenance Savings} \times \text{ECM Lifetime})$$

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

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

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 (LVG) rate structure. Gateway Energy Service Corporation is a 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.

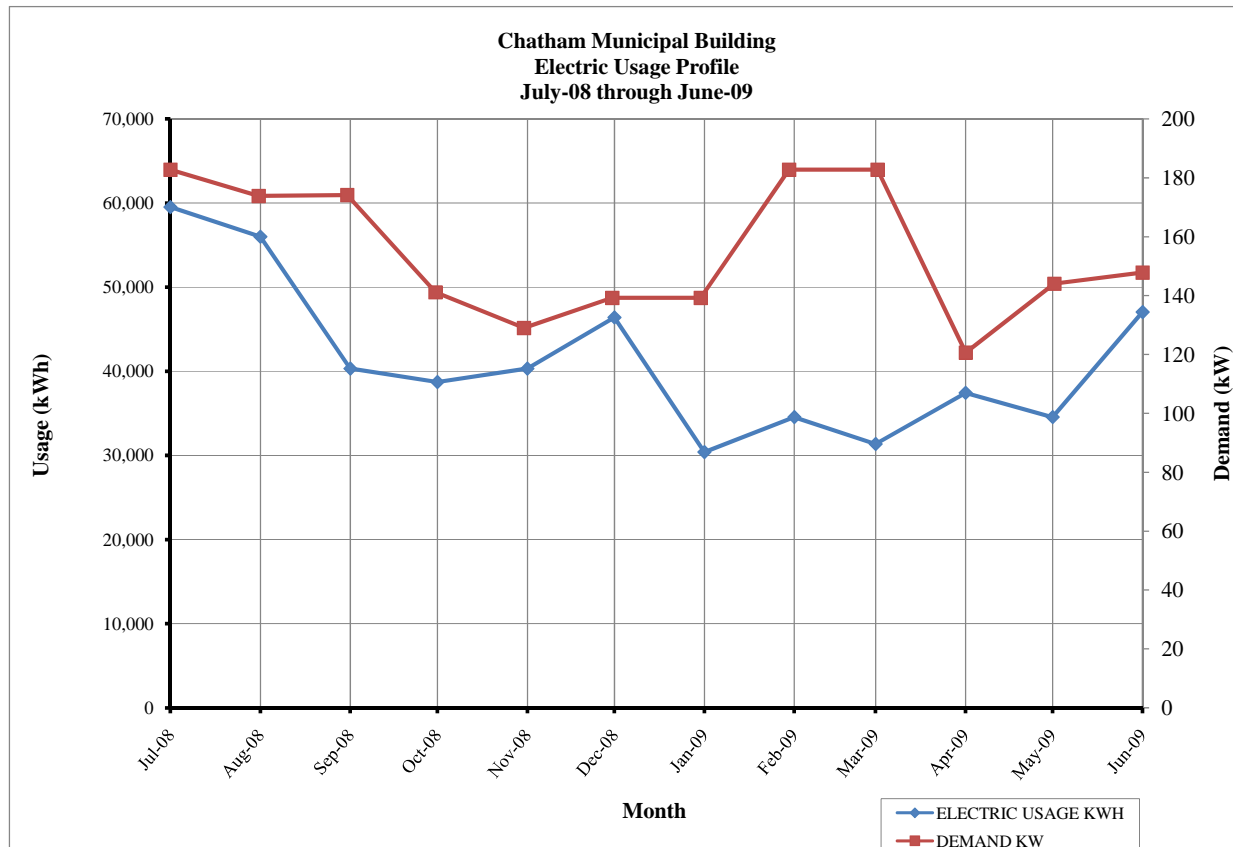
The overall cost for utilities is calculated by dividing the total cost by the total usage. Based on the utility history provided, the average cost for utilities at this facility is as follows:

<u>Description</u>	<u>Average</u>
Electricity	17.1¢ / kWh
Natural Gas	\$1.246 / Therm

**Table 3  
Electricity Billing Data**

<b>ELECTRIC USAGE SUMMARY</b>			
Utility Provider: JCP&L			
Rate: JC_GS3_01F			
Meter No: G21077177			
Customer ID No: 0801529503			
Third Party Utility           0			
TPS Meter / Acct No:        0			
<b>MONTH OF USE</b>	<b>CONSUMPTION KWH</b>	<b>DEMAND</b>	<b>TOTAL BILL</b>
Jul-08	59,520	182.7	\$10,798
Aug-08	56,000	173.8	\$10,173
Sep-08	40,320	174.1	\$7,550
Oct-08	38,720	141.1	\$6,177
Nov-08	40,320	129.0	\$6,342
Dec-08	46,400	139.2	\$7,411
Jan-09	30,400	139.2	\$5,298
Feb-09	34,560	182.7	\$5,629
Mar-09	31,360	182.7	\$5,092
Apr-09	37,440	120.6	\$6,072
May-09	34,560	144.0	\$5,818
Jun-09	47,040	147.8	\$8,632
<b>Totals</b>	<b>496,640</b>	<b>182.7 Max</b>	<b>\$84,991</b>
<b>AVERAGE DEMAND</b>		<b>154.7 KW average</b>	
<b>AVERAGE RATE</b>		<b>\$0.171 \$/kWh</b>	

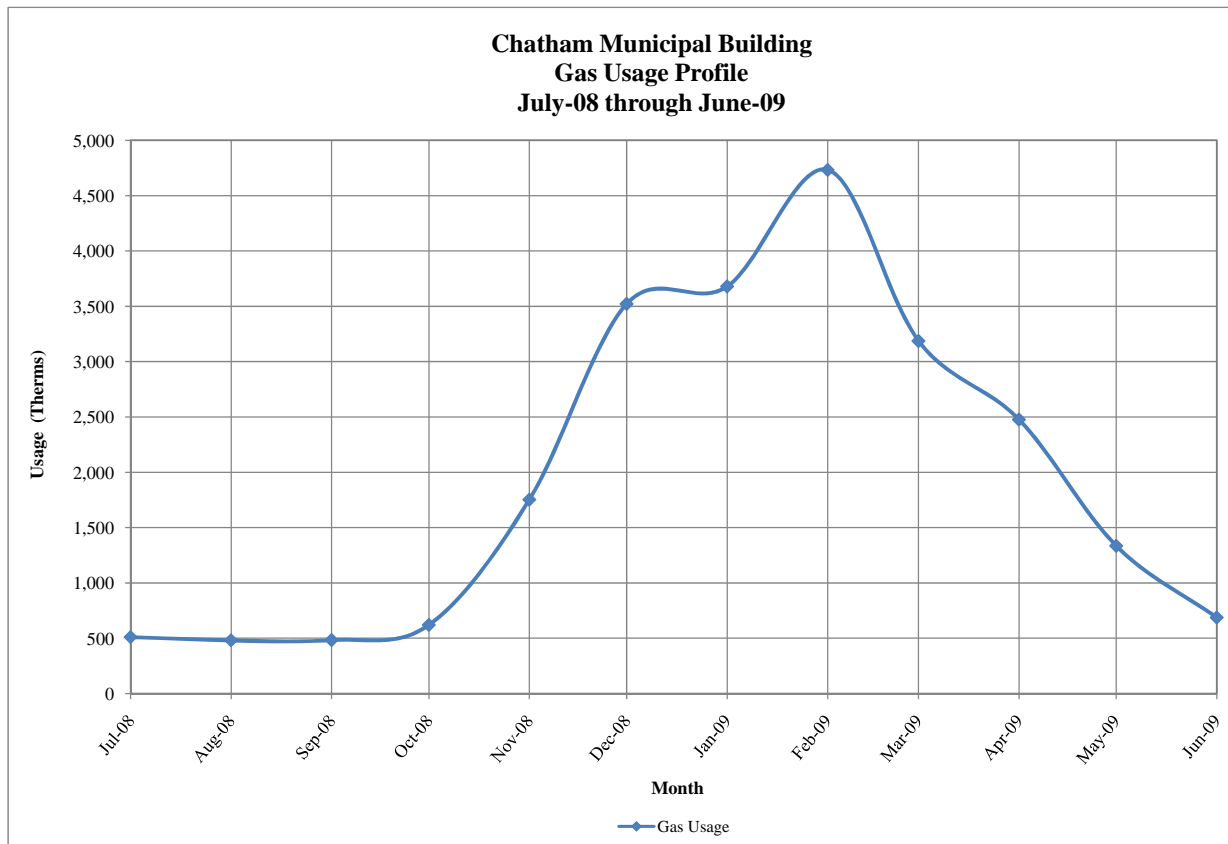
**Figure 1**  
**Electricity Usage Profile**



