ENERGY AUDIT – FINAL REPORT

BRICK TOWNSHIP M.U.A.
BASE 1 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.
Base 1
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.)	$31,919
Natural Gas	$ 0
Total	$ 31,919

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	$332	$90	3.7	305.2%
ECM #2	Lighting Controls	$1,120	$68	16.4	-8.5%
ECM #3	High-Efficiency Split System Heat Pump	$23,910	$2,827	8.5	136.5%
ECM #4	Thru-the-Wall A/C Unit Replacement	$2,526	$280	9.0	10.8%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	4.37 KW PV Solar System	$39,330	$2,516	15.6	59.9%

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	0.3	532.5	-
ECM #2	Lighting Controls	0.0	480.9	-
ECM #3	High-Efficiency Split System Heat Pump	6.6	19,911.0	-
ECM #4	Thru-the-Wall A/C Unit Replacement	1.1	1,972.0	-
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	4.37 KW PV Solar System	4.4	5,114.0	-

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 Upgrade
- **ECM #3:** High Efficiency Split System Heat Pump
- **ECM #4:** Thru-the-Wall A/C Unit Replacement

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 1,850 square foot Base 1 Building, which includes the following spaces: computer 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, 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.

There is no gas service at this building

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	N/A

Table 3
Electricity Billing Data

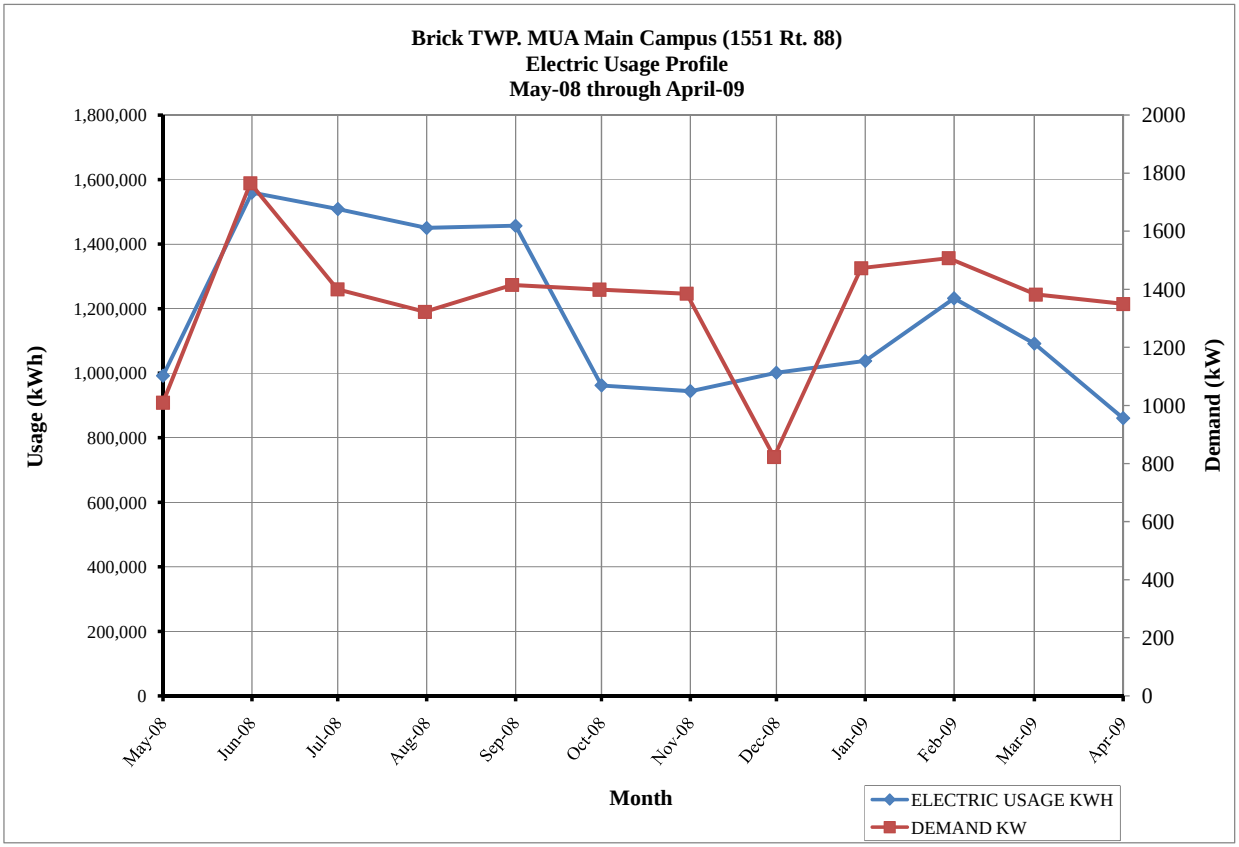
ELECTRIC USAGE SUMMARY

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
Electricity 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	0.277
Ops / Warehouse	10,802	0.186
Maintenance Garage	3,362	0.058
Generator Bldg	4,438	0.076
Base 1	1,850	0.032
Raw Water Pump Station	2,490	0.043
Pre-Treatment	4,080	0.070
Control	12,582	0.216
Finished Water Pump Station	2,424	0.042
Campus Total	**58,156**	**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**
Base 1	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 Base 1 Building was constructed in 1971. It has vinyl sided exterior walls with painted gypsum wallboard on the interior. The building is a three story structure, which includes the basement, first and second floors. The overall floor area is 1,850 square feet. The building has a barn style pitched roof with dark shaded shingles. The windows are vinyl and appear to be in good condition.

Currently the facility is minimally occupied and houses IT servers in the first floor area. Based on information provided by the owner, there are two (2) employees for approximately forty (40) hours per week occupying the facility.

