



# **ENERGY AUDIT – FINAL REPORT**

## **GLOUCESTER CITY PUBLIC WORKS**

**615 BRICK STREET  
GLOUCESTER CITY, NJ 08030  
ATTN: MR. JACK LIPSETT**

**CEG PROPOSAL No. 9C08131**

## **CONCORD ENGINEERING GROUP**



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## I. EXECUTIVE SUMMARY

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

Gloucester City  
 Department of Public Works  
 615 Brick Street  
 Gloucester City, NJ 08030

Municipal Contact Person: Jack Lipsett  
 Facility Contact Person: Jim "Bowie" Johnson

This audit was performed in connection with the New Jersey Clean Energy Local Government Energy Audit Program. These energy audits are conducted to promote the office of Clean Energy's mission, 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	\$ 5,966
Natural Gas	\$ 9,974
#2 Fuel Oil	\$ 570
<b>Total</b>	<b>\$16,510</b>

The potential annual energy cost savings are shown below in Table 1. Be aware that the measures are not additive because of the interrelation of several of the measures. The cost of each measure for this level of auditing is  $\pm 20\%$  until detailed engineering, specifications, and hard proposals are obtained.

**Table 1**  
**Energy Conservation Measures (ECM's)**

ECM NO.	DESCRIPTION	COST <sup>A</sup>	ANNUAL SAVINGS	SIMPLE PAYBACK (YEARS)	SIMPLE RETURN ON INVESTMENT
1	Lighting Upgrade	\$4,326	\$1,408	3.1	47.8%
2	Install Compact Fluorescent Lamps	\$50	\$36	1.4	74.2%
3	Lighting Controls	\$330	\$50	6.6	14.5%
4	Install LED Exit Signs	\$69	\$120	0.6	130.1%
5	Shop Heater Replacement – Infrared Heaters	\$12,300	\$1,733	7.1	13.5%
6	High-Efficiency Gas-Fired Furnace	\$5,800	\$316	18.4	(0.4%)

**Note A:** Includes applicable incentive and maintenance savings

The estimated demand and energy savings are shown below in Table 2. The information in this table corresponds to the ECM's in Table 1.

**Table 2**  
**Estimated Energy Savings**

ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION			
		ELECT DEMAND (KW)	ELECT CONSUMPTION (KWH)	NAT GAS (THERMS)	#2 FUEL OIL (GALLONS)
1	Lighting Upgrade	4.64	7,741	-	-
2	Install Compact Fluorescent Lamps	0.23	196	-	-
3	Lighting Controls	-	272	-	-
4	Install LED Exit Signs	0.08	657	-	-
5	Shop Heater Replacement – Infrared Heaters	-	356	490	-
6	High-Efficiency Gas-Fired Furnace	-	-	(153)	161

Recommendation:

Concord Engineering Group strongly recommends the implementation of all ECM's that provide a calculated simple payback at or under seven (7) years. The potential energy and cost savings from these ECM's are too great to pass upon. The following Energy Conservation Measures are recommended for Gloucester City's Public Works Facility:

- **ECM #1:** Lighting Upgrade
- **ECM #2:** Install Compact Fluorescent Lamps
- **ECM #3:** Lighting Controls
- **ECM #4:** Install LED Exit Signs

The CEG energy audit team recommends the implementation of all the lighting Energy Conservation Measures which include ECM #1 thru ECM # 4 with a combined simple payback of 2.9 years. CEG also has a secondary recommendation to move forward with ECM #5: Shop Heater Replacement – Infrared Heaters. With a simple payback of 7.1 years only if the owner believes this upgrade would be valuable for the facility operation.

## II. INTRODUCTION

This comprehensive energy audit covers the 9,600 square foot Department of Public Works complex that includes the DPW garage building and its associated spaces in addition to the superintendent's administration building and its associated spaces. The DPW garage is constructed of concrete block, pre-fabricated metal siding and some areas are wood structures. The Superintendent's Administration building is typical of wood frame construction, with vinyl siding and asphalt shingles. The DPW Garage was built in 1978 and the Superintendent's Office in 2005.

The first energy auditing task was to collect and review 2008 utility energy data for electricity, natural gas and #2 fuel oil. This information was used to analyze operational characteristics, calculate energy benchmarks for comparison to industry averages, estimate savings potential, and establish a baseline to monitor the effectiveness of implemented measures. A computer spreadsheet was used to enter, sum, and calculate benchmarks and to graph utility information (see Appendix A).

The Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year (BTU/ft<sup>2</sup>/yr) and can be 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 annual consumption of all fuels to BTU's then dividing by the area (gross square footage) of the building. EUI is a good indicator of the relative potential for energy savings. A comparatively low EUI indicates less potential for large energy savings. Blueprints (where available) were obtained from the municipal and were utilized to calculate/verify the gross area of the facility.

After gathering the utility data and calculating the EUI, the next step in the audit process is obtaining Architectural and Engineering drawings (where available). By reviewing the Architectural and Engineering drawings, questions regarding the building envelope, lighting systems/controls, HVAC equipment and controls are noted. These questions are then compared to the energy usage profiles developed during the utility data gathering step. Furthermore, 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. After this information is gathered the next step in the process is the site visit.

The site visit was spent inspecting the actual systems and answering specific questions from the preliminary review. The building manager provided occupancy schedules, O & M practices, the building energy management program, and other information that has an impact on energy consumption.

The post-site work includes evaluation of the information gathered during the site visit, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on mechanical, lighting and building envelope improvements.

### III. METHOD OF ANALYSIS

CEG completed the preliminary audit tasks noted in Section II preparing for the site survey. The site survey is a critical input in deciphering where energy opportunities exist within a facility. The auditor walks the entire site to inventory the building envelope (roof, windows, etc.), the heating, ventilation, and air conditioning equipment (HVAC), the lighting equipment, other facility-specific equipment, and to gain an understanding of how each facility is used.

The collected data is then processed using energy engineering calculations to calculate the anticipated energy usage for the proposed energy conservation measures (ECMs). The actual energy usage is entered directly from the utility bills provided by the Owner. The anticipated energy usage is compared to the actual usage to determine energy savings for the proposed ECMs.

It is pertinent to note, that the savings noted in this report are not duplicative. The savings for each recommendation may actually be higher if the individual recommendations were installed instead of the entire project. For example, the lighting module calculates the change in wattage and multiplies it by the new operating hours instead of the existing operating hours (if there was a change in the hours at all). The lighting controls module calculates the change in hours and multiplies it by the new system wattage instead of the existing wattage. Therefore, if you chose to install the recommended lighting system but not the lighting controls, the savings achieved with the new lighting system would actually be higher because there would have been no reduction in the hours of use.

The same principal follows for heating, cooling, and temperature recommendations – even with fuel switching. If there are recommendations to change the temperature settings to reduce fuel use, then the savings for the heating/cooling equipment recommendations are reduced, as well.

Our thermal module calculates the savings for temperature reductions utilizing automated engineering calculations within Microsoft Excel™ spreadsheets. The savings are calculated in “output” values – meaning energy, not fuel savings. To show fuel savings we multiply the energy values times the fuel conversion factor (these factors are different for electricity, natural gas, fuel oil, etc.) and also take into account the heating/cooling equipment efficiency. The temperature recommendation savings are lower when the heating/cooling equipment is more efficient or is using a cheaper fuel.

Thermal recommendations (insulation, windows, etc.) are evaluated by taking the difference in the thermal load due to reduced heat transfer. Again, the “thermal load” is the thermal load after the other recommendations have been accounted for.

Lastly, installation costs, refer to Appendix B, are then applied to each recommendation and simple paybacks are calculated. Costs are derived from Means Cost Data, other industry publications, and local contractors and suppliers. The NJ SmartStart Building® program incentives (refer to Appendix C) are calculated for the appropriate ECM's and subtracted from the installed cost prior to calculation of the simple payback. In addition, where applicable, maintenance cost savings are estimated and applied to the net savings. Simple return on

investment is calculated using the standard formula of the difference of gains minus investments, divided by the investments. Included within the gains are the annual energy savings, utility incentives and maintenance savings as a total sum. The calculation is completed assuming the project is 100% direct purchased by the Owner with an energy cost escalation of 2.4% for natural gas and 2.2% for electricity.

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## IV. HISTORIC ENERGY CONSUMPTION/COST

### A. Energy Usage / Tariffs

Table 3 and Figure 1 represent the electrical usage for the surveyed facility from January-08 to December-08. Public Service Electric and Gas Company (PSE&G) provides electricity to the facility under the General Lighting and Power Service (GLP) Rate Schedule. This electric rate has a component for consumption that is measured in kilowatt-hours (kWh). It is calculated by multiplying the wattage of the equipment times the hours that it operates. For example, a 1,000 Watt lamp operating for 5 hours would measure 5,000 Watt-hours. Since one kilowatt is equal to 1,000 Watts, the measured consumption would be 5 kWh. 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 most current rate structure available.