**Table 4  
Natural Gas Billing Data**

<b>NATURAL GAS USAGE SUMMARY</b>		
Utility Provider: PSE&G		
Rate: LVG		
Meter No: 2678950		
Point of Delivery ID: 0		
Third Party Utility Provider: Gateway Energy Services Corp.		
TPS Meter No: 0		
<b>MONTH OF USE</b>	<b>CONSUMPTION (THERMS)</b>	<b>TOTAL BILL</b>
Jul-08	510.70	\$949.73
Aug-08	481.81	\$825.10
Sep-08	483.91	\$705.45
Oct-08	620.52	\$808.23
Nov-08	1,753.13	\$2,496.81
Dec-08	3,522.99	\$4,351.02
Jan-09	3,680.41	\$4,520.61
Feb-09	4,733.55	\$5,503.41
Mar-09	3,187.30	\$4,099.28
Apr-09	2,477.59	\$1,005.64
May-09	1,335.26	\$561.11
Jun-09	688.31	\$3,413.13
<b>TOTALS</b>	<b>23,475.48</b>	<b>\$29,239.52</b>
<b>AVERAGE RATE:</b>	<b>\$1.246</b>	<b>\$/THERM</b>

**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:

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

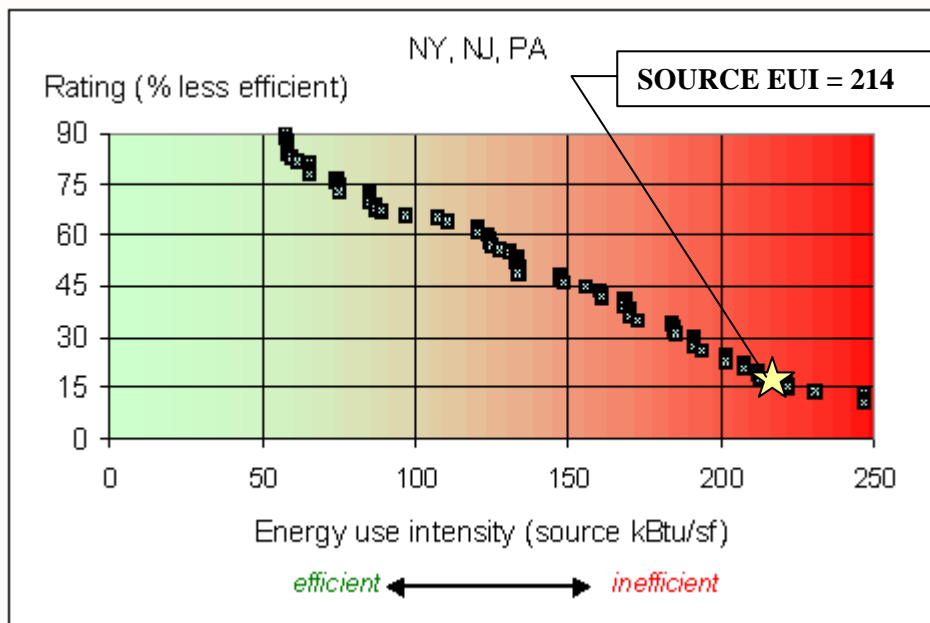
$$\text{Building Source EUI} = \frac{(\text{Electric Usage in kBtu} \times \text{SS Ratio} + \text{Gas Usage in kBtu} \times \text{SS Ratio})}{\text{Building Square Footage}}$$

**Table 5**  
**Facility Energy Use Index (EUI) Calculation**

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	BUILDING USE			SITE ENERGY kBtu	SITE-SOURCE RATIO	SOURCE ENERGY kBtu
	kWh	Therms	Gallons			
ELECTRIC	497600.0			1,698,806	3.340	5,674,013
NATURAL GAS		23475.5		2,347,548	1.047	2,457,883
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				4,046,355		8,131,896
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
<b>BUILDING AREA</b>	37,994 SQUARE FEET					
<b>BUILDING SITE EUI</b>	106.50 kBtu/SF/YR					
<b>BUILDING SOURCE EUI</b>	214.03 kBtu/SF/YR					

Figure 3 below depicts a national EUI grading for the source use of Office Buildings.

**Figure 3**  
**Source Energy Use Intensity Distributions: Office Buildings**



### 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](http://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 Municipal Building	31	50

Refer to **Statement of Energy Performance Appendix** for the detailed energy summary.

## V. FACILITY DESCRIPTION

The 37,994 SF Municipal Building is a two story facility comprised of a mechanical room, offices, conference room, court room, rest rooms and closets. The typical occupied hours of operation for this facility are 50 hours per week. Exterior walls are concrete block construction with minimum insulation typical of the time period. The amount of insulation within the wall is unknown. The windows throughout the facility are in fair to poor condition and appear to be maintained. Personnel noted vapor appearing between some glazing units. Typical windows throughout the facility are double pane, ¼” clear glass with aluminum frames with thermal breaks. The roof is a built-up roof with light color stone covering, where all rooftop HVAC equipment is located. The amount of insulation below the roofing is unknown. The building was built in 1971 with no additions since the original construction.

### HVAC Systems

The building is conditioned by four (4) packaged roof top units made by Trane. There are three (3) units model SXHCC304. These packaged rooftop units each include 30 nominal tons of direct expansion cooling, no heat. These units were fitted with a variable frequency drive (VFD) in 2009. The perimeter VAV terminals have hot water reheat where local temperature sensors control each VAV box’s airflow to regulate space temperature. Interior VAV terminals are shut-off cooling only. VAV box re-heat is activated in the heating season where additional heating is required. Chatham Township personnel informed CEG that there are hot water unit heaters in the ceiling plenum to offset the roof heating load.

The courtroom is conditioned by one (1) Trane model BYC130G40ADB. This unit is a packaged roof top, direct expansion cooling, gas heat exchanger heating, single zone, constant volume unit. Conditioned air is distributed to the courthouse through ductwork and diffusers. A single thermostat controls the unit operation. The four (4) rooftop units are 22 years old and in fair condition.

The Senior Center, on the lower level, has two (2) cooling only ductless split system made by Sanyo. The units are 19 and 17 years old and are in fair condition. The ductless split systems are controlled by local thermostat.

Entrance doorways are heated via hot water cabinet heaters. The perimeter of the building has hot water fin tube radiation. The fin tube radiation and entrance heaters appear to be 38 years old and in fair to poor condition. Fin tube radiation is zoned in four (4) zones; North, South, East and West.

Heating hot water is provided by three (3) 300 MBH modular sections of the Multi Temp water boiler with a total of 900 MBH natural gas input for heating hot water. The heating hot water is circulated throughout the building by two (2) inline pumps. Each circulation pump is controlled by an aqua stat. The domestic hot water piping insulation appeared to be in good condition. The boiler was built in 1987 and is 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 were retrofitted with DDC controls approximately five (5) years ago.

### Domestic Hot Water

Domestic hot water for the restrooms is provided by three (3) 300 MBH modular sections of the Multi Temp water boiler with a total of 900 MBH natural gas input for domestic hot water. 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 good condition. The boiler was built in 1987 and is in good condition.

### Lighting

Typical lighting throughout building is fluorescent tube lay-in and pendant mount fixtures with T-12 lamps and magnetic ballasts. Incandescent lamps are in areas such as the Gym Stair, Restroom, and Second Floor Entrance. Halogen lamps are used in the Court Room. Metal halide lamps are used in the Second Floor Corridor.