Heating System

The heating system is divided into four (4) separate areas which include the basement, first floor data area and lavatory, first floor backrooms, and second floor. The basement and second floor each have one (1) QMark Electric Unit Heater. Both heaters have a capacity of 17 MBH with a 1/100 horsepower motor. The first floor data area and lavatory has an electric baseboard heater. The first floor backrooms have one (1) Qmark Electric Unit Heater and one (1) Singer Electric Unit Heater. Both unit heaters have a capacity of 17 MBH.

Cooling System

The cooling system is divided into the same four (4) areas as the heating system. Each area is cooled using a standard R-22 refrigerant, through-wall air conditioning unit. Nameplate data for the majority of the units was not available on the equipment. The basement has a vintage Goldstar air-conditioning unit with an estimated 12 MBH capacity. The first floor data area has a Frigidaire air-conditioning unit with an estimated 24 MBH capacity that was installed within the last year or so. The first floor backroom is air-conditioned by a Frigidaire air-conditioning unit with an estimated 12 MBH capacity that was also installed recently. The second floor has a vintage air-conditioning unit with an estimated 24 MBH capacity.

Domestic Hot Water

The domestic hot water for the building is provided by an electric US Craftmaster Water Heater. It is located in the basement storage room and has a 3.5 kW input and 28 gallon storage capacity. The hot water heater is approximately four (4) years old and has an estimated eight (8) years remaining useful life.

Controls System

The unit heaters are controlled by Honeywell Dial-Type Thermostats. The air conditioning units are controlled individually using unit-mounted controls.

Lighting

The first floor lighting fixtures are surface-mounted at the ceiling and contain two (2) T8 lamps per fixture. The lavatory has a 60 W incandescent lamp. The second floor lighting fixtures are recessed and contain two (2) T8 lamps per fixture. The basement lighting is comprised of CFL high hats and recessed and surface mounted fixtures with T12 lamps. Standard switching is utilized throughout.

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: General

The lighting in the Base 1 building is primarily made up of fluorescent fixtures with T-12 lamps and magnetic ballasts, T-8 lamps with electronic ballasts. There are a few storage rooms, original boiler room and closets with incandescent lighting and compact fluorescent fixtures.