Table 4 and Figure 2 show the natural gas energy usage for the surveyed Department of Public Works facility from January-08 to December-08. Woodruff Energy supplies the natural gas from the wellhead to the PSE&G pipelines on the GSG (general service gas) rate structure. PSE&G charges a rate per therm for delivery of the natural gas via their pipelines to the burners.

In addition, #2 Burner Fuel Oil is purchased for the oil furnace in the parks/recreation rooms within the Parks and Recreation Office. The owner provided CEG with oil delivery information for 2008. The data provided indicated approximately 160.5 gallons was delivered in total for 2008.

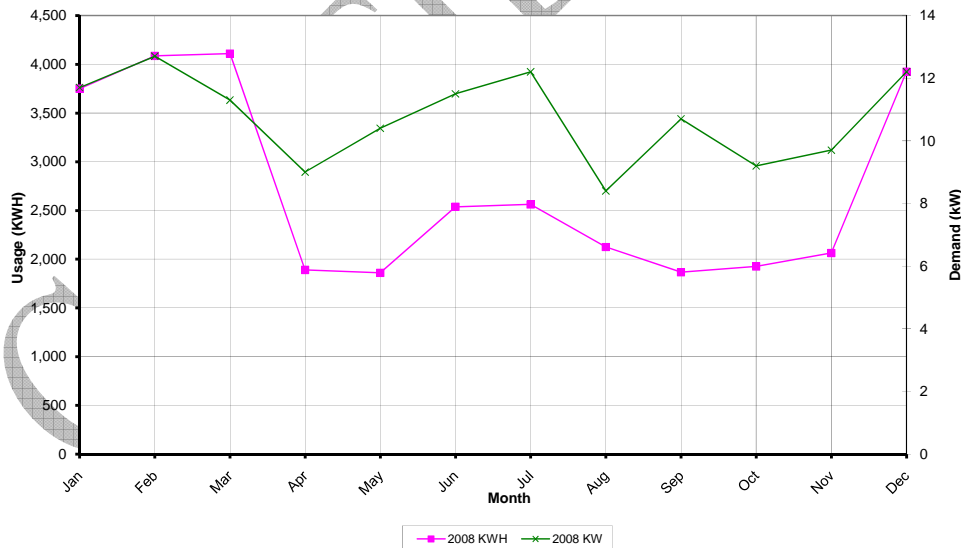
<u>Description</u>	<u>Average</u>
Electricity	18.2¢ / kWh
Natural Gas	\$1.66 / Therm
#2 Fuel Oil	\$3.55 / Gallon

**Table 3  
Electricity Billing Data**

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
1/08	3,750	12	\$477
2/08	4,086	13	\$531
3/08	4,110	11	\$517
4/08	1,890	9	\$263
5/08	1,860	10	\$269
6/08	2,538	12	\$541
7/08	2,562	12	\$562
8/08	2,124	8	\$470
9/08	1,866	11	\$445
10/08	1,926	9	\$317
11/08	2,064	10	\$1,029
12/08	3,924	12	\$543
<b>Totals</b>	<b>32,700</b>	<b>13 Max</b>	<b>\$5,966</b>

**Figure 1  
Electricity Usage Profile**

Public Works  
Electric Usage Profile  
January through December of 2008

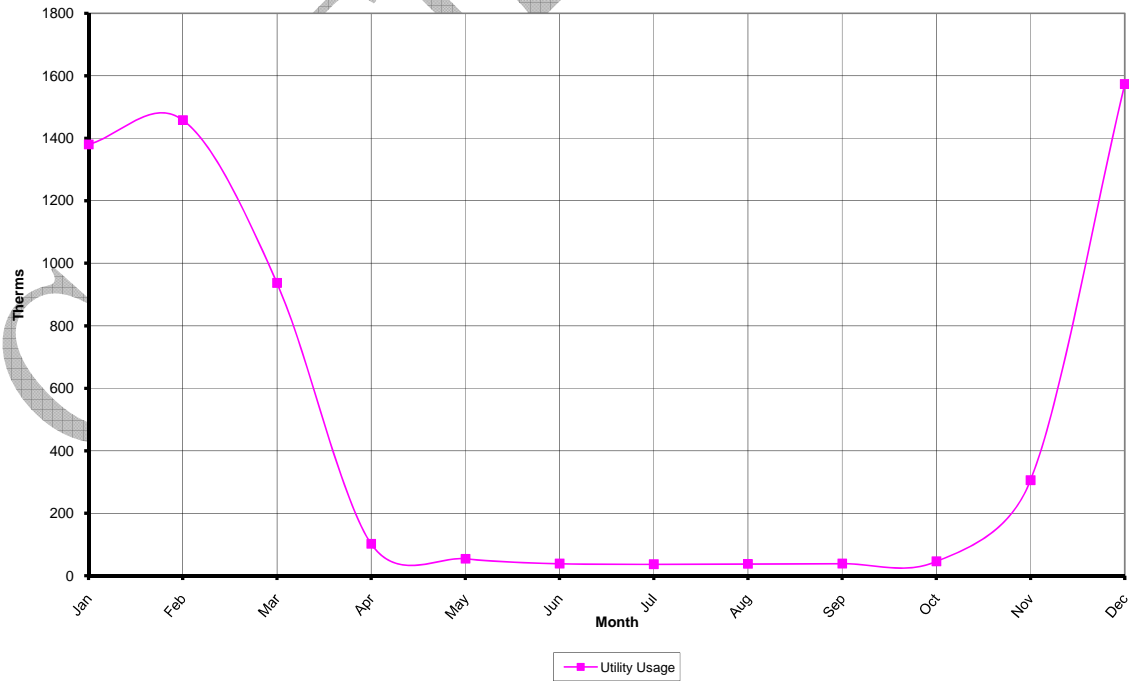


**Table 4**  
**Natural Gas Billing Data**

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
1/08	1380	\$2,211
2/08	1458	\$2,335
3/08	937	\$1,503
4/08	102	\$163
5/08	54	\$91
6/08	39	\$81
7/08	37	\$83
8/08	38	\$71
9/08	39	\$68
10/08	46	\$74
11/08	305	\$434
12/08	1,574	\$2,859
<b>Totals</b>	<b>6,009</b>	<b>\$9,974</b>

**Figure 2**  
**Natural Gas Usage Profile**

Public Works  
Gas Usage Profile  
January through December of 2008



## B. Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's energy utilization per square foot of building. This calculation is completed by converting all utility usage (gas, electric, oil) consumed by a building over a specified time period, typically 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 amongst building of similar type. The EUI for this facility is calculated as follows:

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

$$\begin{aligned} \text{Electric} &= ((32,700 \text{ kWh}) * (1000 \text{ W/kW}) * (3.414 \text{ Btu/h} / 1 \text{ W})) / (1000 \text{ Btu/h} / 1 \text{ kBtu/h}) \\ &= 111,638 \text{ kBtu} \end{aligned}$$

$$\text{Gas} = ((6,009 \text{ therms}) * (100,000 \text{ Btu/Therm})) / (1000 \text{ Btu/h} / 1 \text{ kBtu/h}) = 600,900 \text{ kBtu}$$

$$\text{Oil} = ((160.5 \text{ gallons}) * (140,000 \text{ Btu/Gallon})) / (1000 \text{ Btu/h} / 1 \text{ kBtu/h}) = 22,470 \text{ kBtu}$$

$$\text{Building EUI} = \frac{(111,638 \text{ kBtu} + 22,470 \text{ kBtu} + 600,900 \text{ kBtu})}{9,600 \text{ SF}} = \frac{735,008 \text{ kBtu}}{9,600 \text{ SF}}$$

$$\text{Department of Public Works Building EUI} = \underline{76.56 \text{ kBtu/SF}}$$

### 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 you to track and assess 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 more emphasis is being placed throughout multiple arenas 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. Therefore, it is vital that local government municipalities assess their energy usage, benchmark this usage utilizing Portfolio Manager, set priorities and goals to lessen their energy usage and move forward with these priorities and goals. Saving energy will in-turn save the environment.

In accordance with the Local Government Energy Audit Program, CEG has created an Energy Start account for the municipal in order to allow the municipal access to monitoring their yearly energy usage as it compares to facilities of similar type. This account can be used to calculate the EUI which can be used to monitor the energy performance of the building. The account can be accessed at the following address; the username and password are also listed below:

<https://www.energystar.gov/istar/pmpam/index.cfm?fuseaction=login.login>

Username: gloucestercity

Password: lgeaceg2009

Specific building types are detailed on the ENERGY STAR website. Non-typical buildings are covered by an "Other" category. The "Other" category is used if your building type or a section of the building is not represented by one of the specific categories. An Energy Performance Rating cannot be calculated if more than 10% of a building is classified as "Other." The majority of the Public Works Facility would be classified as "Other" and therefore cannot be given an Energy Performance Rating. Portfolio manager can still be used to track the buildings energy use index.