The exterior lighting is incandescent lamps, high pressure sodium lamps and quartz lamps.

## 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 10% 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 46 sensors required for this project (approximately 30,000 SF of space).

#### Energy Savings Calculations:

From the **Investment Grade Lighting Audit Appendix** of this report, we calculated the lighting power density (Watts/ft<sup>2</sup>) of the existing offices, conferences rooms, file rooms, copy rooms, storage rooms, equipment rooms, etc. to be 1.65 Watts/SF. Thirty percent of this value is the resultant energy savings due to installation of occupancy sensors:

$$\text{Energy Savings} = (10\% \times \text{Watts} / \text{SF} \times \text{Building SF} \times \text{Operating Hours} \times \$ / \text{kWh})$$

$$\text{Energy Savings} = (10\% \times 1.65 \text{ Watts} / \text{SF} \times 30,000 \text{ SF} \times 4800 \text{ hrs} / \text{yr} \times \$0.171 / \text{kWh}) = \underline{\$4,063 \text{ per year}}$$

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

$$\text{Installation Cost} = (\# \text{ of sensors} \times \$ \text{ per sensor}) = (46 \times \$165) = \$7,590$$

NJ Smart Start<sup>®</sup> Program Incentives are calculated as follows:

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

$$\text{Smart Start}^{\text{®}} \text{ Incentive} = (\# \text{ of controller} \times \$ 20) = (46 \times \$ 20) = \$920$$

**Energy Savings Summary:**

<b>ECM #1 - ENERGY SAVINGS SUMMARY</b>	
<b>Installation Cost (\$):</b>	\$7,590
<b>NJ Smart Start Equipment Incentive (\$):</b>	\$920
<b>Net Installation Cost (\$):</b>	\$6,670
<b>Maintenance Savings (\$/Yr):</b>	\$0
<b>Energy Savings (\$/Yr):</b>	\$4,063
<b>Total Yearly Savings (\$/Yr):</b>	\$4,063
<b>Estimated ECM Lifetime (Yr):</b>	15
<b>Simple Payback</b>	1.6
<b>Simple Lifetime ROI</b>	813.7%
<b>Simple Lifetime Maintenance Savings</b>	\$0
<b>Simple Lifetime Savings</b>	\$60,945
<b>Internal Rate of Return (IRR)</b>	61%
<b>Net Present Value (NPV)</b>	\$41,833.83

## ECM #2: Lighting Upgrade – General

### Description:

The Chatham Municipal Building is 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: 4,800 Hrs per year.

### Energy Savings Calculations:

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

NJ Smart Start<sup>®</sup> 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.

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

$$\text{Smart Start}^{\circledR} \text{ Incentive} = (202 \times \$10) + (323 \times \$20) = \underline{\$8,480}$$

Replacement and Maintenance Savings are calculated as follows:

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

$$\text{Savings} = (1645 \text{ lamps per year}) \times (\$2.00 + \$5.00) = \underline{\$16,450}$$

**Energy Savings Summary:**

<b>ECM #2 - ENERGY SAVINGS SUMMARY</b>	
<b>Installation Cost (\$):</b>	\$70,750
<b>NJ Smart Start Equipment Incentive (\$):</b>	\$8,480
<b>Net Installation Cost (\$):</b>	\$62,270
<b>Maintenance Savings (\$/Yr):</b>	\$16,450
<b>Energy Savings (\$/Yr):</b>	\$33,486
<b>Total Yearly Savings (\$/Yr):</b>	\$49,936
<b>Estimated ECM Lifetime (Yr):</b>	15
<b>Simple Payback</b>	1.2
<b>Simple Lifetime ROI</b>	1102.9%
<b>Simple Lifetime Maintenance Savings</b>	\$246,750
<b>Simple Lifetime Savings</b>	\$749,040
<b>Internal Rate of Return (IRR)</b>	80%
<b>Net Present Value (NPV)</b>	\$533,862.73

### ECM #3: Premium Efficient Motor Replacement

#### Description:

Replacing the boiler and hot water circulation pump motors with new NEMA premium efficient motors is a simple change that can provide substantial savings.

Existing electric motors equal to or greater than one horsepower ranged from 78 to 93% efficient. The improved efficiency of the NEMA premium efficient motors is primarily due to better designs with use of better materials to reduce losses. Surprisingly, the electricity used to power a motor represents 95 % of its total lifetime operating cost. Because many motors operate 40-80 hours per week, even small increases in efficiency can yield substantial energy and dollar savings.

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

#### Energy Savings Calculations:

The following calculation was used to calculate the efficiency increase for switching to a NEMA Premium® Efficient Motor.

1 HP = 0.746 kW

Load Factor = 75%

Annual Hours of Operations = 3,696(Average)

Cost of electricity = \$0.171/ kWh

$$\text{Motor Savings} = \frac{(0.746\text{kW} / 1\text{HP}) \times (\text{Motor HP}) \times (\text{Load Factor}) \times (\text{Hrs of Operation})}{(\text{New Motor Efficiency} - \text{Old Motor Efficiency})}$$

<b>NEMA Premium Efficient Motor Replacement</b>						
<b>Equipment Tag</b>	<b>Motor HP</b>	<b>Existing Efficiency</b>	<b>NEMA Premium Efficiency</b>	<b>kW Savings</b>	<b>kWh Savings</b>	<b>Cost Savings</b>
P-1	2	81.0%	87.5%	0.10	379	\$65
P-2	2	81.0%	87.5%	0.10	379	\$65
P-3	2	81.0%	87.5%	0.10	379	\$65
<b>Total Savings</b>				<b>0.3</b>	<b>1,138</b>	<b>\$195</b>

$$\text{Smart Start}^{\circledR} \text{ Incentive} = (\# \text{ 2 HP Motors} \times \$ 54) = (3 \times \$ 54) = \$162$$

The total cost to install two (3) 2 HP motors is \$1,620.

**Energy Savings Summary:**

<b>ECM #3 - ENERGY SAVINGS SUMMARY</b>	
<b>Installation Cost (\$):</b>	\$1,620
<b>NJ Smart Start Equipment Incentive (\$):</b>	\$162
<b>Net Installation Cost (\$):</b>	\$1,458
<b>Maintenance Savings (\$/Yr):</b>	\$0
<b>Energy Savings (\$/Yr):</b>	\$195
<b>Total Yearly Savings (\$/Yr):</b>	\$195
<b>Estimated ECM Lifetime (Yr):</b>	18
<b>Simple Payback</b>	7.5
<b>Simple Lifetime ROI</b>	140.7%
<b>Simple Lifetime Maintenance Savings</b>	\$0
<b>Simple Lifetime Savings</b>	\$3,510
<b>Internal Rate of Return (IRR)</b>	11%
<b>Net Present Value (NPV)</b>	\$1,223.94

## 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 5,200 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 73.37 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 84,783 KWh annually, reducing the overall utility bill by approximately 17% 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**

<b>FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM</b>			
<b>PAYMENT TYPE</b>	<b>SIMPLE PAYBACK</b>	<b>SIMPLE ROI</b>	<b>INTERNAL RATE OF RETURN</b>
Direct Purchase	14.95 Years	67.2%	5.1%

\*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 comprised of a mechanical room, offices, conference room, court room, rest rooms and closets. The typical occupied hours of operation for this facility are 50 hours per week. The building was built in 1971 with no additions since the original construction.

The Electric Usage Profile demonstrates a fairly typical load shape. The general load profile is said to be typical because the summer (April-August) is higher in consumption, while the winter (December – March) demonstrates lower usage. The summer usage is typical with cooling (air conditioning) load. In this facility conditioning is provided by (4) four packaged roof top units. The courtroom is conditioned by a roof top packaged, direct expansion cooling only unit. The senior center is cooled by (2) two Sanyo split systems.