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

This ECM also includes replacement of all incandescent lamps to compact fluorescent lamps. The energy usage of an incandescent compared to a compact fluorescent 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.

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix – ECM#1** 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) = $25 per fixture; T-5 or T-8 (3-4 lamp) = $30 per fixture.

$$\text{Smart Start®}\ Incentive = (\#\ of\ 1-2\ lamp\ \ fixtures \times\ \$\,25) + (\#\ of\ 3-4\ lamp\ \ fixtures \times\ \$\,30)$$
$$\text{Smart Start®}\ Incentive = (3 \times\ \$\,25) = \underline{\$}75$$

Replacement and Maintenance Savings are calculated as follows:

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

$$Savings = (2\ lamps\ \ per\ \ year) \times (\$2.00 + \$5.00) = \$14$$

From the Smart Start Incentive appendix, there is no incentive for replacing incandescent lamps with compact fluorescent lamps. The incentive is only available if the entire light fixture is replaced. In most cases, the existing fixtures can be re-lamped by the facility's staff to obtain the energy savings without the expense of a new fixture and the involvement of an electrician to install a new fixture.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$407
NJ Smart Start Equipment Incentive ($):	$75
Net Installation Cost ($):	$332
Maintenance Savings ($/Yr):	$14
Energy Savings ($/Yr):	$76
Total Yearly Savings ($/Yr):	$90
Estimated ECM Lifetime (Yr):	15
Simple Payback	3.7
Simple Lifetime ROI	305.2%
Simple Lifetime Maintenance Savings	$210
Simple Lifetime Savings	$1,344
Internal Rate of Return (IRR)	26%
Net Present Value (NPV)	$738.01

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

ECM #2: 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 classrooms, private offices, conference rooms, restrooms, lunch rooms, lounges, file rooms, etc.

Energy Savings Calculations:

The **Investment Grade Lighting Audit ECM#2- Lighting Controls Appendix** outlines the proposed retrofits, costs, savings, and payback periods. The hallways of the building is a 24/7 facility while the majority of the building is only occupied 40 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 480.9 kWh/year and $68/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 7. Total cost to install sensors is $140/ceiling unit x 7 units = $980.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,120
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$1,120
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$68
Total Yearly Savings ($/Yr):	$68
Estimated ECM Lifetime (Yr):	15
Simple Payback	16.4
Simple Lifetime ROI	-8.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$1,024
Internal Rate of Return (IRR)	-1%
Net Present Value (NPV)	($304.76)

ECM #3: High-Efficiency Split System Heat Pump

Description:

General heating and cooling for the Base 1 building is provided by window air conditioning units and electric resistance unit heaters. The HVAC units serving this space are past their useful life. This equipment is antiquated and is in need of replacement. It is estimated that the existing air-cooled condensing unit is operating at an efficiency of 7.0 EER (8.0 SEER) and a heating efficiency COP of 1.0.

Due to the lack of a natural gas service at the Base 1 building, CEG recommends utilizing heat pump technology for heating and cooling the building. This energy conservation measure would replace the HVAC system with a split system air-to-air heat pump. The new units will provide heating and cooling capacities typical to that of the existing equipment. The NJ State Energy Code (ASHRAE 90.1-2004) mandates a minimum energy efficiency of 12.0 SEER for units of this type and this baseline will be utilized in selecting the new equipment. The new air-to-air heat pump shall be a Carrier M/N25HPA548 air-cooled, heat pump condensing unit with matching Carrier 58-Series air-handling unit or equivalent. The unit will be provided with low-ambient controls to -20ºF operation in heating mode and an automatic change-over, programmable thermostat. The unit will provide approximately 48 MBH cooling capacity at an efficiency of 12 EER (14.5 SEER) during cooling mode and approximately 68.3 MBH at a 2.6 COP heating efficiency.