Refer to Appendix D for detailed energy benchmarking report entitled "STATEMENT OF ENERGY PERFORMANCE."

## V. FACILITY DESCRIPTION

The Gloucester City Department of Public Works building consists of the supervisor's office, manager's office, tool room, storage rooms, medium-bay mechanic's shop, a garage for storage of road equipment, etc.; totaling approximately 9,600 SF. The Public Works buildings are single story pre-fabricated steel and concrete structures. The original facility was built in 1978 and the superintendent's office in 2005. The facility is typically occupied from 7 AM until approximately 5 PM except during winter snow removal.

### Heating System

The Manager of Public Works office, lunchroom, restroom, etc. are heated by electric strip heaters. The shop and garage are heated by Reznor gas-fired unit heaters. The Parks/Recreation areas are heated by an oil-fired furnace. The Superintendent's office is heated with a gas-fired furnace.

### Domestic Hot Water

Domestic hot water for the garage restroom/shower is provided by a Bradford White, gas-fired hot water heater with 50-gallon capacity and rated at 40,000 Btu/hour input. The restroom in the Superintendent's office is served by a Bradford White electric water heater with a 30-gallon capacity.

### Cooling System

Cooling in the Manager of Public Works office is performed by window AC unit rated at 12,000 BTUH. Cooling for the Superintendent's office is provided by a Rheem split condensing unit rated at 30,000 BTUH.

### Lighting

The offices within the DPW Garage are lit via 2-foot by 4-foot lay-in fixtures containing T12 fluorescent lamps and magnetic ballasts. Some areas are also lit by incandescent lamps. Standard switching is utilized and there are no other types of lighting controls present. The garage and medium-bay areas are lit via 1-foot by 8-foot fixtures containing T12 lamps and magnetic ballasts. Adjacent areas to the garage and medium-bay areas are also lit with T12 fixtures of various size and type containing magnetic ballasts. Standard wall switching is utilized for lighting control.

The Superintendent's office is lit with 2-foot x 4-foot lay-in fixtures containing T-8 lamps and electronic ballasts. Standard switching is utilized and there are not other types of lighting controls present.

The exit signs throughout the DPW Garage contain incandescent lamps and consume an estimated 30 watts of electricity per sign.

The exit signs in the Superintendent's office are LED type fixtures.

The exterior lighting for the DPW Garage is mounted on the building and consists of 250 Watt Metal Halide fixtures.

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## VI. MAJOR EQUIPMENT LIST

Equipment denoted by an asterisk indicates an estimate of the equipment ratings due to equipment inaccessibility, worn nameplates, lack of nameplates, etc.

**Table 5 thru 7  
Existing Equipment Listing**

HEATING EQUIPMENT							
Description	Qty	Location	Rated Capacity (BTUH)	Fuel Type	Approx. Age (yrs)	ASHRAE Service Life (yrs)	Remaining Life (yrs)
Armstrong Oil Furnace	1	Parks and Recreation	95,000	#2 Fuel Oil	30	18	(12)
Reznor Unit Heaters	7	Public Works Garage	35,000	NG	30	18	(12)
RHEEM 90 Plus Gas-fired furnace	1	Superintendent's Office	65,000	NG	3	18	15

COOLING EQUIPMENT								
Description	Qty	Location	Cooling Capacity (Tons)	Cooling Capacity (BTUH)	Fuel Type	Approx. Age (yrs)	ASHRAE Service Life (yrs)	Remaining Life (yrs)
Window AC Unit	1	Parks and Recreation	1	12,000	Electric	8	10	2
RHEEM Condensing Unit Model # RALA-030JA	1	Superintendent's Office	2.5	30,000	Electric	3	15	12

DOMESTIC HOT WATER SYSTEM							
Description	Qty	Location	Capacity	Fuel Type	Approx. Age (yrs)	ASHRAE Service Life (yrs)	Remaining Life (yrs)
Bradford White Energy Saver M-I503	1	Public Works Garage	50 gallon	NG	6	12	6
Bradford White MI-30L6DS13	1	Superintendent's Office	30 gallon	Electric	3	12	9

Note: Equipment noted as having a negative (#) remaining life is considered past its standard service life as described in 2007 ASHRAE Applications Handbook and is most likely a good candidate for replacement.

## VII. ENERGY CONSERVATION MEASURES

### ECM #1: Lighting Upgrade

#### Description:

New fluorescent lamps and ballasts are available as direct replacements for the existing lamps and ballasts. A simple change from the old to the new can provide substantial savings. A typical drop-ceiling lay in fixture with four, 4-foot lamps (40 Watt lamps) has a total wattage of 188 Watts. By retrofitting with new lamps, reflector and electronic ballasts the total wattage would be reduced to about 91 Watts per fixture and the space light levels and light quality would increase by about 15% and 35%, respectively.

CEG recommends a replacement of the existing fixtures within the DPW Garage 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 Municipality on electrical costs due to the better performance of the electronic ballasts. In addition to functional cost savings, the fixture replacement will also provide operational cost savings. The operational cost savings will be realized through the lesser number of lamps that will be required to be replaced per year. The expected lamp life of a T8 lamp, approximately 30,000 burn-hours, in comparison to the existing T12 lamps, approximately 20,000 burn-hours, will provide the Municipality with fewer lamps to replace per year. Based on the operating hours of this portion of the facility, approximately 2,080 hours per year, the Municipality will be changing approximately 33% less lamps per year.

#### Energy Savings Calculations:

A detailed Investment Grade Lighting Audit can be found in Appendix E that outlines the proposed retrofits, costs, savings, and payback periods.

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

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

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

$$\text{Smart Start}^{\text{®}} \text{ Incentive} = (42 \times \$ 25) + (9 \times \$ 30) = \$1,320$$

Maintenance Savings are calculated as follows:

$$\text{Maintenance Savings} = (\# \text{ of lamps} \times \% \text{ reduction} \times \$ \text{ per lamp}) + \text{Installation Labor}$$

$$\text{Maintenance Savings} = (111 \times 33\% \text{ reduction} \times \$ 2.00) + (\$20 \times 51) = \$1,094$$

**Energy Savings Summary:**

<b>ECM #1 - ENERGY SAVINGS SUMMARY</b>	
<b>Installation Cost (\$):</b>	\$6,740
<b>NJ Smart Start Equipment Incentive (\$):</b>	(\$1,320)
<b>Maintenance Savings (\$):</b>	(\$1,094)
<b>Net Installation Cost (\$):</b>	\$4,326
<b>Total Energy Savings (\$ / yr):</b>	\$1,408
<b>Simple Payback (yrs):</b>	3.1
<b>Simple Return on Investment:</b>	47.8%

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## ECM #2: Install Compact Fluorescent Lamps

### Description:

Compact fluorescent lamps (CFL's) were created to be direct replacements for the standard incandescent lamps which are common to table lamps, spot lights, hi-hats, bathroom vanity lighting, etc. The light output of the CFL has been designed to resemble the incandescent lamp. The color rendering index (CRI) of the CFL is much higher than standard fluorescent lighting, and therefore provides a much "truer" light.

The CFL is available in a myriad of shapes and sizes depending on the specific application. Typical replacements are: a 13-Watt CFL for a 60-Watt incandescent lamp, an 18-Watt CFL for a 75-Watt incandescent lamp, and a 25-Watt CFL for a 100-Watt incandescent lamp.

The CFL is also available for a number of "brightness colors" that is indicated by the Kelvin rating. A 2700K CFL is the "warmest" color available and is closest in color to the incandescent lamp. CFL's are also available in 3000K, 3500K, and 4100K. The 4100K would be the "brightest" or "coolest" output. A CFL can be chosen to screw right into your existing fixtures, or hardwired into your existing fixtures.

### Energy Savings Calculations:

There are five (5) 60-Watt incandescent lamps in the facility that can be upgraded to 13-Watt CFL units. The average operating hours for these lamps is estimated to be 780.

The energy cost savings is 5 units x [(60W – 13W) \* 780 hours \* 1 kW/1,000 W \* \$0.182/kWh] = \$33.

The cost of five (5) 13-Watt CFL's is \$50

### Energy Savings Summary:

<b>ECM #2 – ENERGY SAVINGS SUMMARY</b>	
<b>Installation Cost (\$):</b>	\$50
<b>NJ Smart Start Equipment Incentive (\$):</b>	-
<b>Maintenance Savings (\$):</b>	-
<b>Net Installation Cost (\$):</b>	\$50
<b>Total Energy Savings (\$ / yr):</b>	\$36
<b>Simple Payback (yrs):</b>	1.4
<b>Simple Return on Investment:</b>	74.2%

## ECM #3: 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 and will switch the lights on when the room is occupied. They can either be mounted in place of the current wall switch, or they can be mounted on the ceiling to cover large areas. Lastly, photocells are a lighting control that sense light levels and will turn the lights off when there is adequate daylight. These are mostly used outside, but they are becoming much more popular in energy-efficient office designs as well.