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 October through April during the standard heating season. Heating for this facility is supplied by (4) four package roof top units. VAV terminals have hot water reheat. The courtroom has a roof top packaged unit that with a zone reheat hot water coil. The entrance doorways are heated by hot water cabinet heaters. The perimeter of the building is heated by hot water fin tube radiation. Heating hot water is provided by (3) three modular sections of the Multi Temp water boiler with natural gas input for heating hot water. Domestic hot water is also supplied by this system

Natural gas delivery-service is provided by Public Service Electric and Gas Company (PSE&G) on a LVG 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 (LVG) 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.

LVG Rate: This utility tariff is for “firm” delivery service for general purposes. This rate schedule has a Delivery Charge, 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 Commodity Charge serviced through the utility or by a Third Party Supplier (TPS). 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.

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.

Commodity Charges: Customer may choose to receive gas supply from either: A TPS or PSE&G through its Basic Gas Supply Service default service. PSE&G may also supply Emergency Sales Service in certain instances. This is at a much higher than normal rate. It should be perceived as a penalty.

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 charges. 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](http://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 pay 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

Chatham Municipal Building

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME (Yr)	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 Saving * 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)	(\$)	(\$)
ECM #1	Lighting Controls	\$7,590	\$0	\$920	\$6,670	\$4,063	\$0	\$4,063	15	\$60,945	\$0	813.7%	1.6	60.87%	\$41,833.83
ECM #2	Lighting Upgrade - General	\$70,750	\$0	\$8,480	\$62,270	\$33,486	\$16,450	\$49,936	15	\$749,040	\$246,750	1102.9%	1.2	80.18%	\$533,862.73
ECM #3	Premium Efficient Motor Replacement	\$1,620	\$0	\$162	\$1,458	\$195	\$0	\$195	18	\$3,510	\$0	140.7%	7.5	11.48%	\$1,223.94
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	73.37 KW PV System	\$660,330	\$0	\$0	\$660,330	\$14,498	\$29,674	\$44,172	25	\$1,104,300	\$741,850	67.2%	14.9	4.42%	\$108,843.56

- Notes:**
- 1) The variable C<sub>n</sub> 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 C<sub>n</sub> is the cash flow during each period.



# Concord Engineering Group, Inc.

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## SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of 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	
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### **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
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### **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
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### 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 Municipal Building

Building ID: 1830893  
For 12-month Period Ending: June 30, 2009<sup>1</sup>  
Date SEP becomes ineligible: N/A

Date SEP Generated: February 04, 2010

**Facility**  
Municipal Building  
58 Meyersville Rd  
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:** 1971  
**Gross Floor Area (ft<sup>2</sup>):** 37,994

**Energy Performance Rating<sup>2</sup> (1-100)** 31

**Site Energy Use Summary<sup>3</sup>**

Electricity - Grid Purchase(kBtu)	1,697,811
Natural Gas (kBtu) <sup>4</sup>	2,347,548
Total Energy (kBtu)	4,045,359

**Energy Intensity<sup>5</sup>**

Site (kBtu/ft <sup>2</sup> /yr)	106
Source (kBtu/ft <sup>2</sup> /yr)	214

**Emissions (based on site energy use)**

Greenhouse Gas Emissions (MtCO <sub>2</sub> e/year)	383
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**Electric Distribution Utility**

FirstEnergy - Jersey Central Power & Lt Co

**National Average Comparison**

National Average Site EUI	87
National Average Source EUI	175
% Difference from National Average Source EUI	22%
Building Type	Courthouse

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<sup>6</sup> 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	<input checked="" type="checkbox"/>
<b>Building Name</b>	Municipal Building	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		<input type="checkbox"/>
<b>Type</b>	Courthouse	Is this an accurate description of the space in question?		<input type="checkbox"/>
<b>Location</b>	58 Meyersville Rd, Chatham, NJ 07928	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		<input type="checkbox"/>
<b>Single Structure</b>	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		<input type="checkbox"/>
Municipal Building (Courthouse)				
CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	<input checked="" type="checkbox"/>
<b>Gross Floor Area</b>	37,994 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.		<input type="checkbox"/>
<b>Weekly operating hours</b>	50 Hours	Is this the total number of hours per week that the Courthouse 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.		<input type="checkbox"/>
<b>Workers on Main Shift</b>	28	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.		<input type="checkbox"/>
<b>Number of PCs</b>	30	Is this the number of personal computers in the Courthouse?		<input type="checkbox"/>
<b>Percent Cooled</b>	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		<input type="checkbox"/>
<b>Percent Heated</b>	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		<input type="checkbox"/>

## ENERGY STAR® Data Checklist for Commercial Buildings

### Energy Consumption

**Power Generation Plant or Distribution Utility:** FirstEnergy - Jersey Central Power & Lt Co

Fuel Type: Electricity		
<b>Meter: Municipale Electric (kWh (thousand Watt-hours))</b> <b>Space(s):</b> Entire Facility <b>Generation Method:</b> Grid Purchase		
Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
06/01/2009	06/30/2009	48,000.00
05/01/2009	05/31/2009	34,560.00
04/01/2009	04/30/2009	37,440.00
03/01/2009	03/31/2009	31,360.00
02/01/2009	02/28/2009	34,560.00
01/01/2009	01/31/2009	30,400.00
12/01/2008	12/31/2008	46,400.00
11/01/2008	11/30/2008	40,320.00
10/01/2008	10/31/2008	38,720.00
09/01/2008	09/30/2008	40,320.00
08/01/2008	08/31/2008	56,000.00
07/01/2008	07/31/2008	59,520.00
<b>Municipale Electric Consumption (kWh (thousand Watt-hours))</b>		<b>497,600.00</b>
<b>Municipale Electric Consumption (kBtu (thousand Btu))</b>		<b>1,697,811.20</b>
<b>Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))</b>		<b>1,697,811.20</b>
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		<input type="checkbox"/>

Fuel Type: Natural Gas		
<b>Meter: Municipale Gas (therms)</b> <b>Space(s):</b> Entire Facility		
Start Date	End Date	Energy Use (therms)
06/01/2009	06/30/2009	688.31
05/01/2009	05/31/2009	1,335.26
04/01/2009	04/30/2009	2,477.59
03/01/2009	03/31/2009	3,187.30
02/01/2009	02/28/2009	4,733.55
01/01/2009	01/31/2009	3,680.41
12/01/2008	12/31/2008	3,522.99
11/01/2008	11/30/2008	1,753.13
10/01/2008	10/31/2008	620.52
09/01/2008	09/30/2008	483.91

08/01/2008	08/31/2008	481.81
07/01/2008	07/31/2008	510.70
<b>Municipale Gas Consumption (therms)</b>		<b>23,475.48</b>
<b>Municipale Gas Consumption (kBtu (thousand Btu))</b>		<b>2,347,548.00</b>
<b>Total Natural Gas Consumption (kBtu (thousand Btu))</b>		<b>2,347,548.00</b>
<b>Is this the total Natural Gas consumption at this building including all Natural Gas meters?</b>		<input type="checkbox"/>

<b>Additional Fuels</b>	
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.	<input type="checkbox"/>

<b>On-Site Solar and Wind Energy</b>	
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.	<input type="checkbox"/>

### 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**  
Municipal Building  
58 Meyersville Rd  
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

Municipal Building	
Gross Floor Area Excluding Parking: (ft <sup>2</sup> )	37,994
Year Built	1971
For 12-month Evaluation Period Ending Date:	June 30, 2009

## Facility Space Use Summary

Municipal Building	
Space Type	Courthouse
Gross Floor Area(ft <sup>2</sup> )	37,994
Weekly operating hours	50
Workers on Main Shift	28
Number of PCs	30
Percent Cooled	50% or more
Percent Heated	50% or more

## Energy Performance Comparison

Performance Metrics	Evaluation Periods		Comparisons		
	Current (Ending Date 06/30/2009)	Baseline (Ending Date 06/30/2009)	Rating of 75	Target	National Average
Energy Performance Rating	31	31	75	N/A	50
Energy Intensity					
Site (kBtu/ft <sup>2</sup> )	106	106	64	N/A	87
Source (kBtu/ft <sup>2</sup> )	214	214	129	N/A	175
Energy Cost					
\$/year	\$ 114,231.52	\$ 114,231.52	\$ 69,041.03	N/A	\$ 93,342.18
\$/ft <sup>2</sup> /year	\$ 3.01	\$ 3.01	\$ 1.82	N/A	\$ 2.46
Greenhouse Gas Emissions					
MtCO <sub>2</sub> e/year	383	383	231	N/A	313
kgCO <sub>2</sub> e/ft <sup>2</sup> /year	10	10	6	N/A	8

More than 50% of your building is defined as Courthouse. Please note that your rating accounts for all of the spaces listed. The National Average column presents energy performance data your building would have if your building had an average rating of 50.

