ENERGY AUDIT – FINAL REPORT

WARREN COUNTY
ROAD DEPARTMENT
185 COUNTY ROAD
BELVIDERE, NJ 07823
ATTN: CHRISTOPHER J. PESSOLANO,
DIRECTOR OF PURCHASING

CEG PROJECT NO. 9C09086

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I. EXECUTIVE SUMMARY

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

Warren County
Road Department
185 County Road
Belvidere, NJ 07823

Municipal Contact Person: Christopher J. Pessolano
Facility Contact Person: Thomas R. Kitchen

This audit is performed in connection with the New Jersey Clean Energy - Local Government Energy Audit Program. The energy audit is conducted to promote the mission of the office of Clean Energy, which is to use innovation and technology to solve energy and environmental problems in a way that improves the State's economy. This can be achieved through the wiser and more efficient use of energy.

The annual energy costs at this facility are as follows:

Electricity	$ 26,943
Natural Gas	$ 62,075
Total	$ 89,018

The potential annual energy cost savings for each energy conservation measure (ECM) are shown below in Table 1. Be aware that the ECM's are not additive because of the interrelation of some of the measures. This audit is consistent with an ASHRAE level 2 audit. The cost and savings for each measure is ± 20%. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

Table 1
Energy Conservation Measures (ECM's)

ECMs	ECM Description	COST[A]	ANNUAL SAVINGS[B]	SIMPLE PAYBACK (Years)	LIFETIME ROI
ECM #1	Lighting Upgrade	$23,419	$3,457	6.8	269.1%
ECM #2	Lighting Controls	$2,805	$1,836	1.5	881.9%
ECM #3	Boiler Lockout Controls	$1,084	$3,529	0.3	4783.3%
ECM #4	Window AC Unit Replacements	$976	$104	9.4	6.6%
ECM #5	Garage Door Vehicle Exhaust Kits	$9,546	$4,672	2.0	1123.5%
ECM #6	Solar Photovoltaic	$1,279,260	$83,278	15.4	62.7%

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

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

Table 2
Estimated Energy Savings

ECMs	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELEC. DEMAND (KW)	ELEC. CONSUMPTION (KWH)	GAS (Therms)
ECM#1	Lighting Upgrade	8.83	19,990	NA
ECM#2	Lighting Controls	NA	10,995	NA
ECM#3	Boiler Lockout Controls	NA	NA	2,271
ECM#4	Window AC Unit Replacements	0.78	622	NA
ECM#5	Garage Door Vehicle Exhaust Kits	NA	NA	3,014
ECM#6	Solar Photovoltaic System	142.14	161,079	NA

*Elec. Demand Savings are calculated for cooling season only. Elec. consumption savings are totaled annually.

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

- **ECM #1:** Lighting Upgrade
- **ECM #2:** Lighting Controls
- **ECM #3:** Boiler Lockout Controls
- **ECM #4:** Window AC Unit Replacements
- **ECM #5:** Garage Door Vehicle Exhaust Kits

In addition to the ECMs, there are maintenance and operational measures that can provide significant energy savings and provide immediate benefit. For this facility it is recommended to check the control of the outdoor lighting controls by photocell / time clocks. Check the operation of all photocells to ensure lighting is only on as desired for the needs of the facility and only at night.

This facility is typical for service garages with high gas usage and relatively low electric usage due to the lack of air conditioning. Despite this building's profile there are multiple energy saving approaches in both gas and electric usage. Overall this facility's "Source Energy Use Index" rating is approximately 78% higher than when compared to other service garages The relatively high usage is primarily due to lighting and overall building operations. Light fixtures throughout the facility are old technology fixtures that have the potential to see a 35 to 40% reduction in energy if changed to modern fixtures. Operationally the heating system has limited controls to avoid unnecessary heat loss. Implementation of simple boiler controls would reduce the heating usage by 6% at minimal cost. Infiltration loads due to garage doors being open account for considerable energy usage as well. Installation of vehicle exhaust thru-wall kits would limit the time garage doors are open. Reducing the time a single garage door is open by one hour per day saves approximately $1,170 per year. These issues have effective energy reduction solutions that CEG recommends to be implemented.

II. INTRODUCTION

The comprehensive energy audit provided within this report, covers the 22,530 square foot Warren County Road Department building. This facility is used for vehicle storage and servicing. The operation of the facility is from 7:00 AM to 3:30 PM, 5 days per week. The occupancy is typically 12 people on average, however the occupancy grows in the winter when road service attention is greater. The Energy utilities for the building are comprised of electricity for service equipment power and lighting, and natural gas for heating and domestic hot water production. The facility includes large high bay service areas, offices, parts storage room, lounge/common room, and specialty production rooms such as road sign production and paint room.

Electrical and natural gas utility information is collected and analyzed for one full year's energy use of the building. The utility information allows for analysis of the building's operational characteristics; calculate energy benchmarks for comparison to industry averages, estimated savings potential, and baseline usage/cost to monitor the effectiveness of implemented measures. A computer spreadsheet is used to calculate benchmarks and to graph utility information (see the utility profiles in section IV.)

The Energy Use Index (EUI) is established for the building. Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year (BTU/ft^2/yr), which is used to compare energy consumption to similar building types or to track consumption from year to year in the same building. The EUI is calculated by converting the annual consumption of all energy sources to BTU's and dividing by the area (gross square footage) of the building. Blueprints (where available) are utilized to verify the gross area of the facility. The EUI is a good indicator of the relative potential for energy savings. A low EUI indicates less potential for energy savings, while a high EUI indicates poor building performance therefore a high potential for energy savings.

Existing building architectural and engineering drawings (where available) are utilized for additional background information. The building envelope, lighting systems, HVAC equipment, and controls information gathered from building drawings allow for a more accurate and detailed review of the building. The information is compared to the energy usage profiles developed from utility data. Through the review of the architectural and engineering drawings a building profile can be defined that documents building age, type, usage, major energy consuming equipment or systems, etc.

The preliminary audit information is gathered in preparation for the site survey. The site survey provides critical information in deciphering where energy is spent and opportunities exist within a facility. The entire site is surveyed to inventory the following to gain an understanding of how each facility operates:

- Building envelope (roof, windows, etc.)
- Heating, ventilation, and air conditioning equipment (HVAC)
- Lighting systems and controls
- Facility-specific equipment

The building site visit is performed to survey all major building components and systems. The site visit includes detailed inspection of energy consuming components. Summary of building occupancy schedules, operating and maintenance practices, and energy management programs provided by the building manager are collected along with the system and components to determine a more accurate impact on energy consumption.

III. METHOD OF ANALYSIS

Post site visit work includes evaluation of the information gathered, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on HVAC, lighting and building envelope improvements. Data collected is processed using energy engineering calculations to anticipate energy usage for each of the proposed energy conservation measures (ECMs). The actual building's energy usage is entered directly from the utility bills provided by the owner. The anticipated energy usage is compared to the historical data to determine energy savings for the proposed ECMs.

It is pertinent to note, that the savings noted in this report are not additive. The savings for each recommendation is calculated as standalone energy conservation measures. Implementation of more than one ECM may in some cases affect the savings of each ECM. The savings may in some cases be relatively higher if an individual ECM is implemented in lieu of multiple recommended ECMs. For example implementing reduced operating schedules for inefficient lighting will result in a greater relative savings. Implementing reduced operating schedules for newly installed efficient lighting will result in a lower relative savings, because there is less energy to be saved. If multiple ECM's are recommended to be implemented, the combined savings is calculated and identified appropriately.

ECMs are determined by identifying the building's unique properties and deciphering the most beneficial energy saving measures available that meet the specific needs of the facility. The building construction type, function, operational schedule, existing conditions, and foreseen future plans are critical in the evaluation and final recommendations. Energy savings are calculated base on industry standard methods and engineering estimations. Energy consumption is calculated based on manufacturer's cataloged information when new equipment is proposed.

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers. The NJ Smart Start Building® program incentives savings (where applicable) are included for the appropriate ECM's and subtracted from the installed cost. Maintenance savings are calculated where applicable and added to the energy savings for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The costs and savings are applied and a simple payback, simple lifetime savings, and simple return on investment are calculated. See below for calculation methods:

ECM Calculation Equations:

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

$$Simple\ Lifetime\ Savings = \left(Yearly\ Savings \times ECM\ Lifetime \right)$$

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

$$Lifetime\ Ma\,\mathrm{int}\,enance\ Savings = \left(Yearly\ Ma\,\mathrm{int}\,enance\ Savings \times ECM\ Lifetime \right)$$

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

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

Net Present Value calculations based on Interest Rate of 3%.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

The electric usage profile represents the actual electrical usage for the facility. Jersey Central Power and Light (JCP&L) provides electricity to the facility under their General Service Secondary Three-Phase rate structure. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile shows the actual natural gas energy usage for the facility. Elizabethtown Gas provides natural gas to the facility under the Multi Family Use rate structure. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

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

Description	Average
Electricity	16.7¢ / kWh
Natural Gas	$1.55 / Therm

The energy usage for the facility has been tabulated and plotted in graph form as depicted within this section. Each energy source has been identified and monthly consumption and cost noted base on the information provided by the owner.

Table 3
Electricity Billing Data

Utility Provider: JCP&L, General Service Secondary 3 Phase (Meter # L86432861)			
MONTH OF USE	**CONSUMPTION KWH**	**DEMAND**	**TOTAL BILL**
Jun-08	9,680	37.1	$1,799
Jul-08	9,120	21.9	$1,677
Aug-08	9,120	35.5	$1,706
Sep-08	10,560	35.8	$1,671
Oct-08	9,200	39.4	$1,508
Nov-08	16,960	47.5	$2,632
Dec-08	18,400	54.5	$3,004
Jan-09	20,480	56.1	$3,337
Feb-09	19,600	48.3	$3,151
Mar-09	15,680	47.4	$2,523
Apr-09	12,320	45.9	$2,038
May-09	10,320	35.7	$1,898
Totals	**161,440**	**56.1 Max**	**$26,943**
AVERAGE DEMAND 42.1 KW average			
AVERAGE RATE $0.167 $/kWh			