To determine an estimated savings for lighting controls, we used ASHRAE 90.1-2004 (NJ Energy Code). Appendix G of the referenced standard, states that occupancy sensors have a 10% power adjustment factor for daytime occupancies for buildings over 5,000 SF. CEG recommends the installation of dual technology occupancy sensors in all private offices, conference rooms, restrooms, lunch rooms, storage rooms, locker rooms, file rooms, etc. (six rooms - approximately 1,100 SF).

CEG would recommend wall switches for individual rooms, ceiling mount sensors for large office areas or restrooms, and fixture mount box sensors for some applications as manufactured by Sensorswitch, Watt Stopper, etc.

### Energy Savings Calculations:

From Appendix E of this report, we calculated the lighting power density (Watts/ft<sup>2</sup>) of the existing offices, tool rooms, storage rooms, small shops, etc. to be ±1.19 Watts/SF. Ten percent of this value is the resultant energy savings due to installation of occupancy sensors:

$$\text{Savings} = 10\% \times 1.19 \text{ Watts/SF} \times 1,100 \text{ SF} \times 2,080 \text{ hrs/yr.} = 272 \text{ kWh} \times \$0.182/\text{kWh}$$

$$\text{Savings} = \underline{\$49.55} \text{ per year}$$

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is \$75/unit including material and labor.

The SmartStart Buildings® incentive is \$20 per control which equates to an installed cost of \$55/unit. Total number of spaces to be retrofitted is six.

$$\text{Total cost to install sensors is } \$55/\text{unit} \times 6 \text{ units} = \underline{\$330}$$

**Energy Savings Summary:**

<b>ECM #3 – ENERGY SAVINGS SUMMARY</b>	
<b>Installation Cost (\$):</b>	\$450
<b>NJ Smart Start Equipment Incentive (\$):</b>	(\$120)
<b>Maintenance Savings (\$):</b>	-
<b>Net Installation Cost (\$):</b>	\$330
<b>Total Energy Savings (\$ / yr):</b>	\$49.55
<b>Simple Payback (yrs):</b>	6.6
<b>Simple Return on Investment:</b>	14.5%

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## ECM #4: Install LED Exit Signs

### Description:

LED is an acronym for light-emitting-diode. LED's are small light sources that are readily associated with electronic equipment. LED exit signs have been manufactured in a variety of shapes and sizes. There are also retrofit kits that allow for simply modification of existing exit signs to accommodate LED technology. The benefits of LED technology are substantial. LED exit signs will last for 20-30 years without maintenance. This results in tremendous maintenance savings considering that incandescent or fluorescent lamps need to be replaced at a rate of 1-5 times per year. Lamp costs (\$2-\$7 each) and labor costs (\$8-\$20 per lamp) add up rapidly. Additionally, LED exit lights only uses 3.8 Watts. In comparison, conventional exit signs use 30 Watts. It is recommended that samples of the products be installed to confirm that they are compatible with the existing electrical system.

This ECM replaces all of the incandescent lamp exit signs, three (3) in total, throughout the original facility with highly energy efficient LED exit signs. A Pegasus Associates Lighting LED exit sign or equivalent was used for the bases of design.

### Energy Savings Calculations:

Existing exit sign energy costs: 3 units x 30 watts/unit x 8,760 hrs/yr x \$0.182/kWh = \$143.49

New LED exit sign energy costs: 3 units x 5 watts/unit x 8,760 hrs x \$0.182/kWh = \$23.91

Net energy savings = \$143.49 - \$23.91 = \$119.58

Installed cost of new LED exit signs = \$80 x 3 = \$240

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

From Appendix C, the replacement of an incandescent exit sign warrants the following incentive:  
LED Exit Sign = \$20 per fixture.

Smart Start<sup>®</sup> Incentive = (# of exit signs × \$ 20) = (3 × \$20) = \$60

Maintenance Savings are calculated as follows:

*Maintenance Savings* = (# of lamps × \$ per lamp) + Installation Labor

*Maintenance Savings* = (6 × \$4.50) + (6 × \$14) = \$111

**Energy Savings Summary:**

<b>ECM #4 – ENERGY SAVINGS SUMMARY</b>	
<b>Installation Cost (\$):</b>	\$240
<b>NJ Smart Start Equipment Incentive (\$):</b>	(\$60)
<b>Maintenance Savings (\$):</b>	(\$111)
<b>Net Installation Cost (\$):</b>	\$69
<b>Total Energy Savings (\$ / yr):</b>	\$120
<b>Simple Payback (yrs):</b>	0.6
<b>Simple Return on Investment:</b>	130.1%

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## ECM #5: Shop Heater Replacement - Infrared Heaters

### Description:

The interior spaces of the vehicle maintenance garage are heated by Reznor gas-fired unit heaters whenever the large overhead doors are opened. The remote thermostats that control these heating units are set at 60°F. These units do not provide adequate heating because of the high ceilings and losses through garage doors when open. In addition, these units are beyond their expected service life as outlined in Chapter 36 of the 2007 ASHRAE Applications Handbook. Due to escalating owning and maintenance costs, these units should be replaced.

Our team recommends replacing the existing unit heaters with low intensity infrared (IR) tube heaters. When compared to convective heating systems, IR heaters provide more efficient heating in large areas and warehouses for two reasons: they only heat people and objects (not air); they can be conveniently located and directed to provide heat to only a smaller section occupied by workers.

### Energy Savings Calculations:

Based on the existing Reznor unit heater data, thermostat settings and natural gas bills, the total energy consumed by these heating units is approximately 5,450 Therms/Year. The total rated heat capacity of the IR tubes is 80% of the current load or  $0.8 \times 5,450$  Therms = 4,360 Therms/Year. The total amount of IR heaters and their size can be estimated based on the current heat load and building layout. In general, a building 200 feet wide or less will require two rows of tubes. Heat output of each 20-foot section is approximately 60,000 Btu/hr.

### Estimated Fan Energy Savings:

Each of the Reznor gas-fired unit heaters have a ¼ HP fan that runs each time the unit calls for heating. Assuming that these motors are 80% efficient and the total run hours is 2,800, this equates to an electrical savings of

Existing ¼ HP Motor Operating Cost =

$\{0.746 \text{ Watt/HP} \times \text{Motor HP} \times \text{Load Factor} \times \text{Hours of Operation} \times \text{Cost of Electricity}\} \div \text{Motor Efficiency}$

$= [0.746 \times 0.25 \times 0.75 \times 2,800 \times 0.182] \div 0.80 = \$71.28 / \text{Year}$

Based on four (4) existing units, this equates to  $4 \times \$71.28 = \$285/\text{Year Savings}$

### Natural Gas Energy Savings:

$20\% \text{ savings} \times 4,360 \text{ Therms/Yr} \times \$1.66/\text{Therm} = \$1,448/\text{Year}$

Total Energy Savings = Fan Energy Savings + Natural Gas Savings  
 = \$285 + \$1,448 = \$1,733 per year

The total implementation cost including material and labor is estimated at approximately \$12,300. It is pertinent to note, the labor cost includes installation of the infra-red heaters and required modifications of the existing natural gas piping.

**Energy Savings Summary:**

<b>ECM #5 – ENERGY SAVINGS SUMMARY</b>	
<b>Installation Cost (\$):</b>	\$12,300
<b>NJ Smart Start Equipment Incentive (\$):</b>	- <sup>A</sup>
<b>Maintenance Savings (\$):</b>	-
<b>Net Installation Cost (\$):</b>	\$12,300
<b>Total Energy Savings (\$ / yr):</b>	\$1,733
<b>Simple Payback (yrs):</b>	7.1
<b>Simple Return on Investment:</b>	13.5%

**Note A:** CEG believes that a NJ Smart Start<sup>®</sup> Custom Measure incentive could be applied for in order to offset the installation cost. However, further study is required.

## ECM #6: Replace Oil-Fired Furnace with High-Efficiency Gas-Fired Unit

### Description:

The Parks/Recreation section of the DPW facility consists of woodshop, painting, and storage areas that are heated by a very inefficient Armstrong Ultra 80 oil-fired furnace. This unit was rated at 95,000 Btu/hr output when new but due to age is now approximately 60% efficient (57,000 Btu/hr). This measure would replace this inefficient unit with a York Model YP9C (or equal) gas-fired unit with modulating (ECM motor) multi-position gas furnace and a rated output of 58,000 Btu/hr. The average efficiency of this unit is 88% (94% AFUE). The existing gas line to the garage would need to be extended to the parks/recreation rooms.

