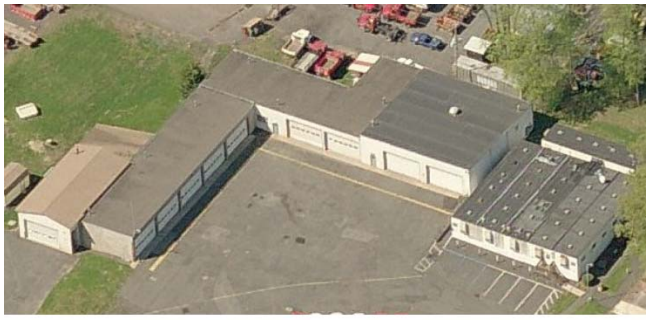


ENERGY AUDIT – FINAL REPORT

BRANCHBURG TOWNSHIP
DPW BLDG.
34 KENBURY ROAD
BRANCHBURG, NJ 08876
ATTN: JOHN GREGORY JR.,
ASSISTANT ADMINISTRATOR

CEG PROJECT NO. 9C09060

CONCORD ENGINEERING GROUP

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

CONTACT: RAY JOHNSON, PRINCIPAL
EMAIL: rjohnson@ceg-inc.net

Table of Contents

REPORT DISCLAIMER

The information contained within this report, including any attachment(s), is intended solely for use by the named addressee(s). If you are not the intended recipient, or a person designated as responsible for delivering such messages to the intended recipient, you are not authorized to disclose, copy, distribute or retain this report, in whole or in part, without written authorization from Concord Engineering Group, Inc., 520 S. Burnt Mill Road, Voorhees, NJ 08043.

This report may contain proprietary, confidential or privileged information. If you have received this report in error, please notify the sender immediately. Thank you for your anticipated cooperation.

I. EXECUTIVE SUMMARY

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

Branchburg Township
DPW Garage
34 Kenbury Road
Branchburg, NJ 08876

Municipal Contact Person: John Gregory
Facility Contact Person: Ron Cheesman

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	$ 13,079
Natural Gas	$ 17,195
Total	$ 30,273

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

Table 1
Financial Summary Table

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Lighting Upgrade - General	$10,722	$3,051	3.5	318.0%
ECM #2	Metal Halide Bay Lights	$7,000	$835	8.4	23.4%
ECM #3	High Wattage CFL Bay Lights	$1,377	$1,748	0.8	1639.7%
ECM #4	Fluorescent Bay Lights	$7,042	$1,887	3.7	234.0%
ECM #5	Lighting Controls	$2,340	$1,578	1.5	911.5%
ECM #6	Programmable Thermostats	$1,800	$4,208	0.4	3406.7%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	Solar Photovoltaic System	$428,490	$30,362	14.1	77.1%

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

The estimated demand and energy savings for each ECM and REM is shown below in Table 2. The descriptions in this table correspond to the ECM's and REM's listed in Table 1.

Table 2
Estimated Energy Savings Summary Table

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	Lighting Upgrade - General	6.2	14,791	0
ECM #2	Metal Halide Bay Lights	1.2	2,850	0
ECM #3	High Wattage CFL Bay Lights	3.4	7,905	0
ECM #4	Fluorescent Bay Lights	3.3	7,764	0
ECM #5	Lighting Controls	0.0	7,811	0
ECM #6	Programmable Thermostats	0.0	0	3,420
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION	NATURAL GAS (THERMS)
REM #1	Solar Photovoltaic System	46.6	55,004	0

Concord Engineering Group (CEG) recommends proceeding with the implementation of all ECM's that provide a calculated simple payback at or under ten (10) years. ECMs 2, 3 & 4 are different options for the same retrofitted equipment. Only one of these ECMs can be implemented. The following Energy Conservation Measures are recommended for the facility:

- **ECM #1:** Lighting Upgrade - General
- **ECM #3:** High Wattage CFL Bay Lights
- **ECM #5:** Lighting Controls
- **ECM #6:** Programmable Thermostats

Although ECM # 4 pays back in a longer period that ECM #3 for the bay lighting retrofits, it is recommended to consider fluorescent bay fixtures in lieu of CFLs for replacement of the garage bay lighting if higher lighting output and better quality lighting over the existing is desired.

All recommended ECMs pay back in a very short period of time. The lighting retrofits along with lighting controls provide substantial reductions in the facilities electrical energy consumption. Lighting is estimated to be the majority of the building's electrical energy use. The proposed lighting retrofits offer far superior overall lighting efficiency than the existing lighting. It is highly recommended to implement the general lighting retrofit along with one of the three bay lighting options shown above along with occupancy sensor lighting controls.

The source of heat in the building is natural gas utilized with gas fired unit heaters. The majority of the unit heaters are in good condition with little potential for efficiency upgrades, however the control of the existing units is lacking. Replacement of the existing standard thermostats with modern programmable thermostats will capture a large amount of wasted energy lost during unoccupied periods. Programmable thermostats allow a building to supply minimal heat when it is not needed; while at the same time ensure the space is up to full temperature prior to occupancy with no loss reduction in the workers' comfort. The programmable thermostats provide the shortest payback of any ECM calculated (within one season), and provides an annual savings of 4,208. This ECM should be considered the first priority for energy reduction and cost savings.

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

1. Maintain all weather barrier on garage doors to minimize infiltration. Ensure the exhaust ports are closed after use.
2. Clean all light fixtures to maximize light output.
3. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ. Typical for all AHU and furnaces in the facility

II. INTRODUCTION

The comprehensive energy audit covers the 10,273 square foot DPW Garage, which includes a main service garage, storage garages, as well as small administration area, toilet rooms, and locker room.

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

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

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

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

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

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

III. METHOD OF ANALYSIS

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

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

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

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

ECM Calculation Equations:

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

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

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

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

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

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

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

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

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

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

The gas usage profile shows the actual natural gas energy usage for the facility. Public Service Electric and Gas (PSE&G) provides natural gas to the facility under the Basic General Supply Service (GSGH) 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	20.2¢ / kWh
Natural Gas	$1.23 / Therm

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: JCP&L
Rate: GSS
Meter No: D21673576
Customer ID No: 100002978656
Third Party Utility
TPS Meter / Acct No:

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Jul-08	4,879	46.6	$1,096
Aug-08	4,173	46.6	$980
Sep-08	4,218	46.5	$865
Oct-08	5,076	46.4	$983
Nov-08	5,735	46.5	$1,082
Dec-08	6,597	46.4	$1,243
Jan-09	8,292	46.3	$1,495
Feb-09	7,308	46.3	$1,347
Mar-09	4,907	46.4	$985
Apr-09	5,356	46.5	$1,049
May-09	3,548	46.3	$905
Jun-09	4,679	46.5	$1,049
Totals	**64,768**	**46.6 Max**	**$13,079**

AVERAGE DEMAND **46.4 KW average**
AVERAGE RATE **$0.202** **$/kWh**

Figure 1
Electricity Usage Profile

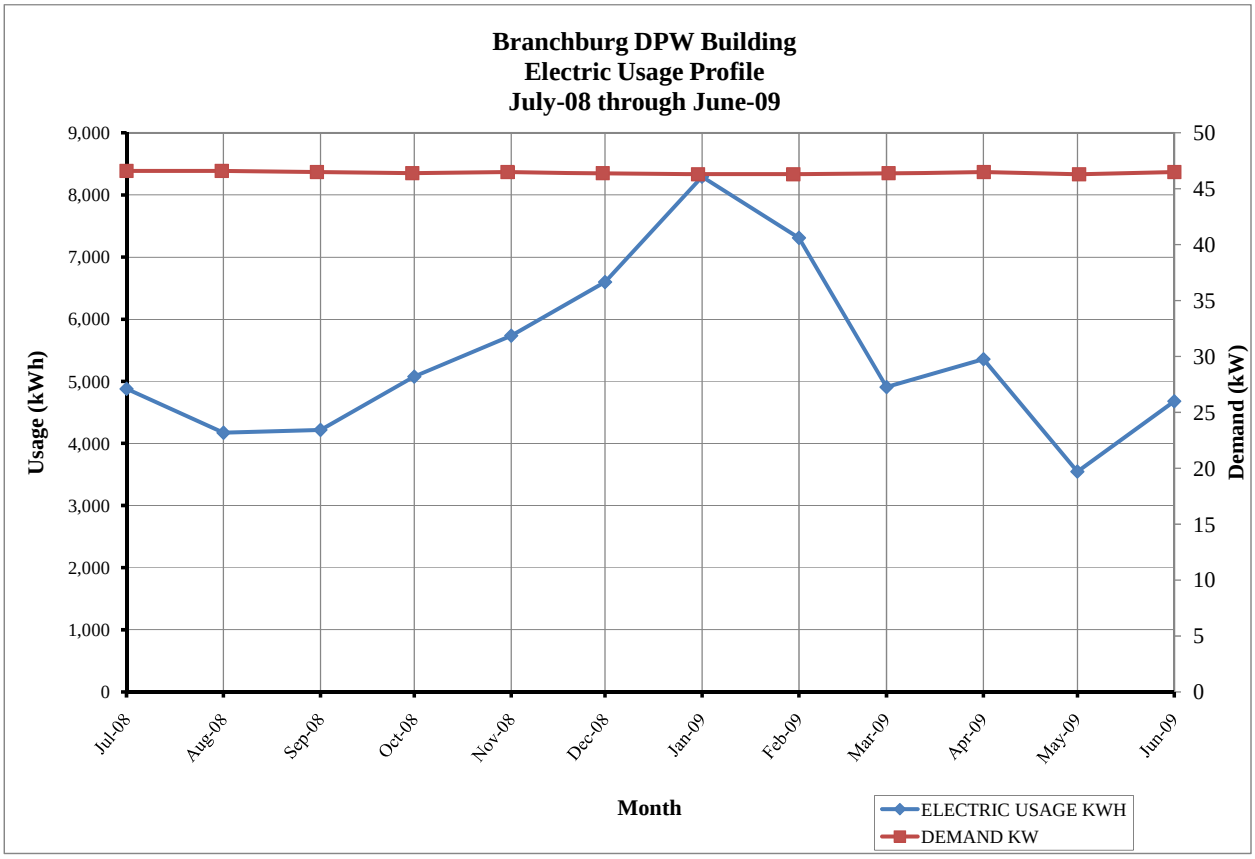
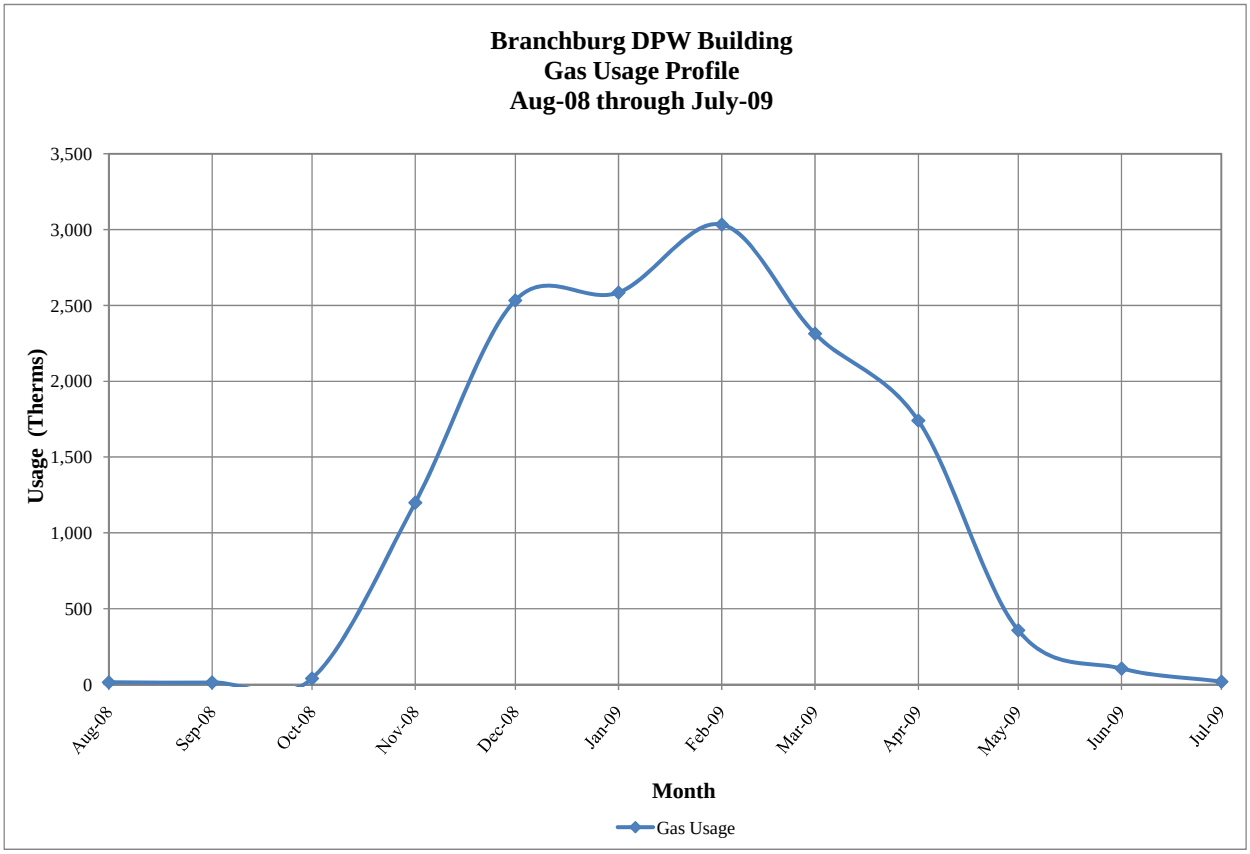


Table 4
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider:	PSE&G	
Rate:	GSGH	
Meter No:	2670469, 1715713, 2049395	
Point of Delivery ID:	PG00011437846623031, PG000009731195520998	
Third Party Utility Provider:		
TPS Meter No:		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Aug-08	15	$44
Sep-08	14	$40
Oct-08	40	$74
Nov-08	1,199	$1,645
Dec-08	2,533	$3,430
Jan-09	2,585	$3,464
Feb-09	3,034	$3,766
Mar-09	2,314	$2,564
Apr-09	1,741	$1,678
May-09	358	$340
Jun-09	105	$113
Jul-09	19	$38
TOTALS	**13,955**	**$17,195**
AVERAGE RATE:	**$1.232**	**$/THERM**

Figure 2
Natural Gas Usage Profile



B. Energy Use Index (EUI)

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

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

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

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

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

Table 5
Facility Energy Use Index (EUI) Calculation

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	**BUILDING USE**			**SITE ENERGY**	**SITE-SOURCE RATIO**	**SOURCE ENERGY**
	kWh	**Therms**	**Gallons**	**kBtu**		**kBtu**
ELECTRIC	64768.0			221,118	3.340	738,534
NATURAL GAS		13954.9		1,395,491	1.047	1,461,079
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				1,616,609		2,199,613
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		10,736	SQUARE FEET			
BUILDING SITE EUI		*150.58*	kBtu/SF/YR			
BUILDING SOURCE EUI		*204.88*	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.