Figure 1
Electricity Usage Profile

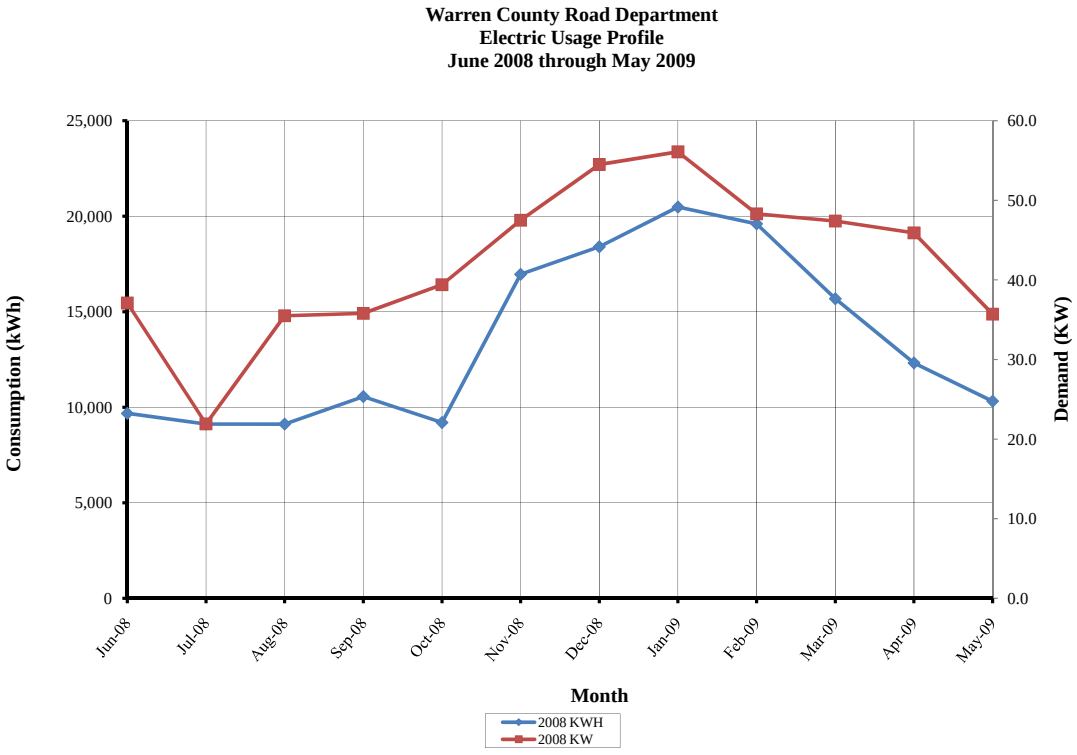
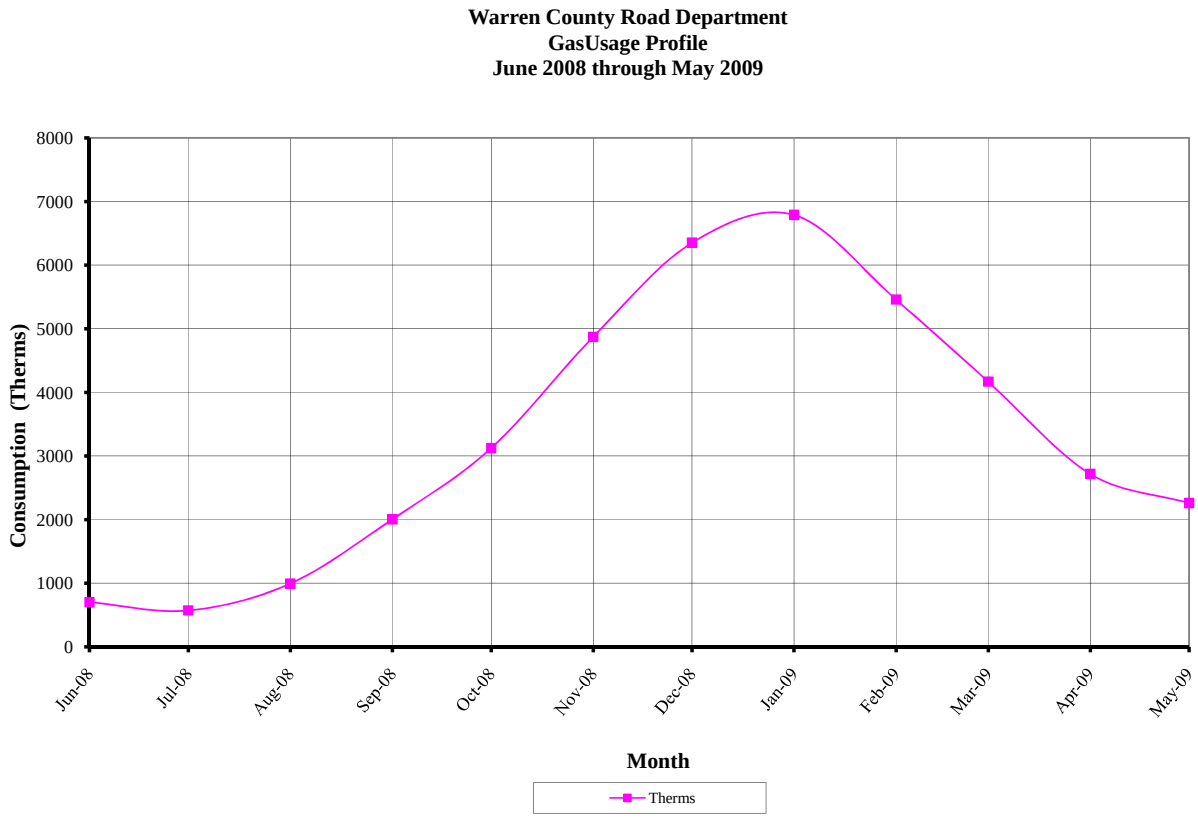


Table 4
Gas Billing Data

Utility Provider: Elizabethtown Gas, Rate - Multi Family Use, (Meter # 01061722)		
MONTH OF USE	**CONSUMPTION (Therms)**	**TOTAL BILL**
Jun-08	703	$1,112.29
Jul-08	573	$947.59
Aug-08	995	$1,469.12
Sep-08	2,006	$2,887.19
Oct-08	3,124	$4,936.09
Nov-08	4,872	$7,561.95
Dec-08	6,351	$9,778.55
Jan-09	6,790	$10,435.67
Feb-09	5,459	$8,441.49
Mar-09	4,168	$6,507.37
Apr-09	2,719	$4,339.12
May-09	2,262	$3,658.36
TOTALS	**40,021**	**$62,074.79**
AVERAGE RATE:	**$1.55**	**$/Therm**

Figure 2
Gas Usage Profile



B. Energy Use Index

Energy Use Index (EUI) is a measure of a building's annual energy utilization per square foot of building (also known as energy use intensity.) This calculation is completed by converting all utility usage consumed by a building for one year, to British Thermal Units (BTU) and dividing this number by the building square footage. EUI is a good measure of a building's energy use and is utilized regularly for comparison of energy performance for similar building types. The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of Energy maintains a Benchmarking Building Energy Performance Program. The ORNL website determines how a building's energy use compares with similar facilities throughout the U.S. and in a specific region or state.

Source use differs from site usage when comparing a building's energy consumption with the national average. Site energy use is the energy consumed by the building at the building site only. Source energy use includes the site energy use as well as all of the losses to create and distribute the energy to the building. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses, which allows for a complete assessment of energy efficiency in a building. The type of utility purchased has a substantial impact on the source energy use of a building. The EPA has determined that source energy is the most comparable unit for evaluation purposes and overall global impact. Both the site and source EUI ratings for the building are provided to understand and compare the differences in energy use.

The site and source EUI for this facility is calculated as follows:

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

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

Table 5
Warren County Road Department EUI Calculations

ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu	RATIO	kBtu
ELECTRIC	161,440			551,156	3.340	1,840,862
NATURAL GAS		40,020.50		4,002,050	1.047	4,190,146
FUEL OIL			0.00	0	1.010	0
PROPANE			0.00	0	1.010	0
TOTAL				4,553,206		6,031,008
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		22,530		SQUARE FEET		
BUILDING SITE EUI		202.10		kBtu/SF/YR		
BUILDING SOURCE EUI		**267.69**		**kBtu/SF/YR**		

As a comparison, data has been gathered by the US Department of Energy (DOE) for various facilities cataloguing the standard site and source energy utilization. This data has been published in the 2003 Commercial Building Energy Consumption Survey and is noted as follows for facilities of this type:

- Service (Vehicle Repair):
  77 kBtu/SF Site Energy, 150 kBtu/SF Source Energy.

C. EPA Energy Benchmarking System

The United States Environmental Protection Agency (EPA) in an effort to promote energy management has created a system for benchmarking energy use amongst various end users. The benchmarking tool utilized for this analysis is entitled Portfolio Manager. The Portfolio Manager tool allows tracking and assessment of energy consumption via the template forms located on the ENERGY STAR website (www.energystar.gov). The importance of benchmarking for local government municipalities is becoming more important as utility costs continue to increase and emphasis is being placed on carbon reduction, greenhouse gas emissions and other environmental impacts.

Based on information gathered from the ENERGY STAR website, Government agencies spend more than $10 billion a year on energy to provide public services and meet constituent needs. Furthermore, energy use in commercial buildings and industrial facilities is responsible for more than 50 percent of U.S. carbon dioxide emissions. It is vital that local government municipalities assess facility energy usage, benchmark energy usage utilizing Portfolio Manager, set priorities and goals to lessen energy usage and move forward with priorities and goals.

In accordance with the Local Government Energy Audit Program, CEG has created an ENERGY STAR account for the municipality to access and monitoring the facility's yearly energy usage as it compares to facilities of similar type. The following is the user name and password for this account:

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

User Name:	warrencountylgea
Password:	lgeaceg2009
Security Question:	What is your birth city?
Security Answer:	"warren county"

The utility bills and other information gathered during the energy audit process are entered into the Portfolio Manager. The following is a summary of the results for the facility:

Table 6
ENERGY STAR Performance Rating

FACILITY DESCRIPTION	ENERGY PERFORMANCE RATING	NATIONAL AVERAGE
Warren County Road Dept.	N/A	N/A

The energy performance rating is unavailable because the facility does not fall within the acceptable categories defined by Energy Star. See the **Statement of Energy Performance Appendix** for the detailed energy summary.

V. FACILITY DESCRIPTION

General

The 22,530 square foot Road Department building was built in 1964. The building is comprised of a main service floor and mezzanine above the office area. The building construction is CMU block walls with metal siding skin. There is no insulation visible in the wall construction. The roof is a standing metal seem slopped roof and rigid insulation below the roof deck. The insulation thickness below the roof is estimated to be 1 1/2" thick. There are 18 high bay garage doors into the building for road department truck service and storage. The majority of the garage is without windows except for the windows integral to the garage doors and office area windows. Windows in the office area are operable single pane clear glass windows with aluminum frames.

Operation

The road department's typical operation is from 7:00 AM to 3:30 PM, 5 days per week, however in the winter where road maintenance is increased, the building will be occupied as needed to facilitate road clean up and service. The typical occupancy is approximately 8 people in the shop area and 4 people in the office area. There are 5 computers total in the building for administration. The administration portion of the facility is approximately 2.5%-5% of the floor space.

Energy Utilities

Utilities for the facility are electricity and natural gas. The primary heat source is four natural gas fired modular heating water boilers that provide heating hot water throughout the facility. The primary use for electricity is lighting and service equipment. Electrical power is also used for the lounge refrigerator, vending machines, computers, office area window air conditioners, and domestic hot water heaters.

HVAC Systems

The building does not have a main cooling system. The front office area is air conditioned by window air conditioners. The main heating system in the building is four gas fired modular heating water boilers made by Hydro Therm. Each boiler has an input capacity of 1,200 MBH. Heating water is distributed by one base mounted constant volume 7.5 HP heating water pump. The high bay area is heated with down-blast hot water unit heaters from the boiler loop. The boilers are manually turned on and off and maintain constant water loop temperature. The heating water loop pump is manually operated, and typically operates year round continuously.