Energy Savings Calculations:

Given Information

Building Square Footage:	±1,850 SF
Estimated Cooling Load:	Nominal 4 Tons, 48 MBH
Full-Load Cooling Hours:	1,800 hours per year (June through September)
Estimated Heating Load:	68.3 MBH (20 kW)
Full-Load Heating Hours:	1,200 hours per year (November through March)
Total Full-Load Hours:	3,000 hours per year
Cost of Electricity:	$0.142 / kWh

Existing Equipment

Cooling Efficiency:	7.0 SEER (Estimate based on age.)
Heating Efficiency:	1.0 COP (Electric Heat)

New Equipment

Cooling Efficiency:	12.0 EER
Heating Efficiency:	2.6 COP

Cooling Energy Savings Calculations

$$EnergySavings = \frac{[CoolingTons \times 12{,}000\ Btu/ton]}{[1000\ W/kW]} \times \left(\frac{1}{EER_{OLD}} - \frac{1}{EER_{NEW}} \right) \times Hrs.ofCooling$$

$$EnergySavings = \frac{[4Tons \times 12{,}000\ Btu/ton]}{[1000\ W/kW]} \times \left(\frac{1}{7} - \frac{1}{12} \right) \times 1800 = \underline{5{,}142\ kWh\ per\ year}$$

Heating Energy Savings Calculations

$$Base\ Heating\ Use = Heating\ Load \times Heating\ Hours = 20kW \times 1{,}200 = \underline{24{,}000\ kWh\ per\ year}$$

$$EnergySavings = Base\ Heating\ Use \times \left(\frac{1}{COP_{OLD}} - \frac{1}{COP_{NEW}} \right) = \underline{14{,}769\ kWh\ per\ year}$$

Total Energy Savings = Cooling Energy Savings + Heating Energy Savings
= 5,142 + 14,769 kWh = 19,911 kWh per year

Energy Cost Savings = 19,911 kWh x $0.142 / kWh = $2,827 per year

Estimated Demand Savings = kWh Saved / Hrs at Load = 19,911 kWh / 3,000 hrs = 6.6 kW

NJ Smart Start® Program Incentives are calculated as follows:

From the **New Jersey Smart Start® Program Incentives Appendix**, the replacement of an air-to-air heat pump system totaling less than 5.4 cooling tons with efficiency greater than 14 SEER, warrants an incentive of $92 per cooling ton.

Smart Start® Equipment Incentive = (4 Tons x $92 per ton) = $368

Maintenance savings could not be calculated due to the fact that there is not adequate data to baseline the existing expenditures.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$24,278
NJ Smart Start Equipment Incentive ($):	$368
Net Installation Cost ($):	$23,910
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,827
Total Yearly Savings ($/Yr):	$2,827
Estimated ECM Lifetime (Yr):	20
Simple Payback	8.5
Simple Lifetime ROI	136.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$56,540
Internal Rate of Return (IRR)	10%
Net Present Value (NPV)	$18,148.62

ECM #4: Thru-the-Wall A/C Unit Replacement

Description:

Air-conditioning is provided to the basement office and 2nd floor office via residential-style window air-conditioning units. The existing window air-conditioning units are inefficient with an estimated seasonal energy efficiency ratio (SEER) of 8.0. The NJ State Energy Code (ASHRAE 90.1-2004) mandates a minimum energy efficiency of 10.6 SEER for units of this type. The existing window air-conditioning units appears to be approximately 15-plus years of age and is past their service life as outlined in Chapter 36 of the 2007 ASHRAE Applications Handbook. The estimated service life for a window air-conditioning unit is 10 years.

This energy conservation measure would replace the window-air conditioning units serving the basement office and 2nd floor office. The existing units will be replaced with high energy efficient, window air-conditioning units with cooling capacities typical of the existing units; approximately 12,000 Btu/h for the basement and 24,000 Btu/h for the 2nd floor. The average EER of the new equipment will be upwards of 9.4 EER (11.5 SEER est.). Basis of Design: Friedrich Model WS13 or equivalent.