Based on the information compiled for the studied facility, as compared to the national average the energy usage in this facility is approximately 37% higher than the average data.

C. EPA Energy Benchmarking System

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

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

In accordance with the Local Government Energy Audit Program, CEG has created an ENERGY STAR account for the municipality to access and monitoring the facility's yearly energy usage as it compares to facilities of similar type. The login page for the account can be accessed at the following web address; the username and password are also listed below:

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

User Name:	branchburg
Password:	lgeaceg2009
Security Question:	What city were you born in?
Security Answer:	"branchburg"

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

Table 6
ENERGY STAR Performance Rating

ENERGY STAR PERFORMANCE RATING		
FACILITY DESCRIPTION	**ENERGY PERFORMANCE RATING**	**NATIONAL AVERAGE**
Branchburg – DPW Bldg	NA	NA

The DPW garage fall under an "other" category. This is not applicable for an Energy Performance Rating. See the **Statement of Energy Performance Appendix** for the detailed energy summary.

V. FACILITY DESCRIPTION

The 10,736 SF DPW Building is a single story service garage with a small locker room and a few offices for administration. The typical hours of operation for this facility are between 7:00 am an 3:30 pm. The garage operation is typical throughout the year except for the winter season where there is an increase in road service throughout the municipality. Exterior walls are block construction with no insulation. There are no windows in the facility except for small glass panes within the garage doors. Garage doors represent a significant portion of the exterior façade. The garage doors appear to be in good condition, however in some locations the garage doors to not meet the floor and seal well. The majority of the roof is a flat roof with the exception of one service bay dedicated for school bus service. There are minimal penetrations in the roof and no equipment other than a single garage exhaust fan in the high bay portion of the garage. The amount of insulation below the roofing is unknown. The estimated building age is 20 years.

HVAC Systems

There is no cooling in the service garage with the exception of one small split system which serves the small office area and one through-wall unit which serves a small maintenance shop. The split system is in good condition. The through wall unit is used infrequently and in fair condition. These units are controlled by local thermostats.

Heat is provided for the service garages by multiple gas fired unit heaters mounted at the ceiling. These units operate on local thermostats. There is no form of programmability on the thermostats. The unit heaters range from fair to new condition. The locker rooms and the lounge area is heated by a residential size gas fired furnace. This unit is in poor condition, however adequately heats the space. The school bus garage and small office area is heated by a gas fired boiler. The boiler produces heating hot water which serves baseboard radiation in the office area and hot water coil unit heaters in the single school bus garage. The boiler is in fair condition located in an unconditioned mechanical room next to the service garage.

Exhaust System

The main exhaust system for the service garage in mounted on the roof of the high bay area. The remainder of the garages utilizes the garage doors for ventilation as needed. Toilet rooms and the locker room is exhausted by small exhaust fans through the side wall. The fans are operated by manual switch controls.

Domestic Hot Water

Domestic hot water for the rest rooms and locker rooms is provided by a gas fired 75 gallon Rheem hot water heater, capacity of 75.5 MBH. The hot water heater is in fair condition and adequate for the needs of the facility.

Lighting

Typical lighting in the high bay service garage is fluorescent tube pendent mounted fixtures with T-12 lamps and magnetic ballasts. The remaining garages have a mixture of high bay

incandescent fixtures and metal halide fixtures. The incandescent fixtures are slowly being replaced by the metal halide fixtures. Storage rooms and closets are primarily lit with incandescent lamps. The exterior is lit with wall mounted high pressure sodium lights, and incandescent down lights. All interior lighting is controlled by manual switches. The exterior lights are controlled by photocells.

VI. MAJOR EQUIPMENT LIST

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

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

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade - General

Description:

The majority of the DPW building support spaces including the main service garage and bus garage is lit with T-12 fixtures with magnetic ballasts. The remaining garage lighting is comprise of a combination of 300W incandescent pendant fixtures and 175-Watt metal halide fixtures. The metal halide fixtures have been used to replace the incandescent fixtures on a gradual basis.

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 non garage bay incandescent fixtures to compact fluorescent fixtures. The energy usage of an incandescent compared to a compact fluorescent is 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.

This ECM excludes the retrofit of the garage bay fixtures as these fixtures will be addressed with three separate options in ECMs 2, 3 & 4. All other areas of the building with recommended light fixture replacements are included in this ECM.

Hours of Operation:

45 Hrs per week, 52 weeks per year – 2340 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.

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

$$\text{Smart Start®}\ \textit{Incentive} = (55 \times\ \$10) + (20 \times\ \$20) = \underline{\$950}$$

Replacement and Maintenance Savings are calculated as follows:

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

$$\textit{Savings} = (9\ \textit{lamps per year}) \times (\$2.00 + \$5.00) = \underline{\$63}$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$11,672
NJ Smart Start Equipment Incentive ($):	$950
Net Installation Cost ($):	$10,722
Maintenance Savings ($/Yr):	$63
Energy Savings ($/Yr):	$2,988
Total Yearly Savings ($/Yr):	$3,051
Estimated ECM Lifetime (Yr):	15
Simple Payback	3.5
Simple Lifetime ROI	318.0%
Simple Lifetime Maintenance Savings	$945
Simple Lifetime Savings	$44,820
Internal Rate of Return (IRR)	28%
Net Present Value (NPV)	$25,700.64

ECM #2: Metal Halide Bay Lights

Description:

The majority of the DPW building support spaces including the main service garage and bus garage is lit with T-12 fixtures with magnetic ballasts. The remaining garage lighting is comprised of a combination of 300W incandescent pendant fixtures and 175-Watt metal halide fixtures. The metal halide fixtures have been used to replace the incandescent fixtures on a gradual basis.

The existing 300W incandescent fixtures are very inefficiency when compared to most other types of lighting. The 175 metal halide fixtures are far more efficiency than incandescent fixtures. Metal halide fixtures however have some draw backs including poor lumen maintenance (approximately 30% reduction in lighting output at 40% of rated lamp life). Also, the fixture ballast can be noisy, require up to 10 minutes to re-strike after shutdown, and there is a noticeable color shift as the lamp approaches the end of its life. Despite the drawbacks, the metal halide light fixtures require far less energy than incandescent. This ECM is calculated to show the savings over incandescent fixtures as compared to ECMs #3 &4.

This ECM includes replacement of each of the existing incandescent garage light fixtures with new low-bay metal halide fixtures. This retrofit is based on similar fixtures to the metal halide fixtures that are currently being utilized to replace the incandescent bay fixtures. The metal halide fixtures will utilize 50% of the energy used by the incandescent fixtures, as well as provide a substantial increase in overall lighting output. The metal halide lamps are rated for approximately 15,000 hours with a usable average life of approximately 10,000 burn-hours depending on bulb manufacturers. The Incandescent fixture lamp life is approximately 1000 burn-hours.

Hours of Operation:

45 Hrs per week, 52 weeks per year – 2340 Hrs per year.

Energy Savings Calculations:

Refer to the **Investment Grade Lighting Audit Appendix** for a detailed energy savings calculation for the replacement of the garage bay fixtures.

The Smart Start Incentive program does not provide incentives for installation of CFL bulbs, therefore no incentives were included for this ECM.

Replacement and Maintenance Savings are calculated as follows:

$$Savings = \left(Incandescent\ lamps\ per\ year\right) \times \left(replacment\ \$\ per\ lamp + Labor\ \$\ per\ lamp\right) - \left(MH\ lamps\ per\ year\right) \times \left(replacment\ \$\ per\ lamp + Labor\ \$\ per\ lamp\right)$$

$$Savings = (33\ incandescent\ lamps\ per\ year) \times (\$5.00 + \$5.00) - (3.25\ MH\ lamps\ per\ year) \times (\$17.00 + \$5.00) = \underline{\$259}$$

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$7,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$7,000
Maintenance Savings ($/Yr):	$259
Energy Savings ($/Yr):	$576
Total Yearly Savings ($/Yr):	$835
Estimated ECM Lifetime (Yr):	15
Simple Payback	8.4
Simple Lifetime ROI	23.4%
Simple Lifetime Maintenance Savings	$3,885
Simple Lifetime Savings	$8,640
Internal Rate of Return (IRR)	8%
Net Present Value (NPV)	$2,968.18

ECM #3: High Wattage CFL Bulb Bay Lights

Description:

The majority of the DPW building support spaces including the main service garage and bus garage is lit with T-12 fixtures with magnetic ballasts. The remaining garage lighting is comprised of a combination of 300W incandescent pendant fixtures and 175-Watt metal halide fixtures. The metal halide fixtures have been used to replace the incandescent fixtures on a gradual basis.

The existing 300W incandescent fixtures are very inefficiency when compared to most other types of lighting. The 175 metal halide fixtures are far more efficiency than incandescent fixtures, however metal halides have some draw backs including poor lumen maintenance (approximately 30% reduction in lighting output at 40% of rated lamp life). Also, the fixture ballast can be noisy, require up to 10 minutes to re-strike after shutdown, and there is a noticeable color shift as the lamp approaches the end of its life. Compact fluorescent fixtures maintain lumen levels at approximately 90% through their lifespan and can immediately re-strike after being turned off. These advantages allow CFL fixtures to be controlled with occupancy sensors.

This ECM includes replacement of each of the existing incandescent garage bay light bulbs with high wattage CFL bulbs. The retrofit for the incandescent fixtures includes replacing only the bulbs. This ECM also includes replacing the metal halide fixtures with mogul base light fixtures to accept high wattage CFL bulbs. The new fixtures would be retrofitted with high bay reflectors. The CFL bulbs selected will provide approximately 10% more light than the existing incandescent fixtures at approximately 1/3 the energy. The CFL bulbs are rated for approximately 8,000 burn-hours. The Incandescent fixture lamp life is approximately 1000 burn-hours. The metal halide lamps are rated for approximately 15,000 hours with a usable average life of approximately 10,000 burn-hours depending on bulb manufacturers.

Hours of Operation:

45 Hrs per week, 52 weeks per year – 2340 Hrs per year.

Energy Savings Calculations:

Refer to the **Investment Grade Lighting Audit Appendix** for a detailed energy savings calculation for the replacement of the garage bay fixtures.

The Smart Start Incentive program does not provide incentives for installation of CFL bulbs, therefore no incentives were included for this ECM.

Replacement and Maintenance Savings are calculated as follows:

$$Savings = (Incandescent\ lamps\ per\ year) \times (replacment\ \$\ per\ lamp + Labor\ \$\ per\ lamp) + (MH\ lamps\ per\ year) \times (replacment\ \$\ per\ lamp + Labor\ \$\ per\ lamp) - (CFL\ lamps\ per\ year) \times (replacment\ \$\ per\ lamp + Labor\ \$\ per\ lamp)$$

$$Savings = (33\ incandescent\ lamps\ per\ year) \times (\$5.00 + \$5.00) + (1.4\ MH\ lamps\ per\ year) \times (\$17.00 + \$5.00) - (6\ CFL\ lamps\ per\ year) \times (\$30.00 + \$5.00) = \underline{\$151}$$

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,377
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$1,377
Maintenance Savings ($/Yr):	$151
Energy Savings ($/Yr):	$1,597
Total Yearly Savings ($/Yr):	$1,748
Estimated ECM Lifetime (Yr):	15
Simple Payback	0.8
Simple Lifetime ROI	1639.7%
Simple Lifetime Maintenance Savings	$2,265
Simple Lifetime Savings	$23,955
Internal Rate of Return (IRR)	127%
Net Present Value (NPV)	$19,490.51

ECM #4: Fluorescent Bay Lights

Description:

The majority of the DPW building support spaces including the main service garage and bus garage is lit with T-12 fixtures with magnetic ballasts. The remaining garage lighting is comprised of a combination of 300W incandescent pendant fixtures and 175-Watt metal halide fixtures. The metal halide fixtures have been used to replace the incandescent fixtures on a gradual basis.

