ENERGY AUDIT – FINAL REPORT

SHAMONG TOWNSHIP
DEPARTMENT OF PUBLIC WORKS
105 WILLOW GROVE RD.
SHAMONG, NJ 08088
ATTN: MRS. SUE ONORATO

CEG PROPOSAL NO. 9C08155

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I. EXECUTIVE SUMMARY

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

Shamong Township DPW Building
105 Willow Grove Road
Shamong, NJ 08088

Facility Contact Person:
Municipal Contact Person: Susan D. Onorato

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	$ 2,452
Natural Gas	$ 3,554
Total	$ 6,006

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 ± 20% until detailed engineering, specifications, and hard proposals are obtained.

Table 1
Energy Conservation Measures (ECM's)

ECM NO.	DESCRIPTION	COST	ANNUAL SAVINGS	SIMPLE PAYBACK (YEARS)	SIMPLE RETURN ON INVESTMENT
1	Garage Lighting Upgrade	$437	$367	1.2	86.4%
2	Outdoor Lighting Upgrade	$4,200	$280	15	2.1%
3	Garage Infrared Heating	$16,300	$960	17	0.6%
4	Add roof insulation	$18,900	$465	40.6	-8.5%

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)
1	Garage Lighting Upgrade	1.6	2,211	-
2	Outdoor Lighting Upgrade	-	1,687	-
3	Garage Infrared Heating	-	1,482	475
4	Add Roof Insulation	-	-	310

Recommendation:

Concord Engineering Group (CEG) strongly recommends the implementation of all ECM's that provide a calculated simple payback of approximately 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 the Shamong Township DPW Building:

- **ECM #1:** Garage Lighting Upgrade
- **ECM #2:** Outdoor Lighting Upgrade

If the municipality decides to package the two (2) recommended energy conservation measures, the approximate total cost would equal $4,637, total annual savings $647 and a combined simple payback equal to 7.1 years.

Furthermore, CEG would like to make a secondary recommendation that the Owner move forward with the solar array installation as the estimated annual kWh production exceeds the actual consumption for the facility. There are various funding options available as noted in Section X of this report.

II. INTRODUCTION

This comprehensive energy audit covers the 5,760 square foot Department of Public Works facility that includes two (2) offices, rest room, repair and equipment storage garage, and emergency vehicle storage.

The first task was to collect and review one year worth of utility energy data for electricity and natural gas. 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^2/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 obtained from the Township were used to calculate the gross area of the buildings.

Obtaining Architectural and Mechanical drawings, a building profile was created that included age, occupancy, description, and existing conditions of Architectural and Mechanical Systems. The profile noted the major energy consuming equipment or systems and components that are inherently inefficient. Also, by reviewing the mechanical and electrical drawings and equipment schedules, questions regarding the lighting systems/controls, HVAC zone controls, or setback operations were noted.

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 included 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

The first step in the energy analysis is the site survey. 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 engineering calculations, Microsoft Excel spread sheets and Trane Trace 700™ building simulation software that calculate the anticipated energy usage. The actual energy usage is entered directly from the utility bills. The anticipated energy usage is compared to the actual usage. If necessary, corrections are made to the site-collected data until the anticipated energy usage matches the actual usage. This process develops an end-use baseline for all of the fuels used at the facility. This baseline is used to calculate the energy savings for the measures that are recommended in this report.

The savings 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 Trane Trace 700™ building simulation software. 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 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.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

Table 3 and Figure 1 represent the electrical usage for the surveyed facility from December-07 to November-08. Atlantic City Electric provides electricity to the facility under the Monthly General Service (MGS) – Secondary Rate Schedules. 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 facility from January-08 to December-08. South Jersey Gas supplies the natural gas for the facility under their General Service Gas Rate.

The average utility costs for the facility are as follows:

Description	Average
Electricity	16.6¢/kWh
Natural Gas	$1.50/Therm

Table 3
Electricity Billing Data

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
1/08	2,192	10.6	$347
2/08	2,255	10.8	$351
3/08	1,579	9.0	$260
4/08	1,243	8.6	$201
5/08	907	9.1	$148
6/08	691	8.6	$132
7/08	729	5.5	$139
8/08	700	6.9	$133
9/08	858	7.4	$163
10/08	936	7.5	$152
11/08	972	8.5	$158
12/08	1,671	9.6	$266
Totals	**14,733**	**10.8 Max**	**$2,452**