### Energy Savings Calculations:

# 2 Burner Fuel Oil Energy Usage (at 60% efficiency) = 160.6 gallons x 140,000 Btu/gallon = 22,479 MBTU

Equivalent Natural Gas Usage (at 88% efficiency) = 22,479 MBTU – Equivalent NG Usage

= 22,479 MBTU – {Burner Fuel Oil Energy Input \* [(New Furnace Efficiency – Old Furnace Efficiency) / New Furnace Efficiency]}

= 22,479 MBTU – [22,479 MBTU x  $\frac{0.88-0.60}{0.88}$ ] = 22,479 MBTU - 7,152 MBTU

Equivalent Natural Gas Usage = 15,327 MBTU = 153.3 Therms

Energy Cost Savings (Convert to Gas-Fired Furnace) = (160.6 gallons x \$3.55/gallon) – (153.3 Therms x \$1.66/Therm) = \$316

Installed cost of a York Model YP9C gas-fired furnace including extension of the existing gas line is estimated at \$6,200. The SmartStart Buildings® incentive is \$400 per furnace which equates to a net installation cost = \$5,800

Simple Payback = \$5,800 / \$316 = 18.4 Years

**Energy Savings Summary:**

<b>ECM #6 – ENERGY SAVINGS SUMMARY</b>	
<b>Installation Cost (\$):</b>	\$6,200
<b>NJ Smart Start Equipment Incentive (\$):</b>	(\$400)
<b>Maintenance Savings (\$):</b>	-
<b>Net Installation Cost (\$):</b>	\$5,800
<b>Total Energy Savings (\$ / yr):</b>	\$316
<b>Simple Payback (yrs):</b>	18.4
<b>Simple Return on Investment:</b>	(0.4%)

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## 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 technologies for Gloucester City, and concluded that there is potential for solar energy generation.

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 is 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 330 S.F. can be utilized for a PV system the DPW Facility. A depiction of the area utilized is shown in Appendix F. Using this square footage it was determined that a system size of 5.29 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 8,255 KWh annually, reducing the overall utility bill by 25% percent. A detailed financial analysis can be found in Appendix F. 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.

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. 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 and internal rate of return for the respective method of payment:

<b>PAYMENT TYPE</b>	<b>SIMPLE PAYBACK</b>	<b>INTERNAL RATE OF RETURN</b>
Self-Finance	11.2 Years	13.2%
Direct Purchase	11.2 Years	8.1%

Wind energy production is another option available through the Renewable Energy Incentive Program. Small wind turbines can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. CEG has reviewed the applicability of wind energy for the DPW Facility and has determined it is not a viable option. The electrical demand of the DPW facility is not high enough to justify the cost of a wind turbine installation.

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## 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 Section IV, Figures 1 and 2 included within this report to reference the electricity and natural gas usage load profile for January 2008 through December 2008.

### Electricity:

Section IV, Figure 1 demonstrates a profile of a building that is predominately heated. The electric consumption curve rises and falls based on the respective heating and cooling months.

### Natural Gas:

Section IV, Figure 2 demonstrates a typical heating load profile with major consumption occurring between December through March 2008.

### Tariff Analysis:

### Electricity:

Gloucester City receives electrical service through Public Service Electric and Gas Company (PSE&G) on a GLP (General Lighting and Power) rate. This utility tariff is for delivery service for general purposes at secondary distribution voltages. The rate schedule has a Delivery Charge, Societal Benefits Charge, Non-utility Generation Charge, Securitization Charge, System Control Charge, Customer Account Services Charge, Standby Fee, Base Rate Distribution Adjustment Charge, Solar Pilot Recovery Charge and RGGI Charge. The customer can elect to have the Commodity Charge serviced through the utility or by a Third Party Supplier (TPS).

### Natural Gas:

Gloucester City receives natural gas service through Public Service Electric and Gas Company (PSE&G) on a GSG utility rate class for delivery and received commodity by a Third Party Supplier (TPS); Woodruff Energy. The GSG utility tariff is for 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. It is pertinent to note, since Gloucester City has elected to utilize a TPS, if the TPS should 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.

**Recommendations:**

CEG's recommendation pertains to Gloucester City's electric costs (mainly because Gloucester City does not have a large Natural Gas Critical Mass). CEG recognized the electric cost is competitive with current market prices for a single facility. However, there are opportunities available by aggregation of all facilities and procuring energy from third party suppliers.

CEG advises Gloucester City take a global approach that will be consistent for all facilities within the municipality. Gloucester City's "weighted average price" per kWh (kilowatt hour) for all buildings is approximately \$0.1225 per kWh (kWh is the common unit of electric measure). The weighted average price per dekatherm for natural gas is \$11.37/dth (Dth is the common unit of measure). Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. Gloucester City could realize savings if it were to take advantage of these current market prices quickly, before energy increases. Based on last year's historical consumption (January through December 2008) and current electric rates, Gloucester City would see savings of over \$10,000 per year (Note: Savings were calculated using Gloucester City's Average Annual Consumption of 490,135 kWh and a variance of \$.02258 /kWh utilizing a fixed one-year commodity contract). Gloucester City should aggregate its entire electric load to gain the most optimal energy costs. CEG recommends advisory services for alternative sourcing and supply of energy on a "managed approach."

Lastly, CEG recommends that Gloucester City schedule a meeting with their current utility provider to review their utility charges and current tariff structure for electricity. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), Gloucester City will learn more about the competitive supply process. Gloucester City 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), and should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the data to manage ongoing demand-side management projects. Furthermore, CEG recommends special attention to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with their utility representative. In addition, Gloucester City should also ask the utility representative about alternative billing options. Some utilities allow for consolidated billing options when utilizing the service of a Third Party Supplier.

## X. INSTALLATION FUNDING OPTIONS

CEG has reviewed various funding options for the 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. Use cog-belts instead of v-belts on all belt-driven fans, etc. These can reduce electrical consumption of the motor by 2-5%.
- D. Reduce lighting in specified areas where the foot candle levels are above 70 in private offices and above 30 in corridor, lobbies, etc.
- E. Provide more frequent air filter changes to decrease overall fan horsepower requirements and maintain better IAQ.
- F. Recalibrate existing sensors serving the office spaces
- G. Clean all light fixtures to maximize light output.

# Electric Cost Summary

PSE&G - Electric (rate - GLP)

## Public Works

Account # 61 875 081 06

Meter # 58017950

**2008**

Month	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Total
Billing Days	31	28	31	30	31	30	31	31	30	31	30	31	
KWH	3,750	4,086	4,110	1,890	1,860	2,538	2,562	2,124	1,866	1,926	2,064	3,924	32,700
KW	12	13	11	9	10	12	12	8	11	9	10	12	13
Monthly Load Factor	43%	48%	49%	29%	24%	31%	28%	34%	24%	28%	30%	43%	34%
Electric Delivery, \$	\$ 136	\$ 148	\$ 143	\$ 83	\$ 88	\$ 206	\$ 214	\$ 159	\$ 177	\$ 85	\$ 91	\$ 150	\$1,681
Delivery \$/kwh	\$0.036	\$0.036	\$0.035	\$0.044	\$0.047	\$0.081	\$0.084	\$0.075	\$0.095	\$0.044	\$0.044	\$0.038	\$0.051
Electric Supply, \$	\$ 341	\$ 383	\$ 374	\$ 180	\$ 181	\$ 336	\$ 347	\$ 311	\$ 267	\$ 233	\$ 938	\$ 393	\$4,284
Supply \$/kwh	\$0.091	\$0.094	\$0.091	\$0.095	\$0.097	\$0.132	\$0.136	\$0.146	\$0.143	\$0.121	\$0.455	\$0.100	\$0.131
Total Cost, \$	\$477	\$531	\$517	\$263	\$269	\$541	\$562	\$470	\$445	\$317	\$1,029	\$543	\$5,966
\$/KWH	\$0.127	\$0.130	\$0.126	\$0.139	\$0.144	\$0.213	\$0.219	\$0.221	\$0.238	\$0.165	\$0.499	\$0.138	<b>\$0.182</b>

## Summary of Natural Gas Cost

PSE&G - Natural Gas (rate - GSG)

Third Party Supplier - Woodruff Energy

Public Works

Account# 507-555 - Woodruff

Account# 61 875 081 06- PSE&G

Meter # Combined (1718484 & 1865665)

**2008**

Month	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Total
Billing Days	31	28	31	30	31	30	31	31	30	31	30	31	
Therms (Burner Tip)	1380.4	1458.3	936.9	102.3	54.2	38.6	36.6	37.7	38.7	46.0	305.6	1573.9	6009.1
Total Distribution Cost	\$553	\$584	\$377	\$41	\$26	\$22	\$21	\$21	\$22	\$24	\$129	\$642	2,461
Cost per Therm	\$0.401	\$0.400	\$37.340	\$0.397	\$0.483	\$0.000	\$0.000	\$0.563	\$0.557	\$37.340	\$0.422	\$0.408	\$0.410
Total Commodity Cost	\$1,658	\$1,752	\$1,125	\$123	\$65	\$60	\$62	\$49	\$46	\$51	\$305	\$2,217	7,513
Cost per Therm	\$1.20	\$1.20	\$1.20	\$1.20	\$1.20	\$0.00	\$0.00	\$1.31	\$1.20	\$1.10	\$1.00	\$1.41	\$1.25
Total Cost	\$2,211	\$2,335	\$1,503	\$163	\$91	\$81	\$83	\$71	\$68	\$74	\$434	\$2,859	\$9,974
Cost per Therm	\$1.602	\$1.602	\$1.604	\$1.598	\$1.684	\$0.000	\$0.000	\$1.869	\$1.756	\$1.615	\$1.420	\$1.817	<b>\$1.660</b>