The existing 300W incandescent fixtures are very inefficiency when compared to most other types of lighting. The 175 metal halide fixtures are far more efficiency than incandescent fixtures, however metal halides have some draw backs including poor lumen maintenance (approximately 30% reduction in lighting output at 40% of rated lamp life). Also, the fixture ballast can be noisy, require up to 10 minutes to re-strike after shutdown, and there is a noticeable color shift as the lamp approaches the end of its life. Fluorescent tube fixtures maintain lumen levels at approximately 90% through their lifespan and can immediately re-strike after being turned off. These advantages allow fluorescent fixtures to be controlled with occupancy sensors. In addition fluorescent tube fixtures provide superior light quality and distribution compared to high bay round reflectors.

This ECM includes replacement of each of the existing incandescent garage bay light fixtures and metal halide fixtures with pendant mounted T-8 fluorescent fixtures. The retrofit for the incandescent and metal halide fixtures includes a one for one pendant style fixture replacement. The fluorescent fixtures selected will provide approximately 50% more light than the existing incandescent fixtures at approximately 1/3 of the energy. In addition the fluorescent bulbs are rated for approximately 30,000 burn-hours. The Incandescent fixture lamp life is approximately 1000 burn-hours. The metal halide lamps are rated for approximately 15,000 hours with a usable average life of approximately 10,000 burn-hours depending on bulb manufacturers.

Hours of Operation:

45 Hrs per week, 52 weeks per year – 2340 Hrs per year.

Energy Savings Calculations:

Refer to the **Investment Grade Lighting Audit Appendix** for a detailed energy savings calculation for the replacement of the garage bay fixtures.

NJ Smart Start® Program Incentives are calculated as follows:

From the Smart Start Incentive appendix, the replacement of a HID fixture to a T-5 or T-8 fixture warrants a $43 incentive. The replacement of an Incandescent fixture to a T-5 or T-8 fixture warrants a $50 incentive.

$$\text{Smart Start®}\ Incentive = (\#\ of\ 175W\ HID\ \ fixtures \times\ \$\,43) + (\#\ of\ \ 300W\ Incandescent\ \ fixtures \times\ \$\,50)$$

$$\text{Smart Start®}\ Incentive = (6 \times\ \$\,43) + (14 \times\ \$\,50) = \underline{\$958}$$

Replacement and Maintenance Savings are calculated as follows:

$$Savings = (Incandescent\ lamps\ \ per\ \ year) \times (replacment\ \$\ \ per\ lamp + Labor\ \$\ \ per\ lamp) +$$
$$(MH\ \ lamps\ \ per\ \ year) \times (replacment\ \$\ \ per\ lamp + Labor\ \$\ \ per\ lamp) -$$
$$(T8\ lamps\ \ per\ \ year) \times (replacment\ \$\ \ per\ lamp + Labor\ \$\ \ per\ lamp)$$

$$Savings = (33\ incandescent\ lamps\ \ per\ \ year) \times (\$5.00 + \$5.00) +$$
$$(1.4\ MH\ \ lamps\ \ per\ \ year) \times (\$17.00 + \$5.00) - (6\ T8\ lamps\ \ per\ \ year) \times (\$2.00 + \$5.00)$$
$$= \underline{\$319}$$

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$8,000
NJ Smart Start Equipment Incentive ($):	$958
Net Installation Cost ($):	$7,042
Maintenance Savings ($/Yr):	$319
Energy Savings ($/Yr):	$1,568
Total Yearly Savings ($/Yr):	$1,887
Estimated ECM Lifetime (Yr):	15
Simple Payback	3.7
Simple Lifetime ROI	234.0%
Simple Lifetime Maintenance Savings	$4,785
Simple Lifetime Savings	$23,520
Internal Rate of Return (IRR)	26%
Net Present Value (NPV)	$15,484.88

ECM #5: 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 off when a room is left or on when a room is first occupied. This is particularly evident is spaces with metal halide fixtures such as the garage bay fixtures due to the relatively long period these fixtures take to reach full illumination. 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 when considering fluorescent fixtures. 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 installation of occupancy sensors for all individual spaces such as locker room, lounge, storage rooms, etc. The ECM also includes installation of occupancy sensors for the incandescent fixtures in the garage storage and service bays. This ECM does not include control of the metal halide fixtures in the garage bays due to the impractical time delay of metal halide lighting. 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 sensors. No demand savings are expected through the implementation of this ECM.

Light Energy = 39,055 kWh/Yr. proposed lighting controlled energy

Energy Savings Calculations:

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

$$Energy\ Savings = 20\% \times 39{,}055\left(kWh\right) = 7{,}811\left(kWh\right)$$

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

$$Savings. = 7{,}811\left(kWh\right) \times 0.202\left(\frac{\$}{kWh}\right) = \$1{,}578$$

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

Installation Cost = $110 x 26 motion sensors = $2,860

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

$$\text{Smart Start®}\ Incentive = \left(\#\ of\ \ wall\ mount\ devices \times\ \$\ 20\right) = \left(26 \times \$20\right) = \$520$$

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$2,860
NJ Smart Start Equipment Incentive ($):	$520
Net Installation Cost ($):	$2,340
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,578
Total Yearly Savings ($/Yr):	$1,578
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.5
Simple Lifetime ROI	911.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$23,670
Internal Rate of Return (IRR)	67%
Net Present Value (NPV)	$16,498.06

ECM #6: Programmable Thermostats

Description:

The garage is heated by multiple gas fired unit heaters. The thermostats controlling the unit heaters are standard non programmable thermostats. The thermostats are set manually for the winter and are not re-adjusted throughout the day. The heat loss of the facility is compounded during the unoccupied periods due to increased wind speeds, lower ambient temperatures, etc.

Programmable thermostats provide automatic control of the space temperature during occupied and unoccupied periods of the day. When the space is not occupied the equipment can operate at the unoccupied set point. Once the space becomes occupied the thermostat raises the temperature of the space to the occupied set point. This control system approach is ideal for facilities with low occupancy levels and long unoccupied periods. New programmable have built in capability to adjust heating start times to ensure the space is up to temperature by the specified occupancy period. This is an added comfort feature so programming does not need to be re-adjusted as the season heating load changes.

This ECM includes replacement of the various HVAC unit thermostats with programmable 7-day thermostats with night time setback control. The recommended thermostat set points for heating in the DPW Garage is as follows:

Occupied Heating = 65° F (6:30AM – 3:30 PM)

Unoccupied Heating = 55° F (3:30 PM – 6:30 AM)

CEG recommends replacement of each unit heater's dedicated thermostat in the service garages as well as the administration area thermostat and lounge / lockers thermostat. The total quantity of thermostats is as shown below. This ECM is based on the Honeywell RTH7500D 7-day programmable thermostats or equivalent.

High Bay Service Garage -	2 T-Stats
Small Service Garage-	2 T-Stats
Lounge / Lockers-	1 T-Stat
Truck Storage Garage-	3 T-Stats
School Bus Garage	1 T-Stat
School Admin Area	1 T-Stat
Total	10 T-Stats

Energy Savings Calculations:

The energy savings of the 7-day programmable thermostats was calculated by using Energy Star Life Cycle Cost Estimate software for qualified programmable thermostats. Additional information on the referenced calculator can be found at www.energystar.gov.

Products that earn the ENERGY STAR prevent greenhouse gas emissions by meeting strict energy efficiency guidelines set by the U.S. Environmental Protection Agency and the U.S. Department of Energy.
www.energystar.gov

CHANGE FOR THE BETTER WITH ENERGY STAR

Life Cycle Cost Estimate for 10 ENERGY STAR Qualified Programmable Thermostat(s)

This energy savings calculator was developed by the U.S. EPA and U.S. DOE and is provided for estimating purposes only. Actual energy savings may vary based on use and other factors.

Enter your own values in the gray boxes or use our default values.

Number of Units	10
Initial Cost per ENERGY STAR Unit (retail price)	$180
Initial Cost per Conventional Unit (retail price)	$0
Unit Fuel Cost (Cooling) ($/kWh)	$0.202
Unit Fuel Cost (Heating) ($/Therm)	$1.23

24 Hour Typical Usage Patterns*

	Weekday	Weekend
Nighttime Set-Back/Set-Up Hours	15	20
Daytime Set-Back/Set-Up Hours	9	4
Hours without Set-Back/Set-Up	0	0

Choose your city from the drop-down menu

City: NJ-Newark

Heating Season*

Typical Indoor Temperature w/o Set-Back	65
Nighttime Set-Back Temperature (Average)	55
Daytime Set-Back Temperature (Average)	65
Heating System Type	Gas Furnace

Cooling Season*

Typical Indoor Temperature w/o Set-Up	78
Nighttime Set-Up Temperature (Average)	82
Daytime Set-Up Temperature (Average)	85
Cooling System Type	None

**All temperatures are in degrees Fahrenheit. Setpoint is defined as the temperature setting for any given time period. Set-back temperature is defined as the lower setpoint temperature for the energy-savings periods during the heating season, generally nighttime and daytime. Set-up temperature is defined as the higher setpoint temperature for the energy-savings periods during the cooling season, generally nighttime and daytime.*

Annual and Life Cycle Costs and Savings for 10 Programmable Thermostat(s)

	10 ENERGY STAR Unit(s)	10 Conventional Unit(s)	Savings with ENERGY STAR
Annual Energy Costs			
Heating Energy Cost	$14,439	$18,647	$4,208
Heating Energy Consumption (MBTU)	*1,172*	*1,514*	*342*
Cooling Energy Cost	$0	$0	$0
Cooling Energy Consumption (MBTU)	*0.0*	*0.0*	*0*
Total	**$14,439**	**$18,647**	**$4,208**
Life Cycle Costs			
Energy Costs	$160,540	$207,327	$46,787
Heating Energy Costs	*$160,540*	*$207,327*	*$46,787*
Heating Energy Consumption (MBTU)	17,580	22,704	5,123
Cooling Energy Costs	$0	$0	$0
Cooling Energy Consumption (MBTU)	0	0	0
Purchase Price for 10 Unit(s)	*$1,800*	*$0*	*-$1,800*
Total	**$162,340**	**$207,327**	**$44,987**
		Simple payback of initial cost (years)	**0.4**

There are no smart start incentives available for programmable thermostats; therefore no incentives were included in the calculations.

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,800
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$1,800
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$4,208
Total Yearly Savings ($/Yr):	$4,208
Estimated ECM Lifetime (Yr):	15
Simple Payback	0.4
Simple Lifetime ROI	3406.7%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$63,120
Internal Rate of Return (IRR)	234%
Net Present Value (NPV)	$48,434.83

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

Globally, renewable energy has become a priority affecting international and domestic energy policy. The State of New Jersey has taken a proactive approach, and has recently adopted in its Energy Master Plan a goal of 30% renewable energy by 2020. To help reach this goal New Jersey created the Office of Clean Energy under the direction of the Board of Public Utilities and instituted a Renewable Energy Incentive Program to provide additional funding to private and public entities for installing qualified renewable technologies. A renewable energy source can greatly reduce a building's operating expenses while producing clean environmentally friendly energy. CEG has assessed the feasibility of installing renewable energy measures (REM) for the municipality utilizing renewable technologies and concluded that there is potential for solar energy generation. The solar photovoltaic system calculation summary will be concluded as **REM#1** within this report.

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which will be mounted on all south and southwestern facades of the building. Flat roof, as well as sloped areas can be utilized; flat areas will have the panels turned to an optimum solar absorbing angle. (A structural survey of the roof would be necessary before the installation of PV panels is considered). The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit is around $350, this value was used in our financial calculations. This equates to $0.35 per kWh generated.

CEG has reviewed the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 3030 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 47.6 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 55,004 KWh annually, reducing the overall utility bill by approximately 85% percent. A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix**. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

The proposed photovoltaic array layout is designed based on the specifications for the Sun Power SPR-230 panel. This panel has a "DC" rated full load output of 230 watts, and has a total panel conversion efficiency of 18%. Although panels rated at higher wattages are available through Sun Power and other various manufacturers, in general most manufacturers who produce commercially available solar panels produce a similar panel in the 200 to 250 watt range. This provides more manufacturer options to the public entity if there is a wish to pursue the proposed solar recommendation without losing significant system capacity.

The array system capacity is sized on available roof space on the facility. Estimated solar array generation is calculated based on the National Renewable Energy Laboratory PVWatts Version

1.0 Calculator, in order to calculate the array generation. The system DC rated kilowatt (kW) capacity is inputted with a DC to AC de-rate factor, panel tilt angle, and array azimuth angle. The DC to AC de-rate factor is based on the panel nameplate DC rating, inverter and transformer efficiencies (95%), mismatch factor (98%), diodes and connections (100%), dc and ac wiring(98%, 99%), soiling, (95%), system availability (95%), shading (if applicable), and age(new/100%). The overall DC to AC de-rate factor has been calculated at an overall rating of 81%. The PVWatts Calculator program calculates estimated system generation based on average monthly solar irradiance and user provided inputs. The monthly energy generation and offset electric costs from the PVWatts calculator is shown in the **Renewable/Distributed Energy Measures Calculation Appendix**.

