ENERGY AUDIT – FINAL REPORT

BRICK TOWNSHIP M.U.A.
MAINTENANCE BUILDING
1551 HIGHWAY 88 WEST
BRICK, NJ 08724

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I. EXECUTIVE SUMMARY

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

Brick Township M.U.A.
Maintenance Garage
1551 Highway 88 West
Brick, NJ 08724-2399

Facility Contact Person: Jay Delaney, Project Manager

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 Campus	$1,003,386 (Total)
Electricity (SF Est.)	$58,006
Natural Gas	$ 6,305
Total	$ 64,311

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 Controls	$1,820	$179	10.2	47.1%
ECM #2	Domestic Water Heater Replacement	$3,830	$51	75.3	-84.1%
ECM #3	Unit Heater Replacement	$5,650	$869	6.5	99.9%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	14.26 PV Solar System	$128,340	$6,850	18.7	33.4%

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 Controls	-	2,514.2	-
ECM #2	Domestic Water Heater Replacement	-	-	33.8
ECM #3	Unit Heater Replacement	0.1	75.6	574.5
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	14.26 PV Solar System	14.3	16,270.0	-

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

- **ECM #1:** Lighting Controls
- **ECM #3:** Unit Heater Replacement - Infrared Heaters

Although ECM #2 does not provide a payback less than 10 years, it is recommended to proceed with the installation of a domestic water heater unit as suggested in ECM #2 (or equal) since the existing water heater is past its expected lifespan.

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

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

II. INTRODUCTION

The comprehensive energy audit covers the 6,633 square foot Maintenance Garage Building, which includes the following spaces: machine shop, mechanic station, welding area, vehicle service area, office space and toilet rooms.

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, through a campus service under their General Service Primary rate structure. ConEdison is a third party supplier. 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. New Jersey Natural Gas provides natural gas to the facility under the Basic General Supply Service (BGS) 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	14.2¢ / kWh
Natural Gas	$1.504 / Therm

Table 3
Campus Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: JCP&L
Rate: JC_GP_01D
Meter No: L97024331 /
Customer ID No: 0801431959
Third Party Utility ConEdison
TPS Meter / Acct No: 517809

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
May-08	496,245	1009.9	$69,412
Jun-08	779,938	1765.4	$111,093
Jul-08	754,427	1400.4	$105,271
Aug-08	725,072	1322.6	$101,046
Sep-08	728,453	1415.3	$102,106
Oct-08	481,309	1399.2	$70,051
Nov-08	472,382	1385.3	$69,192
Dec-08	500,951	823.0	$69,134
Jan-09	519,121	1473.1	$75,703
Feb-09	616,249	1507.7	$88,262
Mar-09	545,960	1382.4	$78,496
Apr-09	430,501	1350.0	$63,620
Totals	**7,050,608**	**1765.4 Max**	**$1,003,386**

AVERAGE DEMAND 1352.9 KW average
AVERAGE RATE $0.142 $/kWh

Figure 1
Campus Electricity Usage Profile

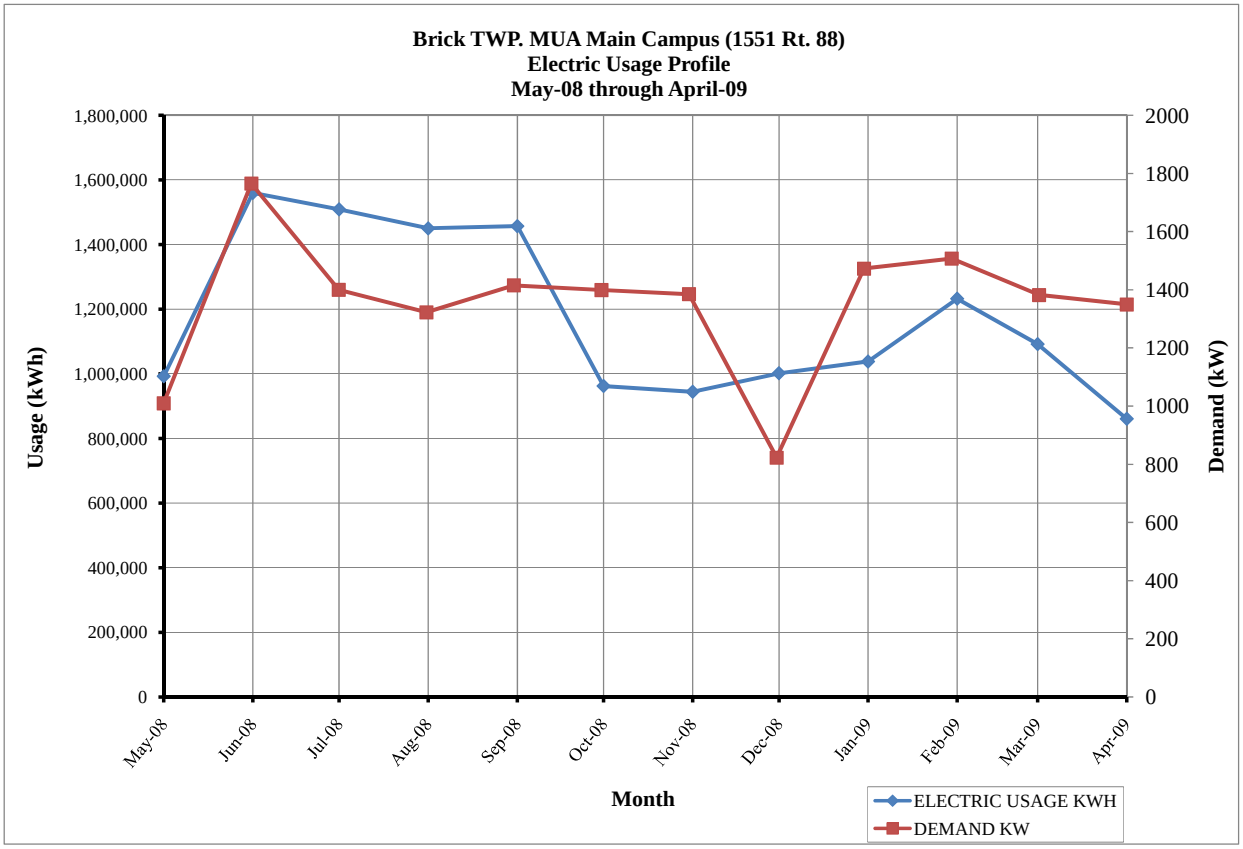
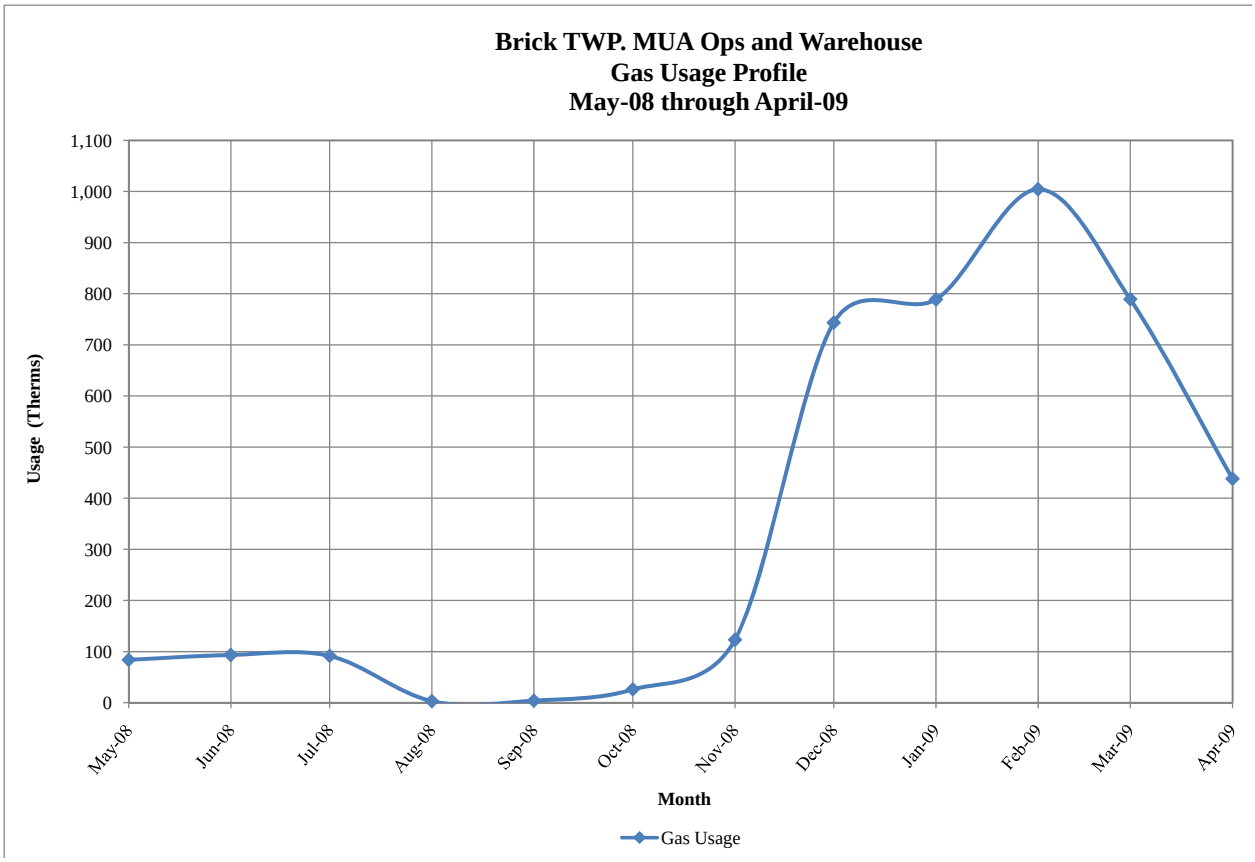