Domestic Water

Domestic water is provided by the city. Domestic hot water is provided by an electric hot water heater for the facilities lavatories, lounge sink, and showers. The domestic hot water tank is a 30 gallon tank with input capacity of 3.375KW.

HVAC Controls

The air conditioners have local thermostats for control. The boilers are controlled by a Hydro Therm staging controller with outside air water temperature re-set controller. The re-set controller sets back the heating water temperature based on the ambient outside air temperature, however the minimum water temperature set-point is 125°F causing the boilers to operate and maintain a warm loop temperature year round. The unit heaters throughout the facility do not have control valves to regulate water flow. These units are controlled by built in thermostats or respond to a pre-determined boiler loop temperature to turn on the down-blast fans.

Exhaust / Ventilation System

Ventilation is provided by operation of the garage doors manually by the occupants. Exhaust is provided throughout the facility for bathrooms and maintenance rooms by side-wall exhaust fans. Large industrial axial fans are provided for specific operations such as the paint rooms. The exhaust fans are operated manually as needed by the occupants.

Lighting

The lighting in the garage and office area is fluorescent tube pendent fixtures with T-12 lamps and magnetic ballasts. The mezzanine is lit with pendent shop fixtures with incandescent bulbs. Lights are manually operated throughout the facility on an as needed basis, however typically left on continuously throughout the day.

VI. MAJOR EQUIPMENT LIST

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

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

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade – General

Description:

The lighting in Warren Haven Road Department is primarily made up of fluorescent fixtures with T-12 lamps and magnetic ballasts. There are a few storage area including the mezzanine and closets with incandescent lighting and some compact fluorescent fixtures.

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

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

Hours of Operation:

Service Garage and Work Rooms:
42.5 Hrs per week, 52 weeks per year – 2210 Hrs per year.

Storage / Mechanical Rooms:
25% of normal hours (above) – 552.5 Hrs per year.

Outdoor Lighting:
10 Hrs per day, 7 days per week, 52 weeks per year – 3640 Hrs per year.

Energy Savings Calculations:

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

NJ Smart Start® Program Incentives are calculated as follows:

From the Smart Start Incentive appendix, the replacement of a T-12 fixture to a T-5 or T-8 fixture warrants the following incentive: T-5 or T-8 (1-2 lamp) = $10 per fixture; T-5 or T-8 (3-4 lamp) = $20 per fixture.

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

$$\text{Smart Start®}\ Incentive = (85 \times\ \$10) + (59 \times\ \$20) = \underline{\$2{,}030}$$

Replacement and Maintenance Savings are calculated as follows:

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

$$Savings = (17\ lamps\ \ per\ \ year) \times (\$2.00 + \$5.00) = \underline{\$119}$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$25,449
NJ Smart Start Equipment Incentive ($):	($2,030)
Net Installation Cost ($):	$23,419
Yearly Maintenance Savings ($/Yr):	$119
Yearly Energy Savings ($/Yr):	$3,338
Total Yearly Savings ($/Yr):	$3,457
Estimated ECM Lifetime (Yr):	25
Simple Payback	6.8
Simple Lifetime ROI	269.1%
Simple Lifetime Maintenance Savings	$2,975
Simple Lifetime Savings	$86,435
Internal Rate of Return (IRR)	14%
Net Present Value (NPV)	$36,785.29

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

ECM #2: Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. In many cases the lights are left on because of the inconvenience to manually switch lights on and off when a space is used. In some instances lights are left on due to the misconception that it is better to keep the lights on rather than to continuously switch lights on and off. Although increased switching reduces lamp life, the energy savings outweigh the lamp replacement costs. The payback timeframe for when to turn the lights off is approximately two minutes. If the lights are off for at least a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is adequate to provide reduced lighting levels when full light output is not needed. Occupancy sensors detect motion and will switch the lights on when the room is occupied. Occupancy sensors can either be mounted in place of a current wall switch, or on the ceiling to cover large areas. Photocell control senses light levels and turn off or reduce lights when there is adequate daylight. Photocells are mostly used outside, but are becoming more popular in energy-efficient interior lighting designs as well.

The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings is based on the "Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways," document posted for public use April 2005. The study has found that commercial buildings have the potential to achieve significant energy savings through the use of building controls. The average energy savings are as follows based on the report:

- Occupancy Sensors for Lighting Control - 20%-28%.

Energy savings achieved for "Occupancy Sensors for Lighting Control" average 20%-28%. Savings resulting from the implementation of this ECM for energy management controls are estimated to be 20% of the total light energy controlled by occupancy sensors.

The ECM includes replacement of standard wall switches with sensor wall switches for individual offices and work rooms. The high bay area includes multiple occupancy sensors installed overhead to cover larger areas. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent. See the "Investment Grade Lighting Audit" Appendix for details.

The **Investment Grade Lighting Audit Appendix** of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by 20% for all areas that include occupancy sensor lighting controls.

Light Energy = 54,976 kWh/Yr. occupancy sensor controlled lighting

Energy Savings Calculations:

$$Energy\ Savings = 20\% \times Occuapancy\ Sensored\ Light\ Energy\ (kWh/Yr)$$

$$Energy\ Savings = 20\% \times 54{,}976\ (kWh) = 10{,}995\ (kWh)$$

$$Savings. = Energy\ Savings\ (kWh) \times Ave\ Elec\ Cost\left(\frac{\$}{kWh}\right)$$

$$Savings. = 10{,}995\ (kWh) \times 0.167\left(\frac{\$}{kWh}\right) = \$1{,}836$$

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

Installation Cost = $75 x 51 motion sensors = $3,825

From the NJ Smart Start appendix, the installation of a lighting control device warrants the following incentive: occupancy = $20 per fixture, daylight = $25 per fixture.

$$\text{Smart Start®}\ Incentive = (\#\ of\ \ wall\ mount\ devices \times\ \$\ 20) = (51 \times \$20) = \$1{,}020$$

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$3,825
NJ Smart Start Equipment Incentive ($):	($1,020)
Net Installation Cost ($):	$2,805
Yearly Maintenance Savings ($/Yr):	$0
Yearly Energy Savings ($/Yr):	$1,836
Total Yearly Savings ($/Yr):	$1,836
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.5
Simple Lifetime ROI	881.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$27,543
Internal Rate of Return (IRR)	65%
Net Present Value (NPV)	$19,115.32

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

ECM #3: Boiler Lockout Controls

Description:

The Road Department has four modular boilers control by a boiler control panel. The existing control system has the capability to re-set boiler water supply temperature through a 3-way mixing valve based on outdoor temperature. The system has a lower limit to the supply water temperature of approximately 125°F. The controls do not include any form of boiler lockout to avoid boiler operation when there is no need for heat. This operation causes standby losses due to the boiler operations and piping network throughout the building in the summer months. The standby loss in the piping system is unnecessary natural gas energy that provides no value to the building. Since there are no control valves throughout the system, the piping is kept hot all summer long at the minimum supply temperature. Since the domestic hot water heater in the building is electrically heated, all of the summer month gas usage is attributed to this loss and can be saved.

This ECM includes installing a Boiler lockout relay based on outdoor temperature. The lockout relay is wired ahead of the boiler power circuit to turn off the boiler when the outside temperature is above a specified set point (65°F). This will effectively eliminate boiler operation during the summer months. The implementation of these controls would eliminate gas usage in the summer and reduce discomfort in service garage in the summer months.

Savings from the implementation of this ECM will be achieved through reduced gas consumption from unnecessary heating energy. Estimated savings is based on utility data information for months June, July and August. The installation cost of a lockout relay, remote outdoor temperature sensor is estimated to be $1,084 ($542 Materials)

Average Summer Gas usage (Average of Jun, Jul, Aug)	= 757 Therms/Month
Average Cost of Gas (Average of Jun, Jul, Aug)	= $1.55 / Therm

Energy Savings Calculations:

Heating Savings Calculations

$$Heat\ Savings = Ave\ Cons.\left(\frac{Therms}{Month}\right)\times Non\ Heating\ Season(Months)$$

$$Heat\ Savings = 757\left(\frac{Therms}{Month}\right)\times 3(Months) = 2{,}271(Therms)$$

$$GasSavings. = Heat\ \mathrm{Re}duction(Therms)\times Ave\ Gas\ Cost\left(\frac{\$}{Therm}\right)$$

$$GasSavings. = 2{,}271(Therms) \times 1.55\left(\frac{\$}{Therm}\right) = \$3{,}529$$

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,084
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$1,084
Yearly Maintenance Savings ($/Yr):	$0
Yearly Energy Savings ($/Yr):	$3,529
Total Yearly Savings ($/Yr):	$3,529
Estimated ECM Lifetime (Yr):	15
Simple Payback	0.3
Simple Lifetime ROI	4783.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$52,935
Internal Rate of Return (IRR)	326%
Net Present Value (NPV)	$41,044.97

ECM #4: Window AC Unit Replacement

Description:

The administration area of the Road Department is currently conditioned by three window air conditioning units. The unit's cooling efficiencies average approximately 8.0 EER. The existing unit are in poor condition and in need of replacement. The efficiencies of the existing units are below today's standards for cooling efficiency. The proposed units are high efficiency one for one replacements of the existing units.

This ECM includes installation of three high efficient window AC units. The ECM calculations are based on GE window air conditioners model number: GE AEM08FM or equivalent. Efficiency of this unit is 10.8 EER. Installation cost of the window air conditioner is estimated to be $976 ($826 Materials).

Full Load Cooling Hrs.	= 800 hrs/yr.
Average Cost of Electricity	= $0.167/kWh
Cooling Capacity (Total Three units)	= 2 Tons
Existing Unit Eff.	= 8.0 EER
Proposed Unit Eff. (GE)	= 10.8 EER

Energy Savings Calculations:

Cooling Savings:

$$EnergySavings = \frac{Cooling(Tons)\times 12{,}000\left(\frac{Btu}{Ton\ hr}\right)}{1000\left(\frac{Wh}{kWh}\right)}\times\left(\frac{1}{EER_{OLD}}-\frac{1}{EER_{NEW}}\right)\times Full\ Load\ Hrs.$$

$$EnergySavings = \frac{2\,(Tons)\times 12{,}000\left(\frac{Btu}{Ton\ hr}\right)}{1000\left(\frac{Wh}{kWh}\right)}\times\left(\frac{1}{8.0\left(\frac{Btu}{W}\right)}-\frac{1}{10.8\left(\frac{Btu}{W}\right)}\right)\times 800\ hours$$

$$= 622\ kWh$$

$$Demand\ Savings = \frac{Energy\ Savings\,(kWh)}{Hrs\ of\ Cooling}$$

$$Demand\ Savings = \frac{622(kWh)}{800\ Hrs.} = 0.78\ KW$$

$$Cooling\ Cost\ Savings = 622\,(kWh) \times 0.167\left(\frac{\$}{kWh}\right) = \$104$$

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$976
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$976
Yearly Maintenance Savings ($/Yr):	$0
Yearly Energy Savings ($/Yr):	$104
Total Yearly Savings ($/Yr):	$104
Estimated ECM Lifetime (Yr):	10
Simple Payback	9.4
Simple Lifetime ROI	6.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$1,040
Internal Rate of Return (IRR)	1%
Net Present Value (NPV)	($88.86)

ECM #5: Garage Door Vehicle Exhaust Kits.