The proposed solar array is qualified by the New Jersey Board of Public Utilities Net Metering Guidelines as a Class I Renewable Energy Source. These guidelines allow onsite customer generation using renewable energy sources such as solar and wind with a capacity of 2 megawatts (MW) or less. This limits a customer system design capacity to being a net user and not a net generator of electricity on an annual basis. Although these guidelines state that if a customer does net generate (produce more electricity than they use), the customer will be credited the kilowatt-hours generated to be carried over for future usage on a month to month basis. On an annual basis, if the customer is a net generator the customer will be compensated by the utility the average annual PJM Grid LMP price per kilowatt-hour for the over generation. Due to the aforementioned legislation, the customer is at limited risk if they generate less than they use on an annual basis. With the inefficiency of today's energy storage systems, such as batteries, the added cost of storage systems is not warranted and is not recommended for this measure.

The roof area available at the DPW garage is more than adequate to provide the full electric usage for the building. Since it is desirable to remain a net user rather than a net producer, the total area used for the solar calculations is limited to 85% of the current electric use of the building.

CEG has reviewed financing 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 and internal rate of return for the respective methods of payment:

Table 7
Financial Summary – Photovoltaic System

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM		
PAYMENT TYPE	**SIMPLE PAYBACK**	**INTERNAL RATE OF RETURN**
Self-Finance	14.11 Years	0.5%
Direct Purchase	14.11 Years	5.8%

*The solar energy measure is shown for reference in the executive summary Renewable Energy Measure (REM) table

The resultant Internal Rate of Return indicates that if the owner was able to "direct purchase" the solar project, the project would be more beneficial. 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 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 the facility, it was determined that the average wind speed is not adequate, and the kilowatt demand for the building is below the threshold (200 kW) for purchase of a commercial wind turbine. Therefore, wind energy is not a viable option to implement.

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

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

Electricity:

The Electric Usage Profile demonstrates a fairly atypical electrical load profile. The summer (May-August) demonstrates decreased consumption, while the winter months demonstrate almost two times as much peak usage. There is a very steady yearlong electric demand on the building. The major contributor to increased heating season electric load is due to the winter season operation of the DPW building. Demand seems very constant which indicates that despite the increased operational hours in the winter the facility is utilized year round. A flat load profile will allow for more competitive energy prices when shopping for alternative suppliers.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical natural gas (heat load) profile. The summer months demonstrate very low consumption (complimenting the cooling electric load), May through September. There is an increase in consumption January through March, and again October through December. Gas heat exchangers in the court room rooftop unit and entrance hallway rooftop unit are responsible for the natural gas load. If the central VAV system's gas heat exchanger becomes operational, a significant portion of the electric base load will be shifted to natural gas use in the heating season. A base-load shaping (flat) will secure more competitive energy prices when procuring through an alternative energy source.

Tariff Analysis:

Electricity:

This facility receives electrical service through Jersey Central Power & Light (JCP&L) on a GSS (General Service Secondary) rate. Service classification GS is available for general service purposes on secondary voltages not included under Service Classifications RS, RT, RGT or GST. This facility's rate is a 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:

This facility receives natural gas service through Public Service Electric and Gas Company (PSE&G) on a GSGH (General Service Gas-Heating) rate when not receiving commodity by a Third Party Supplier. The utility tariff rate (GSGH) is for General Service. This is a firm delivery service (higher level of delivery) for general purposes where 1) customer does not qualify for RSG (residential) and 2) customers usage does not exceed 3,000 therms in any month. Customers may either purchase gas supply from a Third Party (TPS) or from Public Services Basic Gas Supply Service default service as detailed in the rate schedule.

The service described above has a much higher priority of delivery, based on the pipeline capacity. When the pipelines capacity was unbundled (much like the telecom service), it was divided into various levels of service. The "firm" service is the highest priority, and does not get interrupted.

This rate schedule has a Delivery Charge Mechanism which includes: Balancing Charge, Societal Benefits Charge, Realignment Adjustment Charge, Margin Adjustment Charge, RGGI Charge and Customer Account Service Charge. The customer can elect to have the Supply Charge (Commodity Charge) serviced through the utility or by a Third Party Supplier (TPS). Note: Should the TPS not deliver, the customer may receive service from PSE&G under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service. Should the TPS un-deliver to the utility on behalf of the client, the utility will automatically supply this default service to the client.

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

Recommendations:

CEG recommends a global approach that will be consistent with all facilities within the Township. 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 $.1374/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 $ 11.08 / dth (dth, is the common unit of measure). Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. The Township could see improvement in its energy costs if it were to take advantage of these current market prices quickly, before energy increases. Based on annual historical consumption (May 2008 through April 2009) and current electric rates, the Township could see an improvement in its electric costs of up to 20% annually. (Note: Savings were calculated using Average Annual Consumption and a variance to a Fixed Average

One-Year commodity contract). CEG recommends aggregating the entire electric load to gain the most optimal energy costs. CEG recommends advisement for alternative sourcing and supply of energy on a "managed approach".

CEG's secondary recommendation coincides with the natural gas costs. Based on the current market, Branchburg could improve its natural gas costs by up to 25%. CEG recommends that Branchburg receive further advisement on these prices through an energy advisor. The Township should also consider procuring energy (natural gas) through alternative supply sources.

CEG also recommends that the municipality schedule 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. Branchburg can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu. Branchburg should consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the information for ongoing demand-side management projects. Furthermore, special attention should be given to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with the utility representative. The Township should ask the utility representative about alternative billing options, such as consolidated billing when utilizing the service of a Third Party Supplier. Finally, if the supplier for energy (natural gas) is changed, closely monitor balancing, particularly when the contract is close to termination. This could be performed with the aid of an "energy advisor".

X. INSTALLATION FUNDING OPTIONS

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

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

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

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

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

XI. ADDITIONAL RECOMMENDATIONS

The following recommendations include no cost/low cost measures, Operation & Maintenance (O&M) items, and water conservation measures with attractive paybacks. These measures are not eligible for the Smart Start Buildings incentives from the office of Clean Energy but save energy none the less.

A. Maintain tight seal on garage door thresholds. If garage doors are not closing properly, ensure good seal to prevent leakage of outdoor air. Ensure the exhaust ports are closed after each use in the heating season.

B. Clean all light fixtures to maximize light output. Although this recommendation does not save energy, it will allow for better light output and discourage the use of additional task lighting when not necessary.

C. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ. Due to the nature and orientation of the existing air handling unit furnace, it is prone to collection of dust and debris.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Branchburg - DPW Building

ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM #1	Lighting Upgrade - General	$11,672	$0	$950	$10,722	$2,988	$63	$3,051	15	$44,820	$945	318.0%	3.5	27.73%	$25,700.64
ECM #2	Metal Halide Bay Lights	$7,000	$0	$0	$7,000	$576	$259	$835	15	$8,640	$3,885	23.4%	8.4	8.34%	$2,968.18
ECM #3	High Wattage CFL Bay Lights	$1,377	$0	$0	$1,377	$1,597	$151	$1,748	15	$23,955	$2,265	1639.7%	0.8	126.94%	$19,490.51
ECM #4	Fluorescent Bay Lights	$8,000	$0	$958	$7,042	$1,568	$319	$1,887	15	$23,520	$4,785	234.0%	3.7	25.96%	$15,484.88
ECM #5	Lighting Controls	$2,860	$0	$520	$2,340	$1,578	$0	$1,578	15	$23,670	$0	911.5%	1.5	67.41%	$16,498.06
ECM #6	Programmable Thermostats	$1,800	$0	$0	$1,800	$4,208	$0	$4,208	15	$63,120	$0	3406.7%	0.4	233.78%	$48,434.83
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	Solar Photovoltaic System	$428,490	$0	$0	$428,490	$30,362	$0	$30,362	25	$759,050	$0	77.1%	14.1	4.99%	$100,207.99

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

Concord Engineering Group, Inc.

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

SmartStart Building Incentives

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

Electric Chillers

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

Gas Cooling

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

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

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

Ground Source Heat Pumps

Closed Loop & Open Loop	$370 per ton

Gas Heating

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

Variable Frequency Drives

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

Natural Gas Water Heating

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

Premium Motors

Three-Phase Motors	$45 - $700 per motor

Prescriptive Lighting

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

Lighting Controls – Occupancy Sensors

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

Lighting Controls – HID or Fluorescent Hi-Bay Controls

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

Other Equipment Incentives

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

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
DPW Building

Building ID: 1927701
For 12-month Period Ending: June 30, 2009[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: November 05, 2009

Facility
DPW Building
34 Kenbury St
Branchburg, NJ 08876

Facility Owner
Township of Branchburg
1077 US Highway 202 North
Branchburg, NJ 08876

Primary Contact for this Facility
John Gregory
1077 US Highway 202 North
Branchburg, NJ 08876

Year Built: 1980
Gross Floor Area (ft²): 10,736

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	220,988
Natural Gas (kBtu)[4]	1,523,165
Total Energy (kBtu)	1,744,153

Energy Intensity[5]

Site (kBtu/ft²/yr)	162
Source (kBtu/ft²/yr)	217

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	115

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	45%
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	DPW Building	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	34 Kenbury St, Branchburg, NJ 08876	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐
Garage (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	10,736 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	0 (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	10 (Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: 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))
06/01/2009	06/30/2009	4,679.00
05/01/2009	05/31/2009	3,548.00
04/01/2009	04/30/2009	5,356.00
03/01/2009	03/31/2009	4,907.00
02/01/2009	02/28/2009	7,308.00
01/01/2009	01/31/2009	8,292.00
12/01/2008	12/31/2008	6,597.00
11/01/2008	11/30/2008	5,735.00
10/01/2008	10/31/2008	5,076.00
09/01/2008	09/30/2008	4,218.00
08/01/2008	08/31/2008	4,173.00
07/01/2008	07/31/2008	4,879.00

Electric Meter Consumption (kWh (thousand Watt-hours))	**64,768.00**
Electric Meter Consumption (kBtu (thousand Btu))	**220,988.42**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))	**220,988.42**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?	☐

Fuel Type: Natural Gas

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

Start Date	End Date	Energy Use (therms)
06/01/2009	06/30/2009	105.00
05/01/2009	05/31/2009	358.00
04/01/2009	04/30/2009	1,741.00
03/01/2009	03/31/2009	2,314.00
02/01/2009	02/28/2009	3,034.00
01/01/2009	01/31/2009	2,585.00
12/01/2008	12/31/2008	2,533.00
11/01/2008	11/30/2008	1,199.00
10/01/2008	10/31/2008	40.00
09/01/2008	09/30/2008	14.00

08/01/2008	08/31/2008	15.00
Gas Meters Consumption (therms)		**13,938.00**
Gas Meters Consumption (kBtu (thousand Btu))		**1,393,800.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**1,393,800.00**
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
DPW Building
34 Kenbury St
Branchburg, NJ 08876

Facility Owner
Township of Branchburg
1077 US Highway 202 North
Branchburg, NJ 08876

Primary Contact for this Facility
John Gregory
1077 US Highway 202 North
Branchburg, NJ 08876

General Information

DPW Building	
Gross Floor Area Excluding Parking: (ft^2)	10,736
Year Built	1980
For 12-month Evaluation Period Ending Date:	June 30, 2009

Facility Space Use Summary

Garage	
Space Type	Other - Service (Vehicle Repair/Service, Postal Service)
Gross Floor Area(ft^2)	10,736
Number of PCs[o]	0
Weekly operating hours[o]	42.5
Workers on Main Shift[o]	10

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 06/30/2009)	**Baseline** (Ending Date 06/30/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft^2)	162	162	0	N/A	77
Source (kBtu/ft^2)	217	217	0	N/A	150
Energy Cost					
$/year	$ 30,237.00	$ 30,237.00	N/A	N/A	$ 14,331.21
$/$ft^2$/year	$ 2.82	$ 2.82	N/A	N/A	$ 1.34
Greenhouse Gas Emissions					
$MtCO_2e$/year	115	115	0	N/A	55
$kgCO_2e/ft^2$/year	11	11	0	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.

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Branchburg DPW Garage"

Domestic Hot Water Heaters

Service	Location	Manufacturer	Type	Qty.	Model #	Serial #	Input (MBH)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life
Lounge / Locker Room	Electrical Room	Rheem	Gas Storage	1	21VR75	0197G02792	75.5	68.6	75	-	Nat Gas	Unknown	10	-

Boiler

Service	Location	Manufacturer	Type	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
School Bus Garage & Office	School Bus Garage Mech Room	New Yorker	Gas Fired Hot Water Boiler	1	GG-80-NNI	19003306	232	166.1	72%	Nat Gas		30		Residential style boiler with 2 small circulation pumps

Unit Heaters and Cabinet Unit Heaters

Service	Location	Manufacturer	Type	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	HP / Amps	GPM	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Bus Garage	Bus Garage	Trane	Hot Water coil unit heater	3	UN-D70B-BA-AAB	77H…	-	-		1 / 8 HP	-	Unknown	20		Unit heaters fed from boiler loop
Service & Storage Garage	Service Garage & Storage Garage	Modine	Indirect Gas Fired	7	PDP175AE0130	39101015104	175	140	80%	5.1 A	-	<5 Yrs	13		

Air Compressor Motor

Service	Location	Manufacturer	Type	Qty.	Model #	Serial #	HP	Efficiency	Capacity	Volts	FLA	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Air Compressor	Service Garage	Baldor	Electric Motor	1	-	-	5	84%	-	208	-	Unknown	18		

Split Systems

Service	Location	Manufacturer	Type	Qty.	Model #	Serial #	Cooling Type	Cooling Capacity	SEER	Refrigerant	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Bus Garage Office	AHU - Above Ceiling	York	Split System Cooling Only	1	-	-	DX R-22	30 MBH	13	R-22	-	-	Unknown	15	-	
	CU - Grade			1	CMA03011A	WGNM027671					208	1	<5 Yrs	15	-	

*Equipment efficiencies listed above are based on new equipment product data.