Notes:

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



**MAJOR EQUIPMENT LIST**

Concord Engineering Group

Chatham Municipal Building

Boiler													
Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Mechanical Room	Municipal Bldg	Multi Temp	6	MR-1800B	MNL-2778	1,200	1,404	78	NG	1987	35	13	Air Separator built 1985, (3) Sections DW, (3) sections HW

Boiler - Pumps																
Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	RPM	GPM	Fl. Hd	Frame Size	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
BOILER ROOM	Municipal Bldg	Bell & Gossett	1	Series 80 - 804TB	1364963 E78	2	1450	-	-	182JM	-	3	22	10	(-12)	Motor 8 1/4 EHP
BOILER ROOM	Municipal Bldg	Bell & Gossett	1	Series 80 - 804TB	1364014 D78	2	1450	-	-	182JM	-	3	22	10	(-12)	Motor 8 1/4 EHP
BOILER ROOM	Municipal Bldg	Bell & Gossett	1	Series 80 - 804TB	1364018 D78	2	1450	-	-	182JM	-	3	22	10	(-12)	Motor 8 1/4 EHP

Air Handling Units																				
Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Coil	Cooling Eff. (EER)	Cooling Capacity	Heating Type	Input (MBh)	Output (MBh)	Heating Eff. (%)	Fuel	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
ROOF	Municipal Bldg	Trane	1	SXHCC3040D35C37D3D00F0MNRTRBG	187H72609	30 Ton Nom.	-	DX	None	-	-	N/A	-	460	3	-	22	15	(-7)	30hp supply fan
ROOF	Municipal Bldg	Trane	2	SXHCC304GD35C56D3CF0FMNRTRB	178H72616	30 Ton Nom.	-	DX	None	-	-	N/A	-	460	3	-	22	15	(-7)	15 hp supply fan
ROOF	Court Room	Trane	1	BYC130G40ADB	B38144602D	11 Ton Nom.	-	DX	NG HTX	250	195	78%	NG	460	3	-	22	15	(-7)	Type # 263-1939-1-B

Split Systems and AC Condensers															
Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity	EER	Refrigerant	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
On Grade	Senior Center	Sanyo	1	CS3012	25904	28,600	9.5	R-22	-	-	-	1990	15	(-4)	INDOOR UNIT: KS3012W
On Grade	Senior Center	Sanyo	1	CS0911	19522	9,000	9.5	R-22	-	-	-	1992	15	(-2)	INDOOR UNIT: KS0911

CEG Job #: 9C09084  
 Project: Chatham Municipal Building  
 Address: 58 Meyersville Road  
 Chatham, NJ 07928

"Municipal Building"

KWH COST: \$0.171

Building 37,994

**ECM #1: Lighting Upgrade - General**

EXISTING LIGHTING										PROPOSED LIGHTING										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly \$ Savings	Yearly Simple Payback	
1	Exterior	2184	65	1	Recessed Down Light, 75w PAR FL Lamp	75	4.88	10,647.0	\$1,820.64	65	1	18w R30 CFL Flood	20	1.30	2839.2	\$485.50	\$9.00	\$585.00	3.58	7807.8	\$1,335.13	0.44	
		4380	2	1	150w Flood Lamp	150	0.30	1,314.0	\$224.69	2	1	70w MH Flood	94	0.19	823.44	\$140.81	\$230.00	\$460.00	0.11	490.56	\$83.89	5.48	
		4380	1	1	Wallpack, 70w HPS	90	0.09	394.2	\$67.41	1	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.09	394.2	\$67.41	0.00	
		2184	8	1	500w Qtz Flood Light	500	4.00	8,736.0	\$1,493.86	8	1	70w MH Flood	94	0.75	1642.368	\$280.84	\$230.00	\$1,840.00	3.25	7093.632	\$1,213.01	1.52	
		4380	12	1	250w HPS Shoebox	300	3.60	15,768.0	\$2,696.33	12	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	3.60	15768	\$2,696.33	0.00	
1	Gym Stairway	4800	12	1	Recessed Down Light, 75w PAR FL Lamp	75	0.90	4,320.0	\$738.72	12	1	18w R30 CFL Flood	20	0.24	1152	\$196.99	\$9.00	\$108.00	0.66	3168	\$541.73	0.20	
3		4800	1	1	1x1 Recessed, 60w A19	60	0.06	288.0	\$49.25	1	1	18w CFL Spiral	20	0.02	96	\$16.42	\$9.00	\$9.00	0.04	192	\$32.83	0.27	
2	Boy's Restroom	4800	1	1	Recessed Down Light, 100w A19 Lamp	100	0.10	480.0	\$82.08	1	1	18w R30 CFL Flood	20	0.02	96	\$16.42	\$9.00	\$9.00	0.08	384	\$65.66	0.14	
4		4800	5	3	2x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Prismatic	130	0.65	3,120.0	\$533.52	5	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.41	1968	\$336.53	\$120.00	\$600.00	0.24	1152	\$196.99	3.05	
2	Back Stairway	4800	10	1	Recessed Down Light, 100w A19 Lamp	100	1.00	4,800.0	\$820.80	10	1	18w R30 CFL Flood	20	0.20	960	\$164.16	\$9.00	\$90.00	0.80	3840	\$656.64	0.14	
5	Center Walkway/Ramp	4800	60	1	Recessed Wall Washer, 75w BR30	75	4.50	21,600.0	\$3,693.60	60	1	18w R30 CFL Flood	20	1.20	5760	\$984.96	\$9.00	\$540.00	3.30	15840	\$2,708.64	0.20	
6	2nd Floor Entrance	4800	14	1	Recessed Wall Washer, 18w CFL	20	0.28	1,344.0	\$229.82	14	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.28	1344	\$229.82	0.00	
7		4800	2	1	Round Back Track Head, 60w BR20 Lamp	60	0.12	576.0	\$98.50	2	1	11w BR20 CFL	12	0.02	115.2	\$19.70	\$12.19	\$24.38	0.10	460.8	\$78.80	0.31	
8	2nd Floor Corridor	4800	19	1	Recessed Down Light, 100w MH	125	2.38	11,400.0	\$1,949.40	19	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	2.38	11400	\$1,949.40	0.00	
11		4800	2	2	2x2 2 Lamp 34w T12 Utube, Recessed, Prismatic	80	0.16	768.0	\$131.33	2	3	2x2 3 Lamp 17w T8, Elect. Ballast, Recessed, Prismatic	47	0.09	451.2	\$77.16	\$100.00	\$200.00	0.07	316.8	\$54.17	3.69	
12		4800	56	3	2x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	7.28	34,944.0	\$5,975.42	56	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	4.59	22041.6	\$3,769.11	\$135.00	\$7,560.00	2.69	12902.4	\$2,206.31	3.43	
4.1	Women's Restroom	4800	2	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	0.26	1,248.0	\$213.41	2	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.16	787.2	\$134.61	\$120.00	\$240.00	0.10	460.8	\$78.80	3.05	
9		4800	2	1	4' Channel, 1 Lamp 34w T12, Magnetic Ballast	50	0.10	480.0	\$82.08	2	1	4' Channel, 1 Lamp 32w T8, Elect. Ballast, Surface Mnt., No Lamp	28	0.06	268.8	\$45.96	\$75.00	\$150.00	0.04	211.2	\$36.12	4.15	
10	Booth	3000	2	2	1x4 2 Lamp 34w T12, Magnetic Ballast, Recessed, Prismatic	80	0.16	480.0	\$82.08	2	2	1x4, 2 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	58	0.12	348	\$59.51	\$100.00	\$200.00	0.04	132	\$22.57	8.86	
4.1	Men's Restroom	4800	2	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	0.26	1,248.0	\$213.41	2	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.16	787.2	\$134.61	\$120.00	\$240.00	0.10	460.8	\$78.80	3.05	
9		4800	2	1	4' Channel, 1 Lamp 34w T12, Magnetic Ballast	50	0.10	480.0	\$82.08	2	1	4' Channel, 1 Lamp 32w T8, Elect. Ballast, Surface Mnt., No Lamp	28	0.06	268.8	\$45.96	\$75.00	\$150.00	0.04	211.2	\$36.12	4.15	
	Court Room	3000	65	1	Recessed Down Light, 100w A21 Long Neck	100	6.50	19,500.0	\$3,334.50	65	1	18w CFL Dimmable	20	1.30	3900	\$666.90	\$20.00	\$1,300.00	5.20	15600	\$2,667.60	0.49	
		3000	10	1	Recessed Down Light, 100w Halogen	100	1.00	3,000.0	\$513.00	10	1	18w CFL Dimmable	20	0.20	600	\$102.60	\$20.00	\$200.00	0.80	2400	\$410.40	0.49	
13	BOE GPS Room	4800	4	2	2x4 2 Lamp 34w T12, Magnetic Ballast, Recessed, Prismatic	80	0.32	1,536.0	\$262.66	4	2	2x4 2 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	58	0.23	1113.6	\$190.43	\$100.00	\$400.00	0.09	422.4	\$72.23	5.54	