Figure 1
Electricity Usage Profile

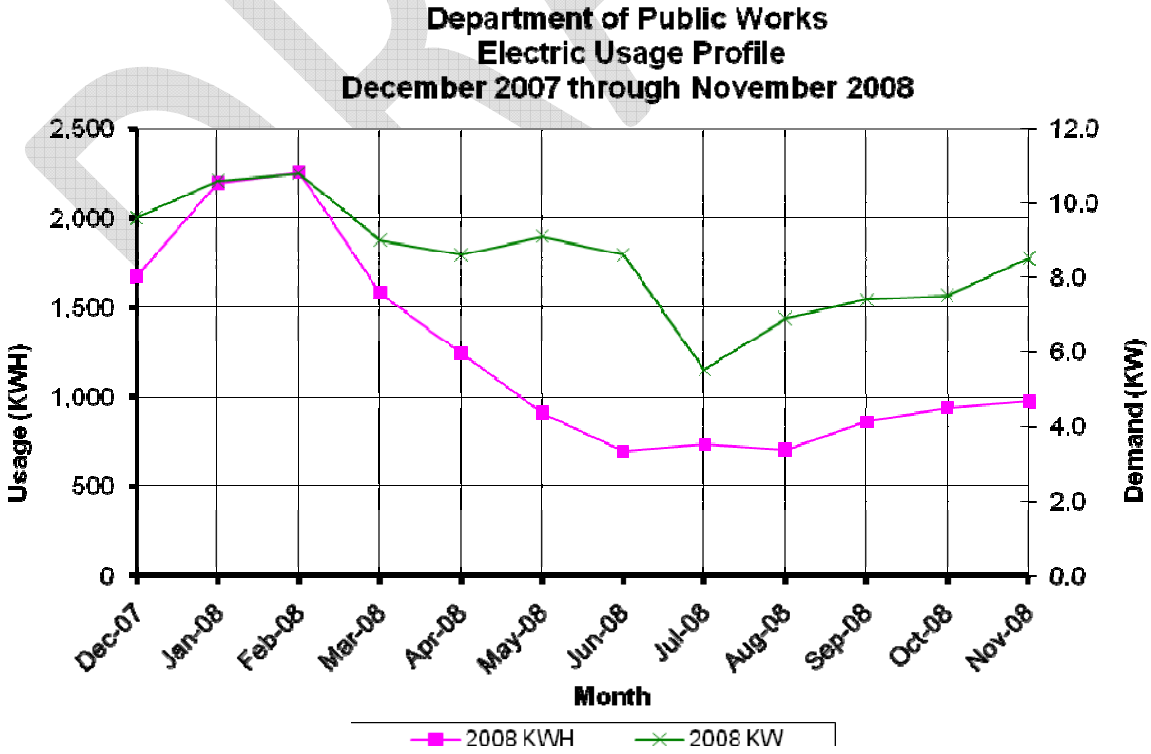
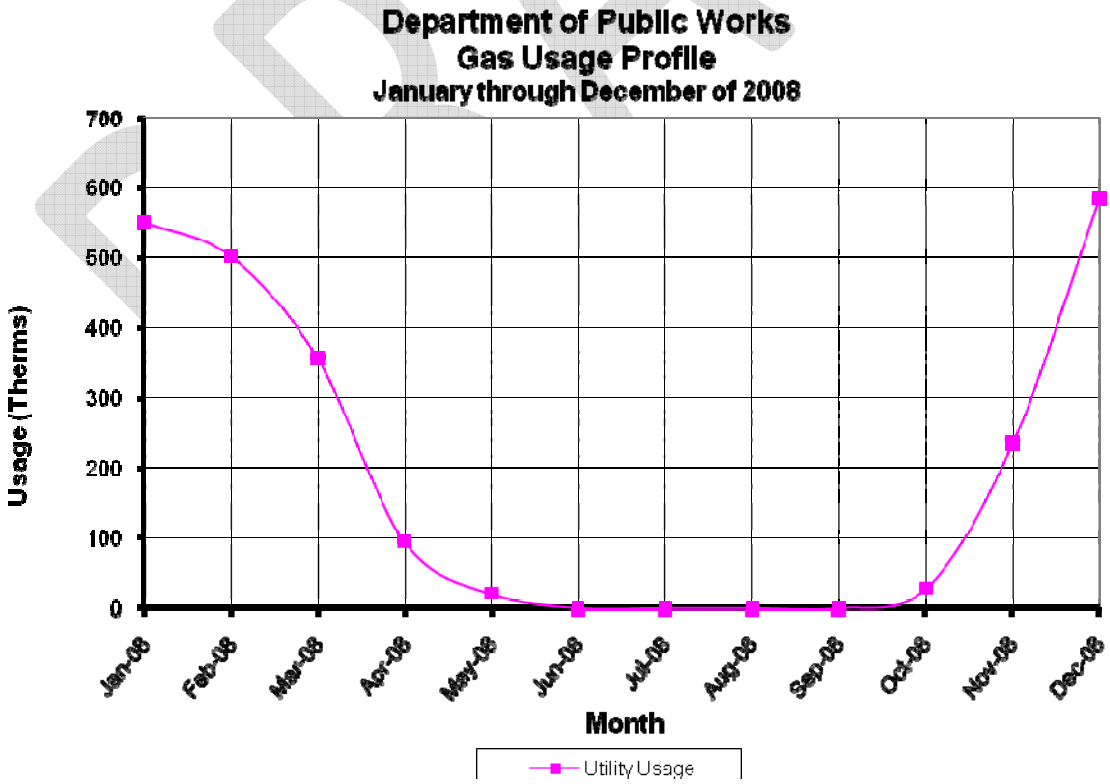