Table 4
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider:	New Jersey Natural Gas	
Rate:	BGS	
Meter No:	811146	
Point of Delivery ID:	0	
Third Party Utility Provider:		
TPS Meter No:		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
May-08	83.96	$133.09
Jun-08	93.39	$152.72
Jul-08	91.59	$165.23
Aug-08	3.17	$19.66
Sep-08	4.21	$21.17
Oct-08	26.29	$56.95
Nov-08	123.12	$218.39
Dec-08	743.54	$1,199.81
Jan-09	789.08	$1,187.70
Feb-09	1,004.73	$1,405.21
Mar-09	789.67	$1,085.42
Apr-09	438.23	$659.46
TOTALS	**4,190.98**	**$6,304.81**
AVERAGE RATE:	**$1.504**	**$/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:

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

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

The site and source EUI cannot be accurately calculated for this building. There are nine (9) buildings on the campus electric meter and the individual buildings are not sub-metered. It would not be an accurate estimate to average the usage based on building square footage as this would improperly proportion the loading on the larger buildings like the Administration building where the pump stations would have the larger electrical loading. The proportioned square footages for the complex are as indicated in Table 5 below:

Table 5
Campus Building Areas

1551 Rt. 88 Campus		
BUILDING	AREA (SQFT)	% AREA
Administration Bldg.	16,128	0.263
Ops / Warehouse	10,802	0.176
Maintenance Garage	6,633	0.108
Generator Bldg	4,438	0.072
Base 1	1,850	0.030
Raw Water Pump Station	2,490	0.041
Pre-Treatment	4,080	0.066
Control	12,582	0.205
Finished Water Pump Station	2,424	0.039
Campus Total	**61,427**	**1.000**

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:	bricktwpmua
Password:	lgeaceg2009
Security Question:	What city were you born in?
Security Answer:	Brick

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**
Maintenance Garage	N/A	50

A **Statement of Energy Performance** detailing energy summary cannot be provided for this campus facility. The electric service to this building is not separately metered and an accurate estimate cannot be made.

V. FACILITY DESCRIPTION

The Brick Utilities Maintenance Garage constructed in 1990 and renovated in 1995, is a one-story structure totaling approximately 6,630 square feet. The facility is divided into two (2) major areas; the Garage and the Office. The Garage includes areas such as: machine shop, mechanic station, welding area, and vehicle service area. The Office area has standard office space and the toilet rooms. The building construction is standard with walls consisting of brick/block construction. The roof is flat with open-web metal roof joists and the windows are double pane. Based on information provided by the Owner, the building is occupied by four (4) employees for approximately fifty (50) hours per week. The facility is utilized for repairing and storing vehicles by the MUA's personnel.

HVAC Systems

The Garage portion of the facility is heated by multiple gas-fired unit heaters suspended from the structural steel. The majority of the equipment is original to the facility and there have been two (2) new unit heaters installed recently. For detailed information regarding the unit heaters, their capacity and remaining useful life refer to the **Major Equipment List Appendix**. It is pertinent to note, the Garage portion of the facility is not air-conditioned. Generally, the unit heaters are in decent condition and the Owner has been replacing them only after the equipment ceases to work.

The Office portion of the facility is heated and cooled via a water-source heat pump manufactured by Florida Heat Pump located above the ceiling outside of the toilet rooms. The heat pump is approximately thirteen (13) years of age and has a remaining service life of six (6) years.

Air Distribution

The vehicle service area within the Garage portion of the facility has two (2) roof exhaust fans. The backdraft/ motor-operated damper on both fans are trapped open. This incidence will result in major infiltration issues in the winter during heating season. The dampers on both fans are in need of repair.

Domestic Hot Water

The domestic hot water for the building is provided by one (1) A.O. Smith Energy Saver domestic hot water heater, located in the garage mezzanine. The domestic hot water heater burns natural gas, has a 40 MBH input, storage capacity of 30 gallons and recovery rate equal to 42.6 gallons per hour. The hot water heater is approximately sixteen (16) years old and is an estimated four (4) years past its useful service life. This piece of equipment should be reviewed for replacement.