Furnace Air Handling Unit

Service	Location	Manufacturer	Type	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	HP / Amps	Volts	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Service Garage Lounge / Lockers	Electric Room	Ghrysler Airtemp	Indirect Gas Fired	1	-	-	-	-	-	-	-	Unknown	18		No longer manufacturered. No Info on unit.

CEG Job #: 9C09060
Project: DPW Garage
Address: 34 Kenbury Road
Branchburg, NJ 08876

"Branchburg Township - DPW Garage"

KWH COST: $0.202

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
1	DPW - Truck Garage	2340	8	0	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	2.40	5,616.0	$1,134.43	8	0	No Change	300	2.40	5616	$1,134.43	$0.00	$0.00	0.00	0	$0.00	0.00
2		2340	3	0	175W Lamp, High Bay Metal Halide, Pendant Fixture	213	0.64	1,495.3	$302.04	3	0	No Change	213	0.64	1495.26	$302.04	$0.00	$0.00	0.00	0	$0.00	0.00
3	DPW - Truck Garage Storage	2340	1	0	3-Lamp 32W T-8 Elect Ballast, Surface Mounted	91	0.09	212.9	$43.01	1	0	No Change	91	0.09	212.94	$43.01	$0.00	$0.00	0.00	0	$0.00	0.00
4		2340	2	0	100W Lamp, Incandescent, Surface Mounted	100	0.20	468.0	$94.54	2	0	26 W CFL Lamp	26	0.05	121.68	$24.58	$5.75	$11.50	0.15	346.32	$69.96	0.16
5	DPW - Lounge	2340	4	4	4-Lamp 34W, T12, Magnetic Ballast, Recessed Mount	160	0.64	1,497.6	$302.52	4	3	2'x4' 3-Lamp 32W T-8 Elect Ballast, Recessed; Metalux M/N 2GC8	91	0.36	851.76	$172.06	$140.00	$560.00	0.28	645.84	$130.46	4.29
1	DPW - Sign Garage	2340	2	0	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	0.60	1,404.0	$283.61	2	0	No Change	300	0.60	1404	$283.61	$0.00	$0.00	0.00	0	$0.00	0.00
3		2340	1	0	3-Lamp 32W T-8 Elect Ballast, Surface Mounted	91	0.09	212.9	$43.01	1	0	No Change	91	0.09	212.94	$43.01	$0.00	$0.00	0.00	0	$0.00	0.00
1	DPW - Electric Room	2340	1	0	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	0.30	702.0	$141.80	1	0	No Change	300	0.30	702	$141.80	$0.00	$0.00	0.00	0	$0.00	0.00
5	DPW - Locker Room	2340	2	4	4-Lamp 34W, T12, Magnetic Ballast, Recessed Mount	160	0.32	748.8	$151.26	2	3	2'x4' 3-Lamp 32W T-8 Elect Ballast, Recessed; Metalux M/N 2GC8	91	0.18	425.88	$86.03	$140.00	$280.00	0.14	322.92	$65.23	4.29
5	DPW - Locker Bath Room	2340	2	4	4-Lamp 34W, T12, Magnetic Ballast, Recessed Mount	160	0.32	748.8	$151.26	2	3	2'x4' 3-Lamp 32W T-8 Elect Ballast, Recessed; Metalux M/N 2GC8	91	0.18	425.88	$86.03	$140.00	$280.00	0.14	322.92	$65.23	4.29
6	DPW - Lounge Closet	2340	1	2	2-Lamp 34W, T12, Magnetic Ballast, Surface Mounted Strip	80	0.08	187.2	$37.81	1	2	1'X4' 2-Lamp 32W T-8 Elect Ballast; Metalux M/N GC	55	0.06	128.7	$26.00	$100.00	$100.00	0.03	58.5	$11.82	8.46
1	DPW - Small Parking Garage	2340	3	0	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	0.90	2,106.0	$425.41	3	0	No Change	300	0.90	2106	$425.41	$0.00	$0.00	0.00	0	$0.00	0.00
2		2340	3	0	175W Lamp, High Bay Metal Halide, Pendant Fixture	213	0.64	1,495.3	$302.04	3	0	No Change	213	0.64	1495.26	$302.04	$0.00	$0.00	0.00	0	$0.00	0.00
4	DPW - Service Garage Mezz	2340	5	0	100W Lamp, Incandescent, Surface Mounted	100	0.50	1,170.0	$236.34	5	0	26 W CFL Lamp	26	0.13	304.2	$61.45	$5.75	$28.75	0.37	865.8	$174.89	0.16
7	DPW - Main Service Garage	2340	24	2	8 Foot, 2-Lamp, T12, Magnetic Ballast, Surface Mounted Strip	222	5.33	12,467.5	$2,518.44	24	2	8' 2-Lamp T-8 Cooper Metalux, Electronic Ballast M/N 8TDIM-232-UNV-EB81-U	118	2.83	6626.88	$1,338.63	$207.00	$4,968.00	2.50	5840.64	$1,179.81	4.21
6	DPW - Service Garage Storage Room	2340	4	2	2-Lamp 34W, T12, Magnetic Ballast, Surface Mounted Strip	80	0.32	748.8	$151.26	4	2	1'X4' 2-Lamp 32W T-8 Elect Ballast; Metalux M/N GC	55	0.22	514.8	$103.99	$100.00	$400.00	0.10	234	$47.27	8.46
6	DPW - Service Garage Oil Room	2340	2	2	2-Lamp 34W, T12, Magnetic Ballast, Surface Mounted Strip	80	0.16	374.4	$75.63	2	2	1'X4' 2-Lamp 32W T-8 Elect Ballast; Metalux M/N GC	55	0.11	257.4	$51.99	$100.00	$200.00	0.05	117	$23.63	8.46

8	DPW - Outside	3640	2	0	1 Par Lamp Incandescents Flood Light	60	0.12	436.8	$88.23	2	0	18 W CFL Par Lamp	18	0.04	131.04	$26.47	$5.75	$11.50	0.08	305.76	$61.76	0.19
9		3640	1	0	175W Lamp, High Bay Metal Halide, Wall Mounted	213	0.21	775.3	$156.61	1	0	No Change	213	0.21	775.32	$156.61	$0.00	$0.00	0.00	0	$0.00	0.00
10		3640	4	0	70W Lamp, High Pressure Sodium, Wall Mounted	90	0.36	1,310.4	$264.70	4	0	No Change	90	0.36	1310.4	$264.70	$0.00	$0.00	0.00	0	$0.00	0.00
11	School - Office 1	2340	4	4	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.75	1,759.7	$355.46	4	3	2'x4' 3-Lamp 32W T-8 Elect Ballast, Recessed; Metalux M/N 2GC8	91	0.36	851.76	$172.06	$140.00	$560.00	0.39	907.92	$183.40	3.05
11	School - Office 2	2340	1	4	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.19	439.9	$88.86	1	3	2'x4' 3-Lamp 32W T-8 Elect Ballast, Recessed; Metalux M/N 2GC8	91	0.09	212.94	$43.01	$140.00	$140.00	0.10	226.98	$45.85	3.05
11	School - Center Office	2340	4	4	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.75	1,759.7	$355.46	4	3	2'x4' 3-Lamp 32W T-8 Elect Ballast, Recessed; Metalux M/N 2GC8	91	0.36	851.76	$172.06	$140.00	$560.00	0.39	907.92	$183.40	3.05
11	School - Lounge / Corridor	2340	3	4	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.56	1,319.8	$266.59	3	3	2'x4' 3-Lamp 32W T-8 Elect Ballast, Recessed; Metalux M/N 2GC8	91	0.27	638.82	$129.04	$140.00	$420.00	0.29	680.94	$137.55	3.05
12		2340	1	2	2-Lamp 40W, T12, U-Lamp, Magnetic Ballast, Recessed Mounted	94	0.09	220.0	$44.43	1	2	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast, Architectural surface or Recessed static METALUX 2AC-217-UNV-EB81-U	73	0.07	170.82	$34.51	$204.00	$204.00	0.02	49.14	$9.93	20.55
13	School - Mens Room	2340	1	1	2 Foot, 1-Lamp, T12, Magnetic Ballast, Surface Mount	40	0.04	93.6	$18.91	1	1	2' 1-Lamp T-8 17W wall Mtd. Metalux BC117	20	0.02	46.8	$9.45	$148.00	$148.00	0.02	46.8	$9.45	15.66
13	School - Womens Room	2340	1	1	2 Foot, 1-Lamp, T12, Magnetic Ballast, Surface Mount	40	0.04	93.6	$18.91	1	1	2' 1-Lamp T-8 17W wall Mtd. Metalux BC117	20	0.02	46.8	$9.45	$148.00	$148.00	0.02	46.8	$9.45	15.66
14	School - Boiler Room	2340	1	0	100W Lamp Incandescents Surface Mount	100	0.10	234.0	$47.27	1	0	26 W CFL Lamp	26	0.03	60.84	$12.29	$5.75	$5.75	0.07	173.16	$34.98	0.16
15	School - Bus Garage	2340	16	2	2-Lamp 40W, T12, Magnetic Ballast, Surface Mounted	80	1.28	2,995.2	$605.03	16	2	1'X4' 2-Lamp 32W T-8 Elect Ballast; Metalux M/N GC	55	0.88	2059.2	$415.96	$100.00	$1,600.00	0.40	936	$189.07	8.46
16		2340	5	2	2-Lamp 96W, T12, Magnetic Ballast, Surface Mounted	222	1.11	2,597.4	$524.67	5	2	8' 2-Lamp T-8 Cooper Metalux, Electronic Ballast M/N 8TDIM-232-UNV-EB81-U	118	0.59	1380.6	$278.88	$207.00	$1,035.00	0.52	1216.8	$245.79	4.21
17	School - Outside	3640	2	0	1-Lamp, High Pressure Sodium Fixture, Wall Mounted	90	0.18	655.2	$132.35	2	0	No Change	90	0.18	655.2	$132.35	$0.00	$0.00	0.00	0	$0.00	0.00
18		3640	2	0	100W Lamp Incandescents Recessed Mounted	100	0.20	728.0	$147.06	2	0	26 W CFL Lamp	26	0.05	189.28	$38.23	$5.75	$11.50	0.15	538.72	$108.82	0.11
	Totals		116	44			19.52	47,074.0	$9,508.96	116	37			13.329	32283.16	$6,521.20		$11,672.00	6.19	14790.9	$2,987.76	3.91

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

2. Lamp totals only include T-12 tube replacment calculations

CEG Job #: 9C09060
Project: DPW Garage
Address: 34 Kenbury Road
Branchburg, NJ 08876

"Branchburg Township - DPW Garage"

KWH COST: $0.202

ECM #2: Metal Halide Bay Lights

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
1	DPW - Truck Garage	2340	8	1	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	2.40	5,616.0	$1,134.43	8	1	175W Lamp, High Bay Metal Halide Fixture	213	1.70	3987.36	$805.45	$500.00	$4,000.00	0.70	1628.64	$328.99	12.16
2		2340	3	0	175W Lamp, High Bay Metal Halide, Pendant Fixture	213	0.64	1,495.3	$302.04	3	0	No Change	213	0.64	1495.26	$302.04	$0.00	$0.00	0.00	0	$0.00	0.00
3	DPW - Truck Garage Storage	2340	1	0	3-Lamp 32W T-8 Elect Ballast, Surface Mounted	91	0.09	212.9	$43.01	1	0	No Change	91	0.09	212.94	$43.01	$0.00	$0.00	0.00	0	$0.00	0.00
4		2340	2	0	100W Lamp, Incandescent, Surface Mounted	100	0.20	468.0	$94.54	2	0	No Change	100	0.20	468	$94.54	$0.00	$0.00	0.00	0	$0.00	0.00
5	DPW - Lounge	2340	4	0	4-Lamp 34W, T12, Magnetic Ballast, Recessed Mount	160	0.64	1,497.6	$302.52	4	0	No Change	160	0.64	1497.6	$302.52	$0.00	$0.00	0.00	0	$0.00	0.00
1	DPW - Sign Garage	2340	2	1	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	0.60	1,404.0	$283.61	2	1	175W Lamp, High Bay Metal Halide Fixture	213	0.43	996.84	$201.36	$500.00	$1,000.00	0.17	407.16	$82.25	12.16
3		2340	1	0	3-Lamp 32W T-8 Elect Ballast, Surface Mounted	91	0.09	212.9	$43.01	1	0	No Change	91	0.09	212.94	$43.01	$0.00	$0.00	0.00	0	$0.00	0.00
1	DPW - Electric Room	2340	1	1	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	0.30	702.0	$141.80	1	1	175W Lamp, High Bay Metal Halide Fixture	213	0.21	498.42	$100.68	$500.00	$500.00	0.09	203.58	$41.12	12.16
5	DPW - Locker Room	2340	2	0	4-Lamp 34W, T12, Magnetic Ballast, Recessed Mount	160	0.32	748.8	$151.26	2	0	No Change	160	0.32	748.8	$151.26	$0.00	$0.00	0.00	0	$0.00	0.00
5	DPW - Locker Bath Room	2340	2	0	4-Lamp 34W, T12, Magnetic Ballast, Recessed Mount	160	0.32	748.8	$151.26	2	0	No Change	160	0.32	748.8	$151.26	$0.00	$0.00	0.00	0	$0.00	0.00
6	DPW - Lounge Closet	2340	1	0	2-Lamp 34W, T12, Magnetic Ballast, Surface Mounted Strip	80	0.08	187.2	$37.81	1	0	No Change	80	0.08	187.2	$37.81	$0.00	$0.00	0.00	0	$0.00	0.00
1	DPW - Small Parking Garage	2340	3	1	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	0.90	2,106.0	$425.41	3	1	175W Lamp, High Bay Metal Halide Fixture	213	0.64	1495.26	$302.04	$500.00	$1,500.00	0.26	610.74	$123.37	12.16
2		2340	3	0	175W Lamp, High Bay Metal Halide, Pendant Fixture	213	0.64	1,495.3	$302.04	3	0	No Change	213	0.64	1495.26	$302.04	$0.00	$0.00	0.00	0	$0.00	0.00
4	DPW - Service Garage Mezz	2340	5	0	100W Lamp, Incandescent, Surface Mounted	100	0.50	1,170.0	$236.34	5	0	No Change	100	0.50	1170	$236.34	$0.00	$0.00	0.00	0	$0.00	0.00
7	DPW - Main Service Garage	2340	24	0	8 Foot, 2-Lamp, T12, Magnetic Ballast, Surface Mounted Strip	222	5.33	12,467.5	$2,518.44	24	0	No Change	222	5.33	12467.52	$2,518.44	$0.00	$0.00	0.00	0	$0.00	0.00
6	DPW - Service Garage Storage Room	2340	4	0	2-Lamp 34W, T12, Magnetic Ballast, Surface Mounted Strip	80	0.32	748.8	$151.26	4	0	No Change	80	0.32	748.8	$151.26	$0.00	$0.00	0.00	0	$0.00	0.00
6	DPW - Service Garage Oil Room	2340	2	0	2-Lamp 34W, T12, Magnetic Ballast, Surface Mounted Strip	80	0.16	374.4	$75.63	2	0	No Change	80	0.16	374.4	$75.63	$0.00	$0.00	0.00	0	$0.00	0.00