Description:

Warren County Road Department is a service garage that operates to continuously maintain the road service vehicles. The service includes running the engines of the trucks and equipment while within the garage which require the garage door to be open during service. The resulting infiltration and turn-over of outdoor air creates a large heating load in the winter. Due to health risks this operation is unavoidable in the current configuration of the building.

This ECM includes the installation of vehicle exhaust systems for each of the garage door bays. The system includes installation of a thru wall exhaust vent at the floor of each garage door. The system also includes vehicle exhaust hoses and tail pipe connectors to exhaust vehicle exhaust to the outdoors with the garage door closed.

Existing Heating System Parameters:

Boiler Efficiency	= 80%
Ave Gas Cost	= $1.55/Therm

ASHRAE Fundamentals Thermal Force Air flow Rate Variables:

C_D = discharge coefficient for opening
Delta H_{NPL} = height from mid of lower opening
Ti = indoor temperature (°R)
To = outdoor temperature (°R)
A = Area of opening

Operation Assumptions:

Average garage door area	= 144 SF
Number doors open per day	= 4 doors
Time doors open per day	= 1.0 Hrs
Number active service bays	= 12 bays

Energy Savings Calculations:

$$Garage\ Door\ Airflow = 60 \times C_D \times A \times \sqrt{2g\Delta H_{NPL} \left(T_i - T_o\right) / T_i}$$

$$C_D = 0.40 + 0.0025\left|T_i - T_o\right|$$

$$Garage\ Door\ Airflow = 60 \times \left(0.40 + 0.0025\left(525°F - 470°F\right)\right) \times 144\left(Ft^2\right) \times ...$$
$$... \sqrt{2 \times 32.2 \times 3(Ft)\left(525°F - 470°F\right) / 525°F} = 22{,}082\left(\frac{CFM}{Door}\right)$$

$$Heat\ Load\ Per\ Door. = 1.1 \times CFM \times \Delta T$$

$$Heat\ Load\ Per\ Door. = 1.1 \times 22{,}082 \times \left(65°F - 10°F\right) = 1{,}336\left(\frac{kBtu}{Hr.}\right)$$

$$EnergySavings. = \frac{Heat\ Load\left(\frac{kBtu}{Hr}\right) \times No.\ Doors \times Heat\ Deg\ Days \times Hrs \times Correction\ Factor}{Design\ Temp\ Difference(°F) \times Fuel\ Heat\ Value\left(\frac{kBtu}{Therm}\right) \times Boiler\ Eff\ \%}$$

$$EnergySavings = \frac{1{,}336\left(\frac{kBtu}{Hr}\right) \times 4 \times 4{,}888\ (HDD) \times 1.0\ Hrs \times 0.6}{65\ (°F) \times 100\left(\frac{kBtu}{Therm}\right) \times 0.80} = 3{,}014\ (Therms)$$

$$GasSavings. = Heat\ \text{Re}duction(Therms) \times Ave\ Gas\ Cost\left(\frac{\$}{Therm}\right)$$

$$GasSavings. = 3{,}014(Therms) \times 1.55\left(\frac{\$}{Therm}\right) = \$4{,}672$$

Installed cost of the 5" garage door venting kit for Diesel Trucks and Buses is estimated to be $9,546 (7,746 Materials).

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$9,546
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$9,546
Yearly Maintenance Savings ($/Yr):	$0
Yearly Energy Savings ($/Yr):	$4,672
Total Yearly Savings ($/Yr):	$4,672
Estimated ECM Lifetime (Yr):	25
Simple Payback	2.0
Simple Lifetime ROI	1123.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$116,800
Internal Rate of Return (IRR)	49%
Net Present Value (NPV)	$71,808.23

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 Warren Haven Nursing Home, 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 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 9,074 S.F. can be utilized for a PV system. A depiction of the area utilized is shown in Renewable / Distributed Energy Measures Calculation Appendix. Using this square footage it was determined that a system size of 142.1 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 161,079 KWh annually, reducing the overall utility bill by approximately 99.8% percent. A detailed financial analysis can be found in the Renewable / Distributed Energy Measures Calculation appendix. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

Note the solar electric production of the proposed system above is approximately the entire current electric usage of the facility. If any electrical ECMs are implemented, the size of the solar PV system should be reduced so the facility is not creating excess electricity. The market value to sell excess electricity to the grid is very low and does not warrant the installation of additional solar panels. The system size above is for reference to the maximum production capability of the facility.

The solar panel system analysis is based on Sun Power SPR-230 panels. The panel efficiency is 18%. The overall DC-to-AC derate factor is 81%. The panel tilt angle and direction is based on the actual proposed roof conditions and roof slope. For flat roof installations, the tilt is based on 10° from horizontal and facing South. The solar radiation and resultant AC energy calculations are based on the "National Renewable Energy Laboratory PVWatts Version 1.0 Calculator." The

monthly energy output and savings from the PVWatts calculator is shown in the **Renewable / Distributed Energy Measures Calculation Appendix**.

The proposed solar PV system utilizes the New Jersey guidelines for net metering. Net metering allows excess energy generated at production peaks to flow onto the grid. The excess energy is metered and subtracted from the facility's total energy usage on an annual basis. Due to this allowance the system design excludes the use of inefficient battery storage.

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

PAYMENT TYPE	SIMPLE PAYBACK	INTERNAL RATE OF RETURN
Self-Finance	15.4 Years	-3.71%
Direct Purchase	15.4 Years	4.8%

The resultant Internal Rate of Return indicates that if the Owner was able to "Direct Purchase" the solar project, the project would be slightly more beneficial to the Owner. However, if the Owner was able to work out a Power Purchase Agreement with a third-party and agree upon a decent base energy rate for kilowatt hour production, this option could also prove to be a beneficial route.

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

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

Load Profile analysis was performed to determine the seasonal energy usage of the facility. Irregularities in the load profile will indicate potential problems within the facility. Consequently based on the profile a recommendation will be made to remedy the irregularity in energy usage. For this report, the facility's energy consumption data was gathered in table format and plotted in graph form to create the load profile. Refer to the Electric and Natural Gas Usage Profiles included within this report to reference the respective electricity and natural gas usage load profiles.

Electricity:

The Electric Usage Profile demonstrates an atypical electric load profile. There is a steady usage throughout the year, but in the winter when road maintenance is increased, the building is occupied as needed. The primary source for electricity in this facility is for lighting and service equipment. There are 5 computers in this facility. Secondary use for power is for the lounge refrigerator, vending machines, computers, office area window air conditioners and domestic hot water heaters. These are reasons for the base-load (consistent) energy use, throughout the year. Window air-conditioning units provide cooling for the front office. Domestic hot-water is supplied by an electric hot water heater, which serves the facilities lavatories, lounge sink and showers. These factors all contribute to this elevated base-load electric profile that is observed annually. A flatter load profile, will allow for more competitive energy prices when shopping for alternative suppliers.

Natural Gas:

The Natural Gas Usage Profile demonstrates a typical natural gas, heating load profile. With the winter period (October –March), demonstrating the largest use of energy. This of course is due to the demand for heating the building. The primary source for heat is (4) four, natural gas fired modular heating water boilers that provide heating hot water throughout the building. The boilers are manually turned on and off. The flatter the load profile the easier it is to procure more competitive energy when shopping for a Third Party Supplier.

Tariff Analysis:

Electricity:

This facility receives electrical service through Jersey Central Power & Light (JCP&L) on a GSS (General Service Secondary – 3 Phase) rate. Service classification GS is available for general service purposes on secondary voltages not included under Service Classifications RS, RT, RGT or GST. This facility's rate is a single or three phase service at secondary voltages. For electric supply (generation), the customer will use the utilities Basic Generation Service (BGS) or a Third Party Supplier (TPS). This facility uses Basic Generation service from the utility.

Therefore, they will pay according to the BGS default service. The Delivery Service includes the following charges: Customer Charge, Supplemental Customer Charge, Distribution Charge (kW Demand), kWh Charge, Non-utility Generation Charge, TEFA, SBC, SCC, Standby Fee and RGGI.

Natural Gas:

Natural gas service is provided by Elizabethtown Gas Company on a Multi Family Service (MFS) natural gas tariff service rate. This service classification is closed, and only available to customers who are currently receiving this service as of December 1, 2002, and whose annual weather normalized usage as determined by the Company is equal to or greater 3,000 therms per year and have maintained continuous thereafter. Additional facilities added at these customers' existing site after this date will qualify for service under this classification. The following building types qualify for this service:

Governmental Buildings
Religious Institutions
Hospitals and Nursing Homes

Provided that gas supplied under this rates is the primary source of energy for all of the following purposes:

a). Central Heating
b). Heating water where water is used..

..and Gas Company's facilities are suitable and the required quantity of gas is available for the service desired. Commercial or Industrial use is not permitted under this rate. This service is not available for new or additional boiler equipment with a rated input in excess of 12.5 million BTU's per hour. The Gas Company may waive this limitation in cases where the Customer enters into a longer term contract or agrees to guarantee a monthly minimum revenue level as may be determined by the Gas Company. This is a continuous service.
The following are the charges associated with this service classification:

Service Charge
Demand Charge
Distribution Charge
Commodity Charge (Ride A)

Recommendations:

CEG recommends a global approach that will be consistent with all facilities within the BOE. The primary area for potential improvement is seen in the electric costs. The average price per kWh (kilowatt hour) for all buildings based on 1-year historical average price is $.1398/kWh (this is the average "price to compare" if the client intends to shop for energy). The average price per decatherm for natural gas is $ 11.46 / dth (dth, is the common unit of measure). The weighted average price per gallon for propane is $1.4934 / gallon. The average price per gallon for Heating Oil is $2.2763/ gallon.

Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. Warren County could see improvement in its energy costs

if it were to take advantage of these current market prices quickly, before energy prices increase. Based on annual historical consumption (July 2008 through June 2009) and current electric rates, the county could see an improvement in its electric costs of up to 24% annually. This number is substantial noting that the annual expenditure is over $500,000. (Note: Savings were calculated using Average Annual Consumption and a variance to a Fixed Average One-Year commodity contract). CEG recommends aggregating the entire electric load to gain the most optimal energy costs. CEG recommends advisement for alternative sourcing and supply of energy on a "managed approach".

CEG's second recommendation coincides with the natural gas costs. Based on the current market, Warren County could improve its natural gas costs by up to 24%. CEG recommends the county receive further advisement on these prices through an energy advisor. They should also consider procuring energy (natural gas) through an alternative supply source.