HVAC Controls

Each heating area within the Garage area is controlled by a Honeywell dial type thermostat. The thermostats are non-programmable and vary based on occupant comfort. The heat pump serving the Office area is controlled by a programmable thermostat.

Lighting

Most of the lighting fixtures have two (2) or four (4) T8 lamps. These fixtures are either pendant or surface mounts on the ceiling. There are five (5) eight (8) foot T12 vapor lights in the garage. The outdoor lighting fixtures are 100 W metal halide wall packs.

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: Install Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. There has been a belief that it is better to keep the lights on rather than to continuously switch them on and off. This on/off dilemma was studied, and it was determined that the best option is to turn the lights off whenever possible. Although this practice reduces the lamp life, the energy savings far outweigh the lamp replacement costs.

Lighting controls are available in many forms. Lighting controls can be as simplistic as an additional switch. Timeclocks are often used which allow the user to set an on/off schedule. Timeclocks range from a dial clock with on/off indicators to a small box the size of a thermostat with user programs for on/off schedule in digital format. Occupancy sensors detect motion and will switch the lights on when the room is occupied. They can either be mounted in place of the current wall switch, or they can be mounted on the ceiling to cover large areas. Lastly, photocells are a lighting control that sense light levels and will turn the lights off when there is adequate daylight. These are mostly used outside, but they are becoming much more popular in energy-efficient office designs as well.

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

Energy Savings Calculations:

The **Investment Grade Lighting Audit ECM#1- Lighting Controls Appendix** outlines the proposed retrofits, costs, savings, and payback periods. The building is occupied 50 hours a week and other areas are only a few hours a day. Ten percent of this value is the resultant energy savings due to installation of occupancy sensors and was calculated to be 2,514 kWh/year and $357/year.

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is $160/unit including material and labor. The SmartStart Buildings® incentive is $20 per control which equates to an installed cost of $140/unit. Total number of rooms to be retrofitted is 13. Total cost to install sensors is $140/ceiling unit x 13 units = $1,820.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$2,080
NJ Smart Start Equipment Incentive ($):	$260
Net Installation Cost ($):	$1,820
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$357
Total Yearly Savings ($/Yr):	$357
Estimated ECM Lifetime (Yr):	15
Simple Payback	5.1
Simple Lifetime ROI	194.2%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$5,355
Internal Rate of Return (IRR)	18%
Net Present Value (NPV)	$2,442.08

ECM #2: Domestic Water Heater Replacement

Description:

The domestic water for the building is provided by one (1) A.O. Smith FGR30224 domestic water heater located in the Maintenance Garage. The water heater has a natural gas input of 40 MBH, and a storage capacity of 30 gallons with recovery at 42.6 gallons per hour and has an 80% thermal efficiency.

This energy conservation measure will replace the existing water heater with a commercial grade 90% thermal efficient Bradford White model BTX-80 gas fired domestic hot water heater having 75 MBH input and 50-gallon storage capacity and 83 GPH recovery or equivalent.

Energy Savings Calculations:

Existing Natural Gas DW Heater
Rated Capacity = 40 MBH input; 40 gallons storage
Combustion Efficiency = 80%
Age & Radiation Losses = 5%
Thermal Efficiency = 75%

Proposed Natural Gas-Fired, High-Efficiency DW Heater
Rated Capacity = 76 MBH input; 50 gallons storage
Thermal Efficiency = 90%
Radiation Losses = 0.5%
Net Efficiency = 89.5%

NATURAL GAS EQUIPMENT LIST - Estimated Usage							
Concord Engineering Group Maintenance Garage							
LOCATION	**AREA SERVED**	**MANUFACTURER**	**MODEL NUMBER**	**SERIAL NUMBER**	**NATURAL GAS INPUT (MBH)**	**% of TOTAL INPUT**	**ESTIMATED ANNUAL THERMS**
Mezzanine in Garage	Maintenance Garage	A.O. Smith	FGR30224	MG930061876-224	40.0	0.05	208.9
Machine Shop	Machine Shop	Modine	PAE50AG0130	05081011196-7904	50.0	0.06	261.1
Office	Office	Reznor	UDAP100	-	105.0	0.13	548.4
Mechanical Station	Mechanical Station	Modine	PAE50AG0130	05081011196-7899	50.0	0.06	261.1
Welding Area	Welding Area	Modine	PAE50AG0130	05081011196-7900	50.0	0.06	261.1
Vehicle Service Area	Vehicle Service Area	Reznor	UDAP100	BGD79Y2N 57229X	105.0	0.13	548.4
Vehicle Service Area	Vehicle Service Area	Modine	PAH90SF	15012020591	90.0	0.11	470.0
Vehicle Service Area	Vehicle Service Area	Modine	PAH90SF	15012020591	90.0	0.11	470.0
Vehicle Service Area	Vehicle Service Area	Modine	PAH90SF	-	90.0	0.11	470.0
Vehicle Service Area	Vehicle Service Area	Modine	PAH130SF	15012020191	130.0	0.16	678.9
Abv. Ceiling Outside Toilet Room	Office, Hallway, Toilet	Florida Heat Pump	SL030-4HZC	CB082413	2.5	0.00	13.1
				TOTAL	802.50	1.00	
				FACILITY TOTAL THERMS	4,190.98		4,190.98

Operating Data for Domestic Water Heater

$$\text{Estimated Consumption} = \frac{40 MBH input}{802.5 MBH bldg input} x 4190.98 Therms/year = 208.9 Therms/year$$

Energy Savings = Old Water Heater Energy Input x ((New Water Heater Efficiency – Old Water Heater) / New Water Heater Efficiency))

Energy Savings = 208.9 Therms x (89.5% - 75%) = 33.8 Therms
(89.5%)

Average Cost of Natural Gas = $1.504/Therm

Yearly Savings = 33.8 Therm x $1.504/ Therm = $51/year

Cost of one (1) Commercial Domestic Water Heater and Installation = $3,880

Simple Payback = $3,880 / $51 = 76 years

Smart Start Incentive = $50 per water heater

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$3,880
NJ Smart Start Equipment Incentive ($):	$50
Net Installation Cost ($):	$3,830
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$51
Total Yearly Savings ($/Yr):	$51
Estimated ECM Lifetime (Yr):	12
Simple Payback	75.3
Simple Lifetime ROI	-84.1%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$610
Internal Rate of Return (IRR)	-21%
Net Present Value (NPV)	($3,323.94)

ECM #3: Unit Heater Replacement - Infrared Heaters

Description:

The truck bay of the Maintenance Building is heated by six (7) Modine gas-fired units. These units are controlled by standard programmable thermostats. These units do not provide adequate heating because of the high ceilings and losses through garage doors when open.