8	DPW - Outside	3640	2	0	1 Par Lamp Incandescents Flood Light	60	0.12	436.8	$88.23	2	0	No Change	60	0.12	436.8	$88.23	$0.00	$0.00	0.00	0	$0.00	0.00
9		3640	1	0	175W Lamp, High Bay Metal Halide, Wall Mounted	213	0.21	775.3	$156.61	1	0	No Change	213	0.21	775.32	$156.61	$0.00	$0.00	0.00	0	$0.00	0.00
10		3640	4	0	70W Lamp, High Pressure Sodium, Wall Mounted	90	0.36	1,310.4	$264.70	4	0	No Change	90	0.36	1310.4	$264.70	$0.00	$0.00	0.00	0	$0.00	0.00
11	School - Office 1	2340	4	0	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.75	1,759.7	$355.46	4	0	No Change	188	0.75	1759.68	$355.46	$0.00	$0.00	0.00	0	$0.00	0.00
11	School - Office 2	2340	1	0	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.19	439.9	$88.86	1	0	No Change	188	0.19	439.92	$88.86	$0.00	$0.00	0.00	0	$0.00	0.00
11	School - Center Office	2340	4	0	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.75	1,759.7	$355.46	4	0	No Change	188	0.75	1759.68	$355.46	$0.00	$0.00	0.00	0	$0.00	0.00
11	School - Lounge / Corridor	2340	3	0	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.56	1,319.8	$266.59	3	0	No Change	188	0.56	1319.76	$266.59	$0.00	$0.00	0.00	0	$0.00	0.00
12		2340	1	0	2-Lamp 40W, T12, U-Lamp, Magnetic Ballast, Recessed Mounted	94	0.09	220.0	$44.43	1	0	No Change	94	0.09	219.96	$44.43	$0.00	$0.00	0.00	0	$0.00	0.00
13	School - Mens Room	2340	1	0	2 Foot, 1-Lamp, T12, Magnetic Ballast, Surface Mount	40	0.04	93.6	$18.91	1	0	No Change	40	0.04	93.6	$18.91	$0.00	$0.00	0.00	0	$0.00	0.00
13	School - Womens Room	2340	1	0	2 Foot, 1-Lamp, T12, Magnetic Ballast, Surface Mount	40	0.04	93.6	$18.91	1	0	No Change	40	0.04	93.6	$18.91	$0.00	$0.00	0.00	0	$0.00	0.00
14	School - Boiler Room	2340	1	0	100W Lamp Incandescents Surface Mount	100	0.10	234.0	$47.27	1	0	No Change	100	0.10	234	$47.27	$0.00	$0.00	0.00	0	$0.00	0.00
15	School - Bus Garage	2340	16	0	2-Lamp 40W, T12, Magnetic Ballast, Surface Mounted	80	1.28	2,995.2	$605.03	16	0	No Change	80	1.28	2995.2	$605.03	$0.00	$0.00	0.00	0	$0.00	0.00
16		2340	5	0	2-Lamp 96W, T12, Magnetic Ballast, Surface Mounted	222	1.11	2,597.4	$524.67	5	0	No Change	222	1.11	2597.4	$524.67	$0.00	$0.00	0.00	0	$0.00	0.00
17	School - Outside	3640	2	0	1-Lamp, High Pressure Sodium Fixture, Wall Mounted	90	0.18	655.2	$132.35	2	0	No Change	90	0.18	655.2	$132.35	$0.00	$0.00	0.00	0	$0.00	0.00
18		3640	2	0	100W Lamp Incandescents Recessed Mounted	100	0.20	728.0	$147.06	2	0	No Change	100	0.20	728	$147.06	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		116	4			19.52	47,074.0	$9,508.96	116	4			18.303	44223.92	$8,933.23		$7,000.00	1.22	2850.1	$575.72	12.16

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

2. Lamp totals only include T-12 tube replacment calculations

CEG Job #: 9C09060
Project: DPW Garage
Address: 34 Kenbury Road
Branchburg, NJ 08876

"Branchburg Township - DPW Garage"

KWH COST: $0.202

ECM #3: High Wattage CFL Bulb Bay Lights

EXISTING LIGHTING										PROPOSED LIGHTING										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
1	DPW - Truck Garage	2340	8	1	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	2.40	5,616.0	$1,134.43	8	1	105W Lamp, CFL Mogul Base Retrofit bulb; Longstar M/N: Z-105	105	0.84	1965.6	$397.05	$49.95	$399.60	1.56	3650.4	$737.38	0.54
2		2340	3	1	175W Lamp, High Bay Metal Halide, Pendant Fixture	213	0.64	1,495.3	$302.04	3	1	105W Lamp, CFL Mogul Base Retrofit bulb; Longstar M/N: Z-105 with High Bay Reflector	105	0.32	737.1	$148.89	$112.90	$338.70	0.32	758.16	$153.15	2.21
3	DPW - Truck Garage Storage	2340	1	0	3-Lamp 32W T-8 Elect Ballast, Surface Mounted	91	0.09	212.9	$43.01	1	0	No Change	91	0.09	212.94	$43.01	$0.00	$0.00	0.00	0	$0.00	0.00
4		2340	2	0	100W Lamp, Incandescent, Surface Mounted	100	0.20	468.0	$94.54	2	0	No Change	100	0.20	468	$94.54	$0.00	$0.00	0.00	0	$0.00	0.00
5	DPW - Lounge	2340	4	0	4-Lamp 34W, T12, Magnetic Ballast, Recessed Mount	160	0.64	1,497.6	$302.52	4	0	No Change	160	0.64	1497.6	$302.52	$0.00	$0.00	0.00	0	$0.00	0.00
1	DPW - Sign Garage	2340	2	1	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	0.60	1,404.0	$283.61	2	1	105W Lamp, CFL Mogul Base Retrofit bulb; Longstar M/N: Z-105	105	0.21	491.4	$99.26	$49.95	$99.90	0.39	912.6	$184.35	0.54
3		2340	1	0	3-Lamp 32W T-8 Elect Ballast, Surface Mounted	91	0.09	212.9	$43.01	1	0	No Change	91	0.09	212.94	$43.01	$0.00	$0.00	0.00	0	$0.00	0.00
1	DPW - Electric Room	2340	1	1	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	0.30	702.0	$141.80	1	1	105W Lamp, CFL Mogul Base Retrofit bulb; Longstar M/N: Z-105	105	0.11	245.7	$49.63	$49.95	$49.95	0.20	456.3	$92.17	0.54
5	DPW - Locker Room	2340	2	0	4-Lamp 34W, T12, Magnetic Ballast, Recessed Mount	160	0.32	748.8	$151.26	2	0	No Change	160	0.32	748.8	$151.26	$0.00	$0.00	0.00	0	$0.00	0.00
5	DPW - Locker Bath Room	2340	2	0	4-Lamp 34W, T12, Magnetic Ballast, Recessed Mount	160	0.32	748.8	$151.26	2	0	No Change	160	0.32	748.8	$151.26	$0.00	$0.00	0.00	0	$0.00	0.00
6	DPW - Lounge Closet	2340	1	0	2-Lamp 34W, T12, Magnetic Ballast, Surface Mounted Strip	80	0.08	187.2	$37.81	1	0	No Change	80	0.08	187.2	$37.81	$0.00	$0.00	0.00	0	$0.00	0.00
1	DPW - Small Parking Garage	2340	3	1	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	0.90	2,106.0	$425.41	3	1	105W Lamp, CFL Mogul Base Retrofit bulb; Longstar M/N: Z-105	105	0.32	737.1	$148.89	$49.95	$149.85	0.59	1368.9	$276.52	0.54
2		2340	3	1	175W Lamp, High Bay Metal Halide, Pendant Fixture	213	0.64	1,495.3	$302.04	3	1	105W Lamp, CFL Mogul Base Retrofit bulb; Longstar M/N: Z-105 with High Bay Reflector	105	0.32	737.1	$148.89	$112.90	$338.70	0.32	758.16	$153.15	2.21
4	DPW - Service Garage Mezz	2340	5	0	100W Lamp, Incandescent, Surface Mounted	100	0.50	1,170.0	$236.34	5	0	No Change	100	0.50	1170	$236.34	$0.00	$0.00	0.00	0	$0.00	0.00
7	DPW - Main Service Garage	2340	24	0	8 Foot, 2-Lamp, T12, Magnetic Ballast, Surface Mounted Strip	222	5.33	12,467.5	$2,518.44	24	0	No Change	222	5.33	12467.52	$2,518.44	$0.00	$0.00	0.00	0	$0.00	0.00
6	DPW - Service Garage Storage Room	2340	4	0	2-Lamp 34W, T12, Magnetic Ballast, Surface Mounted Strip	80	0.32	748.8	$151.26	4	0	No Change	80	0.32	748.8	$151.26	$0.00	$0.00	0.00	0	$0.00	0.00
6	DPW - Service Garage Oil Room	2340	2	0	2-Lamp 34W, T12, Magnetic Ballast, Surface Mounted Strip	80	0.16	374.4	$75.63	2	0	No Change	80	0.16	374.4	$75.63	$0.00	$0.00	0.00	0	$0.00	0.00

8	DPW - Outside	3640	2	0	1 Par Lamp Incandescents Flood Light	60	0.12	436.8	$88.23	2	0	No Change	60	0.12	436.8	$88.23	$0.00	$0.00	0.00	0	$0.00	0.00
9		3640	1	0	175W Lamp, High Bay Metal Halide, Wall Mounted	213	0.21	775.3	$156.61	1	0	No Change	213	0.21	775.32	$156.61	$0.00	$0.00	0.00	0	$0.00	0.00
10		3640	4	0	70W Lamp, High Pressure Sodium, Wall Mounted	90	0.36	1,310.4	$264.70	4	0	No Change	90	0.36	1310.4	$264.70	$0.00	$0.00	0.00	0	$0.00	0.00
11	School - Office 1	2340	4	0	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.75	1,759.7	$355.46	4	0	No Change	188	0.75	1759.68	$355.46	$0.00	$0.00	0.00	0	$0.00	0.00
11	School - Office 2	2340	1	0	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.19	439.9	$88.86	1	0	No Change	188	0.19	439.92	$88.86	$0.00	$0.00	0.00	0	$0.00	0.00
11	School - Center Office	2340	4	0	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.75	1,759.7	$355.46	4	0	No Change	188	0.75	1759.68	$355.46	$0.00	$0.00	0.00	0	$0.00	0.00
11	School - Lounge / Corridor	2340	3	0	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.56	1,319.8	$266.59	3	0	No Change	188	0.56	1319.76	$266.59	$0.00	$0.00	0.00	0	$0.00	0.00
12		2340	1	0	2-Lamp 40W, T12, U-Lamp, Magnetic Ballast, Recessed Mounted	94	0.09	220.0	$44.43	1	0	No Change	94	0.09	219.96	$44.43	$0.00	$0.00	0.00	0	$0.00	0.00
13	School - Mens Room	2340	1	0	2 Foot, 1-Lamp, T12, Magnetic Ballast, Surface Mount	40	0.04	93.6	$18.91	1	0	No Change	40	0.04	93.6	$18.91	$0.00	$0.00	0.00	0	$0.00	0.00
13	School - Womens Room	2340	1	0	2 Foot, 1-Lamp, T12, Magnetic Ballast, Surface Mount	40	0.04	93.6	$18.91	1	0	No Change	40	0.04	93.6	$18.91	$0.00	$0.00	0.00	0	$0.00	0.00
14	School - Boiler Room	2340	1	0	100W Lamp Incandescents Surface Mount	100	0.10	234.0	$47.27	1	0	No Change	100	0.10	234	$47.27	$0.00	$0.00	0.00	0	$0.00	0.00
15	School - Bus Garage	2340	16	0	2-Lamp 40W, T12, Magnetic Ballast, Surface Mounted	80	1.28	2,995.2	$605.03	16	0	No Change	80	1.28	2995.2	$605.03	$0.00	$0.00	0.00	0	$0.00	0.00
16		2340	5	0	2-Lamp 96W, T12, Magnetic Ballast, Surface Mounted	222	1.11	2,597.4	$524.67	5	0	No Change	222	1.11	2597.4	$524.67	$0.00	$0.00	0.00	0	$0.00	0.00
17	School - Outside	3640	2	0	1-Lamp, High Pressure Sodium Fixture, Wall Mounted	90	0.18	655.2	$132.35	2	0	No Change	90	0.18	655.2	$132.35	$0.00	$0.00	0.00	0	$0.00	0.00
18		3640	2	0	100W Lamp Incandescents Recessed Mounted	100	0.20	728.0	$147.06	2	0	No Change	100	0.20	728	$147.06	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		116	6			19.52	47,074.0	$9,508.96	116	6			16.143	39169.52	$7,912.24		$1,376.70	3.38	7904.5	$1,596.71	0.86