CEG's third recommendation coincides with the propane costs associated with the Nursing Home. Based on a one-year weighted average price per gallon, Warren County pays $1.4934 / gallon for propane. The county has a contract with Amerigas Propane Inc., for a (2) two year period, expiring August 31, 2009. Because of the liquidity and volatility issues associated with propane, CEG strongly recommends renegotiating this contract with Amerigas for a (1) or (2) year fixed price contract. This will allow the county to improve its propane costs by up to 29%. CEG suggests the use of an energy advisor for the procurement of propane.

CEG's forth recommendation coincides with the Heating Oil (HO; # 2 Fuel Oil), costs. The county's average annual price per gallon of HO is $2.2763 / gallon. At the current time "spot" (daily or monthly) prices are very competitive. The fear is that along with crude price increases (and crude will escalate first), the HO will follow. Also as the winter approaches, Heating Oil prices will increase (subject to many physical factors such as refining). CEG noticed that the county has a 2-year contract with Allied Oil Company expiring August 2009. While energy prices remain competitive, CEG would suggest renegotiating this contract for a (1) or (2) year fixed price. This will allow for budget certainty while hedging the county against HO price increases.

CEG also recommends scheduling a meeting with the current utility providers to review their utility charges and current tariff structures for electricity and natural gas. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), the municipality can learn more about the competitive supply process. The county can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu. They should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the information for ongoing demand-side management projects. Furthermore, special attention should be given to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with the utility representative. Warren County should ask the utility representative about alternative billing options, such as consolidated billing when utilizing the service of a Third Party Supplier. Finally, if the supplier for energy (natural gas) is changed, closely monitor balancing, particularly when the contract is close to termination. This could be performed with the aid of an "energy advisor".

X. INSTALLATION FUNDING OPTIONS

CEG has reviewed various funding options for the facility owner to utilize in subsidizing the costs for installing the energy conservation measures noted within this report. Below are a few alternative funding methods:

i. *Energy Savings Improvement Program (ESIP)* – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and par for the costs using the value of energy savings that result from the improvements. The "Energy Savings Improvement Program (ESIP)" law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources.

ii. *Municipal Bonds* – Municipal bonds are a bond issued by a city or other local government, or their agencies. Potential issuers of municipal bonds include cities, counties, redevelopment agencies, school districts, publicly owned airports and seaports, and any other governmental entity (or group of governments) below the state level. Municipal bonds may be general obligations of the issuer or secured by specified revenues. Interest income received by holders of municipal bonds is often exempt from the federal income tax and from the income tax of the state in which they are issued, although municipal bonds issued for certain purposes may not be tax exempt.

iii. *Power Purchase Agreement* – Public Law 2008, Chapter 3 authorizes contractor of up to fifteen (15) years for contracts commonly known as "power purchase agreements." These are programs where the contracting unit (Owner) procures a contract for, in most cases, a third party to install, maintain, and own a renewable energy system. These renewable energy systems are typically solar panels, windmills or other systems that create renewable energy. In exchange for the third party's work of installing, maintaining and owning the renewable energy system, the contracting unit (Owner) agrees to purchase the power generated by the renewable energy system from the third party at agreed upon energy rates.

CEG recommends the Owner review the use of the above-listed funding options in addition to utilizing their standard method of financing for facilities upgrades in order to fund the proposed energy conservation measures.

XI. ADDITIONAL RECOMMENDATIONS

The following recommendations include no cost/low cost measures, Operation & Maintenance (O&M) items, and water conservation measures with attractive paybacks. These measures are not eligible for the Smart Start Buildings incentives from the office of Clean Energy but save energy none the less. As stated in the executive summary these items should be considered the first form of action for this facility.

A. Confirm proper operation of outdoor lighting controls including photocells and time clocks to minimize outdoor lighting energy usage.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Warren County Road Department

ECMs	ECM Description	Installation Cost				Yearly Savings			ECM Lifetime	Lifetime Savings	Lifetime Maint. Savings	Lifetime ROI	Payback	Internal Rate of Return (IRR)	Net Present Value (NPV)
		Material	Labor	NJ Smart Start	Net	Energy	Maint.	Total		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{N=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	Lighting Upgrade	$12,724	$12,724	($2,030)	$23,419	$3,338	$119	$3,457	25	$86,435	$2,975	269.1%	6.8	14.23%	$36,785.29
ECM #2	Lighting Controls	$390	$3,435	($1,020)	$2,805	$1,836	$0	$1,836	15	$27,543	$0	881.9%	1.5	65.43%	$19,115.32
ECM #3	Boiler Lockout	$542	$542	$0	$1,084	$3,529	$0	$3,529	15	$52,935	$0	4783.3%	0.3	325.55%	$41,044.97
ECM #4	Window AC Unit Replacements	$826	$150	$0	$976	$104	$0	$104	10	$1,040	$0	6.6%	9.4	1.17%	($88.86)
ECM #5	Garage Door Vehicle Exhaust Kits	$7,746	$1,800	$0	$9,546	$4,672	$0	$4,672	25	$116,800	$0	1123.5%	2.0	48.94%	$71,808.23
ECM #6	Solar Photovoltaic System	$1,279,260	$0	$0	$1,279,260	$83,278	$0	$83,278	25	$2,081,950	$0	62.7%	15.4	4.16%	$170,872.11

Notes:
1) The variable Cn in the formulas for Internal Rate of Return and Net Present Value stands for the cash flow during each period.
2) The variable DR in the NPV equation stands for Discount Rate
3) For NPV and IRR calculations: From n=0 to N periods where N is the *lifetime of ECM* and Cn is the *cash flow during each period* .

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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

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Warren County Road Department"

Boiler

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Garage Mechanical Room	Heating Water Loop	Hydro Therm	4	MR 1200B	R-2005-104	1,200	960	80%	Natural Gas	4	35	31	Modular Boilers staged with boiler controller.

Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	RPM	GPM	Ft. Hd	Frame Size	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Garage Mechanical Room	Building Heating Water Loop	Taco	1	EE2508E2F1F4L0A	-	7.5	1750	-	-	-	208	3	Unknown	20	-	Base Mounted Pump, Baldor Elec. Motor

Domestic Hot Water Heater

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Input (KW)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Garage Mechanical Room	Domestic Hot Water	A.O. Smith	1	EES-30	-	3.375	-	30	100	Electric	Unknown	10	-	

Air Handling Units

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Fan HP	Cooling Type	Heating Type	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Mounted above Paint Room Hallway	Paint Room	-	1	-	-	5 (Est)	None	Hot Water Coil	208	3	-	Unknown	15	-	Utilized for 100% Make-Up air for paint booth.

Unit Heaters

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Fan HP	Cooling Type	Heating Type	Volts	Phase	KW	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Mounted high in Service Bay	Service Bays	-	10	-	-	1 (Est)	None	Hot Water Coil	120	1	-	Unknown	20	-	Unit heater without control valve. Fan On/Off controls temperature.
Store Room Ceiling Mount	Store Room	Warren Webster	2	-	-	1 / 2 (Est)	None	Hot Water Coil	120	1	-	Unknown	20	-	Unit heater without control valve. Fan On/Off controls temperature.
Break Room	Break Room	-	1	-	-	1 / 2 (Est)	None	Electric	208	1	3 (KW)	Unknown	20	-	

Split Systems

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity	Eff.	Refrigerant	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Indoor - Store Room Office	Store Room Office	Enviro Master International	1	-	-	12 MBH	8.0 EER (Est.)	R-22	208	1		Unknown	15	-	Efficiency based on poor condition of indoor and outdoor unit
Outdoor - Grade			1	CCB12000000AA0A	-				208	1					

Window AC

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity	Eff.	Refrigerant	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Front Offices	Front Offices	Windown AC Units	3	-	-	8 MBH (Est)	8.0 EER (Est.)	R-22	208	1		Unknown	15		Capacity and Efficiency are estimated averages

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Road Department

Building ID: 1867783
For 12-month Period Ending: May 31, 2009[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: October 01, 2009

Facility
Road Department
185 County Road
Belvidere, NJ 07823

Facility Owner
County of Warren
165 County Rd. 519S Wayne Dumont, Jr.
Administration Building
Velvidere, NJ 07823

Primary Contact for this Facility
Chris Pessolano
165 County Rd. 519S Wayne Dumont, Jr.
Administration Building
Belvidere, NJ 07823

Year Built: 1964
Gross Floor Area (ft²): 22,530

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	550,833
Natural Gas (kBtu)[4]	4,002,200
Total Energy (kBtu)	4,553,033

Energy Intensity[5]

Site (kBtu/ft²/yr)	202
Source (kBtu/ft²/yr)	268

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	297

Electric Distribution Utility
Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	77
National Average Source EUI	150
% Difference from National Average Source EUI	78%
Building Type	Service (Vehicle Repair/Service, Postal Service)

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
Ray 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	Road Department	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Service (Vehicle Repair/Service, Postal Service)	Is this an accurate description of the space in question?		☐
Location	185 County Road, Belvidere, NJ 07823	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		☐
Office (Office)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	450 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.		☐
Weekly operating hours	43 Hours	Is this the total number of hours per week that the Office 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	4	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. The normal worker density ranges between 0.3 and 10 workers per 1000 square feet (92.8 square meters)		☐
Number of PCs	4	Is this the number of personal computers in the Office?		☐
Percent Cooled	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Garage (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑

Gross Floor Area	22,080 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		
Number of PCs	1 (Optional)	Is this the number of personal computers in the space?		
Weekly operating hours	42.5 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	8 (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: Jersey Central Power & Lt Co

Fuel Type: Electricity

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

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
05/01/2009	05/31/2009	10,320.00
04/01/2009	04/30/2009	12,320.00
03/01/2009	03/31/2009	15,680.00
02/01/2009	02/28/2009	19,600.00
01/01/2009	01/31/2009	20,480.00
12/01/2008	12/31/2008	18,400.00
11/01/2008	11/30/2008	16,960.00
10/01/2008	10/31/2008	9,200.00
09/01/2008	09/30/2008	10,560.00
08/01/2008	08/31/2008	9,120.00
07/01/2008	07/31/2008	9,120.00
06/01/2008	06/30/2008	9,680.00
Electric Meter Consumption (kWh (thousand Watt-hours))		**161,440.00**
Electric Meter Consumption (kBtu (thousand Btu))		**550,833.28**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**550,833.28**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

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

Start Date	End Date	Energy Use (therms)
05/01/2009	05/31/2009	2,262.00
04/01/2009	04/30/2009	2,719.00
03/01/2009	03/31/2009	4,168.00
02/01/2009	02/28/2009	5,459.00
01/01/2009	01/31/2009	6,790.00
12/01/2008	12/31/2008	6,351.00
11/01/2008	11/30/2008	4,872.00
10/01/2008	10/31/2008	3,124.00
09/01/2008	09/30/2008	2,006.00
08/01/2008	08/31/2008	995.00

07/01/2008	07/31/2008	573.00
06/01/2008	06/30/2008	703.00
Gas Meter Consumption (therms)		**40,022.00**
Gas Meter Consumption (kBtu (thousand Btu))		**4,002,200.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**4,002,200.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

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

On-Site Solar and Wind Energy	
Do the fuel consumption totals shown above include all on-site solar and/or wind power located at your facility? Please confirm that no on-site solar or wind installations have been omitted from this list. All on-site systems must be reported.	☐

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same as the PE that signed and stamped the SEP.)