Table 4
Natural Gas Billing Data

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
1/08	551	$770
2/08	503	$702
3/08	357	$505
4/08	95	$147
5/08	21	$47
6/08	0	$18
7/08	0	$20
8/08	0	$18
9/08	0	$21
10/08	28	$57
11/08	235	$346
12/08	585	$903
Totals	**2,375**	**$3,554**

Figure 2
Natural Gas Usage Profile



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:

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

Electric = ((14,733 kWh) * (1000 W/kW) * (3.414 Btu/h / 1 W))/ (1000 Btu/h / 1 kBtu/h)
= 50,298 kBtu/h

Gas = ((2,375 therms) * (100,000 Btu/h / 1 W)) / (1000 Btu/h / 1 kBtu/h) = 237,500 kBtu/h

$$Building\ \ EUI = \frac{(50{,}298\ kBtu/h + 237{,}500\ kBtu/h)}{5{,}760\ SF} = \frac{287{,}798\ kBtu/h}{5{,}760\ SF}$$

Department of Public Works Building EUI = 50 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). 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.

In accordance with the Local Government Energy Audit Program, CEG has created an Energy Star account for the Department of Public Works in order to allow the municipality access to monitoring their yearly energy usage as it compares to facilities of similar type. 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: shamongtwp
Password: lgeaceg2009

Utilizing the utility bills and other information gathered during the energy audit process, CEG entered the respective data into Portfolio Manager and the following is a summary of the results:

Table 4
ENERGY STAR Performance Rating

FACILITY DESCRIPTION	ENERGY PERFORMANCE RATING	NATIONAL AVERAGE
DPW Facility	N/A	N/A

Specific building types are detailed on the ENERGY STAR website. Non-typical buildings are covered by an "Other" category. The Shamong Township Public Works Garage falls under this "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 then 10% of a building is classified as "Other." The majority of the Public Works Garage would be classified as "Other" and therefore cannot be given an Energy Performance Rating.

Refer to Appendix B for the "Statement of Energy Performance."

V. FACILITY DESCRIPTION

The Shamong Township Department of Public Works building consists of two (2) offices, rest room, repair and equipment storage garage, and an emergency vehicle storage addition totaling approximately 5,760 SF. The Public Works building is a single story steel structure with corrugated metal siding, concrete slab and concrete block construction. The facility was built in 1985 and the emergency vehicle garage/office added in 1997. The facility is typically occupied from 7 AM until approximately 5 PM except during winter snow removal.

Cooling/Heating System

The supervisor's and emergency vehicle offices are heated/cooled by GE heat pumps rated at 11,700 BTUH for cooling and 10,900 BTUH for heating with an EER=10.9. The emergency vehicle storage is heated by a Modine gas-fired unit heater rated at 80,000 BTUH input and 66,000 BTUH output. The original garage is heated by two (2) Modine gas-fired unit heaters rated at 180,000 BTUH input and 149,000 BTUH output.

Domestic Hot Water

Domestic hot water for the restroom/shower is provided by a Bradford White electric hot water heater, 50-gallon capacity and rated at 4,500 watts input.

Controls System

The heating for the emergency vehicle garage and the DPW garage are local thermostats integral to the Modine gas-fired unit heaters.

Lighting

The offices are lit via 2-foot by 4-foot lay-in fixtures containing T8 lamps electronic ballasts. Standard switching is utilized and there are no other types of lighting controls present.

The garage and emergency vehicle storage areas are lit via 1-foot by 8-foot fixtures containing T12 lamps and magnetic ballasts. Standard switching is utilized and there are not other types of lighting controls present.

The exit signs throughout the facility contain the latest LED technology.

The exterior lighting is comprised of twelve (12) wall packs with 70-Watt HPS lamps mounted on the building. These two-lamp fixtures have been de-lamped to one lamp per fixture and only ½ of the fixtures surveyed were lit during a night time site inspection.

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**	**Rated Capacity(BTUH)**	**Fuel Type**	**Approx. Age (yrs)**	**ASHRAE Service Life (yrs)**	**Remaining Life (yrs)**
Modine Unit Heater – EMS Garage	1	80,000	NG	10	18	8
Modine Unit Heater – Vehicle Storage/Repair	2	180,000	NG	16	18	2

HEATING/COOLING EQUIPMENT							
Description	**Qty**	**Cooling Capacity (Tons)**	**Heating Capacity (BTUH)**	**Fuel Type**	**Approx. Age (yrs)**	**ASHRAE Service Life (yrs)**	**Remaining Life (yrs)**
GE Heat Pump	2	1	10,900	NG	10	15	5

DOMESTIC HOT WATER SYSTEM						
Description	**Qty**	**Capacity**	**Fuel Type**	**Approx. Age (yrs)**	**ASHRAE Service Life (yrs)**	**Remaining Life (yrs)**
Bradford White Domestic HW Heater	1	4,500 Watts	Electric	5	12	7

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade – Garage/Vehicle Storage Areas

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 1-foot by 8-foot industrial fixture consumes approximately 212 Watts. By installing new fixtures with four (4) new 4-foot lamps and one 4-lamp electronic ballast, the total wattage would be reduced to about 128 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 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 Owner 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 D that outlines the proposed new fixtures, costs, savings, and payback periods.