Energy Savings Calculations:

$$EnergySavings = \frac{[CoolingTons \times 12{,}000\,Btu/ton]}{[1000W/kW]} \times \left(\frac{1}{SEER_{OLD}} - \frac{1}{SEER_{NEW}} \right) \times Avg.LoadFactor \times Hrs.ofCooling$$

Existing Air Conditioning Units

Rated Capacity = 3 Cooling Tons (Sum of both units.)

Condenser Unit Efficiency = 8.0 SEER

Cooling Season Hrs. of Operation = 1,800 hrs/yr.

Average Cost of Electricity = $0.142 / kWh

Proposed High-Efficiency Air Conditioning Units

Rated Capacity = 3 Cooling Tons

New Condenser Unit Efficiency = 9.4 EER = 11.5 SEER

$$EnergySavings = \frac{[3\,tons \times 12{,}000\,Btu/ton]}{[1000W/kW]} \times \left(\frac{1}{8.0} - \frac{1}{11.5} \right) \times 0.80 \times 1800\,hrs = 1{,}972\,kWh/yr$$

Energy Cost Savings = 1,972 kWh * $0.142 / kWh = $280 per year

Estimated Demand Savings = kWh Saved / Hrs of Operation = 1,972 kWh / 1,800 hrs = 1.1 kW

There are currently no applicable equipment incentives for equipment of this capacity. Furthermore, maintenance savings could not be calculated due to the fact that there is no adequate data to baseline the existing expenditures.

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$2,526
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$2,526
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$280
Total Yearly Savings ($/Yr):	$280
Estimated ECM Lifetime (Yr):	10
Simple Payback	9.0
Simple Lifetime ROI	10.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$2,800
Internal Rate of Return (IRR)	2%
Net Present Value (NPV)	($137.54)

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 300 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 4.37 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 5,114 KWh annually, reducing the overall utility bill by approximately 0.1% 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	15.6 Years	6.4%	3.99%

*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 1971 and houses IT servers in the first floor area. There are two (2) employees for approximately forty (40) hours per week occupying this facility.

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 cooling system is divided into the same four (4) areas as the heating system. Each area is cooled using a standard R-22 refrigerant, through-wall air conditioning unit. 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:

There is no natural gas service at this location.

Tariff Analysis:

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:

There is no natural gas service at this location.

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.

E. Confirm that outside air economizers on the rooftop units are functioning properly to take advantage of free cooling and avoid excess outside air during occupied periods.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Base 1 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 #1	Lighting Upgrade - General	$407	$0	$75	$332	$76	$14	$90	15	$1,344	$210	305.2%	3.7	26.19%	$738.01
ECM #2	Lighting Controls	$1,120	$0	$0	$1,120	$68	$0	$68	15	$1,024	$0	-8.5%	16.4	-1.10%	($304.76)
ECM #3	High-Efficiency Split System Heat Pump	$9,278	$15,000	$368	$23,910	$2,827	$0	$2,827	20	$56,540	$0	136.5%	8.5	10.10%	$18,148.62
ECM #4	Thru-the-Wall A/C Unit Replacement	$2,026	$500	$0	$2,526	$280	$0	$280	10	$2,800	$0	10.8%	9.0	1.92%	($137.54)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	4.37 KW PV Solar System	$39,330	$0	$0	$39,330	$726	$1,790	$2,516	25	$62,900	$44,750	59.9%	15.6	3.99%	$4,481.48

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.