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

Energy Savings Calculations:

Based on the existing unit heater data, thermostat settings and natural gas bills, the total energy consumed by these heating units is approximately 2,872.3 Therms/Year. The total rated heat capacity of the IR tubes is 80% of the current load or 0.8 x 2,872.3 Therms = 2,297.8 Therms/Year. The total amount of IR heaters and their size can be estimated based on the current heat load and building layout. In general, a building 200 feet wide or less will require two rows of tubes. Heat output of each 20-foot section is approximately 60,000 Btu/hr.

NATURAL GAS EQUIPMENT LIST - Estimated Usage							
Concord Engineering Group Maintenance Garage							
LOCATION	**AREA SERVED**	**MANUFACTURER**	**MODEL NUMBER**	**SERIAL NUMBER**	**NATURAL GAS INPUT (MBH)**	**% of TOTAL INPUT**	**ESTIMATED ANNUAL THERMS**
Mezzanine in Garage	Maintenance Garage	A.O. Smith	FGR30224	MG930061876-224	40.0	0.05	208.9
Machine Shop	**Machine Shop**	**Modine**	**PAE50AG0130**	**05081011196-7904**	**50.0**	**0.06**	**261.1**
Office	Office	Reznor	UDAP100	-	105.0	0.13	548.4
Mechanical Station	**Mechanical Station**	**Modine**	**PAE50AG0130**	**05081011196-7899**	**50.0**	**0.06**	**261.1**
Welding Area	**Welding Area**	**Modine**	**PAE50AG0130**	**05081011196-7900**	**50.0**	**0.06**	**261.1**
Vehicle Service Area	Vehicle Service Area	Reznor	UDAP100	BGD79Y2N 57229X	105.0	0.13	548.4
Vehicle Service Area	**Vehicle Service Area**	**Modine**	**PAH90SF**	**15012020591**	**90.0**	**0.11**	**470.0**
Vehicle Service Area	**Vehicle Service Area**	**Modine**	**PAH90SF**	**15012020591**	**90.0**	**0.11**	**470.0**
Vehicle Service Area	**Vehicle Service Area**	**Modine**	**PAH90SF**	**-**	**90.0**	**0.11**	**470.0**
Vehicle Service Area	**Vehicle Service Area**	**Modine**	**PAH130SF**	**15012020191**	**130.0**	**0.16**	**678.9**
Abv. Ceiling Outside Toilet Room	Office, Hallway, Toilet	Florida Heat Pump	SL030-4HZC	CB082413	2.5	0.00	13.1
				TOTAL	802.50	1.00	
				FACILITY TOTAL THERMS	4,190.98		4,190.98

Estimated Fan Energy Savings:

Each of the Modine gas-fired unit heaters have a 1/40 HP fan that runs each time the unit calls for heating. Assuming that these motors are 80% efficient and the total run hours is 522 hrs/yr, this equates to an electrical savings of

Three (3) Existing 1/40 HP Motor Operating Cost =
3x{0.746 Watt/HP x Motor HP x Load Factor x Hours of Operation x Cost of Electricity] ÷ Motor Efficiency
= 3 x [0.746 x 0.025 x 0.75 x 522 x 0.142] ÷ 0.80 = $3.89 / Year Savings

Three (3) Existing 1/30 HP Motor Operating Cost =
3x{0.746 Watt/HP x Motor HP x Load Factor x Hours of Operation x Cost of Electricity] ÷ Motor Efficiency
= 4 x [0.746 x 0.033 x 0.75 x 522 x 0.142] ÷ 0.80 = $6.84 / Year Savings

Total electrical savings=$3.89+$6.84 = $10.73 / year electrical savings

Natural Gas Energy Savings:

20% savings x 2,872.3 Therms/Yr x $1.504/Therm = $864/Year

Total Energy Savings = Fan Energy Savings + Natural Gas Savings

= $10.73 + $864 = $880 per year

The total implementation cost including material and labor is estimated at approximately $5,650. It is pertinent to note, the labor cost includes installation of the infra-red heaters and required modifications of the existing natural gas piping.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$5,650
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$5,650
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$880
Total Yearly Savings ($/Yr):	$880
Estimated ECM Lifetime (Yr):	13
Simple Payback	6.4
Simple Lifetime ROI	102.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$11,440
Internal Rate of Return (IRR)	12%
Net Present Value (NPV)	$3,708.76

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 1000 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 14.26 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 16,270 KWh annually, reducing the overall utility bill by approximately 0.2% percent. A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix**. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

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

The array system capacity was sized on available roof space on the existing facility. Estimated solar array generation was then calculated based on the National Renewable Energy Laboratory

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

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

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

Table 7
Financial Summary – Photovoltaic System

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM			
PAYMENT TYPE	**SIMPLE PAYBACK**	**SIMPLE ROI**	**INTERNAL RATE OF RETURN**
Direct Purchase	16.03 Years	6.2%	3.76%

*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 slightly more beneficial to the Owner.

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

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

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

Electricity:

This facility was constructed in 1990 and renovated in 1995. The facility is divided into two (2) major areas; the Garage and the Office. The Garage includes: machine shop, mechanic station, welding area, and vehicle service area. The building is occupied by four (4) employees for approximately fifty (50) hours per week.

The Electric Usage Profile demonstrates a fairly typical load shape throughout the year. The profile is said to be typical in that the winter consumption consistently drops off. The winter (October – March) is flat and is elevated, still demonstrating a good consumption level. The summer, (May – September) demonstrates a consistent hump, that is consistent with a cooling (air conditioner) load. The Office is cooled via a water-source heat pump manufactured by Florida Heat Pump located above the ceiling outside of the toilet rooms. This facility is supplied electricity by Jersey Central Power and Light (JCP&L). The Delivery service is provided by JCP&L on a GSS 3-phase tariff on all electric accounts. All electric accounts are served electric Commodity service by JCP&L, except the Water Treatment Plant which is served via Con – Ed Solutions a Third Party Supplier. A flatter load profile will allow for more competitive energy prices when shopping for alternative energy suppliers.

Natural Gas:

The Natural Gas Usage Profile demonstrates a fairly typical heating load profile. An increase in consumption is observed November through March during the standard heating season. Heating in the Garage portion of the facility is heated by multiple gas-fired unit heaters suspended from the structural steel. The Office portion of the facility is heated via a water-source heat pump manufactured by Florida Heat Pump located above the ceiling outside of the toilet rooms. This facility receives its natural gas Delivery and Commodity service from New Jersey Natural (NJN) on a GSS and BGS rate schedule.

Tariff:

Electricity:

This facility receives electrical Delivery service through Jersey Central Power & Light (JCP&L) on a GSS (General Service Secondary – 3 Phase) rate. Service classification GS is available for general service purposes on secondary voltages not included under Service Classifications RS, RT, RGT or GST. This facility's rate is a three phase service at secondary voltages. For electric supply (generation), the customer uses the service of a Third Party Supplier (TPS), Con-Ed Solutions and from the utility JCP&L. This facility uses the Delivery Service of the utility (JCP&L). The Delivery Service includes the following charges: Customer Charge, Supplemental Customer Charge, Distribution Charge (kW Demand), kWh Charge, Non-utility Generation Charge, TEFA, SBC, SCC, Standby Fee and RGGI.