4.1	BOE Conf. Room	3000	8	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	1.04	3,120.0	\$533.52	8	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.66	1968	\$336.53	\$120.00	\$960.00	0.38	1152	\$196.99	4.87
4.1	BOE Offices, Common Area	4800	20	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	2.60	12,480.0	\$2,134.08	20	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.64	7872	\$1,346.11	\$120.00	\$2,400.00	0.96	4608	\$787.97	3.05
4.1	BOE Side Offices	4800	12	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	1.56	7,488.0	\$1,280.45	12	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.98	4723.2	\$807.67	\$120.00	\$1,440.00	0.58	2764.8	\$472.78	3.05
4.1	Kitchen	4800	3	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	0.39	1,872.0	\$320.11	3	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.25	1180.8	\$201.92	\$120.00	\$360.00	0.14	691.2	\$118.20	3.05
4.1	Copy Room	4800	3	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	0.39	1,872.0	\$320.11	3	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.25	1180.8	\$201.92	\$120.00	\$360.00	0.14	691.2	\$118.20	3.05
4.1	BOE Large Office	4800	7	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	0.91	4,368.0	\$746.93	7	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.57	2755.2	\$471.14	\$120.00	\$840.00	0.34	1612.8	\$275.79	3.05
4.1	Community Room	4800	18	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	2.34	11,232.0	\$1,920.67	18	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.48	7084.8	\$1,211.50	\$120.00	\$2,160.00	0.86	4147.2	\$709.17	3.05
9	Storage Closet	1200	3	1	4' Channel, 1 Lamp 34w T12, Magnetic Ballast	50	0.15	180.0	\$30.78	3	1	4' Channel, 1 Lamp 32w T8, Elect. Ballast, Surface Mnt., No Lens	28	0.08	100.8	\$17.24	\$75.00	\$225.00	0.07	79.2	\$13.54	16.61
4.1	Men's Restroom	4800	2	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	0.26	1,248.0	\$213.41	2	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.16	787.2	\$134.61	\$120.00	\$240.00	0.10	460.8	\$78.80	3.05
11		4800	1	2	2x2 2 Lamp 34w T12 Utube, Recessed, Prismatic	80	0.08	384.0	\$65.66	1	3	2x2 3 Lamp 17w T8, Elect. Ballast, Recessed, Prismatic	47	0.05	225.6	\$38.58	\$100.00	\$100.00	0.03	158.4	\$27.09	3.69
4		4800	2	3	2x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Prismatic	130	0.26	1,248.0	\$213.41	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	787.2	\$134.61	\$120.00	\$240.00	0.10	460.8	\$78.80	3.05
9	Storage Closet	1200	3	1	4' Channel, 1 Lamp 34w T12, Magnetic Ballast	50	0.15	180.0	\$30.78	3	1	4' Channel, 1 Lamp 32w T8, Elect. Ballast, Surface Mnt., No Lens	28	0.08	100.8	\$17.24	\$75.00	\$225.00	0.07	79.2	\$13.54	16.61
14	Employee's Kitchen	3000	2	4	2x4 4 Lamp 34w T12, Magnetic Ballast, Recessed, Prismatic	160	0.32	960.0	\$164.16	2	3	2x4 3 Lamp 32w T8 w/Specular Reflector, Elect. Ballast, Recessed, Prismatic	82	0.16	492	\$84.13	\$130.00	\$260.00	0.16	468	\$80.03	3.25
4.1	Lunch Room	3000	10	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	1.30	3,900.0	\$666.90	10	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.82	2460	\$420.66	\$120.00	\$1,200.00	0.48	1440	\$246.24	4.87
4.1	Women's Restroom	4800	4	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	0.52	2,496.0	\$426.82	4	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.33	1574.4	\$269.22	\$120.00	\$480.00	0.19	921.6	\$157.59	3.05
9		4800	2	1	4' Channel, 1 Lamp 34w T12, Magnetic Ballast	50	0.10	480.0	\$82.08	2	1	4' Channel, 1 Lamp 32w T8, Elect. Ballast, Surface Mnt., No Lens	28	0.06	268.8	\$45.96	\$75.00	\$150.00	0.04	211.2	\$36.12	4.15
9	Storage Closet	1200	4	1	4' Channel, 1 Lamp 34w T12, Magnetic Ballast	50	0.20	240.0	\$41.04	4	1	4' Channel, 1 Lamp 32w T8, Elect. Ballast, Surface Mnt., No Lens	28	0.11	134.4	\$22.98	\$75.00	\$300.00	0.09	105.6	\$18.06	16.61
9	Office Storage	1200	2	1	4' Channel, 1 Lamp 34w T12, Magnetic Ballast	50	0.10	120.0	\$20.52	2	1	4' Channel, 1 Lamp 32w T8, Elect. Ballast, Surface Mnt., No Lens	28	0.06	67.2	\$11.49	\$75.00	\$150.00	0.04	52.8	\$9.03	16.61
4.1	Mayor's Office	4800	4	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	0.52	2,496.0	\$426.82	4	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.33	1574.4	\$269.22	\$120.00	\$480.00	0.19	921.6	\$157.59	3.05
4.1	Court Clerk	4800	8	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	1.04	4,992.0	\$853.63	8	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.66	3148.8	\$538.44	\$120.00	\$960.00	0.38	1843.2	\$315.19	3.05
4.1	Tax Collector	4800	8	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	1.04	4,992.0	\$853.63	8	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.66	3148.8	\$538.44	\$120.00	\$960.00	0.38	1843.2	\$315.19	3.05
4.1	Construction Office	4800	16	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	2.08	9,984.0	\$1,707.26	16	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.31	6297.6	\$1,076.89	\$120.00	\$1,920.00	0.77	3686.4	\$630.37	3.05