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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

STATEMENT OF ENERGY PERFORMANCE
Base 1

Building ID: 1949759
For 12-month Period Ending: April 30, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: December 08, 2009

Facility
Base 1
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: 1971
Gross Floor Area (ft²): 1,850

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

Site Energy Use Summary[3]

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

Energy Intensity[5]

Site (kBtu/ft²/yr)	
Source (kBtu/ft²/yr)	N/A

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	N/A

Electric Distribution Utility
FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	77
National Average Source EUI	182
% Difference from National Average Source EUI	
Building Type	Office

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	Base 1	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Office	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		☐
Base 1 (Office)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	1,850 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Weekly operating hours	40 Hours	Is this the total number of hours per week that the Office space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	2	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100. The normal worker density ranges between 0.3 and 10 workers per 1000 square feet (92.8 square meters)		☐
Number of PCs	2	Is this the number of personal computers in the Office?		☐
Percent Cooled	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐

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: gas - none (kBtu (thousand Btu)) **Space(s):** Base 1		
Start Date	**End Date**	**Energy Use (kBtu (thousand Btu))**
04/01/2009	04/30/2009	0.00
03/01/2009	03/31/2009	0.00
02/01/2009	02/28/2009	0.00
01/01/2009	01/31/2009	0.00
12/01/2008	12/31/2008	0.00
11/01/2008	11/30/2008	0.00
10/01/2008	10/31/2008	0.00
09/01/2008	09/30/2008	0.00
08/01/2008	08/31/2008	0.00
07/01/2008	07/31/2008	0.00
06/01/2008	06/30/2008	0.00
05/01/2008	05/31/2008	0.00
gas - none Consumption (kBtu (thousand Btu))		**0.00**
gas - none Consumption (kBtu (thousand Btu))		**0.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**0.00**
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
Base 1
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

Base 1	
Gross Floor Area Excluding Parking: (ft^2)	1,850
Year Built	1971
For 12-month Evaluation Period Ending Date:	April 30, 2009

Facility Space Use Summary

Base 1	
Space Type	Office
Gross Floor Area(ft^2)	1,850
Weekly operating hours	40
Workers on Main Shift	2
Number of PCs	2
Percent Cooled	50% or more
Percent Heated	50% or more

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)	N/A	N/A	11	N/A	77
Source (kBtu/ft^2)	N/A	N/A	N/A	N/A	182
Energy Cost					
$/year	N/A	N/A	N/A	N/A	N/A
$/$ft^2$/year	N/A	N/A	N/A	N/A	N/A
Greenhouse Gas Emissions					
$MtCO_2e$/year	N/A	N/A	N/A	N/A	N/A
$kgCO_2e/ft^2$/year	N/A	N/A	N/A	N/A	N/A

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

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Base 1 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 (KW)	RECOVERY (GAL/H)	CAPACITY (GAL)	EFF. (%)	APPROX AGE	ASHRAE SERVICE LIFE	REMAINING LIFE	
-	Basement Storage Area	Entire Building	US Craftmaster Water Heater	E2F30CD035V	0547105401	240/1/60	-	14.6	20	Electric	3.5	20.7	28	0.9 EF	4	12	8	

Unit Heaters (Electric)

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	
-	1st Flr Back Rooms	1st Flr Back Rooms	Qmark Electric	MUH0541	-	480/3/60	-	6	15	Electric Resistance	-	17 (5kW)	-	Electric	7	13	6	
-	1st Flr Back Rooms	1st Flr Back Rooms	Singer	UHS-5	-	480/3/60	-	-	15	Electric Resistance	-	17 (5kW)	-	Electric	38	13	(25)	*Age Approximated
-	2nd Floor	2nd Floor	Qmark Electric	MUH0541	-	480/3/60	-	6	15	Electric Resistance	-	17 (5kW)	-	Electric	7	13	6	
-	Basement Storage Area	Basement Storage Area	Qmark Electric	MUH0541	-	480/3/60	-	6	15	Electric Resistance	-	17 (5kW)	-	Electric	7	13	6	