Natural Gas:

This facility receives utility Delivery and Commodity service from New Jersey Natural Gas Company (NJN) on a GSS (General Service Small) utility rate classification. This service is available to any customer in the entire territory served by the Company who uses less than 5,000 therms annually and uses gas for all purposes other than residential service and interruptible service. Where the customer uses the Air Conditioning and Pool Heating serviced ("CAC"), the company will upon application by the customer, meter the space heating and CAC use separately. Street lighting service will also be applied under this rate schedule. The monthly fees associated with this rate schedule are as follows: Customer Charge, Delivery Charge, BGSS Charge and Balancing Charges.

This service is a "firm" character of service, where the customer may either purchase gas supply from the Company's Rider "A" for Basic Gas Supply Service ("BGSS") or from a Marketer or Broker. This facility purchases its natural gas Commodity service from NJN's Basic Gas Supply Service.

"Firm" delivery service defines the reliability of the transportation segment of the pricing. Much like the telecom industry, natural gas pipelines were un-bundled in the late 1990's and the space was divided up and marketed into reliability of service. Firm Service is said to be the most reliable and last in the pecking order for interruption. This service should not be interrupted. Commodity Charges: Customer may choose to receive gas supply from either: A TPS or from JCP&L through its Basic Gas Supply Service default service. JCP&L may also supply Emergency Sales Service in certain instances. This is at a much higher than normal rate. It should be perceived as a penalty.

Please see CEG recommendations below.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities. Potential savings can be seen equally in the electric costs and the natural gas costs. The average price per kWh (kilowatt hour) for The Brick MUA based on a historical 1-year weighted average fixed "price to-compare" from a weighted average of the Third Party Supplier (TPS) Con–Ed Solutions and the utility JCP&L (Jersey Central Power & Light), is .09952 / kWh. *Note*: *The prices are weighted in an effort to average the rates in order to obtain the most accurate supplied rate. The Third Party Supplier –Con Ed Solutions supplies the Water Treatment Plant but not the other accounts. The Water Treatment Plant is also on a General Service-Primary (GS-P) rate, while the others are on a General Service –Secondary (3-phase) rate classification. The GSP rate is historically a lower delivered rate in that it is delivered at higher voltages, like HTS – (High Tension Service). It is possible that there would be a greater improvement in prices if the GS-P account were identified by itself.*

The fixed weighted average 'price-to-compare" per decatherm for natural gas service provided by the utility (New Jersey Natural-NJN), is approximately $10.78 / Dth (dekatherm is the common unit of measure).

The "price to compare" is the netted cost of the energy (including other costs), that the customer will use to compare to other market driven prices offered by Third Party Supply sources when shopping for alternative suppliers. For electricity this cost would not include the utility transmission and distribution chargers. For natural gas the cost would not include the utility distribution charges and is said to be delivered to the utilities city-gate.

Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. The MUA could see improvement in its energy costs if it were to take advantage of these current market prices quickly, before energy prices increase. Based on electric supply from JCP&L and utilizing the historical consumption data provided (May 2008 through April 2009) and current electric rates, Brick 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". While CEG recommends an RFP process to vet out the best possible prices, CEG further recommends that Brick utilize an energy advisor when creating such a program. CEG would recommend splitting the pricing by utility tariff rates, as to see the best price for the GS-P rate class as compared to the other rate classifications.

CEG's second recommendation coincides with the natural gas costs. Based on current supply rates, CEG feels that there could be an improvement of up to 26 % or up to $13,000 annually in its natural gas costs. CEG recommends the school receive further advisement on these prices through an energy advisor. They should also consider procuring energy (natural gas) through an alternative supply source on a "managed approach".

CEG also recommends scheduling a meeting with the current utility providers to review their utility charges and current tariff structures for electricity and natural gas. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), the municipality can learn more about the competitive supply process. The county can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu. They should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the information for ongoing demand-side management projects. Furthermore, special attention should be given to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with the utility representative. The Brick MUA 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.

iv. *Pay For Performance – The New Jersey Smart Start Pay for Performance program includes incentives based on savings resulted from implemented ECMs. The program is available for all buildings with average demand loads above 200 KW. The facility's participation in the program is assisted by an approved program partner. An "Energy Reduction Plan" is created with the facility and approved partner to shown at least 15% reduction in the building's current energy use. Multiple energy conservation measures implemented together are applicable toward the total savings of at least 15%. No more than 50% of the total energy savings can result from lighting upgrades / changes.*

Total incentive is capped at 50% of the project cost. The program savings is broken down into three benchmarks; Energy Reduction Plan, Project

Implementation, and Measurement and Verification. Each step provides additional incentives as the energy reduction project continues. The benchmark incentives are as follows:

1. *Energy Reduction Plan – Upon completion of an energy reduction plan by an approved program partner, the incentive will grant $0.10 per square foot between $5,000 and $50,000, and not to exceed 50% of the facility's annual energy expense. (Benchmark #1 is not provided in addition to the local government energy audit program incentive.)*

2. *Project Implementation – Upon installation of the recommended measures along with the "Substantial Completion Construction Report," the incentive will grant savings per KWH or Therm based on the program's rates. Minimum saving must be 15%. (Example $0.11 / kWh for 15% savings, $0.12/ kWh for 17% savings, … and $1.10 / Therm for 15% savings, $1.20 / Therm for 17% saving, …) Increased incentives result from projected savings above 15%.*

3. *Measurement and Verification – Upon verification 12 months after implementation of all recommended measures, that actual savings have been achieved, based on a completed verification report, the incentive will grant additional savings per kWh or Therm based on the program's rates. Minimum savings must be 15%. (Example $0.07 / kWh for 15% savings, $0.08/ kWh for 17% savings, … and $0.70 / Therm for 15% savings, $0.80 / Therm for 17% saving, …) Increased incentives result from verified savings above 15%.*

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

XI. ADDITIONAL RECOMMENDATIONS

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

A. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.