NJ Smart Start® 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.

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

$$\text{Smart Start®}\ Incentive = (10 \times\ \$\ 25) = \$250$$

Maintenance Savings are calculated as follows:

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

$$Maintenance\ Savings = (20 \times 33\%\ reduction \times \$\ 2.00) + (\$20 \times 20) = \$413$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,100
NJ Smart Start Equipment Incentive ($):	($250)
Maintenance Savings ($):	($413)
Net Installation Cost ($):	*$437*
Total Energy Savings ($ / yr):	*$367*
Simple Payback (yrs):	*1.2*
Simple Return on Investment	*86.4%*

ECM #2: Outdoor Lighting Upgrade

Description:

During CEG's site survey it was noted that in numerous outdoor fixtures HID lamps are being used throughout the facility. There are twelve (12) wall pack 2-lamp exterior fixtures with a 70-Watt HPS lamp in each. CEG recommends a replacement of these HID lamps with energy-efficient LED lamps. LED is an acronym for light-emitting-diode. LED's are small light sources that are readily associated with electronic equipment. The 70-Watt HPS lamp uses 105 Watts while a LED equivalent uses only 27 Watts, an energy savings of 74%.

This ECM involves replacing HID 70-Watt HPS lamps in the outdoor fixtures with energy efficient LED lamps and new ballasts.

Energy Savings Calculations:

There are twelve outdoor lighting fixtures that would be good candidates for this new technology. Assume that each fixture is on for an average of 10 hours per night all year round (1,800 hrs).

Energy cost savings = 12 units x [1,800 hr/yr x (105-27) watts] x $0.166 = $280

The cost of a LED lamp retrofit kit with new ballast is $410 per outdoor fixture.

12 units x $410/unit = $4,920

Maintenance savings is from the cost of replacement lamps and labor to install. LED lamps last 50,000 hours while HPS lamps last 20,000 hours. Therefore there is a savings of not having to replace lamps twice during the life of a LED lamp.

Maintenance savings = 24 x $10 (cost of 70W HPS) + 24 x $20/Lamp (Labor) = $720

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$4,920
NJ Smart Start Equipment Incentive ($):	-
Maintenance Savings ($):	($720)
Net Installation Cost ($):	*$4,200*
Total Energy Savings ($ / yr):	*$280*
Simple Payback (yrs):	*15*
Simple Return on Investment	*2.1%*

ECM #3: Shop Heater Replacement - Infrared Heaters

Description:

The interior spaces of the vehicle maintenance/storage garages are heated by Modine gas-fired unit heaters totaling 440,000 BTUH. Whenever the large overhead doors are opened, the heaters run continuously until the space temperature becomes 60ºF. The remote thermostats that control these heating units are set at 60ºF. These units do not provide adequate heating because of the high ceilings and losses through garage doors when open.

Our team recommends replacing the existing gas-fired 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 unit heater data, thermostat settings and natural gas bills, the total energy consumed by these heating units is approximately 2,375 Therms/Year. The total rated heat capacity of the IR tubes is 80% of the current load or 0.8 x 2,375 Therms = 1,900 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 60 feet wide will require two rows of tubes. Heat output of each 20-foot section is approximately 60,000 Btu/hr for a total of eight sections required.

Estimated Fan Energy Savings:

Each of the Modine 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 Watt/HP x Motor HP x Load Factor x Hours of Operation x Cost of Electricity] ÷ Motor Efficiency

= [0.746 x 0.25 x 0.75 x 2,800 x 0.166] ÷ 0.80 = $82 / Year

Based on three (3) existing units, this equates to 3 x $82 = $246/Year Savings

Natural Gas Energy Savings:

20% savings x 2,375 Therms/Yr x $1.50/Therm = $713/Year

Total Energy Savings = Fan Energy Savings + Natural Gas Savings

= $246 + $713 = $960 per year

The total implementation cost including material and labor is estimated at approximately $16,300. 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:

ECM #3 – ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$16,300
NJ Smart Start Equipment Incentive ($):	**A**
Maintenance Savings ($):	-
Net Installation Cost ($):	*$16,300*
Total Energy Savings ($ / yr):	*$960*
Simple Payback (yrs):	*17*
Simple Return on Investment	*1.6%*

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

ECM #4: Add Roof Insulation

Description:

The corrugated metal roofing and wall/ceiling junctures in both the EMS and Vehicle repair/storage garages is not insulated. Air filtration can be felt at the wall to ceiling connections. The exterior walls in the two building were insulated with R-11 but the roofs were not. Corrugated metal roofing has an R-value of approximately 0 ($U_{exist} = 0$). We recommend adding 4" of fiberglass insulation between the roof trusses ($U_{NEW} = 0.07$).