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

2. Lamp totals only include T-12 tube replacment calculations

CEG Job #: 9C09060
Project: DPW Garage
Address: 34 Kenbury Road
Branchburg, NJ 08876

"Branchburg Township - DPW Garage"

KWH COST: $0.202

ECM #4: Fluorescent Bay Lights

EXISTING LIGHTING										PROPOSED LIGHTING										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
1	DPW - Truck Garage	2340	8	1	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	2.40	5,616.0	$1,134.43	8	4	4 Lamp, T-8, Electronic Ballast Low Bay Pendant Fixture; Paragon M/N: 1748E	108	0.86	2021.76	$408.40	$400.00	$3,200.00	1.54	3594.24	$726.04	4.41
2		2340	3	1	175W Lamp, High Bay Metal Halide, Pendant Fixture	213	0.64	1,495.3	$302.04	3	4	4 Lamp, T-8, Electronic Ballast Low Bay Pendant Fixture; Paragon M/N: 1748E	108	0.32	758.16	$153.15	$400.00	$1,200.00	0.32	737.1	$148.89	8.06
3	DPW - Truck Garage Storage	2340	1	0	3-Lamp 32W T-8 Elect Ballast, Surface Mounted	91	0.09	212.9	$43.01	1	0	No Change	91	0.09	212.94	$43.01	$0.00	$0.00	0.00	0	$0.00	0.00
4		2340	2	0	100W Lamp, Incandescent, Surface Mounted	100	0.20	468.0	$94.54	2	0	No Change	100	0.20	468	$94.54	$0.00	$0.00	0.00	0	$0.00	0.00
5	DPW - Lounge	2340	4	0	4-Lamp 34W, T12, Magnetic Ballast, Recessed Mount	160	0.64	1,497.6	$302.52	4	0	No Change	160	0.64	1497.6	$302.52	$0.00	$0.00	0.00	0	$0.00	0.00
1	DPW - Sign Garage	2340	2	1	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	0.60	1,404.0	$283.61	2	4	4 Lamp, T-8, Electronic Ballast Low Bay Pendant Fixture; Paragon M/N: 1748E	108	0.22	505.44	$102.10	$400.00	$800.00	0.38	898.56	$181.51	4.41
3		2340	1	0	3-Lamp 32W T-8 Elect Ballast, Surface Mounted	91	0.09	212.9	$43.01	1	0	No Change	91	0.09	212.94	$43.01	$0.00	$0.00	0.00	0	$0.00	0.00
1	DPW - Electric Room	2340	1	1	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	0.30	702.0	$141.80	1	4	4 Lamp, T-8, Electronic Ballast Low Bay Pendant Fixture; Paragon M/N: 1748E	108	0.11	252.72	$51.05	$400.00	$400.00	0.19	449.28	$90.75	4.41
5	DPW - Locker Room	2340	2	0	4-Lamp 34W, T12, Magnetic Ballast, Recessed Mount	160	0.32	748.8	$151.26	2	0	No Change	160	0.32	748.8	$151.26	$0.00	$0.00	0.00	0	$0.00	0.00
5	DPW - Locker Bath Room	2340	2	0	4-Lamp 34W, T12, Magnetic Ballast, Recessed Mount	160	0.32	748.8	$151.26	2	0	No Change	160	0.32	748.8	$151.26	$0.00	$0.00	0.00	0	$0.00	0.00
6	DPW - Lounge Closet	2340	1	0	2-Lamp 34W, T12, Magnetic Ballast, Surface Mounted Strip	80	0.08	187.2	$37.81	1	0	No Change	80	0.08	187.2	$37.81	$0.00	$0.00	0.00	0	$0.00	0.00
1	DPW - Small Parking Garage	2340	3	1	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	0.90	2,106.0	$425.41	3	4	4 Lamp, T-8, Electronic Ballast Low Bay Pendant Fixture; Paragon M/N: 1748E	108	0.32	758.16	$153.15	$400.00	$1,200.00	0.58	1347.84	$272.26	4.41
2		2340	3	1	175W Lamp, High Bay Metal Halide, Pendant Fixture	213	0.64	1,495.3	$302.04	3	4	4 Lamp, T-8, Electronic Ballast Low Bay Pendant Fixture; Paragon M/N: 1748E	108	0.32	758.16	$153.15	$400.00	$1,200.00	0.32	737.1	$148.89	8.06
4	DPW - Service Garage Mezz	2340	5	0	100W Lamp, Incandescent, Surface Mounted	100	0.50	1,170.0	$236.34	5	0	No Change	100	0.50	1170	$236.34	$0.00	$0.00	0.00	0	$0.00	0.00
7	DPW - Main Service Garage	2340	24	0	8 Foot, 2-Lamp, T12, Magnetic Ballast, Surface Mounted Strip	222	5.33	12,467.5	$2,518.44	24	0	No Change	222	5.33	12467.52	$2,518.44	$0.00	$0.00	0.00	0	$0.00	0.00
6	DPW - Service Garage Storage Room	2340	4	0	2-Lamp 34W, T12, Magnetic Ballast, Surface Mounted Strip	80	0.32	748.8	$151.26	4	0	No Change	80	0.32	748.8	$151.26	$0.00	$0.00	0.00	0	$0.00	0.00
6	DPW - Service Garage Oil Room	2340	2	0	2-Lamp 34W, T12, Magnetic Ballast, Surface Mounted Strip	80	0.16	374.4	$75.63	2	0	No Change	80	0.16	374.4	$75.63	$0.00	$0.00	0.00	0	$0.00	0.00

8	DPW - Outside	3640	2	0	1 Par Lamp Incandescents Flood Light	60	0.12	436.8	$88.23	2	0	No Change	60	0.12	436.8	$88.23	$0.00	$0.00	0.00	0	$0.00	0.00
9		3640	1	0	175W Lamp, High Bay Metal Halide, Wall Mounted	213	0.21	775.3	$156.61	1	0	No Change	213	0.21	775.32	$156.61	$0.00	$0.00	0.00	0	$0.00	0.00
10		3640	4	0	70W Lamp, High Pressure Sodium, Wall Mounted	90	0.36	1,310.4	$264.70	4	0	No Change	90	0.36	1310.4	$264.70	$0.00	$0.00	0.00	0	$0.00	0.00
11	School - Office 1	2340	4	0	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.75	1,759.7	$355.46	4	0	No Change	188	0.75	1759.68	$355.46	$0.00	$0.00	0.00	0	$0.00	0.00
11	School - Office 2	2340	1	0	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.19	439.9	$88.86	1	0	No Change	188	0.19	439.92	$88.86	$0.00	$0.00	0.00	0	$0.00	0.00
11	School - Center Office	2340	4	0	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.75	1,759.7	$355.46	4	0	No Change	188	0.75	1759.68	$355.46	$0.00	$0.00	0.00	0	$0.00	0.00
11	School - Lounge / Corridor	2340	3	0	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.56	1,319.8	$266.59	3	0	No Change	188	0.56	1319.76	$266.59	$0.00	$0.00	0.00	0	$0.00	0.00
12		2340	1	0	2-Lamp 40W, T12, U-Lamp, Magnetic Ballast, Recessed Mounted	94	0.09	220.0	$44.43	1	0	No Change	94	0.09	219.96	$44.43	$0.00	$0.00	0.00	0	$0.00	0.00
13	School - Mens Room	2340	1	0	2 Foot, 1-Lamp, T12, Magnetic Ballast, Surface Mount	40	0.04	93.6	$18.91	1	0	No Change	40	0.04	93.6	$18.91	$0.00	$0.00	0.00	0	$0.00	0.00
13	School - Womens Room	2340	1	0	2 Foot, 1-Lamp, T12, Magnetic Ballast, Surface Mount	40	0.04	93.6	$18.91	1	0	No Change	40	0.04	93.6	$18.91	$0.00	$0.00	0.00	0	$0.00	0.00
14	School - Boiler Room	2340	1	0	100W Lamp Incandescents Surface Mount	100	0.10	234.0	$47.27	1	0	No Change	100	0.10	234	$47.27	$0.00	$0.00	0.00	0	$0.00	0.00
15	School - Bus Garage	2340	16	0	2-Lamp 40W, T12, Magnetic Ballast, Surface Mounted	80	1.28	2,995.2	$605.03	16	0	No Change	80	1.28	2995.2	$605.03	$0.00	$0.00	0.00	0	$0.00	0.00
16		2340	5	0	2-Lamp 96W, T12, Magnetic Ballast, Surface Mounted	222	1.11	2,597.4	$524.67	5	0	No Change	222	1.11	2597.4	$524.67	$0.00	$0.00	0.00	0	$0.00	0.00
17	School - Outside	3640	2	0	1-Lamp, High Pressure Sodium Fixture, Wall Mounted	90	0.18	655.2	$132.35	2	0	No Change	90	0.18	655.2	$132.35	$0.00	$0.00	0.00	0	$0.00	0.00
18		3640	2	0	100W Lamp Incandescents Recessed Mounted	100	0.20	728.0	$147.06	2	0	No Change	100	0.20	728	$147.06	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		116	6			19.52	47,074.0	$9,508.96	116	24			16.203	39309.92	$7,940.60		$8,000.00	3.32	7764.1	$1,568.35	5.10

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

2. Lamp totals only include T-12 tube replacment calculations

CEG Job #: 9C09060
Project: DPW Garage
Address: 34 Kenbury Road
Branchburg, NJ 08876

"Branchburg Township - DPW Garage"

KWH COST: $0.202

ECM #5: 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	Lighting Controls Description	Watts Used	Savings (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
1	DPW - Truck Garage	2340	8	0	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	2.40	5,616.0	$1,134.43	8	1	Dual Technology Occupancy Sensor	300	20%	4493	$907.55	$330.00	$330.00	0.00	1123.2	$226.89	1.45
2		2340	3	0	175W Lamp, High Bay Metal Halide, Pendant Fixture	213	0.64	1,495.3	$302.04	3	1	None	213	0%	1495	$302.04	$0.00	$0.00	0.00	0	$0.00	0.00
3	DPW - Truck Garage Storage	2340	1	0	3-Lamp 32W T-8 Elect Ballast, Surface Mounted	91	0.09	212.9	$43.01	1	0	Dual Technology Occupancy Sensor	91	20%	170	$34.41	$110.00	$110.00	0.00	42.588	$8.60	12.79
4		2340	2	0	100W Lamp, Incandescent, Surface Mounted	100	0.20	468.0	$94.54	2	0	Dual Technology Occupancy Sensor	100	20%	374	$75.63	$0.00	$0.00	0.00	93.6	$18.91	0.00
5	DPW - Lounge	2340	4	4	4-Lamp 34W, T12, Magnetic Ballast, Recessed Mount	160	0.64	1,497.6	$302.52	4	3	Dual Technology Occupancy Sensor	160	20%	1198	$242.01	$110.00	$110.00	0.00	299.52	$60.50	1.82
1	DPW - Sign Garage	2340	2	0	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	0.60	1,404.0	$283.61	2	1	Dual Technology Occupancy Sensor	300	20%	1123	$226.89	$110.00	$110.00	0.00	280.8	$56.72	1.94
3		2340	1	0	3-Lamp 32W T-8 Elect Ballast, Surface Mounted	91	0.09	212.9	$43.01	1	0	Dual Technology Occupancy Sensor	91	20%	170	$34.41	$110.00	$110.00	0.00	42.588	$8.60	12.79
1	DPW - Electric Room	2340	1	0	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	0.30	702.0	$141.80	1	1	None	300	0%	702	$141.80	$0.00	$0.00	0.00	0	$0.00	0.00
5	DPW - Locker Room	2340	2	4	4-Lamp 34W, T12, Magnetic Ballast, Recessed Mount	160	0.32	748.8	$151.26	2	3	Dual Technology Occupancy Sensor	160	20%	599	$121.01	$110.00	$110.00	0.00	149.76	$30.25	3.64
5	DPW - Locker Bath Room	2340	2	4	4-Lamp 34W, T12, Magnetic Ballast, Recessed Mount	160	0.32	748.8	$151.26	2	3	Dual Technology Occupancy Sensor	160	20%	599	$121.01	$110.00	$110.00	0.00	149.76	$30.25	3.64
6	DPW - Lounge Closet	2340	1	2	2-Lamp 34W, T12, Magnetic Ballast, Surface Mounted Strip	80	0.08	187.2	$37.81	1	2	None	80	0%	187	$37.81	$0.00	$0.00	0.00	0	$0.00	0.00
1	DPW - Small Parking Garage	2340	3	0	300W Lamp, High Bay, Incandescent, Pendant Fixture	300	0.90	2,106.0	$425.41	3	1	Dual Technology Occupancy Sensor	300	20%	1685	$340.33	$220.00	$220.00	0.00	421.2	$85.08	2.59
2		2340	3	0	175W Lamp, High Bay Metal Halide, Pendant Fixture	213	0.64	1,495.3	$302.04	3	1	None	213	0%	1495	$302.04	$0.00	$0.00	0.00	0	$0.00	0.00
4	DPW - Service Garage Mezz	2340	5	0	100W Lamp, Incandescent, Surface Mounted	100	0.50	1,170.0	$236.34	5	0	Dual Technology Occupancy Sensor	100	20%	936	$189.07	$110.00	$110.00	0.00	234	$47.27	2.33
7	DPW - Main Service Garage	2340	24	2	8 Foot, 2-Lamp, T12, Magnetic Ballast, Surface Mounted Strip	222	5.33	12,467.5	$2,518.44	24	2	Dual Technology Occupancy Sensor	222	20%	9974	$2,014.75	$440.00	$440.00	0.00	2493.504	$503.69	0.87
6	DPW - Service Garage Storage Room	2340	4	2	2-Lamp 34W, T12, Magnetic Ballast, Surface Mounted Strip	80	0.32	748.8	$151.26	4	2	Dual Technology Occupancy Sensor	80	20%	599	$121.01	$110.00	$110.00	0.00	149.76	$30.25	3.64
6	DPW - Service Garage Oil Room	2340	2	2	2-Lamp 34W, T12, Magnetic Ballast, Surface Mounted Strip	80	0.16	374.4	$75.63	2	2	Dual Technology Occupancy Sensor	80	20%	300	$60.50	$110.00	$110.00	0.00	74.88	$15.13	7.27