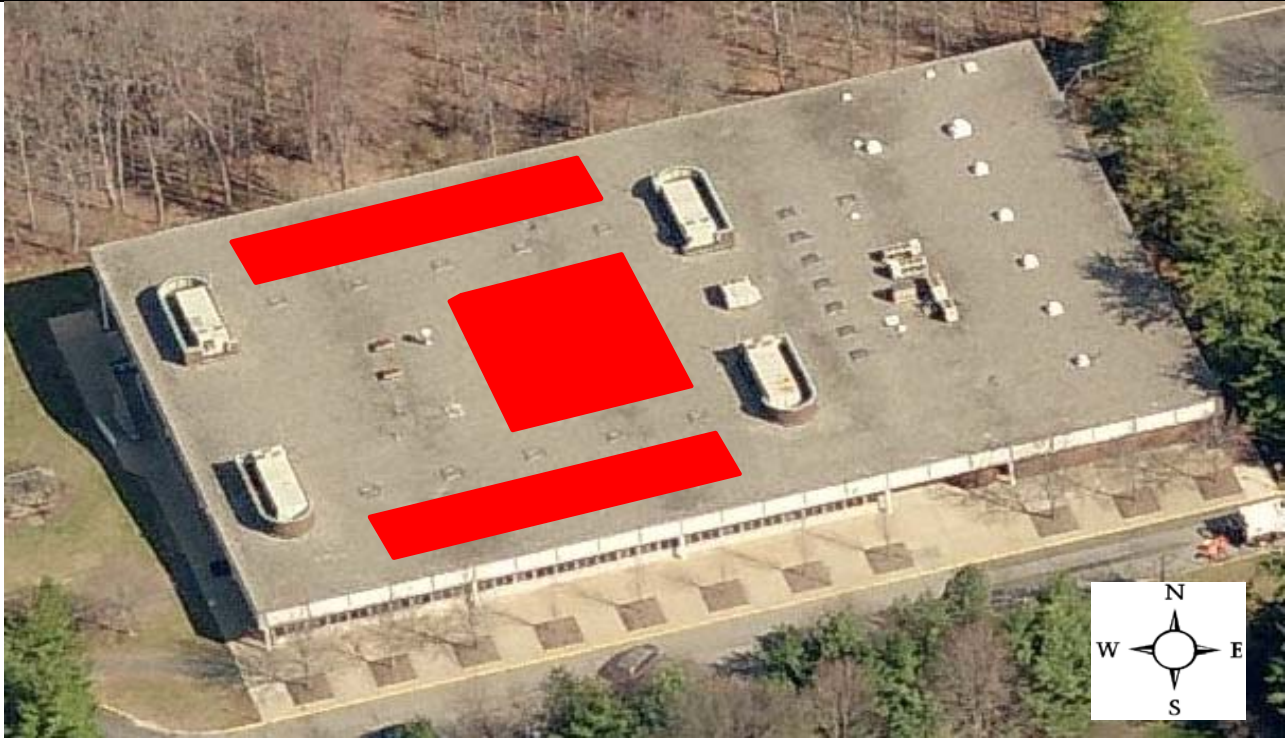
4.1	Records Room	4800	9	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	1.17	5,616.0	\$960.34	9	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.74	3542.4	\$605.75	\$120.00	\$1,080.00	0.43	2073.6	\$354.59	3.05
4.1	Admin. Records	3000	6	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	0.78	2,340.0	\$400.14	6	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.49	1476	\$252.40	\$120.00	\$720.00	0.29	864	\$147.74	4.87
4.1	Tax Assessor	4800	8	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	1.04	4,992.0	\$853.63	8	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.66	3148.8	\$538.44	\$120.00	\$960.00	0.38	1843.2	\$315.19	3.05
4.1	Admin. Common Area	4800	17	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	2.21	10,608.0	\$1,813.97	17	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.39	6691.2	\$1,144.20	\$120.00	\$2,040.00	0.82	3916.8	\$669.77	3.05
4.1	Side Offices	4800	18	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	2.34	11,232.0	\$1,920.67	18	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.48	7084.8	\$1,211.50	\$120.00	\$2,160.00	0.86	4147.2	\$709.17	3.05
4.1	Restroom	4800	1	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	0.13	624.0	\$106.70	1	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.08	393.6	\$67.31	\$120.00	\$120.00	0.05	230.4	\$39.40	3.05
9	Storage Closet	1200	1	1	4' Channel, 1 Lamp 34w T12, Magnetic Ballast	50	0.05	60.0	\$10.26	1	1	4' Channel, 1 Lamp 32w T8, Elect. Ballast, Surface Mnt., No Lens	28	0.03	33.6	\$5.75	\$75.00	\$75.00	0.02	26.4	\$4.51	16.61
4.1	Admin. Conference Room	3000	8	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	1.04	3,120.0	\$533.52	8	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.66	1968	\$336.53	\$120.00	\$960.00	0.38	1152	\$196.99	4.87
14.1	Recreation Director	4800	3	4	2x4 4 Lamp 34w T12, Magnetic Ballast, Recessed, No Lens	160	0.48	2,304.0	\$393.98	3	3	2x4 3 Lamp 32w T8 w/Specular Reflector, Elect. Ballast, Recessed, No Lens	82	0.25	1180.8	\$201.92	\$130.00	\$390.00	0.23	1123.2	\$192.07	2.03
14	Storage Closet	1200	3	4	2x4 4 Lamp 34w T12, Magnetic Ballast, Recessed, Prismatic	160	0.48	576.0	\$98.50	3	3	2x4 3 Lamp 32w T8 w/Specular Reflector, Elect. Ballast, Recessed, Prismatic	82	0.25	295.2	\$50.48	\$130.00	\$390.00	0.23	280.8	\$48.02	8.12
4.1	Municipal Prosecutor	4800	4	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	0.52	2,496.0	\$426.82	4	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.33	1574.4	\$269.22	\$120.00	\$480.00	0.19	921.6	\$157.59	3.05
4.1	Judge's Chamber	3500	2	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	0.26	910.0	\$155.61	2	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.16	574	\$98.15	\$120.00	\$240.00	0.10	336	\$57.46	4.18
15	Mech. Room	4800	9	2	4' Channel, 2 Lamp 34w T12, Magnetic Ballast, Pendant Mnt., No Lens	80	0.72	3,456.0	\$590.98	9	2	4' Channel, 2 Lamp 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.52	2505.6	\$428.46	\$100.00	\$900.00	0.20	950.4	\$162.52	5.54
4.1	Large Seigert Storage	2200	6	3	1x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Parabolic	130	0.78	1,716.0	\$293.44	6	3	1x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.49	1082.4	\$185.09	\$120.00	\$720.00	0.29	633.6	\$108.35	6.65
1	Room 203	2200	12	1	Recessed Down Light, 75w PAR FL Lamp	75	0.90	1,980.0	\$338.58	12	1	18w R30 CFL Flood	20	0.24	528	\$90.29	\$9.00	\$108.00	0.66	1452	\$248.29	0.43
16	Gym	4800	21	8	4x4 8 Lamp 34w T12, Magnetic Ballast, Pendant Mnt., Prismatic	320	6.72	32,256.0	\$5,515.78	21	4	HiBay T5 HO	229	4.81	23083.2	\$3,947.23	\$400.00	\$8,400.00	1.91	9172.8	\$1,568.55	5.36
17		4800	12	1	Round Back Track Head, 75w BR30 Lamp	75	0.90	4,320.0	\$738.72	12	1	18w R30 CFL Flood	20	0.24	1152	\$196.99	\$0.00	\$0.00	0.66	3168	\$541.73	0.00
1		4800	18	1	Recessed Down Light, 75w PAR FL Lamp	75	1.35	6,480.0	\$1,108.08	18	1	18w R30 CFL Flood	20	0.36	1728	\$295.49	\$9.00	\$162.00	0.99	4752	\$812.59	0.20
15	Storage 205	1200	1	2	4' Channel, 2 Lamp 34w T12, Magnetic Ballast, Pendant Mnt., No Lens	80	0.08	96.0	\$16.42	1	2	4' Channel, 2 Lamp 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.06	69.6	\$11.90	\$100.00	\$100.00	0.02	26.4	\$4.51	22.15
10	Wrestling Room	4800	14	2	1x4 2 Lamp 34w T12, Magnetic Ballast, Recessed, Prismatic	80	1.12	5,376.0	\$919.30	14	2	1x4, 2 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	58	0.81	3897.6	\$666.49	\$100.00	\$1,400.00	0.31	1478.4	\$252.81	5.54
10	Girl's Restroom	4800	4	2	1x4 2 Lamp 34w T12, Magnetic Ballast, Recessed, Prismatic	80	0.32	1,536.0	\$262.66	4	2	1x4, 2 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	58	0.23	1113.6	\$190.43	\$100.00	\$400.00	0.09	422.4	\$72.23	5.54