Energy Savings Calculations:

HDD = 4,917°F – day/yr (from the McGuire AFB Weather Station)

Heating system efficiency for existing gas-fired unit heaters = 80%

Energy Savings (Heating) = 8 $\frac{\text{hrs}}{\text{Day}}$ * SF of Roof * ($U_{new} – U_{exist}$) x HDD/Unit Heater Efficiency

= [8 * 9,000 * (0.07) * 4,917] / 0.80

= 30.98 MMBTU = 309.8 Therms

Energy cost savings = 309.8 Therms x $1.50/Therms = $465/Yr

Installed cost of 4-inch roof insulation = $2.10/SF

= $2.10 (9,000 SF) = $18,900

Simple Payback for Roof Insulation = $18,900/$465 = 40.6 Years

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$18,900
NJ Smart Start Equipment Incentive ($):	-
Maintenance Savings ($):	-
Net Installation Cost ($):	*$18,900*
Total Energy Savings ($ / yr):	*$465*
Simple Payback (yrs):	*40.6*
Simple Return on Investment	*-8.5%*

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 Shamong Township, and concluded that there is potential for solar and wind 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 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 625 S.F. can be utilized for a PV system on the DPW Facility. A depiction of the area utilized is shown in Appendix E. Using this square footage it was determined that a system size of 9.89 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 15,434 KWh annually, reducing the overall utility bill by 104% percent. This makes the solar system very attractive for the DPW facility. A detailed financial analysis can be found in Appendix E. 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 for the respective method of payment:

PAYMENT TYPE	SIMPLE PAYBACK	INTERNAL RATE OF RETURN
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 Shamong Township and has determined it is not a viable option. Low average wind speeds for the area are not adequate for wind turbine generation. Typical wind turbines start producing energy at 8 mph wind speeds. Shamong Township averages 4 mph wind speeds making this application impractical.

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 respective electricity and natural gas usage load profile for January 2008 through December 2008.

Electricity:

Section IV, Figure 1 demonstrates a typical cooling profile, (April –October), complimenting the heating load. During the months of January through February 2008 higher than expected electrical consumption occurred. This is most likely associated with evening usage of the facility for township's road department snow plowing and readiness for weather emergencies.

Natural Gas:

Section IV, Figure 2 demonstrates a typical heating load (November –March), and complimentary cooling load (April –October). The natural gas load profile demonstrates a clear separation between the heating and cooling demands of the building.

Tariff Analysis:

Electricity:

Shamong Township receives electrical service through Atlantic City Electric on the Monthly General Service (MGS) – Secondary Rate Schedule. 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:

Shamong Township receives natural gas service through South Jersey Gas on a GSG (General Service Gas) rate class. This utility tariff is for delivery service of natural gas 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). It is pertinent to 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.

Imbalances occur when Third Party Suppliers are used to supply natural gas, full-delivery is not made, and when a new supplier is contracted or the customer returns to the utility. It is important when utilizing a Third Party Supplier, that an experienced regional supplier is used. Otherwise, imbalances can occur, jeopardizing economics and scheduling.

Recommendations:

Based on CEG's review of Shamong Township's utility bills and charges, our recommendation is to continue purchasing energy in the current manner. As compared to current market pricing, it does not appear that the electricity and natural gas rates are very far from standard average for facilities on the same consumption level as the DPW Facility. There could very well be opportunities on the natural gas side; however, the relatively low consumption as compared to large users does not allow competitive procurement. On the other hand, if Shamong Township were to aggregate their natural gas demand with other townships in a collaborative effort, utility savings could be realized.

CEG recommends that Shamong Township schedule a meeting with their 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), Shamong Township will learn more about the competitive supply process. Shamong Township can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at 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, Shamong Township 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:

A. *Performance Contracting* – Performance Contracting is an agreement between a local government and a private energy services company (ESCO) that uses future energy savings to pay for the entire cost of a building's energy efficiency retrofits/upgrades. A local government contracts with an ESCO, then the ESCO purchases, installs and maintains energy-saving equipment. According to State Assembly Bill # 1185, a local government may enter into guaranteed energy savings contracts within a 15-year period. An independent energy auditor must prepare the investment grade audit and perform the measurement/verification of the savings.

B. *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.

C. *County Improvement Authority* – Several local governments in New Jersey have received funding for energy projects through their County Improvement Authority.

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 on the heat pumps periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.

B. Maintain all weather stripping on windows and doors.

C. Annually clean the gas burners on the unit heaters.

D. Use cog-belts instead of v-belts on the unit heater belt-driven fans. These can reduce electrical consumption of the motor by 2-5%.

E. Reduce lighting in areas where the foot candle levels are above 70 in private offices.

F. Clean all light fixtures to maximize light output.

Electric Cost Summary

Atlantic City Electric - Rate (MGS)

Department of Public Works **2008**

Account # 0499716 - 9999 - 3

Meter # XXXX

Month	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-07	**Total**	
Billing Days	31	28	31	30	31	30	31	31	30	31	30	31	0	
KWH	2,192	2,255	1,579	1,243	907	691	729	700	858	936	972	1,671	14,733	
KW	10.6	10.8	9.0	8.6	9.1	8.6	5.5	6.9	7.4	7.5	8.5	9.6	11	Max
Monthly Load Factor	28%	31%	24%	20%	13%	11%	18%	14%	16%	17%	16%	23%	19%	
Electric Delivery, $													$0	
Delivery $/kwh	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	
Electric Supply, $													$0	
Supply $/kwh	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	
Total Cost, $	$347	$351	$260	$201	$148	$132	$139	$133	$163	$152	$158	$266	$2,452	
$/KWH	$0.158	$0.156	$0.165	$0.162	$0.163	$0.190	$0.191	$0.191	$0.190	$0.162	$0.163	$0.159	**$0.166**	

Individual Delivery and Supply cost not obtainable from utility information provided by owner.