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
Road Department
185 County Road
Belvidere, NJ 07823

Facility Owner
County of Warren
165 County Rd. 519S Wayne Dumont, Jr.
Administration Building
Velvidere, NJ 07823

Primary Contact for this Facility
Chris Pessolano
165 County Rd. 519S Wayne Dumont, Jr.
Administration Building
Belvidere, NJ 07823

General Information

Road Department	
Gross Floor Area Excluding Parking: (ft^2)	22,530
Year Built	1964
For 12-month Evaluation Period Ending Date:	May 31, 2009

Facility Space Use Summary

Office	
Space Type	Office
Gross Floor Area(ft^2)	450
Weekly operating hours	43
Workers on Main Shift	4
Number of PCs	4
Percent Cooled	50% or more
Percent Heated	50% or more

Garage	
Space Type	Other - Service (Vehicle Repair/Service, Postal Service)
Gross Floor Area(ft^2)	22,080
Number of PCs[o]	1
Weekly operating hours[o]	42.5
Workers on Main Shift[o]	8

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 05/31/2009)	**Baseline** (Ending Date 05/31/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft^2)	202	202	102	N/A	77
Source (kBtu/ft^2)	268	268	135	N/A	150
Energy Cost					
$/year	N/A	N/A	N/A	N/A	N/A
$/$ft^2$/year	N/A	N/A	N/A	N/A	N/A
Greenhouse Gas Emissions					
$MtCO_2e$/year	297	297	150	N/A	113
$kgCO_2e/ft^2$/year	13	13	7	N/A	5

More than 50% of your building is defined as Service (Vehicle Repair/Service, Postal Service). This building is currently ineligible for a rating. Please note the National Average column represents the CBECS national average data for Service (Vehicle Repair/Service, Postal Service). This building uses X% less energy per square foot than the CBECS national average for Service (Vehicle Repair/Service, Postal Service).

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

CEG Job #: 9C09086
Project: Warren County Road Department
Address: 185 County Road
Belvidere, NJ 07823
Building SF: 22,530

"Warren County - Road Department"

KWH COST: $0.167

ECM #1: Lighting Upgrade

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total KW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
1203	Main Office	2210	6	4	2 X 4, 4-Lamp, T12, Magnetic Ballast, Prismatic Lens	160	0.96	2,122	$354.31	6	3	2'x4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.55	1,207	$201.51	$140.00	$840.00	0.41	914.94	$152.79	5.50
1203	Copy / File Room	2210	5	4	2 X 4, 4-Lamp, T12, Magnetic Ballast, Prismatic Lens	160	0.80	1,768	$295.26	5	3	2'x4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.46	1,006	$167.93	$140.00	$700.00	0.35	762.45	$127.33	5.50
204	Bathroom	2210	2	0	1-Lamp Incandescent Fixture	60	0.12	265	$44.29	2	0	18 W CFL Lamp	18	0.04	80	$13.29	$5.75	$11.50	0.08	185.64	$31.00	0.37
204	Bathroom	2210	2	0	1-Lamp Incandescent Fixture	60	0.12	265	$44.29	2	0	18 W CFL Lamp	18	0.04	80	$13.29	$5.75	$11.50	0.08	185.64	$31.00	0.37
204	Storage	2210	1	0	1-Lamp Incandescent Fixture	60	0.06	133	$22.14	1	0	18 W CFL Lamp	18	0.02	40	$6.64	$5.75	$5.75	0.04	92.82	$15.50	0.37
1203	Office	2210	6	4	2 X 4, 4-Lamp, T12, Magnetic Ballast, Prismatic Lens	160	0.96	2,122	$354.31	6	3	2'x4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.55	1,207	$201.51	$140.00	$840.00	0.41	914.94	$152.79	5.50
1220	Store Room	2210	17	2	1 X 8, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, No Lens	158	2.69	5,936	$991.32	17	2	8' 2-Lamp T-8 Cooper Metalux, Electronic Ballast M/N 8TDIM-232-UNV-EB81-U	118	2.01	4,433	$740.35	$207.00	$3,519.00	0.68	1502.8	$250.97	14.02
1203	Store Room Office	2210	2	4	2 X 4, 4-Lamp, T12, Magnetic Ballast, Prismatic Lens	160	0.32	707	$118.10	2	3	2'x4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.18	402	$67.17	$140.00	$280.00	0.14	304.98	$50.93	5.50
1203	Main Entrance to Store Room	2210	1	4	2 X 4, 4-Lamp, T12, Magnetic Ballast, Prismatic Lens	160	0.16	354	$59.05	1	3	2'x4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.09	201	$33.59	$140.00	$140.00	0.07	152.49	$25.47	5.50
1221	Office Corridor	2210	3	3	1 X 4, 3-Lamp, T12, Magnetic Ballast, Surface Mounted,	130	0.39	862	$143.94	3	3	2'X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.27	603	$100.76	$120.00	$360.00	0.12	258.57	$43.18	8.34
1203	Break Room	2210	12	4	2 X 4, 4-Lamp, T12, Magnetic Ballast, Prismatic Lens	160	1.92	4,243	$708.61	12	3	2'x4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	1.09	2,413	$403.02	$140.00	$1,680.00	0.83	1829.88	$305.59	5.50
1203	Garage Area Break Room	2210	2	4	2 X 4, 4-Lamp, T12, Magnetic Ballast, Prismatic Lens	160	0.32	707	$118.10	2	3	2'x4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.18	402	$67.17	$140.00	$280.00	0.14	304.98	$50.93	5.50
1202	Shower / Wash area	2210	2	2	1 X 4, 2-Lamp, T12, Magnetic Ballast, Prismatic Lens	94	0.19	415	$69.39	2	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.11	243	$40.60	$100.00	$200.00	0.08	172.38	$28.79	6.95
1220	Service Garage	2210	43	2	1 X 8, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, No Lens	158	6.79	15,015	$2,507.46	43	2	8' 2-Lamp T-8 Cooper Metalux, Electronic Ballast M/N 8TDIM-232-UNV-EB81-U	118	5.07	11,214	$1,872.66	$207.00	$8,901.00	1.72	3801.2	$634.80	14.02
1221		2210	14	3	1 X 4, 3-Lamp, T12, Magnetic Ballast, Surface Mounted,	130	1.82	4,022	$671.71	14	3	2'X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	1.27	2,816	$470.20	$120.00	$1,680.00	0.55	1206.66	$201.51	8.34
206		2210	4	0	1-Lamp Halogen Fixture	300	1.20	2,652	$442.88	4	0	100 W Metal-Halide Fixture; CCDew M/N BSF-100HSW	100	0.40	884	$147.63	$179.00	$716.00	0.80	1768	$295.26	2.43

1202		2210	4	2	1 X 4, 2-Lamp, T12, Magnetic Ballast, Prismatic Lens	94	0.38	831	$138.77	4	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.22	486	$81.20	$100.00	$400.00	0.16	344.76	$57.57	6.95
1220	Boiler Room	2210	1	2	1 X 8, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, No Lens	158	0.16	349	$58.31	1	2	8' 2-Lamp T-8 Cooper Metalux, Electronic Ballast M/N 8TDIM-232-UNV-EB81-U	118	0.12	261	$43.55	$207.00	$207.00	0.04	88.4	$14.76	14.02
1221	Back Room	2210	5	3	1 X 4, 3-Lamp, T12, Magnetic Ballast, Surface Mounted,	130	0.65	1,437	$239.90	5	3	2'X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.46	1,006	$167.93	$120.00	$600.00	0.20	430.95	$71.97	8.34
1220	Garage 1	2210	6	2	1 X 8, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, No Lens	158	0.95	2,095	$349.88	6	2	8' 2-Lamp T-8 Cooper Metalux, Electronic Ballast M/N 8TDIM-232-UNV-EB81-U	118	0.71	1,565	$261.30	$207.00	$1,242.00	0.24	530.4	$88.58	14.02
1221		2210	2	3	1 X 4, 3-Lamp, T12, Magnetic Ballast, Surface Mounted,	130	0.26	575	$95.96	2	3	2'X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.18	402	$67.17	$120.00	$240.00	0.08	172.38	$28.79	8.34
301	Garage 13	2210	9	0	1-Lamp Metal Halide Fixture	180	1.62	3,580	$597.89	9	0	No Change	180	1.62	3,580	$597.89	$0.00	$0.00	0.00	0	$0.00	0.00
1202	Rest Room Area	2210	1	2	1 X 4, 2-Lamp, T12, Magnetic Ballast, Prismatic Lens	94	0.09	208	$34.69	1	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.06	122	$20.30	$100.00	$100.00	0.04	86.19	$14.39	6.95
301	Garage Area Mech Room	2210	2	0	1-Lamp Metal Halide Fixture	180	0.36	796	$132.87	2	0	No Change	180	0.36	796	$132.87	$0.00	$0.00	0.00	0	$0.00	0.00
1202	Break Area	2210	2	2	1 X 4, 2-Lamp, T12, Magnetic Ballast, Prismatic Lens	94	0.19	415	$69.39	2	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.11	243	$40.60	$100.00	$200.00	0.08	172.38	$28.79	6.95
1220	Sign Shop	2210	7	2	1 X 8, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, No Lens	158	1.11	2,444	$408.19	7	2	8' 2-Lamp T-8 Cooper Metalux, Electronic Ballast M/N 8TDIM-232-UNV-EB81-U	118	0.83	1,825	$304.85	$207.00	$1,449.00	0.28	618.8	$103.34	14.02
1203		2210	1	4	2 X 4, 4-Lamp, T12, Magnetic Ballast, Prismatic Lens	160	0.16	354	$59.05	1	3	2'x4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.09	201	$33.59	$140.00	$140.00	0.07	152.49	$25.47	5.50
210	Mezzanine Storage	2210	10	0	1-Lamp Incandescent Fixture	100	1.00	2,210	$369.07	10	0	26 W CFL Lamp	26	0.26	575	$95.96	$9.75	$97.50	0.74	1635.4	$273.11	0.36
1220		2210	2	2	1 X 8, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, No Lens	158	0.32	698	$116.63	2	2	8' 2-Lamp T-8 Cooper Metalux, Electronic Ballast M/N 8TDIM-232-UNV-EB81-U	118	0.24	522	$87.10	$207.00	$414.00	0.08	176.8	$29.53	14.02
303	Outside - Building Sides	3640	20	0	1-Lamp High Pressure Soduim Fixture	125	2.50	9,100	$1,519.70	20	0	No Change	125	2.50	9,100	$1,519.70	$0.00	$0.00	0.00	0	$0.00	0.00
301		3640	5	0	1-Lamp Metal Halide Fixture	180	0.90	3,276	$547.09	5	0	No Change	180	0.90	3,276	$547.09	$0.00	$0.00	0.00	0	$0.00	0.00
204	Outside - Door Exit	3640	1	0	1-Lamp Incandescent Fixture	60	0.06	218	$36.47	1	0	18 W CFL Lamp	18	0.02	66	$10.94	$5.75	$5.75	0.04	152.88	$25.53	0.23
102		3640	13	0	1-Lamp Compact Flourescent	26	0.34	1,230	$205.46	13	0	No Change	26	0.34	1,230	$205.46	$0.00	$0.00	0.00	0	$0.00	0.00