## DETAILED COST BREAKDOWN PER ECM

### CONCORD ENGINEERING GROUP

#### Public Works

##### ECM 1 Lighting Upgrade

	Qty	Unit Cost \$	Material \$	Labor \$	Total \$
Lighting Retrofit	LS	\$6,740	<u>\$0</u>	<u>\$0</u>	<u>\$6,740</u>
Total Cost			\$0	\$0	\$6,740
Utility Incentive - NJ Smart Start (\$25 per 1-2 lamp fixture & \$30 per 3-4 lamp fixture)					<u>(\$1,320)</u>
Total Cost Less Incentive					\$5,420

##### ECM 2 Install Compact Fluorescent Lamps

	Qty	Unit Cost \$	Material \$	Labor \$	Total \$
Compact Fluorescent Lamps	LS	\$260	<u>\$260</u>	<u>\$0</u>	<u>\$260</u>
Total Cost			\$260	\$0	\$260
Utility Incentive - NJ Smart Start					<u>\$0</u>
Total Cost Less Incentive					\$260

##### ECM 3 Lighting Controls

	Qty	Unit Cost \$	Material \$	Labor \$	Total \$
Dual Technology Sensor	6	\$75	<u>\$450</u>	<u>\$0</u>	<u>\$450</u>
Total Cost			\$450	\$0	\$450
Utility Incentive - NJ Smart Start (\$20 per control)					<u>(\$120)</u>
Total Cost Less Incentive					\$330

##### ECM 4 Install LED Exit Signs

	Qty	Unit Cost \$	Material \$	Labor \$	Total \$
New LED Exit Signs	3	\$80	<u>\$50</u>	<u>\$30</u>	<u>\$240</u>
Total Cost			\$50	\$30	\$240
Utility Incentive - NJ Smart Start (\$20 per Sign)					<u>(\$60)</u>
Total Cost Less Incentive					\$180

##### ECM 5 Shop Heater Replacement - Infrared Heaters

	Qty	Unit Cost \$	Material \$	Labor \$	Total \$
New Infrared Heaters	LS	\$12,300	<u>\$0</u>	<u>\$0</u>	<u>\$12,300</u>
Total Cost			\$0	\$0	\$12,300
Utility Incentive - NJ Smart Start (Custom Measure Applicable)					<u>\$0</u>
Total Cost Less Incentive					\$12,300

##### ECM 6 High-Efficiency Gas-Fired Furnace

	Qty	Unit Cost \$	Material \$	Labor \$	Total \$
New Gas-Fired Furnace	1	\$5,800	<u>\$3,865</u>	<u>\$1,935</u>	<u>\$5,800</u>
Total Cost			\$3,865	\$1,935	\$5,800
Utility Incentive - NJ Smart Start (\$400 per Unit)					<u>(\$400)</u>
Total Cost Less Incentive					\$5,400

# 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
--------------------	------------------------

**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

## Public Works Garage

**Building ID:** 1773165  
**For 12-month Period Ending:** December 31, 2008<sup>1</sup>  
**Date SEP becomes ineligible:** N/A

**Date SEP Generated:** July 08, 2009

**Facility**  
 Public Works Garage  
 615 Brick St.  
 Gloucester City, NJ 08030

**Facility Owner**  
 Gloucester City  
 512 Monmouth St.  
 Gloucester City, NJ 08030

**Primary Contact for this Facility**  
 Jack Lipsett  
 512 Monmouth St.  
 Gloucester City, NJ 08030

**Year Built:** 1978  
**Gross Floor Area (ft<sup>2</sup>):** 9,600

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

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

Natural Gas (kBtu) <sup>4</sup>	600,920
Electricity (kBtu)	111,709
Fuel Oil (No. 2) (kBtu)	22,470
Total Energy (kBtu)	735,099

### Energy Intensity<sup>5</sup>

Site (kBtu/ft <sup>2</sup> /yr)	77
Source (kBtu/ft <sup>2</sup> /yr)	107

### Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO <sub>2</sub> e/year)	51
---	----

### Electric Distribution Utility

PSE&G - Public Service Elec & Gas Co

### National Average Comparison

National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	-50%
Building Type	Other

Stamp of Certifying Professional

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

### Meets Industry Standards<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

Raymond Johnson  
 520 South Burnt Mill Rd.  
 Voorhees, NJ 08043

**Notes:**

- 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.
- 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.
- Values represent energy consumption, annualized to a 12-month period.
- 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.
- Values represent energy intensity, annualized to a 12-month period.
- 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>	Public Works Garage	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		<input type="checkbox"/>
<b>Type</b>	Other	Is this an accurate description of the space in question?		<input type="checkbox"/>
<b>Location</b>	615 Brick St., Gloucester City, NJ 08030	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"/>

DPW (Other)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	<input checked="" type="checkbox"/>
<b>Gross Floor Area</b>	9,600 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>Number of PCs</b>	1 (Optional)	Is this the number of personal computers in the space?		<input type="checkbox"/>
<b>Weekly operating hours</b>	40 Hours(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		<input type="checkbox"/>
<b>Workers on Main Shift</b>	4 (Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		<input type="checkbox"/>

## ENERGY STAR® Data Checklist for Commercial Buildings

### Energy Consumption

**Power Generation Plant or Distribution Utility:** PSE&G - Public Service Elec & Gas Co

Fuel Type: Electricity		
Meter: Electric Meter (kWh) Space(s): Entire Facility		
Start Date	End Date	Energy Use (kWh)
12/01/2008	12/31/2008	3,964.00
11/01/2008	11/30/2008	2,064.00
10/01/2008	10/31/2008	1,926.00
09/01/2008	09/30/2008	1,866.00
08/01/2008	08/31/2008	2,124.00
07/01/2008	07/31/2008	2,562.00
06/01/2008	06/30/2008	2,538.00
05/01/2008	05/31/2008	1,860.00
04/01/2008	04/30/2008	1,890.00
03/01/2008	03/31/2008	4,110.00
02/01/2008	02/29/2008	4,086.00
01/01/2008	01/31/2008	3,750.00
<b>Electric Meter Consumption (kWh)</b>		<b>32,740.00</b>
<b>Electric Meter Consumption (kBtu)</b>		<b>111,708.88</b>
<b>Total Electricity Consumption (kBtu)</b>		<b>111,708.88</b>
<b>Is this the total Electricity consumption at this building including all Electricity meters?</b>		<input type="checkbox"/>

Fuel Type: Natural Gas		
Meter: Natural Gas Meter (therms) Space(s): Entire Facility		
Start Date	End Date	Energy Use (therms)
12/01/2008	12/31/2008	1,573.90
11/01/2008	11/30/2008	305.60
10/01/2008	10/31/2008	46.00
09/01/2008	09/30/2008	38.70
08/01/2008	08/31/2008	37.70
07/01/2008	07/31/2008	36.60
06/01/2008	06/30/2008	38.60
05/01/2008	05/31/2008	54.20
04/01/2008	04/30/2008	102.30

03/01/2008	03/31/2008	936.90
02/01/2008	02/29/2008	1,458.30
01/01/2008	01/31/2008	1,380.40
<b>Natural Gas Meter Consumption (therms)</b>		<b>6,009.20</b>
<b>Natural Gas Meter Consumption (kBtu)</b>		<b>600,920.00</b>
<b>Total Natural Gas Consumption (kBtu)</b>		<b>600,920.00</b>
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		<input type="checkbox"/>

Fuel Type: Fuel Oil (No. 2)		
Meter: Fuel Oil (Gallons) Space(s): Entire Facility		
Start Date	End Date	Energy Use (Gallons)
12/01/2008	12/31/2008	0.00
11/01/2008	11/30/2008	0.00
10/01/2008	10/31/2008	0.00
09/01/2008	09/30/2008	0.00
08/01/2008	08/31/2008	0.00
07/01/2008	07/31/2008	0.00
06/01/2008	06/30/2008	0.00
05/01/2008	05/31/2008	0.00
04/01/2008	04/30/2008	0.00
03/01/2008	03/31/2008	0.00
02/01/2008	02/29/2008	0.00
01/01/2008	01/31/2008	160.50
<b>Fuel Oil Consumption (Gallons)</b>		<b>160.50</b>
<b>Fuel Oil Consumption (kBtu)</b>		<b>22,469.97</b>
<b>Total Fuel Oil (No. 2) Consumption (kBtu)</b>		<b>22,469.97</b>
Is this the total Fuel Oil (No. 2) consumption at this building including all Fuel Oil (No. 2) meters?		<input type="checkbox"/>