B. Maintain all weather stripping on windows and doors.

C. Clean all light fixtures to maximize light output.

D. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Maintenance Garage

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 Controls	$2,080	$0	$260	$1,820	$357	$0	$357	15	$5,355	$0	194.2%	5.1	17.97%	$2,442.08
ECM #2	Domestic Water Heater Replacement	$3,880	$0	$50	$3,830	$51	$0	$51	12	$610	$0	-84.1%	75.3	-20.94%	($3,323.94)
ECM #3	Unit Heater Replacement - Infrared Heaters	$5,650	$0	$0	$5,650	$880	$0	$880	13	$11,440	$0	102.5%	6.4	12.01%	$3,708.76
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	14.26 PV Solar System	$128,340	$0	$0	$128,340	$2,310	$5,695	$8,005	25	$200,125	$142,375	55.9%	16.0	3.76%	$11,052.25

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

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SmartStart Building Incentives

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

Electric Chillers

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

Gas Cooling

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

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

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

Ground Source Heat Pumps

Closed Loop & Open Loop	$370 per ton

Gas Heating

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

Variable Frequency Drives

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

Natural Gas Water Heating

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

Premium Motors

Three-Phase Motors	$45 - $700 per motor

Prescriptive Lighting

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

Lighting Controls – Occupancy Sensors

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

Lighting Controls – HID or Fluorescent Hi-Bay Controls

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

Other Equipment Incentives

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

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Maintenance Garage

Building ID: 1949756
For 12-month Period Ending: April 30, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: December 08, 2009

Facility
Maintenance Garage
1551 Highway 88 West
Brick Township, NJ 08724

Facility Owner
Brick Utilities
1551 Highway 88 West
Brick Township, NJ 08724

Primary Contact for this Facility
Jay Delaney
1551 Highway 88 West
Brick Township, NJ 08724

Year Built: 1990
Gross Floor Area (ft²): 6,633

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

Site Energy Use Summary[3]

Natural Gas (kBtu)[4]	419,157
Electricity - (kBtu)	0
Total Energy (kBtu)	419,157

Energy Intensity[5]

Site (kBtu/ft²/yr)	63
Source (kBtu/ft²/yr)	66

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	22

Electric Distribution Utility
FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	-69%
Building Type	Other

Stamp of Certifying Professional

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

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

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

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

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

ENERGY STAR® Data Checklist for Commercial Buildings

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

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

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Maintenance Garage	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Other	Is this an accurate description of the space in question?		☐
Location	1551 Highway 88 West, Brick Township, NJ 08724	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		☐
Maintenance Garage (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	6,633 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Number of PCs	2 (Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	50 Hours(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	4 (Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

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

Fuel Type: Natural Gas		
Meter: Maintenance Garage Natural Gas (therms) **Space(s):** Maintenance Garage		
Start Date	**End Date**	**Energy Use (therms)**
04/01/2009	04/30/2009	438.23
03/01/2009	03/31/2009	789.67
02/01/2009	02/28/2009	1,004.73
01/01/2009	01/31/2009	789.67
12/01/2008	12/31/2008	743.54
11/01/2008	11/30/2008	123.12
10/01/2008	10/31/2008	26.29
09/01/2008	09/30/2008	4.21
08/01/2008	08/31/2008	3.17
07/01/2008	07/31/2008	91.59
06/01/2008	06/30/2008	93.39
05/01/2008	05/31/2008	83.96
Maintenance Garage Natural Gas Consumption (therms)		**4,191.57**
Maintenance Garage Natural Gas Consumption (kBtu (thousand Btu))		**419,157.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**419,157.00**
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
Maintenance Garage
1551 Highway 88 West
Brick Township, NJ 08724

Facility Owner
Brick Utilities
1551 Highway 88 West
Brick Township, NJ 08724

Primary Contact for this Facility
Jay Delaney
1551 Highway 88 West
Brick Township, NJ 08724

General Information

Maintenance Garage	
Gross Floor Area Excluding Parking: (ft^2)	6,633
Year Built	1990
For 12-month Evaluation Period Ending Date:	April 30, 2009

Facility Space Use Summary

Maintenance Garage	
Space Type	Other - Other
Gross Floor Area(ft^2)	6,633
Number of PCs[o]	2
Weekly operating hours[o]	50
Workers on Main Shift[o]	4

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 04/30/2009)	**Baseline** (Ending Date 04/30/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft^2)	63	63	0	N/A	104
Source (kBtu/ft^2)	66	66	0	N/A	213
Energy Cost					
$/year	$ 6,304.81	$ 6,304.81	N/A	N/A	$ 10,376.65
$/$ft^2$/year	$ 0.95	$ 0.95	N/A	N/A	$ 1.56
Greenhouse Gas Emissions					
$MtCO_2e$/year	22	22	0	N/A	36
$kgCO_2e/ft^2$/year	3	3	0	N/A	5

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

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

MAJOR EQUIPMENT LIST

Concord Engineering Group
Maintenance Building

Domestic Hot Water Heaters

EQUIPT TAG	LOCATION	AREA SERVED	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	ELECTRICAL DATA				HEATING DATA					SERVICE LIFE			REMARKS
						V/PH/HZ	FLA	MCA	MOP	FUEL	INPUT (MBH)	RECOVERY (GAL/H)	CAPACITY (GAL)	EFF. (%)	APPROX AGE	ASHRAE SERVICE LIFE	REMAINING LIFE	
-	Mezzanine in Garage	Maintenance Garage	A.O. Smith	FGR30224	MG930061876-224	115/1/60	-	-	15	Nat. Gas	40	42.6	30	-	16	12	(4)	

Unit Heaters (Gas-Fired)

EQUIPT TAG	LOCATION	AREA SERVED	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	ELECTRICAL DATA				HEATING DATA					SERVICE LIFE			REMARKS
						V/PH/HZ	FLA	MCA	MOP	TYPE	INPUT (MBH)	OUTPUT (MBH)	EFF. (%)	FUEL	APPROX AGE	ASHRAE SERVICE LIFE	REMAINING LIFE	
-	Machine Shop	Machine Shop	Modine	PAE50AG0130	05081011196-7904	115/1/60	1.3	-	-	Gas-Fired HTX	50	40.5	81	Natural Gas	19	13	(6)	
-	Office	Office	Reznor	UDAP100	-	115/1/60	3.9	-	-	Gas-Fired HTX	105	87.2	83	Natural Gas	1	13	12	
-	Mechanical Station	Mechanical Station	Modine	PAE50AG0130	05081011196-7899	115/1/60	1.3	-	-	Gas-Fired HTX	50	40.5	81	Natural Gas	19	13	(6)	
-	Welding Area	Welding Area	Modine	PAE50AG0130	05081011196-7900	115/1/60	1.3	-	-	Gas-Fired HTX	50	40.5	81	Natural Gas	19	13	(6)	
-	Vehicle Service Area	Vehicle Service Area	Reznor	UDAP100	BGD79Y2N 57229X	115/1/60	3.9	-	-	Gas-Fired HTX	105	87.2	83	Natural Gas	1	13	12	
-	Vehicle Service Area	Vehicle Service Area	Modine	PAH90SF	15012020591	115/1/60	3.9	-	-	Gas-Fired HTX	90	74.7	83	Natural Gas	19	13	(6)	
-	Vehicle Service Area	Vehicle Service Area	Modine	PAH90SF	15012020591	115/1/60	3.9	-	-	Gas-Fired HTX	90	74.7	83	Natural Gas	19	13	(6)	
-	Vehicle Service Area	Vehicle Service Area	Modine	PAH90SF	-	115/1/60	3.9	-	-	Gas-Fired HTX	90	74.7	83	Natural Gas	19	13	(6)	
-	Vehicle Service Area	Vehicle Service Area	Modine	PAH130SF	15012020191	115/1/60	3.6	-	-	Gas-Fired HTX	130	107.9	83	Natural Gas	19	13	(6)	