18	Senior Center Lobby	6760	12	1	Pendant Mnt 32w T8 Elect. Ballast, Direct/Indirect	28	0.34	2,271.4	\$388.40	12	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.34	2271.36	\$388.40	0.00
12.1	Senior Center Corridor	6760	22	3	2x4 3 Lamp 34w T12, Magnetic Ballast, Recessed, Prismatic	130	2.86	19,333.6	\$3,306.05	22	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	1.80	12195.04	\$2,085.35	\$120.00	\$2,640.00	1.06	7138.56	\$1,220.69	2.16
10	SC Classroom 2	4800	33	2	1x4 2 Lamp 34w T12, Magnetic Ballast, Recessed, Prismatic	80	2.64	12,672.0	\$2,166.91	33	2	1x4, 2 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	58	1.91	9187.2	\$1,571.01	\$100.00	\$3,300.00	0.73	3484.8	\$595.90	5.54
1		4800	4	1	Recessed Down Light, 75w PAR FL Lamp	75	0.30	1,440.0	\$246.24	4	1	18w R30 CFL Flood	20	0.08	384	\$65.66	\$9.00	\$36.00	0.22	1056	\$180.58	0.20
1	Restroom	3000	1	1	Recessed Down Light, 75w PAR FL Lamp	75	0.08	225.0	\$38.48	1	1	18w R30 CFL Flood	20	0.02	60	\$10.26	\$9.00	\$9.00	0.06	165	\$28.22	0.32
10	SC Classroom 1	4800	31	2	1x4 2 Lamp 34w T12, Magnetic Ballast, Recessed, Prismatic	80	2.48	11,904.0	\$2,035.58	31	2	1x4, 2 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	58	1.80	8630.4	\$1,475.80	\$100.00	\$3,100.00	0.68	3273.6	\$559.79	5.54
1		4800	4	1	Recessed Down Light, 75w PAR FL Lamp	75	0.30	1,440.0	\$246.24	4	1	18w R30 CFL Flood	20	0.08	384	\$65.66	\$9.00	\$36.00	0.22	1056	\$180.58	0.20
1	Restroom	3000	1	1	Recessed Down Light, 75w PAR FL Lamp	75	0.08	225.0	\$38.48	1	1	18w R30 CFL Flood	20	0.02	60	\$10.26	\$9.00	\$9.00	0.06	165	\$28.22	0.32
10	Senior Center	4800	51	2	1x4 2 Lamp 34w T12, Magnetic Ballast, Recessed, Prismatic	80	4.08	19,584.0	\$3,348.86	51	2	1x4, 2 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	58	2.96	14198.4	\$2,427.93	\$100.00	\$5,100.00	1.12	5385.6	\$920.94	5.54
10	SC Offices	4800	14	2	1x4 2 Lamp 34w T12, Magnetic Ballast, Recessed, Prismatic	80	1.12	5,376.0	\$919.30	14	2	1x4, 2 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	58	0.81	3897.6	\$666.49	\$100.00	\$1,400.00	0.31	1478.4	\$252.81	5.54
15	Storage	1200	20	2	4' Channel, 2 Lamp 34w T12, Magnetic Ballast, Pendant Mnt., No Lens	80	1.60	1,920.0	\$328.32	20	2	4' Channel, 2 Lamp 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	1.16	1392	\$238.03	\$100.00	\$2,000.00	0.44	528	\$90.29	22.15
<b>Totals</b>			871	167			95.60	403,288	\$68,962.28	871	157			47.10	207,463	\$35,476.15		\$70,750.38	48.50	195825	\$33,486.13	2.11

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 - Chatham Municipal Building							
Location: Chatham, NJ							
Description: Photovoltaic System - Direct Purchase							
<b>Simple Payback Analysis</b>							
	<b>Photovoltaic System - Direct Purchase</b>						
Total Construction Cost	\$660,330						
Annual kWh Production	84,783						
Annual Energy Cost Reduction	\$14,498						
Annual SREC Revenue	\$29,674						
First Cost Premium	<b>\$660,330</b>						
Simple Payback:	<b>14.95</b> Years						
<b>Life Cycle Cost Analysis</b>							
Analysis Period (years):	25			Financing %:	0%		
Financing Term (mths):	0			Maintenance Escalation Rate:	3.0%		
Average Energy Cost (\$/kWh)	<b>\$0.171</b>			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	\$660,330	0	0	0	\$0	(660,330)	0
1	\$0	84,783	\$14,498	\$0	\$29,674	\$44,172	(\$616,158)
2	\$0	84,359	\$14,933	\$0	\$29,526	\$44,459	(\$571,700)
3	\$0	83,937	\$15,381	\$0	\$29,378	\$44,759	(\$526,941)
4	\$0	83,518	\$15,842	\$0	\$29,231	\$45,073	(\$481,867)
5	\$0	83,100	\$16,318	\$856	\$29,085	\$44,547	(\$437,321)
6	\$0	82,685	\$16,807	\$852	\$28,940	\$44,895	(\$392,426)
7	\$0	82,271	\$17,311	\$847	\$28,795	\$45,259	(\$347,167)
8	\$0	81,860	\$17,831	\$843	\$28,651	\$45,638	(\$301,529)
9	\$0	81,450	\$18,365	\$839	\$28,508	\$46,034	(\$255,494)
10	\$0	81,043	\$18,916	\$835	\$28,365	\$46,447	(\$209,048)
11	\$0	80,638	\$19,484	\$831	\$28,223	\$46,877	(\$162,171)
12	\$0	80,235	\$20,068	\$826	\$28,082	\$47,324	(\$114,847)
13	\$0	79,834	\$20,671	\$822	\$27,942	\$47,790	(\$67,057)
14	\$0	79,434	\$21,291	\$818	\$27,802	\$48,275	(\$18,782)
15	\$0	79,037	\$21,929	\$814	\$27,663	\$48,778	\$29,996
16	\$0	78,642	\$22,587	\$810	\$27,525	\$49,302	\$79,298
17	\$0	78,249	\$23,265	\$806	\$27,387	\$49,846	\$129,144
18	\$0	77,858	\$23,963	\$802	\$27,250	\$50,411	\$179,555
19	\$0	77,468	\$24,682	\$798	\$27,114	\$50,998	\$230,553
20	\$0	77,081	\$25,422	\$794	\$26,978	\$51,607	\$282,159
21	\$1	76,696	\$26,185	\$790	\$26,843	\$52,238	\$334,398
22	\$2	76,312	\$26,970	\$786	\$26,709	\$52,894	\$387,291
23	\$3	75,931	\$27,779	\$782	\$26,576	\$53,573	\$440,864
24	\$4	75,551	\$28,613	\$778	\$26,443	\$54,277	\$495,142
25	\$5	75,173	\$29,471	\$774	\$26,311	\$55,008	\$550,149
<b>Totals:</b>		1,617,482	\$389,564	\$13,193	\$566,119	\$1,210,479	\$942,489
<b>Net Present Value (NPV)</b>						<b>\$550,174</b>	
<b>Internal Rate of Return (IRR)</b>						<b>5.1%</b>	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW <sub>DC</sub>	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Chatham Municipal Bldg.	5200	Sunpower SPR230	319	14.7	4,691	73.37	84,783	10,527	15.64



 = Proposed PV Layout

Notes:

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



AC Energy  
&  
Cost Savings



Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	73.4 kW
DC to AC Derate Factor:	0.810
AC Rating:	59.4 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 <sup>2</sup> /day)	AC Energy (kWh)	Energy Value (\$)
1	2.39	4402	7.53
2	3.17	5337	9.13
3	4.07	7469	12.77
4	4.83	8275	14.15
5	5.70	9845	16.83
6	5.94	9621	16.45
7	5.77	9546	16.32
8	5.38	8841	15.12
9	4.65	7607	13.01
10	3.61	6262	10.71
11	2.35	3994	6.83
12	2.01	3584	6.13
Year	4.16	84783	144.98

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\*

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