Additional Fuels	
Do the fuel consumption totals shown above represent the total energy use of this building? Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.	<input type="checkbox"/>

## Certifying Professional

(When applying for the ENERGY STAR, this must be the same 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**  
Public Works Garage  
615 Brick St.  
Gloucester City, NJ 08030

**Facility Owner**  
Gloucester City  
512 Monmouth St.  
Gloucester City, NJ 08030

**Primary Contact for this Facility**  
Jack Lipsett  
512 Monmouth St.  
Gloucester City, NJ 08030

## General Information

Public Works Garage	
Gross Floor Area Excluding Parking: (ft <sup>2</sup> )	9,600
Year Built	1978
For 12-month Evaluation Period Ending Date:	December 31, 2008

## Facility Space Use Summary

DPW	
Space Type	Other - Other
Gross Floor Area(ft <sup>2</sup> )	9,600
Number of PCs <sup>o</sup>	1
Weekly operating hours <sup>o</sup>	40
Workers on Main Shift <sup>o</sup>	4

## Energy Performance Comparison

Performance Metrics	Evaluation Periods		Comparisons		
	Current (Ending Date 12/31/2008)	Baseline (Ending Date 12/31/2008)	Rating of 75	Target	National Average
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft <sup>2</sup> )	77	77	0	N/A	104
Source (kBtu/ft <sup>2</sup> )	107	107	0	N/A	213
Energy Cost					
\$/year	\$ 16,506.78	\$ 16,506.78	N/A	N/A	\$ 22,420.07
\$/ft <sup>2</sup> /year	\$ 1.72	\$ 1.72	N/A	N/A	\$ 2.34
Greenhouse Gas Emissions					
MtCO <sub>2</sub> e/year	51	51	0	N/A	69
kgCO <sub>2</sub> e/ft <sup>2</sup> /year	5	5	0	N/A	7

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

Notes:

o - This attribute is optional.

d - A default value has been supplied by Portfolio Manager.

**INVESTMENT GRADE LIGHTING AUDIT**

**CONCORD ENERGY SERVICES**

CEG Job #: 9C08131  
 Project: DPW BUILDING Energy Audit -  
 Address: 615 Brick Street  
 City: Gloucester City, NJ  
 Building SF: 9600

"DPW BUILDING"

DATE: 05/20/2009  
 KWH COST: **\$0.182**

**ECM #1: Lighting Retrofits**

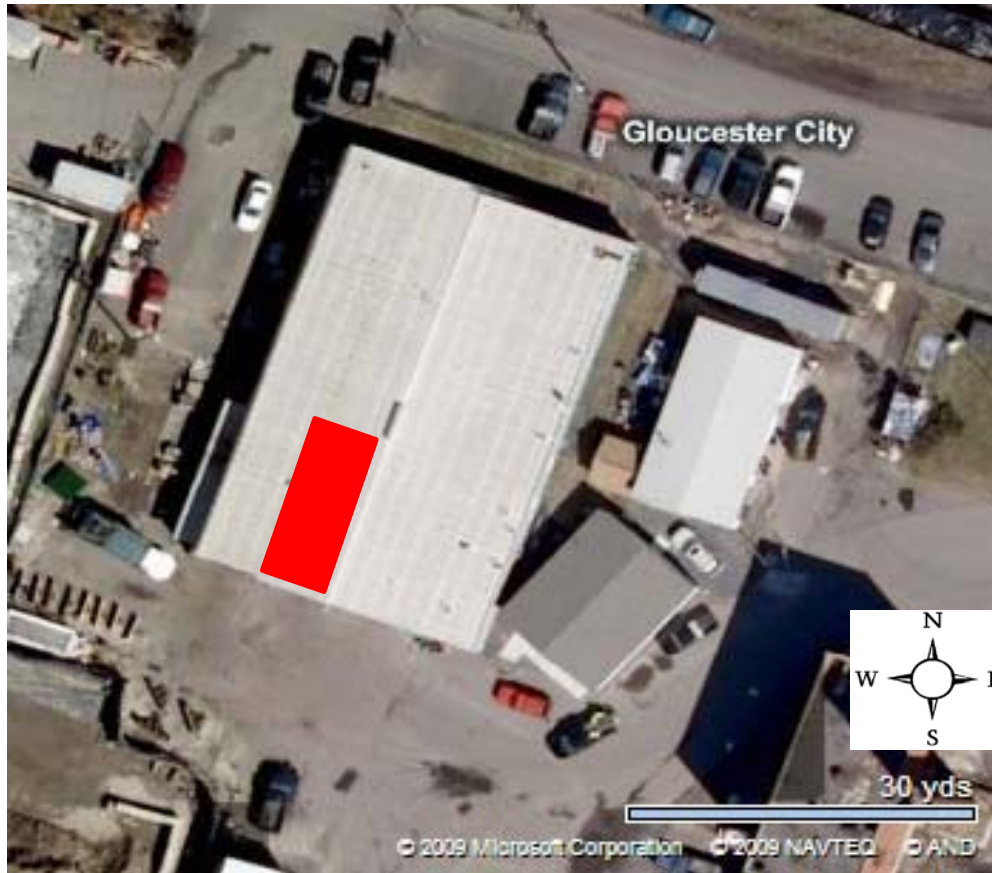
EXISTING LIGHTING										PROPOSED LIGHTING										SAVINGS			
Line No.	CEG Type	Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	No. rFixts	Re-ro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	Unit Cost (INSTALLED)	Total Cost	kWh/Yr Savings	kW Savings	Yearly \$ Savings	Yearly Simple Payback		
1	A	Office (DPW Mgr)	3	2X4' 3-Lamp T-12 Prism Lens Magnetic Ballast	1,040	102	0.31	318.24	\$57.92	3	2X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast, Metalux M/N 2GC8	61	0.18	190.32	\$34.64	\$140.00	\$420.00	127.92	0.12	\$23.28	18.04		
2	E	Garage	29	1X8' 2-Lamp T-12 White Reflector Magnetic Ballast	2,080	192	5.57	11581.44	\$2,107.82	29	2X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast, Metalux M/N 2GC8	91	2.64	5489.12	\$999.02	\$140.00	\$4,060.00	6092.32	2.93	\$1,108.80	3.66		
3	E	Tool Room	1	1X8' 2-Lamp T-12 White Reflector Magnetic Ballast	1,040	192	0.19	199.68	\$36.34	1	1X4' 1-Lamp 32W T-8 Prism Lens/Elect Ballast, Metalux M/N GC	30	0.03	31.2	\$5.68	\$110.00	\$110.00	168.48	0.16	\$30.66	3.59		
4	E	Lounge/Lunch Rm	2	1X8' 2-Lamp T-12 White Reflector Magnetic Ballast	1,040	192	0.38	399.36	\$72.68	2	2X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast, Metalux M/N 2GC8	91	0.18	189.28	\$34.45	\$140.00	\$280.00	210.08	0.20	\$38.23	7.32		
5	-	Restrooms	1	60 W Incandescent	200	60	0.06	12	\$2.18	1	15 W CFL	15	0.02	3	\$0.55	\$10.00	\$10.00	9	0.05	\$1.64	6.11		
6	E	Restrooms	1	1X8' 2-Lamp T-12 White Reflector Magnetic Ballast	200	192	0.19	38.4	\$6.99	1	1X4' 1-Lamp 32W T-8 Prism Lens/Elect Ballast, Metalux M/N GC	30	0.03	6	\$1.09	\$110.00	\$110.00	32.4	0.16	\$5.90	18.65		
7	E	Tool Room	5	1X8' 2-Lamp T-12 White Reflector Magnetic Ballast	1,040	192	0.96	998.4	\$181.71	5	2X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast, Metalux M/N 2GC8	91	0.46	473.2	\$86.12	\$140.00	\$700.00	525.2	0.51	\$95.59	7.32		
8	E	Parks/Recreation Areas	4	1X8' 2-Lamp T-12 White Reflector Magnetic Ballast	1,040	192	0.77	798.72	\$145.37	4	2X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast, Metalux M/N 2GC8	91	0.36	378.56	\$68.90	\$140.00	\$560.00	420.16	0.40	\$76.47	7.32		
9	A	Parks/Recreation Area	2	2X4' 3-Lamp T-12 Prism Lens Magnetic Ballast	1,040	102	0.20	212.16	\$38.61	2	2X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast, Metalux M/N 2GC8	61	0.12	126.88	\$23.09	\$140.00	\$280.00	85.28	0.08	\$15.52	18.04		
10	E	Parks/Recreation Bldg	2	1X4' 2-Lamp T-12 White Reflector Magnetic Ballast	1,040	68	0.14	141.44	\$25.74	2	1X4' 1-Lamp 32W T-8 Prism Lens/Elect Ballast, Metalux M/N GC	30	0.06	62.4	\$11.36	\$110.00	\$220.00	79.04	0.08	\$14.39	15.29		
11		Parks/Recreation Bldg	4	60 W Incandescent	1,040	60	0.24	249.6	\$45.43	4	15 W CFL	15	0.06	62.4	\$11.36	\$10.00	\$40.00	187.2	0.18	\$34.07	1.17		
12		Garage Exits	3	2L 15 W Incandescent Exit Signs	8,760	30	0.09	788.4	\$143.49	3	5 Watt LED Exit Signs	5	0.02	131.4	\$23.91	\$72.00	\$216.00	657	0.08	\$119.57	1.81		
13		Superintendent's Office	16	2X4' 4-Lamp T-8 Prism Lens Electronic Ballast	2,080	144	2.30	4792.32	\$872.20	16	No Replacement												
14		Exits	2	LED Exit Sign	8,760	5	0.01	87.6	\$15.94	2	No Replacement												
					1723		11.41	20617.76	3752.43	75			4.16	7143.76	\$1,300.16		\$7,006.00	8,594.08	4.95	\$1,564.12	4.48		
<b>Totals</b>										75													