Heat Pumps

EQUIPT TAG	LOCATION	AREA SERVED	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	ELECTRICAL DATA				COOLING DATA			HEATING DATA				SERVICE LIFE			REMARKS
						V/PH/HZ	FLA	MCA	MOP	REFRIGERANT	CAPACITY (TONS)	EFF. (EER)	TYPE	INPUT (MBH)	OUTPUT (MBH)	EFF. (COP)	APPROX AGE	ASHRAE SERVICE LIFE	REMAINING LIFE	
-	Abv. Ceiling Outside Toilet Room	Office, Hallway, Toilet	Florida Heat Pump	SL030-4HZC	CB082413	460/3/60	6	5.9	15	R-22	2.5	12.1	Heat Pump	-	22	3.0	6	19	13	*Performance Information is Estimated; Elec Aux Coil

CEG Job #: 9C09064
Project: Brick Township M.U.A. "Maintenance Garage" **KWH COST:** $0.142
Address: 1551 Highway 88 West
Brick NJ 08724
Building SF: 6,633

Investment Grade Lighting Audit

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
	Wood Shop	2600	4	4	1x4 T8 32W, Electronic Ballast, Pendant Mounting, No Lens	109	0.44	1,133.6	$160.97	4	4	No Change Required (N.C.R.)	109	0.44	1133.6	$160.97	$0.00	$0.00	0.00	0	$0.00	0.00
	Machine Shop	2600	6	4	1x4 T8 32W, Electronic Ballast, Pendant Mounting, No Lens	109	0.65	1,700.4	$241.46	6	4	N.C.R.	109	0.65	1700.4	$241.46	$0.00	$0.00	0.00	0	$0.00	0.00
	Mechanics Station	2600	18	2	1x4 T8 32W, Electronic Ballast, Pendant Mounting, No Lens	58	1.04	2,714.4	$385.44	18	2	N.C.R.	58	1.04	2714.4	$385.44	$0.00	$0.00	0.00	0	$0.00	0.00
	Electrical	2600	1	4	1x4 T8 32W, Electronic Ballast, Surface Mounting, Prismatic Lens	109	0.11	283.4	$40.24	1	4	N.C.R.	109	0.11	283.4	$40.24	$0.00	$0.00	0.00	0	$0.00	0.00
	Janitor Closet	2600	1	2	1x4 T8 32W, Electronic Ballast, Surface Mounting, Prismatic Lens	58	0.06	150.8	$21.41	1	2	N.C.R.	58	0.06	150.8	$21.41	$0.00	$0.00	0.00	0	$0.00	0.00
	Vehicle Service Area	2600	52	3	1x4 T8 32W, Electronic Ballast, Pendant Mounting, No Lens	82	4.26	11,086.4	$1,574.27	52	3	N.C.R.	82	4.26	11086.4	$1,574.27	$0.00	$0.00	0.00	0	$0.00	0.00
		2600	2	2	1x4 T8 32W, Electronic Ballast, Pendant Mounting, No Lens	58	0.12	301.6	$42.83	2	2	N.C.R.	58	0.12	301.6	$42.83	$0.00	$0.00	0.00	0	$0.00	0.00
	T.W.	2600	5	2	8' Vapor Tight T12 96W, Magnetic Ballast, Surface Mounting, Prismatic Lens	223	1.12	2,899.0	$411.66	5	2	N.C.R.	223	1.12	2899	$411.66	$0.00	$0.00	0.00	0	$0.00	0.00
	Vestibule	2600	3	2	2x2 T8 17W, Electronic Ballast, Recessed Mounting, Prismatic Lens	34	0.10	265.2	$37.66	3	2	N.C.R.	34	0.10	265.2	$37.66	$0.00	$0.00	0.00	0	$0.00	0.00
	Mens Toilet	2600	1	2	4' Vanity T8 32W, Electronic Ballast, Surface Mounting, Prismatic Lens	58	0.06	150.8	$21.41	1	2	N.C.R.	58	0.06	150.8	$21.41	$0.00	$0.00	0.00	0	$0.00	0.00
	Womens Toilet	2600	1	2	4' Vanity T8 32W, Electronic Ballast, Surface Mounting, Prismatic Lens	58	0.06	150.8	$21.41	1	2	N.C.R.	58	0.06	150.8	$21.41	$0.00	$0.00	0.00	0	$0.00	0.00
	Office	2600	6	3	2x4 T8 32W, Electronic Ballast, Recessed Mounting, Prismatic Lens	82	0.49	1,279.2	$181.65	6	3	N.C.R.	82	0.49	1279.2	$181.65	$0.00	$0.00	0.00	0	$0.00	0.00
	Compressor Rm	2600	2	3	1x4 T8 32W, Electronic Ballast, Surface Mounting, No Lens	82	0.16	426.4	$60.55	2	3	N.C.R.	82	0.16	426.4	$60.55	$0.00	$0.00	0.00	0	$0.00	0.00
	Outside Lighting	2600	8	1	Metal Halide 100W, Surface Mounting, Wall Pack	125	1.00	2,600.0	$369.20	8	1	N.C.R.	125	1.00	2600	$369.20	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		110	36			9.67	25,142.0	$3,570.16	110	36			9.67	25142	$3,570.16		$0.00	0.00	0.0	$0.00	#DIV/0!

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 #: 9C09064
Project: Brick Township M.U.A. "Maintenance Garage" **KWH COST** $0.142
Address: 1551 Highway 88 West
Brick NJ 08724
Building SF: 6,633