8	DPW - Outside	3640	2	0	1 Par Lamp Incandescents Flood Light	60	0.12	436.8	$88.23	2	0	None	60	0%	437	$88.23	$0.00	$0.00	0.00	0	$0.00	0.00
9		3640	1	0	175W Lamp, High Bay Metal Halide, Wall Mounted	213	0.21	775.3	$156.61	1	0	None	213	0%	775	$156.61	$0.00	$0.00	0.00	0	$0.00	0.00
10		3640	4	0	70W Lamp, High Pressure Sodium, Wall Mounted	90	0.36	1,310.4	$264.70	4	0	None	90	0%	1310	$264.70	$0.00	$0.00	0.00	0	$0.00	0.00
11	School - Office 1	2340	4	4	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.75	1,759.7	$355.46	4	3	Dual Technology Occupancy Sensor	188	20%	1408	$284.36	$110.00	$110.00	0.00	351.936	$71.09	1.55
11	School - Office 2	2340	1	4	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.19	439.9	$88.86	1	3	Dual Technology Occupancy Sensor	188	20%	352	$71.09	$110.00	$110.00	0.00	87.984	$17.77	6.19
11	School - Center Office	2340	4	4	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.75	1,759.7	$355.46	4	3	Dual Technology Occupancy Sensor	188	20%	1408	$284.36	$110.00	$110.00	0.00	351.936	$71.09	1.55
11	School - Lounge / Corridor	2340	3	4	4-Lamp 40W, T12, Magnetic Ballast, Recessed Mount	188	0.56	1,319.8	$266.59	3	3	Dual Technology Occupancy Sensor	188	20%	1056	$213.27	$110.00	$110.00	0.00	263.952	$53.32	2.06
12		2340	1	2	2-Lamp 40W, T12, U-Lamp, Magnetic Ballast, Recessed Mounted	94	0.09	220.0	$44.43	1	2	Dual Technology Occupancy Sensor	94	20%	176	$35.55	$0.00	$0.00	0.00	43.992	$8.89	0.00
13	School - Mens Room	2340	1	1	2 Foot, 1-Lamp, T12, Magnetic Ballast, Surface Mount	40	0.04	93.6	$18.91	1	1	Dual Technology Occupancy Sensor	40	20%	75	$15.13	$110.00	$110.00	0.00	18.72	$3.78	29.09
13	School - Womens Room	2340	1	1	2 Foot, 1-Lamp, T12, Magnetic Ballast, Surface Mount	40	0.04	93.6	$18.91	1	1	Dual Technology Occupancy Sensor	40	20%	75	$15.13	$110.00	$110.00	0.00	18.72	$3.78	29.09
14	School - Boiler Room	2340	1	0	100W Lamp Incandescents Surface Mount	100	0.10	234.0	$47.27	1	0	None	100	0%	234	$47.27	$0.00	$0.00	0.00	0	$0.00	0.00
15	School - Bus Garage	2340	16	2	2-Lamp 40W, T12, Magnetic Ballast, Surface Mounted	80	1.28	2,995.2	$605.03	16	2	Dual Technology Occupancy Sensor	80	20%	2396	$484.02	$110.00	$110.00	0.00	599.04	$121.01	0.91
16		2340	5	2	2-Lamp 96W, T12, Magnetic Ballast, Surface Mounted	222	1.11	2,597.4	$524.67	5	2	Dual Technology Occupancy Sensor	222	20%	2078	$419.74	$110.00	$110.00	0.00	519.48	$104.93	1.05
17	School - Outside	3640	2	0	1-Lamp, High Pressure Sodium Fixture, Wall Mounted	90	0.18	655.2	$132.35	2	0	No Change	90	0%	655	$132.35		$0.00	0.00	0	$0.00	0.00
18		3640	2	0	100W Lamp Incandescents Recessed Mounted	100	0.20	728.0	$147.06	2	0	No Change	100	0%	728	$147.06		$0.00	0.00	0	$0.00	0.00
	Totals		116	44			19.52	47,074.0	$9,508.96	116	43			4.4	39263.12	$7,931.15		$2,860.00	0.00	7810.9	$1,577.81	1.81

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

2. Lamp totals only include T-12 tube replacment calculations

Project Name: LGEA Solar PV Project - Branchburg - DPW Bldg
Location: 08876, NJ
Description: Photovoltaic System 95% Financing - 20 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 20 year
Total Construction Cost	$428,490
Annual kWh Production	55,004
Annual Energy Cost Reduction	$11,111
Annual SREC Revenue	$19,251
First Cost Premium	**$428,490**
Simple Payback:	**14.11** Years

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	95%
Financing Term (mths):	300	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.202**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	7.00%	SREC Value ($/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	$21,425	0	0	0	$0	0	0	(21,425)	0
1	$0	55,004	$11,111	$0	$19,251	$28,297	$6,227	($4,162)	($25,587)
2	$0	54,729	$11,444	$0	$19,155	$27,847	$6,678	($3,925)	($29,512)
3	$0	54,455	$11,787	$0	$19,059	$27,364	$7,160	($3,678)	($33,190)
4	$0	54,183	$12,141	$0	$18,964	$26,847	$7,678	($3,420)	($36,610)
5	$0	53,912	$12,505	$555	$18,869	$26,292	$8,233	($3,705)	($40,315)
6	$0	53,643	$12,880	$553	$18,775	$25,697	$8,828	($3,422)	($43,737)
7	$0	53,374	$13,267	$550	$18,681	$25,058	$9,466	($3,126)	($46,863)
8	$0	53,107	$13,665	$547	$18,588	$24,374	$10,151	($2,819)	($49,682)
9	$0	52,842	$14,075	$544	$18,495	$23,640	$10,884	($2,499)	($52,182)
10	$0	52,578	$14,497	$542	$18,402	$22,854	$11,671	($2,167)	($54,349)
11	$0	52,315	$14,932	$539	$18,310	$22,010	$12,515	($1,821)	($56,170)
12	$0	52,053	$15,380	$536	$18,219	$21,105	$13,420	($1,462)	($57,632)
13	$0	51,793	$15,841	$533	$18,128	$20,135	$14,390	($1,089)	($58,721)
14	$0	51,534	$16,317	$531	$18,037	$19,095	$15,430	($702)	($59,423)
15	$0	51,276	$16,806	$528	$17,947	$17,979	$16,545	($300)	($59,723)
16	$0	51,020	$17,310	$526	$17,857	$16,783	$17,741	$117	($59,606)
17	$0	50,765	$17,830	$523	$17,768	$15,501	$19,024	$550	($59,056)
18	$0	50,511	$18,364	$520	$17,679	$14,126	$20,399	$998	($58,058)
19	$0	50,259	$18,915	$518	$17,590	$12,651	$21,874	$1,464	($56,594)
20	$0	50,007	$19,483	$515	$17,503	$11,070	$23,455	$1,946	($54,649)
21	$0	49,757	$20,067	$512	$17,415	$10,085	$21,562	$5,322	($49,327)
22	$0	49,508	$20,669	$510	$17,328	$9,112	$19,659	$8,717	($40,610)
23	$0	49,261	$21,289	$507	$17,241	$8,150	$17,744	$12,130	($28,480)
24	$0	49,015	$21,928	$505	$17,155	$7,199	$15,818	$15,562	($12,918)
25	$0	48,769	$22,586	$502	$17,069	$6,259	$13,881	$19,014	$6,096
	Totals:	1,049,361	$298,552	$8,559	$367,276	$428,725	$261,769	$350,432	($1,116,900)
				Net Present Value (NPV)				**($29,563)**	
				Internal Rate of Return (IRR)				**0.5%**	

Project Name: LGEA Solar PV Project - Branchburg - DPW Bldg
Location: 08876, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$428,490
Annual kWh Production	55,004
Annual Energy Cost Reduction	$11,111
Annual SREC Revenue	$19,251
First Cost Premium	**$428,490**
Simple Payback:	**14.11** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.202**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$428,490	0	0	0	$0	(428,490)	0
1	$0	55,004	$11,111	$0	$19,251	$30,362	($398,128)
2	$0	54,729	$11,444	$0	$19,155	$30,599	($367,529)
3	$0	54,455	$11,787	$0	$19,059	$30,847	($336,682)
4	$0	54,183	$12,141	$0	$18,964	$31,105	($305,577)
5	$0	53,912	$12,505	$555	$18,869	$30,819	($274,757)
6	$0	53,643	$12,880	$553	$18,775	$31,103	($243,654)
7	$0	53,374	$13,267	$550	$18,681	$31,398	($212,256)
8	$0	53,107	$13,665	$547	$18,588	$31,706	($180,551)
9	$0	52,842	$14,075	$544	$18,495	$32,025	($148,525)
10	$0	52,578	$14,497	$542	$18,402	$32,358	($116,168)
11	$0	52,315	$14,932	$539	$18,310	$32,703	($83,464)
12	$0	52,053	$15,380	$536	$18,219	$33,062	($50,402)
13	$0	51,793	$15,841	$533	$18,128	$33,435	($16,966)
14	$0	51,534	$16,317	$531	$18,037	$33,823	$16,856
15	$0	51,276	$16,806	$528	$17,947	$34,225	$51,081
16	$0	51,020	$17,310	$526	$17,857	$34,642	$85,723
17	$0	50,765	$17,830	$523	$17,768	$35,074	$120,797
18	$0	50,511	$18,364	$520	$17,679	$35,523	$156,320
19	$0	50,259	$18,915	$518	$17,590	$35,988	$192,308
20	$0	50,007	$19,483	$515	$17,503	$36,470	$228,779
21	$1	49,757	$20,067	$512	$17,415	$36,970	$265,749
22	$2	49,508	$20,669	$510	$17,328	$37,487	$303,236
23	$3	49,261	$21,289	$507	$17,241	$38,023	$341,259
24	$4	49,015	$21,928	$505	$17,155	$38,578	$379,838
25	$5	48,769	$22,586	$502	$17,069	$39,153	$418,991
	Totals:	1,049,361	$298,552	$8,559	$367,276	$847,481	$657,269
				Net Present Value (NPV)			**$419,016**
				Internal Rate of Return (IRR)			**5.8%**

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW_{DC}	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Branchburg - DPW Garage	3,030	Sunpower SPR230	207	14.7	3,044	47.61	55,004	6,831	15.64

.= Proposed PV Layout

Notes:
1. Estimated kWH based on the National Renewable Energy Laboratory PVWatts Version 1 Calculator Program.
2. Est. Percent of Roof Space Unvailable for Panels 0.00%

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:	47.6 kW
DC to AC Derate Factor:	0.810
AC Rating:	38.6 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	20.2 ¢/kWh

Results			
Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	2.39	2856	576.91
2	3.17	3462	699.32
3	4.07	4846	978.89
4	4.83	5369	1084.54
5	5.70	6387	1290.17
6	5.94	6241	1260.68
7	5.77	6193	1250.99
8	5.38	5736	1158.67
9	4.65	4935	996.87
10	3.61	4062	820.52
11	2.35	2591	523.38
12	2.01	2325	469.65
Year	4.16	55004	11110.81

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

Disclaimer and copyright notice

Return to RReDC home page (http://rredc.nrel.gov)