209	Outside - Front Entrance	3640	1	0	1-Lamp Incandescent Fixture	120	0.12	437	$72.95	1	0	26 W CFL Lamp	26	0.03	95	$15.80	$9.75	$9.75	0.09	342.16	$57.14	0.17
206		3640	1	0	1-Lamp Halogen Fixture	300	0.30	1,092	$182.36	1	0	100 W Metal-Halide Fixture; CCDew M/N BSF-100HSW	100	0.10	364	$60.79	$179.00	$179.00	0.20	728	$121.58	1.47
	Totals		215	64			30.27	72,933	$12,179.79	215	56			21.44	52,943	$8,841.40		$25,448.75	8.83	19990	$3,338.39	7.62

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.
2. Some fixtures are estimated due to inaccessibility
3. Lamp totals only include T-12 tube replacment calculations

CEG Job #: 9C09086
Project: Warren County Road Department
Address: 185 County Road
Belvidere, NJ 07823
Building SF: 22,530

"Warren County - Road Department"

KWH COST: $0.167

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Savings (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
1203	Main Office	2210	6	4	2 X 4, 4-Lamp, T12, Magnetic Ballast, Prismatic Lens	160	0.96	2,122	$354.31	6	3	Dual Technology Occupancy Sensor	160	20%	1,697	$283.45	$75.00	$225.00	0.00	424.32	$70.86	3.18
1203	Copy / File Room	552.2	5	4	2 X 4, 4-Lamp, T12, Magnetic Ballast, Prismatic Lens	160	0.80	442	$73.77	5	3	Dual Technology Occupancy Sensor	160	20%	353	$59.02	$75.00	$75.00	0.00	88.352	$14.75	5.08
204	Bathroom	2210	2	0	1-Lamp Incandescent Fixture	60	0.12	265	$44.29	2	0	Dual Technology Occupancy Sensor	60	20%	212	$35.43	$75.00	$75.00	0.00	53.04	$8.86	8.47
204	Bathroom	2210	2	0	1-Lamp Incandescent Fixture	60	0.12	265	$44.29	2	0	Dual Technology Occupancy Sensor	60	20%	212	$35.43	$75.00	$75.00	0.00	53.04	$8.86	8.47
204	Storage	552.2	1	0	1-Lamp Incandescent Fixture	60	0.06	33	$5.53	1	0	None	60	0%	33	$5.53	$0.00	$0.00	0.00	0	$0.00	0.00
1203	Office	2210	6	4	2 X 4, 4-Lamp, T12, Magnetic Ballast, Prismatic Lens	160	0.96	2,122	$354.31	6	3	Dual Technology Occupancy Sensor	160	20%	1,697	$283.45	$75.00	$75.00	0.00	424.32	$70.86	1.06
1220	Store Room	2210	17	2	1 X 8, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, No Lens	158	2.69	5,936	$991.32	17	2	Dual Technology Occupancy Sensor	158	20%	4,749	$793.06	$75.00	$75.00	0.00	1187.212	$198.26	0.38
1203	Store Room Office	2210	2	4	2 X 4, 4-Lamp, T12, Magnetic Ballast, Prismatic Lens	160	0.32	707	$118.10	2	3	Dual Technology Occupancy Sensor	160	20%	566	$94.48	$75.00	$75.00	0.00	141.44	$23.62	3.18
1203	Main Entrance to Store Room	2210	1	4	2 X 4, 4-Lamp, T12, Magnetic Ballast, Prismatic Lens	160	0.16	354	$59.05	1	3	Dual Technology Occupancy Sensor	160	20%	283	$47.24	$75.00	$75.00	0.00	70.72	$11.81	6.35
1221	Office Corridor	2210	3	3	1 X 4, 3-Lamp, T12, Magnetic Ballast, Surface Mounted,	130	0.39	862	$143.94	3	3	Dual Technology Occupancy Sensor	130	20%	690	$115.15	$75.00	$75.00	0.00	172.38	$28.79	2.61
1203	Break Room	2210	12	4	2 X 4, 4-Lamp, T12, Magnetic Ballast, Prismatic Lens	160	1.92	4,243	$708.61	12	3	Dual Technology Occupancy Sensor	160	20%	3,395	$566.89	$75.00	$75.00	0.00	848.64	$141.72	0.53
1203	Garage Area Break Room	2210	2	4	2 X 4, 4-Lamp, T12, Magnetic Ballast, Prismatic Lens	160	0.32	707	$118.10	2	3	Dual Technology Occupancy Sensor	160	20%	566	$94.48	$75.00	$75.00	0.00	141.44	$23.62	3.18
1202	Shower / Wash area	2210	2	2	1 X 4, 2-Lamp, T12, Magnetic Ballast, Prismatic Lens	94	0.19	415	$69.39	2	2	Dual Technology Occupancy Sensor	94	20%	332	$55.51	$75.00	$75.00	0.00	83.096	$13.88	5.40
1220	Service Garage	2210	43	2	1 X 8, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, No Lens	158	6.79	15,015	$2,507.46	43	2	Dual Technology Occupancy Sensor	158	20%	12,012	$2,005.97	$75.00	$1,800.00	0.00	3002.948	$501.49	3.59
1221		2210	14	3	1 X 4, 3-Lamp, T12, Magnetic Ballast, Surface Mounted,	130	1.82	4,022	$671.71	14	3	Dual Technology Occupancy Sensor	130	20%	3,218	$537.37	$0.00	$0.00	0.00	804.44	$134.34	0.00
206		2210	4	0	1-Lamp Halogen Fixture	300	1.20	2,652	$442.88	4	0	Dual Technology Occupancy Sensor	300	20%	2,122	$354.31	$0.00	$0.00	0.00	530.4	$88.58	0.00

1202		2210	4	2	1 X 4, 2-Lamp, T12, Magnetic Ballast, Prismatic Lens	94	0.38	831	$138.77	4	2	Dual Technology Occupancy Sensor	94	20%	665	$111.02	$0.00	$0.00	0.00	166.192	$27.75	0.00
1220	Boiler Room	552.2	1	2	1 X 8, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, No Lens	158	0.16	87	$14.57	1	2	None	158	0%	87	$14.57	$0.00	$0.00	0.00	0	$0.00	0.00
1221	Back Room	2210	5	3	1 X 4, 3-Lamp, T12, Magnetic Ballast, Surface Mounted,	130	0.65	1,437	$239.90	5	3	Dual Technology Occupancy Sensor	130	20%	1,149	$191.92	$75.00	$75.00	0.00	287.3	$47.98	1.56
1220	Garage 1	2210	6	2	1 X 8, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, No Lens	158	0.95	2,095	$349.88	6	2	Dual Technology Occupancy Sensor	158	20%	1,676	$279.90	$75.00	$300.00	0.00	419.016	$69.98	4.29
1221		2210	2	3	1 X 4, 3-Lamp, T12, Magnetic Ballast, Surface Mounted,	130	0.26	575	$95.96	2	3	Dual Technology Occupancy Sensor	130	20%	460	$76.77	$0.00	$0.00	0.00	114.92	$19.19	0.00
301	Garage 13	2210	9	0	1-Lamp Metal Halide Fixture	180	1.62	3,580	$597.89	9	0	Dual Technology Occupancy Sensor	180	20%	2,864	$478.31	$75.00	$150.00	0.00	716.04	$119.58	1.25
1202	Rest Room Area	2210	1	2	1 X 4, 2-Lamp, T12, Magnetic Ballast, Prismatic Lens	94	0.09	208	$34.69	1	2	Dual Technology Occupancy Sensor	94	20%	166	$27.75	$75.00	$75.00	0.00	41.548	$6.94	10.81
301	Garage Area Mech Room	552.2	2	0	1-Lamp Metal Halide Fixture	180	0.36	199	$33.20	2	0	None	180	0%	199	$33.20	$0.00	$0.00	0.00	0	$0.00	0.00
1202	Break Area	2210	2	2	1 X 4, 2-Lamp, T12, Magnetic Ballast, Prismatic Lens	94	0.19	415	$69.39	2	2	Dual Technology Occupancy Sensor	94	20%	332	$55.51	$75.00	$75.00	0.00	83.096	$13.88	5.40
1220	Sign Shop	2210	7	2	1 X 8, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, No Lens	158	1.11	2,444	$408.19	7	2	Dual Technology Occupancy Sensor	158	20%	1,955	$326.55	$75.00	$150.00	0.00	488.852	$81.64	1.84
1203		2210	1	4	2 X 4, 4-Lamp, T12, Magnetic Ballast, Prismatic Lens	160	0.16	354	$59.05	1	3	Dual Technology Occupancy Sensor	160	20%	283	$47.24	$0.00	$0.00	0.00	70.72	$11.81	0.00
210	Mezzanine Storage	2210	10	0	1-Lamp Incandescent Fixture	100	1.00	2,210	$369.07	10	0	Dual Technology Occupancy Sensor	100	20%	1,768	$295.26	$75.00	$150.00	0.00	442	$73.81	2.03
1220		2210	2	2	1 X 8, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, No Lens	158	0.32	698	$116.63	2	2	Dual Technology Occupancy Sensor	158	20%	559	$93.30	$0.00	$0.00	0.00	139.672	$23.33	0.00
303	Outside - Building Sides	3640	20	0	1-Lamp High Pressure Soduim Fixture	125	2.50	9,100	$1,519.70	20	0	No Change	125	0%	9,100	$1,519.70	$0.00	$0.00	0.00	0	$0.00	0.00
301		3640	5	0	1-Lamp Metal Halide Fixture	180	0.90	3,276	$547.09	5	0	No Change	180	0%	3,276	$547.09	$0.00	$0.00	0.00	0	$0.00	0.00
204	Outside - Door Exit	3640	1	0	1-Lamp Incandescent Fixture	60	0.06	218	$36.47	1	0	No Change	60	0%	218	$36.47	$0.00	$0.00	0.00	0	$0.00	0.00
102		3640	13	0	1-Lamp Compact Flourescent	26	0.34	1,230	$205.46	13	0	No Change	26	0%	1,230	$205.46	$0.00	$0.00	0.00	0	$0.00	0.00

209	Outside - Front Entrance	3640	1	0	1-Lamp Incandescent Fixture	120	0.12	437	$72.95	1	0	No Change	120	0%	437	$72.95	$0.00	$0.00	0.00	0	$0.00	0.00
206		3640	1	0	1-Lamp Halogen Fixture	300	0.30	1,092	$182.36	1	0	No Change	300	0%	1,092	$182.36	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		215	64			30.27	70,648	$11,798.28	215	56			5.20	59,653	$9,962.10		$3,825.00	0.00	10995	$1,836.19	2.08