ECM #1: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS											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	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
	Wood Shop	2600	4	4	1x4 T8 32W, Electronic Ballast, Pendant Mounting, No Lens	109	0.44	1,133.6	$160.97	4	4	Dual Technology Occupancy Sensor	109	0.44	10%	1020.24	$144.87	$160.00	$160.00	0.00	113.36	$16.10	9.94
	Machine Shop	2600	6	4	1x4 T8 32W, Electronic Ballast, Pendant Mounting, No Lens	109	0.65	1,700.4	$241.46	6	4	Dual Technology Occupancy Sensor	109	0.65	10%	1530.36	$217.31	$160.00	$160.00	0.00	170.04	$24.15	6.63
	Mechanics Station	2600	18	2	1x4 T8 32W, Electronic Ballast, Pendant Mounting, No Lens	58	1.04	2,714.4	$385.44	18	2	Dual Technology Occupancy Sensor	58	1.04	10%	2442.96	$346.90	$160.00	$160.00	0.00	271.44	$38.54	4.15
	Electrical	2600	1	4	1x4 T8 32W, Electronic Ballast, Surface Mounting, Prismatic Lens	109	0.11	283.4	$40.24	1	4	Dual Technology Occupancy Sensor	109	0.11	10%	255.06	$36.22	$160.00	$160.00	0.00	28.34	$4.02	39.76
	Janitor Closet	2600	1	2	1x4 T8 32W, Electronic Ballast, Surface Mounting, Prismatic Lens	58	0.06	150.8	$21.41	1	2	Dual Technology Occupancy Sensor	58	0.06	10%	135.72	$19.27	$160.00	$160.00	0.00	15.08	$2.14	74.72
	Vehicle Service Area	2600	52	3	1x4 T8 32W, Electronic Ballast, Pendant Mounting, No Lens	82	4.26	11,086.4	$1,574.27	52	3	Dual Technology Occupancy Sensor	82	4.26	10%	9977.76	$1,416.84	$160.00	$160.00	0.00	1108.64	$157.43	0.99
		2600	2	2	1x4 T8 32W, Electronic Ballast, Pendant Mounting, No Lens	58	0.12	301.6	$42.83	2	2		58	0.12	10%	271.44	$38.54		$0.00	0.00	30.16	$4.28	
	T.W.	2600	5	2	8' Vapor Tight T12 96W, Magnetic Ballast, Surface Mounting, Prismatic Lens	223	1.12	2,899.0	$411.66	5	2	Dual Technology Occupancy Sensor	223	1.12	10%	2609.1	$370.49	$160.00	$160.00	0.00	289.9	$41.17	3.89
	Vestibule	2600	3	2	2x2 T8 17W, Electronic Ballast, Recessed Mounting, Prismatic Lens	34	0.10	265.2	$37.66	3	2	Dual Technology Occupancy Sensor	34	0.10	10%	238.68	$33.89	$160.00	$160.00	0.00	26.52	$3.77	42.49
	Mens Toilet	2600	1	2	4' Vanity T8 32W, Electronic Ballast, Surface Mounting, Prismatic Lens	58	0.06	150.8	$21.41	1	2	Dual Technology Occupancy Sensor	58	0.06	10%	135.72	$19.27	$160.00	$160.00	0.00	15.08	$2.14	74.72
	Womens Toilet	2600	1	2	4' Vanity T8 32W, Electronic Ballast, Surface Mounting,	58	0.06	150.8	$21.41	1	2	Dual Technology Occupancy Sensor	58	0.06	10%	135.72	$19.27	$160.00	$160.00	0.00	15.08	$2.14	74.72
	Office	2600	6	3	2x4 T8 32W, Electronic Ballast, Recessed Mounting, Prismatic Lens	82	0.49	1,279.2	$181.65	6	3	Dual Technology Occupancy Sensor	82	0.49	10%	1151.28	$163.48	$160.00	$160.00	0.00	127.92	$18.16	8.81
	Compressor Rm	2600	2	3	1x4 T8 32W, Electronic Ballast, Surface Mounting, No Lens	82	0.16	426.4	$60.55	2	3	Dual Technology Occupancy Sensor	82	0.16	10%	383.76	$54.49	$160.00	$160.00	0.00	42.64	$6.05	26.42
	Outside Lighting	2600	8	1	Metal Halide 100W, Surface Mounting, Wall Pack	125	1.00	2,600.0	$369.20	8	1	Dual Technology Occupancy Sensor	125	1.00	10%	2340	$332.28	$160.00	$160.00	0.00	260	$36.92	4.33
	Totals		110	36			9.67	25,142.0	$3,570.16	110	36			9.67		22627.8	$3,213.15		$2,080.00	0.00	2514.2	$357.02	5.83

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

Project Name: LGEA Solar PV Project - Brick Township MUA Maintenance Garage
Location: Brick Township, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$128,340
Annual kWh Production	16,270
Annual Energy Cost Reduction	$2,310
Annual SREC Revenue	$5,695
First Cost Premium	**$128,340**
Simple Payback:	**16.03** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.142**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$128,340	0	0	0	$0	(128,340)	0
1	$0	16,270	$2,310	$0	$5,695	$8,005	($120,335)
2	$0	16,189	$2,380	$0	$5,666	$8,046	($112,289)
3	$0	16,108	$2,451	$0	$5,638	$8,089	($104,201)
4	$0	16,027	$2,525	$0	$5,610	$8,134	($96,067)
5	$0	15,947	$2,600	$164	$5,581	$8,018	($88,049)
6	$0	15,867	$2,678	$163	$5,554	$8,068	($79,981)
7	$0	15,788	$2,759	$163	$5,526	$8,122	($71,859)
8	$0	15,709	$2,841	$162	$5,498	$8,178	($63,681)
9	$0	15,630	$2,927	$161	$5,471	$8,236	($55,445)
10	$0	15,552	$3,014	$160	$5,443	$8,298	($47,147)
11	$0	15,475	$3,105	$159	$5,416	$8,362	($38,786)
12	$0	15,397	$3,198	$159	$5,389	$8,428	($30,357)
13	$0	15,320	$3,294	$158	$5,362	$8,498	($21,859)
14	$0	15,244	$3,393	$157	$5,335	$8,571	($13,288)
15	$0	15,167	$3,495	$156	$5,309	$8,647	($4,641)
16	$0	15,092	$3,599	$155	$5,282	$8,726	$4,085
17	$0	15,016	$3,707	$155	$5,256	$8,808	$12,894
18	$0	14,941	$3,819	$154	$5,229	$8,894	$21,788
19	$0	14,866	$3,933	$153	$5,203	$8,983	$30,771
20	$0	14,792	$4,051	$152	$5,177	$9,076	$39,847
21	$1	14,718	$4,173	$152	$5,151	$9,172	$49,019
22	$2	14,644	$4,298	$151	$5,126	$9,273	$58,292
23	$3	14,571	$4,427	$150	$5,100	$9,377	$67,669
24	$4	14,498	$4,560	$149	$5,074	$9,485	$77,154
25	$5	14,426	$4,696	$149	$5,049	$9,597	$86,750
	Totals:	383,255	$84,233	$3,282	$134,139	$215,090	$215,090
				Net Present Value (NPV)		**$86,775**	
				Internal Rate of Return (IRR)		**4.3%**	

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
Maintenance Garage	1000	Sunpower SPR230	62	14.7	912	14.26	16,270	2,046	15.64

.= Proposed PV Layout

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

AC Energy & Cost Savings

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:	14.3 kW
DC to AC Derate Factor:	0.810
AC Rating:	11.6 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	210.0°
Energy Specifications	
Cost of Electricity:	0.1 ¢/kWh

Results			
Month	Solar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	2.35	832	1.18
2	3.11	1016	1.44
3	4.01	1428	2.03
4	4.80	1598	2.27
5	5.67	1905	2.71
6	5.91	1861	2.64
7	5.76	1852	2.63
8	5.35	1704	2.42
9	4.60	1462	2.08
10	3.54	1189	1.69
11	2.28	749	1.06
12	1.96	674	0.96
Year	4.12	16270	23.10

Output Hourly Performance Data * Output Results as Text

About the Hourly Performance Data Saving Text from a Browser

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

Please send questions and comments regarding PVWATTS to Webmaster

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