Summary of Natural Gas Cost

South Jersey Gas - Rate (BGSS)

Department of Public Works **2008**

Account # 2 01 01 2393 0 7

Meter # 351570

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	
Total MCF	533	487	346	92	20	0	0	0	0	27	227	564	2,296
BTU Factor	1.03	1.03	1.03	1.03	1.04	1.04	1.03	1.03	1.04	1.03	1.04	1.04	12
Therms (Burner Tip)	551.1	502.6	356.7	94.9	20.8	0.0	0.0	0.0	0.0	27.9	235.2	585.4	2374.6
Total Distribution Cost	$243	$222	$164	$56	$27	$18	$20	$18	$21	$30	$114	$261	1,193
Cost per Therm	$0.440	$0.441	$0.460	$0.595	$1.304	$0.000	$0.000	$0.000	$0.000	$37.340	$0.483	$0.445	$0.503
Total Commodity Cost	$527	$481	$341	$91	$20	$0	$0	$0	$0	$27	$232	$643	2,361
Cost per Therm	$0.96	$0.96	$0.96	$0.96	$0.96	$0.00	$0.00	$0.00	$0.00	$0.96	$0.99	$1.10	$0.99
Total Cost	$770	$702	$505	$147	$47	$18	$20	$18	$21	$57	$346	$903	$3,554
Cost per Therm	$1.397	$1.398	$1.416	$1.551	$2.261	$0.000	$0.000	$0.000	$0.000	$2.033	$1.470	$1.543	**$1.497**

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Municipal Garage

Building ID: 1794259
For 12-month Period Ending: December 31, 2008[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: July 16, 2009

Facility
Municipal Garage
105 Will Grove Rd.
Shamong, NJ 08088

Facility Owner
Shamong Township
105 Willowgrove Rd.
Shamong, NJ 08088

Primary Contact for this Facility
Sue Onorato
105 Willowgrove Rd.
Shamong, NJ 08088

Year Built: 1985
Gross Floor Area (ft²): 5,760

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

Site Energy Use Summary[3]

Electricity (kBtu)	50,269
Natural Gas (kBtu)[4]	237,460
Total Energy (kBtu)	287,729

Energy Intensity[5]

Site (kBtu/ft²/yr)	50
Source (kBtu/ft²/yr)	72

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	21

Electric Distribution Utility
Atlantic City Electric Co

National Average Comparison

National Average Site EUI	25
National Average Source EUI	56
% Difference from National Average Source EUI	29%
Building Type	Storage/Shipping/Non-Refrigerated Warehouse

Stamp of Certifying Professional

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

Meets Industry Standards[6] **for Indoor Environmental Conditions:**

Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Certifying Professional
Raymond Johnson
520 S. Burnt Mill Road
Voorhees, NJ 08043

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.
NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Municipal Garage	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Storage/Shipping/Non-Refrigerated Warehouse	Is this an accurate description of the space in question?		☐
Location	105 Will Grove Rd., Shamong, NJ 08088	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐

Garage (Other)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	5,760 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Number of PCs	2 (Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	50 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.		☐
Workers on Main Shift	10 (Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Atlantic City Electric Co

Fuel Type: Electricity		
Meter: Electricity (kWh) **Space(s):** Entire Facility		
Start Date	**End Date**	**Energy Use (kWh)**
12/01/2008	12/31/2008	1,671.00
11/01/2008	11/30/2008	972.00
10/01/2008	10/31/2008	936.00
09/01/2008	09/30/2008	858.00
08/01/2008	08/31/2008	700.00
07/01/2008	07/31/2008	729.00
06/01/2008	06/30/2008	691.00
05/01/2008	05/31/2008	907.00
04/01/2008	04/30/2008	1,243.00
03/01/2008	03/31/2008	1,579.00
02/01/2008	02/29/2008	2,255.00
01/01/2008	01/31/2008	2,192.00
Electricity Consumption (kWh)		**14,733.00**
Electricity Consumption (kBtu)		**50,269.00**
Total Electricity Consumption (kBtu)		**50,269.00**
Is this the total Electricity consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas		
Meter: Natural Gas (therms) **Space(s):** Entire Facility		
Start Date	**End Date**	**Energy Use (therms)**
12/01/2008	12/31/2008	585.40
11/01/2008	11/30/2008	235.20
10/01/2008	10/31/2008	27.90
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	20.80
04/01/2008	04/30/2008	94.90

03/01/2008	03/31/2008	356.70
02/01/2008	02/29/2008	502.60
01/01/2008	01/31/2008	551.10
Natural Gas Consumption (therms)		**2,374.60**
Natural Gas Consumption (kBtu)		**237,460.00**
Total Natural Gas Consumption (kBtu)		**237,460.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

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

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
Municipal Garage
105 Will Grove Rd.
Shamong, NJ 08088