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

Project Name: LGEA Solar PV Project - DPW Facility Location: Gloucester City, NJ Description: Photovoltaic System 95% Financing - 20 year										
Simple Payback Analysis										
Photovoltaic System 95% Financing - 20 year										
Total Construction Cost \$115,920										
Annual kWh Production 20,100										
Annual Energy Cost Reduction \$3,337										
Annual SREC Revenue \$7,035										
First Cost Premium \$115,920										
Simple Payback: 11.18 Years										
Life Cycle Cost Analysis										
Analysis Period (years): 25										
Financing Term (mths): 240										
Average Energy Cost (\$/kWh) \$0.166										
Financing Rate: 7.00%										
Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow	
0	\$5,796	0	0	0	\$0	0	0	(5,796)	0	
1	\$0	20,100	\$3,337	\$0	\$7,035	\$7,626	\$2,620	\$126	(\$5,670)	
2	\$0	19,999	\$3,437	\$0	\$7,000	\$7,436	\$2,809	\$191	(\$5,479)	
3	\$0	19,899	\$3,540	\$0	\$6,965	\$7,233	\$3,012	\$259	(\$5,220)	
4	\$0	19,800	\$3,646	\$0	\$6,930	\$7,015	\$3,230	\$330	(\$4,890)	
5	\$0	19,701	\$3,755	\$203	\$6,895	\$6,782	\$3,464	\$202	(\$4,687)	
6	\$0	19,602	\$3,868	\$202	\$6,861	\$6,532	\$3,714	\$281	(\$4,406)	
7	\$0	19,504	\$3,984	\$201	\$6,827	\$6,263	\$3,982	\$364	(\$4,042)	
8	\$0	19,407	\$4,104	\$200	\$6,792	\$5,975	\$4,270	\$451	(\$3,591)	
9	\$0	19,310	\$4,227	\$199	\$6,758	\$5,667	\$4,579	\$541	(\$3,050)	
10	\$0	19,213	\$4,353	\$198	\$6,725	\$5,336	\$4,910	\$635	(\$2,416)	
11	\$0	19,117	\$4,484	\$197	\$6,691	\$4,981	\$5,265	\$733	(\$1,683)	
12	\$0	19,022	\$4,619	\$196	\$6,658	\$4,600	\$5,646	\$835	(\$848)	
13	\$0	18,926	\$4,757	\$195	\$6,624	\$4,192	\$6,054	\$941	\$93	
14	\$0	18,832	\$4,900	\$194	\$6,591	\$3,754	\$6,491	\$1,052	\$1,144	
15	\$0	18,738	\$5,047	\$193	\$6,558	\$3,285	\$6,960	\$1,167	\$2,311	
16	\$0	18,644	\$5,198	\$192	\$6,525	\$2,782	\$7,464	\$1,286	\$3,597	
17	\$0	18,551	\$5,354	\$191	\$6,493	\$2,242	\$8,003	\$1,410	\$5,007	
18	\$0	18,458	\$5,515	\$190	\$6,460	\$1,664	\$8,582	\$1,540	\$6,547	
19	\$0	18,366	\$5,680	\$189	\$6,428	\$1,043	\$9,202	\$1,674	\$8,221	
20	\$0	18,274	\$5,851	\$188	\$6,396	\$78	\$9,867	\$1,813	\$10,033	
21	\$0	18,183	\$6,026	\$187	\$6,364	\$321	\$10,571	\$2,811	\$12,845	
22	\$0	18,092	\$6,207	\$186	\$6,332	\$219	\$11,319	\$4,669	\$17,513	
23	\$0	18,001	\$6,393	\$185	\$6,300	\$0	\$0	\$12,508	\$30,021	
24	\$0	17,911	\$6,585	\$184	\$6,269	\$0	\$0	\$12,669	\$42,691	
25	\$0	17,822	\$6,783	\$184	\$6,238	\$0	\$0	\$12,837	\$55,527	
<b>Totals:</b>					\$89,655	\$134,212	\$94,786	\$110,124	\$126,660	\$149,569
					Net Present Value (NPV)		\$8,611			
					Internal Rate of Return (IRR)		13.2%			

Project Name: LGEA Solar PV Project - DPW Facility							
Location: Gloucester City, NJ							
Description: Photovoltaic System							
<b>Simple Payback Analysis</b>							
		<b>Photovoltaic System</b>					
Total Construction Cost		\$115,920					
Annual kWh Production		20,100					
Annual Energy Cost Reduction		\$3,337					
Annual SREC Revenue		\$7,035					
First Cost Premium		<b>\$115,920</b>					
Simple Payback:		<b>11.18</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>\$0.166</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	\$115,920	0	0	0	\$0	(115,920)	0
1	\$0	20,100	\$3,337	\$0	\$7,035	\$10,372	(\$105,548)
2	\$0	19,999	\$3,437	\$0	\$7,000	\$10,436	(\$95,112)
3	\$0	19,899	\$3,540	\$0	\$6,965	\$10,505	(\$84,608)
4	\$0	19,800	\$3,646	\$0	\$6,930	\$10,576	(\$74,032)
5	\$0	19,701	\$3,755	\$203	\$6,895	\$10,448	(\$63,584)
6	\$0	19,602	\$3,868	\$202	\$6,861	\$10,527	(\$53,057)
7	\$0	19,504	\$3,984	\$201	\$6,827	\$10,610	(\$42,447)
8	\$0	19,407	\$4,104	\$200	\$6,792	\$10,696	(\$31,751)
9	\$0	19,310	\$4,227	\$199	\$6,758	\$10,786	(\$20,965)
10	\$0	19,213	\$4,353	\$198	\$6,725	\$10,880	(\$10,085)
11	\$0	19,117	\$4,484	\$197	\$6,691	\$10,978	\$893
12	\$0	19,022	\$4,619	\$196	\$6,658	\$11,080	\$11,974
13	\$0	18,926	\$4,757	\$195	\$6,624	\$11,186	\$23,160
14	\$0	18,832	\$4,900	\$194	\$6,591	\$11,297	\$34,457
15	\$0	18,738	\$5,047	\$193	\$6,558	\$11,412	\$45,869
16	\$0	18,644	\$5,198	\$192	\$6,525	\$11,532	\$57,401
17	\$0	18,551	\$5,354	\$191	\$6,493	\$11,656	\$69,057
18	\$0	18,458	\$5,515	\$190	\$6,460	\$11,785	\$80,842
19	\$0	18,366	\$5,680	\$189	\$6,428	\$11,919	\$92,761
20	\$0	18,274	\$5,851	\$188	\$6,396	\$12,058	\$104,819
21	\$1	18,183	\$6,026	\$187	\$6,364	\$12,203	\$117,022
22	\$2	18,092	\$6,207	\$186	\$6,332	\$12,353	\$129,375
23	\$3	18,001	\$6,393	\$185	\$6,300	\$12,508	\$141,883
24	\$4	17,911	\$6,585	\$184	\$6,269	\$12,669	\$154,552
25	\$5	17,822	\$6,783	\$184	\$6,238	\$12,837	\$167,389
<b>Totals:</b>		383,463	\$89,655	\$3,128	\$134,212	\$283,309	\$220,739
<b>Net Present Value (NPV)</b>						<b>\$167,414</b>	
<b>Internal Rate of Return (IRR)</b>						<b>8.1%</b>	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
DPW	820	Sunpower SPR230	56	14.7	823	12.88	20,100	1,848	15.64



 . = Proposed PV Layout

Notes:

1. Estimated kWh based on 4.68 hours full output per day per 365 day year. Actual kWh will vary day to day.