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.
2. Some fixtures are estimated due to inaccessibility
3. Lamp totals only include T-12 tube replacment calculations

Project Name: LGEA Solar PV Project - Warren County Road Department
Location: Belvidere, NJ
Description: Photovoltaic System 95% Financing - 25 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 25 year
Total Construction Cost	$1,279,260
Annual kWh Production	161,079
Annual Energy Cost Reduction	$26,900
Annual SREC Revenue	$56,378
First Cost Premium	**$1,279,260**
Simple Payback:	**15.36** Years

Life Cycle Cost Analysis

Analysis Period (years): 25
Financing Term (mths): 240
Average Energy Cost ($/kWh) **$0.167**
Financing Rate: 7.00%
Financing %: 95%
Maintenance Escalation Rate: 3.0%
Energy Cost Escalation Rate: 3.0%
SREC Value ($/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	$63,963	0	0	0	$0	0	0	(63,963)	0
1	$0	161,079	$26,900	$0	$56,378	$84,155	$28,911	($29,788)	($93,751)
2	$0	160,274	$27,707	$0	$56,096	$82,065	$31,001	($29,263)	($123,015)
3	$0	159,472	$28,538	$0	$55,815	$79,824	$33,242	($28,713)	($151,727)
4	$0	158,675	$29,395	$0	$55,536	$77,421	$35,645	($28,135)	($179,863)
5	$0	157,882	$30,276	$1,626	$55,259	$74,844	$38,222	($29,157)	($209,020)
6	$0	157,092	$31,185	$1,618	$54,982	$72,081	$40,985	($28,517)	($237,537)
7	$0	156,307	$32,120	$1,610	$54,707	$69,118	$43,948	($27,849)	($265,386)
8	$0	155,525	$33,084	$1,602	$54,434	$65,941	$47,125	($27,150)	($292,537)
9	$0	154,747	$34,076	$1,594	$54,162	$62,534	$50,532	($26,422)	($318,959)
10	$0	153,974	$35,099	$1,586	$53,891	$58,881	$54,185	($25,663)	($344,621)
11	$0	153,204	$36,152	$1,578	$53,621	$54,964	$58,102	($24,871)	($369,493)
12	$0	152,438	$37,236	$1,570	$53,353	$50,764	$62,302	($24,047)	($393,540)
13	$0	151,676	$38,353	$1,562	$53,086	$46,260	$66,806	($23,189)	($416,728)
14	$0	150,917	$39,504	$1,554	$52,821	$41,431	$71,635	($22,296)	($439,024)
15	$0	150,163	$40,689	$1,547	$52,557	$36,252	$76,814	($21,367)	($460,391)
16	$0	149,412	$41,910	$1,539	$52,294	$30,699	$82,367	($20,401)	($480,792)
17	$0	148,665	$43,167	$1,531	$52,033	$24,745	$88,321	($19,398)	($500,190)
18	$0	147,921	$44,462	$1,524	$51,773	$18,360	$94,706	($18,355)	($518,546)
19	$0	147,182	$45,796	$1,516	$51,514	$11,514	$101,552	($17,273)	($535,818)
20	$0	146,446	$47,170	$1,508	$51,256	$4,173	$108,893	($16,149)	($551,967)
21	$0	145,714	$48,585	$1,501	$51,000	$3,538	$100,106	($5,560)	($557,528)
22	$0	144,985	$50,042	$1,493	$50,745	$2,421	$82,378	$14,494	($543,033)
23	$0	144,260	$51,544	$1,486	$50,491	$0	$0	$100,549	($442,485)
24	$0	143,539	$53,090	$1,478	$50,239	$0	$0	$101,850	($340,635)
25	$0	142,821	$54,683	$1,471	$49,987	$0	$0	$103,199	($237,436)
	Totals:	3,073,050	$722,818	$25,066	$1,075,567	$1,046,027	$1,215,297	$1,397,782	($9,004,021)
					Net Present Value (NPV)			**($241,328)**	
					Internal Rate of Return (IRR)			**-3.71%**	

Project Name: LGEA Solar PV Project - Warren County Road Department
Location: Belvidere, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

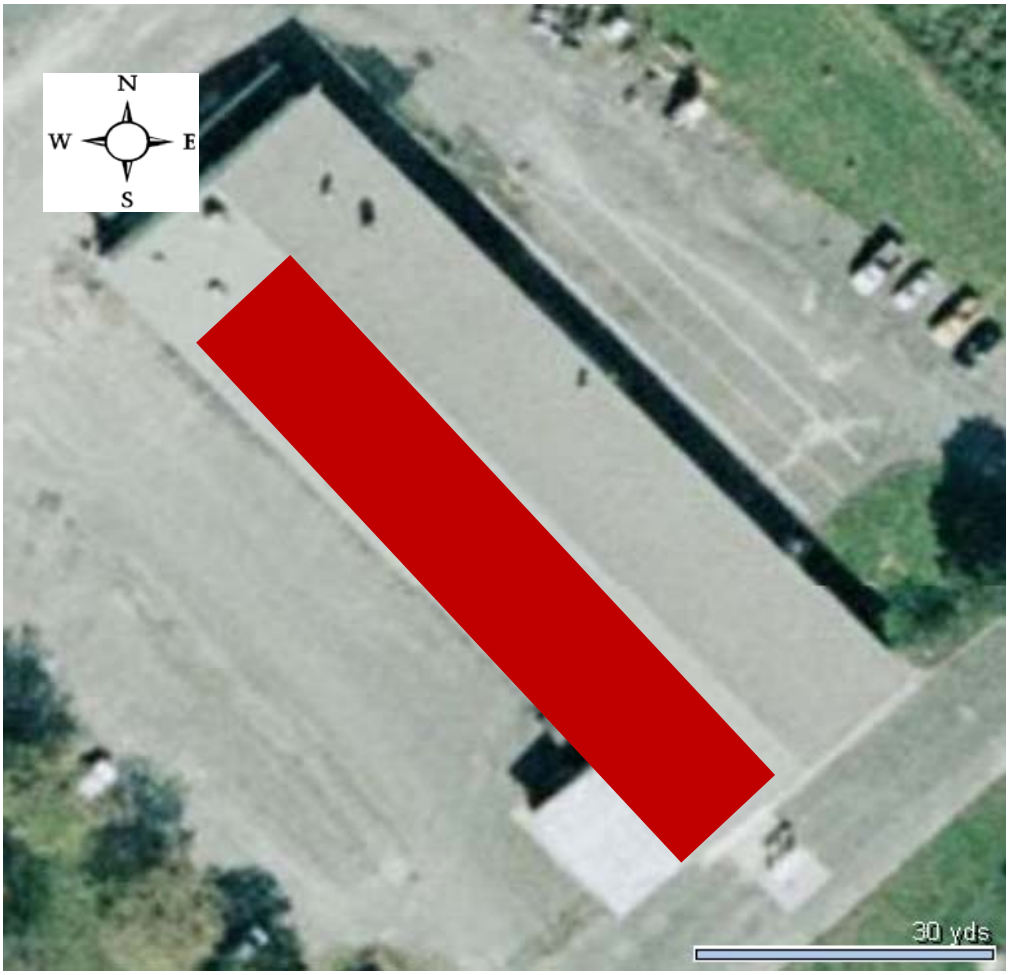
	Photovoltaic System - Direct Purchase
Total Construction Cost	$1,279,260
Annual kWh Production	161,079
Annual Energy Cost Reduction	$26,900
Annual SREC Revenue	$56,378
First Cost Premium	**$1,279,260**
Simple Payback:	**15.36** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.167**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$1,279,260	0	0	0	$0	(1,279,260)	0
1	$0	161,079	$26,900	$0	$56,378	$83,278	($1,195,982)
2	$0	160,274	$27,707	$0	$56,096	$83,803	($1,112,179)
3	$0	159,472	$28,538	$0	$55,815	$84,354	($1,027,825)
4	$0	158,675	$29,395	$0	$55,536	$84,931	($942,895)
5	$0	157,882	$30,276	$1,626	$55,259	$83,909	($858,986)
6	$0	157,092	$31,185	$1,618	$54,982	$84,549	($774,437)
7	$0	156,307	$32,120	$1,610	$54,707	$85,218	($689,219)
8	$0	155,525	$33,084	$1,602	$54,434	$85,916	($603,304)
9	$0	154,747	$34,076	$1,594	$54,162	$86,644	($516,660)
10	$0	153,974	$35,099	$1,586	$53,891	$87,404	($429,256)
11	$0	153,204	$36,152	$1,578	$53,621	$88,195	($341,061)
12	$0	152,438	$37,236	$1,570	$53,353	$89,019	($252,042)
13	$0	151,676	$38,353	$1,562	$53,086	$89,877	($162,164)
14	$0	150,917	$39,504	$1,554	$52,821	$90,770	($71,394)
15	$0	150,163	$40,689	$1,547	$52,557	$91,699	$20,305
16	$0	149,412	$41,910	$1,539	$52,294	$92,665	$112,970
17	$0	148,665	$43,167	$1,531	$52,033	$93,668	$206,638
18	$0	147,921	$44,462	$1,524	$51,773	$94,711	$301,349
19	$0	147,182	$45,796	$1,516	$51,514	$95,793	$397,143
20	$0	146,446	$47,170	$1,508	$51,256	$96,917	$494,060
21	$1	145,714	$48,585	$1,501	$51,000	$98,084	$592,144
22	$2	144,985	$50,042	$1,493	$50,745	$99,294	$691,438
23	$3	144,260	$51,544	$1,486	$50,491	$100,549	$791,986
24	$4	143,539	$53,090	$1,478	$50,239	$101,850	$893,836
25	$5	142,821	$54,683	$1,471	$49,987	$103,199	$997,035
Totals:		3,073,050	$722,818	$25,066	$1,075,567	$2,276,295	$1,773,320
				Net Present Value (NPV)		**$997,060**	
				Internal Rate of Return (IRR)		**4.8%**	

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
Warren County Road Department	9074	Sunpower SPR230	618	14.7	9,087	142.14	161,079	20,394	15.64



.= Proposed PV Layout Area

Notes:

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

PVWatts * * * AC Energy & Cost Savings

Cautions for Interpreting the Results

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	142.1 kW
DC to AC Derate Factor:	0.810
AC Rating:	115.1 kW
Array Type:	Fixed Tilt
Array Tilt:	12.0°
Array Azimuth:	225.0°
Energy Specifications	
Cost of Electricity:	16.7 ¢/kWh

Results			
Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	2.34	8250	1377.75
2	3.08	10066	1681.02
3	3.99	14134	2360.38
4	4.77	15836	2644.61
5	5.65	18860	3149.62
6	5.88	18448	3080.82
7	5.74	18373	3068.29
8	5.32	16887	2820.13
9	4.57	14494	2420.50
10	3.52	11728	1958.58
11	2.25	7371	1230.96
12	1.94	6631	1107.38
Year	4.09	161079	26900.19

Output Hourly Performance Data * Output Results as Text

About the Hourly Performance Data Saving Text from a Browser

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

Please send questions and comments regarding PVWATTS to Webmaster

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