Facility Owner
Shamong Township
105 Willowgrove Rd.
Shamong, NJ 08088

Primary Contact for this Facility
Sue Onorato
105 Willowgrove Rd.
Shamong, NJ 08088

General Information

Municipal Garage	
Gross Floor Area Excluding Parking: (ft^2)	5,760
Year Built	1985
For 12-month Evaluation Period Ending Date:	December 31, 2008

Facility Space Use Summary

Garage	
Space Type	Other - Storage/Shipping/Non-Refrigerated Warehouse
Gross Floor Area(ft^2)	5,760
Number of PCs[o]	2
Weekly operating hours[o]	50
Workers on Main Shift[o]	10

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**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^2)	50	50	0	N/A	25
Source (kBtu/ft^2)	72	72	0	N/A	56
Energy Cost					
$/year	$ 6,004.00	$ 6,004.00	N/A	N/A	$ 3,005.01
$/$ft^2$/year	$ 1.04	$ 1.04	N/A	N/A	$ 0.52
Greenhouse Gas Emissions					
$MtCO_2e$/year	21	21	0	N/A	11
$kgCO_2e/ft^2$/year	4	4	0	N/A	2

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

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

Concord Engineering Group, Inc.

520 BURNT MILL ROAD
VOORHEES, NEW JERSEY 08043
PHONE: (856) 427-0200
FAX: (856) 427-6508

SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of January, 2009:

Electric Chillers

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

Gas Cooling

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

Desiccant Systems

	$1.00 per cfm – gas or electric

Electric Unitary HVAC

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

Ground Source Heat Pumps

Closed Loop & Open Loop	$370 per ton

Gas Heating

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

Variable Frequency Drives

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

Natural Gas Water Heating

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

Premium Motors

Three-Phase Motors	$45 - $700 per motor

Prescriptive Lighting

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

Lighting Controls – Occupancy Sensors

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

Lighting Controls – HID or Fluorescent Hi-Bay Controls

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

Other Equipment Incentives

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

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C08155
Project: Shamong Twp. Energy Audit
Address: 105 Willow Grove Road
City: Shamong
Building SF:

Dept. of Public Works

DATE: 05/04/2009
KWH COST: $0.166

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
Line No.		Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
1		Supv Office	4	2' x 4' 4-Lamp, T-8, Prism Reflector, MB	800	128	0.51	409.6	$67.99		2'X4' 4-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N WN	128	0.00	0	$0.00	$120.00	$0.00	0.51	409.6	$67.99	0.00
2		Restrooms	2	1' x 4' 2-Lamp, T-8, Prism Reflector, MB	400	61	0.12	48.8	$8.10		1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N WN	61	0.00	0	$0.00	$110.00	$0.00	0.12	48.8	$8.10	0.00
3		EMS Office	2	1' x 4' 2-Lamp, T-8, Prism Reflector, MB	400	61	0.12	48.8	$8.10		1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N WN	61	0.00	0	$0.00	$110.00	$0.00	0.12	48.8	$8.10	0.00
4		Vechical Storage & Repair	6	1' x 8' 2-Lamp, t-12	2,500	212	1.27	3180	$527.88	6	1'X8' 4-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux	128	0.77	1920	$318.72	$110.00	$660.00	0.50	1260	$209.16	3.16
5		Emergency Vehicle Garage	4	1' x 8' 2-Lamp, t-12	800	212	0.85	678.4	$112.61	4	1'X8' 4-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux	128	0.51	409.6	$67.99	$110.00	$440.00	0.34	268.8	$44.62	9.86
6		Exit Signs	5	LED Exit signs	8,760	4	0.02	175.2	$29.08		LED Exit Signs	4	0.00	0	$0.00	$75.00	$0.00	0.02	175.2	$29.08	0.00
		Totals	23				2.90	4540.80	753.77	10			1.28	2329.60	$386.71		$1,100.00	1.62	2,211.20	$367.06	3.00

Project Name: LGEA Solar PV Project - DPW Facility
Location: Shamong Twp., NJ
Description: Photovoltaic System 95% Financing - 20 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 20 year
Total Construction Cost	$89,010
Annual kWh Production	15,434
Annual Energy Cost Reduction	$2,562
Annual SREC Revenue	$5,402
First Cost Premium	**$89,010**
Simple Payback:	**11.18** Years

Life Cycle Cost Analysis

Analysis Period (years): 25
Financing Term (mths): 240
Average Energy Cost ($/kWh) **$0.166**
Financing Rate: 7.00%
Financing %: 95%
Maintenance Escalation Rate: 3.0%
Energy Cost Escalation Rate: 3.0%
SREC Value ($/kWh) $0.350

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	$4,451	0	0	0	$0	0	0	(4,451)	0
1	$0	15,434	$2,562	$0	$5,402	$5,855	$2,012	$97	($4,354)
2	$0	15,357	$2,639	$0	$5,375	$5,710	$2,157	$147	($4,207)
3	$0	15,280	$2,718	$0	$5,348	$5,554	$2,313	$199	($4,008)
4	$0	15,203	$2,800	$0	$5,321	$5,387	$2,480	$254	($3,754)
5	$0	15,127	$2,884	$156	$5,295	$5,208	$2,659	$155	($3,599)
6	$0	15,052	$2,970	$155	$5,268	$5,015	$2,852	$216	($3,383)
7	$0	14,977	$3,059	$154	$5,242	$4,809	$3,058	$280	($3,103)
8	$0	14,902	$3,151	$153	$5,216	$4,588	$3,279	$346	($2,757)
9	$0	14,827	$3,245	$153	$5,190	$4,351	$3,516	$415	($2,342)
10	$0	14,753	$3,343	$152	$5,164	$4,097	$3,770	$487	($1,855)
11	$0	14,679	$3,443	$151	$5,138	$3,824	$4,043	$563	($1,292)
12	$0	14,606	$3,546	$150	$5,112	$3,532	$4,335	$641	($651)
13	$0	14,533	$3,653	$150	$5,086	$3,219	$4,648	$723	$71
14	$0	14,460	$3,762	$149	$5,061	$2,883	$4,984	$807	$879
15	$0	14,388	$3,875	$148	$5,036	$2,522	$5,345	$896	$1,774
16	$0	14,316	$3,992	$147	$5,011	$2,136	$5,731	$988	$2,762
17	$0	14,244	$4,111	$147	$4,986	$1,722	$6,145	$1,083	$3,845
18	$0	14,173	$4,235	$146	$4,961	$1,278	$6,590	$1,182	$5,027
19	$0	14,102	$4,362	$145	$4,936	$801	$7,066	$1,285	$6,312
20	$0	14,032	$4,493	$145	$4,911	$290	$7,577	$1,392	$7,704
21	$0	13,962	$4,627	$144	$4,887	$246	$6,965	$2,159	$9,863
22	$0	13,892	$4,766	$143	$4,862	$168	$5,732	$3,585	$13,448
23	$0	13,822	$4,909	$142	$4,838	$0	$0	$9,605	$23,052
24	$0	13,753	$5,056	$142	$4,814	$0	$0	$9,728	$32,780
25	$0	13,684	$5,208	$141	$4,790	$0	$0	$9,857	$42,637
	Totals:	294,445	$68,842	$2,402	$103,056	$72,782	$84,559	$97,257	$114,848

Net Present Value (NPV)	**$6,618**
Internal Rate of Return (IRR)	**13.2%**

Project Name: **LGEA Solar PV Project - DPW Facility**
Location: **Shamong Twp., NJ**
Description: **Photovoltaic System - Direct Purchase**

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$89,010
Annual kWh Production	15,434
Annual Energy Cost Reduction	$2,562
Annual SREC Revenue	$5,402
First Cost Premium	**$89,010**
Simple Payback:	**11.18** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.166**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$89,010	0	0	0	$0	(89,010)	0
1	$0	15,434	$2,562	$0	$5,402	$7,964	($81,046)
2	$0	15,357	$2,639	$0	$5,375	$8,014	($73,032)
3	$0	15,280	$2,718	$0	$5,348	$8,066	($64,966)
4	$0	15,203	$2,800	$0	$5,321	$8,121	($56,846)
5	$0	15,127	$2,884	$156	$5,295	$8,022	($48,823)
6	$0	15,052	$2,970	$155	$5,268	$8,083	($40,740)
7	$0	14,977	$3,059	$154	$5,242	$8,147	($32,593)
8	$0	14,902	$3,151	$153	$5,216	$8,213	($24,380)
9	$0	14,827	$3,245	$153	$5,190	$8,282	($16,098)
10	$0	14,753	$3,343	$152	$5,164	$8,354	($7,744)
11	$0	14,679	$3,443	$151	$5,138	$8,430	$686
12	$0	14,606	$3,546	$150	$5,112	$8,508	$9,194
13	$0	14,533	$3,653	$150	$5,086	$8,590	$17,784
14	$0	14,460	$3,762	$149	$5,061	$8,675	$26,458
15	$0	14,388	$3,875	$148	$5,036	$8,763	$35,221
16	$0	14,316	$3,992	$147	$5,011	$8,855	$44,076
17	$0	14,244	$4,111	$147	$4,986	$8,950	$53,026
18	$0	14,173	$4,235	$146	$4,961	$9,049	$62,075
19	$0	14,102	$4,362	$145	$4,936	$9,152	$71,227
20	$0	14,032	$4,493	$145	$4,911	$9,259	$80,486
21	$1	13,962	$4,627	$144	$4,887	$9,370	$89,856
22	$2	13,892	$4,766	$143	$4,862	$9,485	$99,341
23	$3	13,822	$4,909	$142	$4,838	$9,605	$108,946
24	$4	13,753	$5,056	$142	$4,814	$9,728	$118,674
25	$5	13,684	$5,208	$141	$4,790	$9,857	$128,531
Totals:		294,445	$68,842	$2,402	$103,056	$217,541	$169,496
				Net Present Value (NPV)		**$128,556**	
				Internal Rate of Return (IRR)		**8.1%**	

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
Municipal Building	625	Sunpower SPR230	43	14.7	632	9.89	15,434	1,419	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.