Split Systems & AC Condensors

EQUIPT TAG	LOCATION	AREA SERVED	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	ELECTRICAL DATA				COOLING DATA			SERVICE LIFE			REMARKS
						V/PH/HZ	FLA	MCA	MOP	REFRIGERANT	CAPACITY (TONS)	EFF. (EER)	APPROX AGE	ASHRAE SERVICE LIFE	REMAINING LIFE	
-	Basement Office	Basement Office	Goldstar	-	-	-	-	-	-	R-22	1.0	-	15	10	(5)	Vintage, No Nameplate
-	1st Flr Back Rm	1st Flr Back Rm	Frigidaire	FAC127SIA	-	115/1/60	-	11.4	15	R-22	1.0	10.8	1	10	9	Recently Purchased
-	1st Flr Data Area	1st Flr Data Area	Frigidaire	-	-	115/1/60	-	-	-	R-22	2.0	9.7	1	10	9	Recently Purchased; Nameplate Covered
-	2nd Flr Office	2nd Flr Office	-	-	-	-	-	-	-	R-22	2.0	-	20	10	(10)	Vintage, No Nameplate

CEG Job #: 9C09064
Project: Brick Township M.U.A.
Address: 1551 Highway 88 West
Brick NJ 08724
Building SF: 1,850

"Base 1 Building"

KWH COST: $0.142

ECM #1: Lighting Upgrade - General

EXISTING LIGHTINC										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
	Server Rm	2080	4	2	1x4 T8 32W, Electronic Ballast, Surface Mounting, Prismatic Lens	58	0.23	482.6	$68.52	4	2	No Change Required (N.C.R.)	58	0.23	482.56	$68.52	$0.00	$0.00	0.00	0	$0.00	0.00
	Rest Rm	2080	1	2	60W Round Inc, Surface Mounting	120	0.12	249.6	$35.44	1	2	13W CFL Bulb Replacement	26	0.03	54.08	$7.68	$6.75	$6.75	0.09	195.52	$27.76	0.24
	Test Rm	2080	5	2	4 T8 Vapor 32W, Electronic Ballast, Surface Mounting, Prismatic Lens	109	0.55	1,133.6	$160.97	5	2	N.C.R.	109	0.55	1133.6	$160.97	$0.00	$0.00	0.00	0	$0.00	0.00
	Second Flr	2080	6	4	2x4 T8 32W, Electronic Ballast, Recessed Mounting, Prismatic Lens	109	0.65	1,360.3	$193.17	6	4	N.C.R.	109	0.65	1360.32	$193.17	$0.00	$0.00	0.00	0	$0.00	0.00
	Office	2080	4	1	13W CFL High Hat, Recessed Mounting	13	0.05	108.2	$15.36	4	1	N.C.R.	13	0.05	108.16	$15.36	$0.00	$0.00	0.00	0	$0.00	0.00
	Utility	2080	2	2	T12 34W Magnetic Ballast, Surface Mounting, No Lens	80	0.16	332.8	$47.26	2	2	T8 32W Electronic Ballast, Surface Mounting, No Lens Metalux or equivalent	55	0.11	228.8	$32.49	$100.00	$200.00	0.05	104	$14.77	13.54
		2080	1	2	T12 96W Magnetic Ballast, Surface Mounting, No Lens	222	0.22	461.8	$65.57	2	2	T8 32W Electronic Ballast, Surface Mounting, No Lens Metalux or equivalent	55	0.11	228.8	$32.49	$100.00	$200.00	0.11	232.96	$33.08	6.05
	Office	2080	3	4	2x4 T8 32W, Electronic Ballast, Recessed Mounting, Prismatic Lens	109	0.33	680.2	$96.58	3	4	N.C.R.	109	0.33	680.16	$96.58	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		26	19			2.31	4,809.0	$682.87	27	19			2.056	4276.48	$607.26		$406.75	0.26	532.5	$75.61	5.38

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.
Address: 1551 Highway 88 West
Brick NJ 08724
Building SF: 1,850

"Base 1 Building"

KWH COST $0.142

ECM #2: Lighting Controls

EXISTING LIGHTINC										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
	Server Rm	2080	4	2	1x4 T8 32W, Electronic Ballast, Surface Mounting, Prismatic Lens	58	0.23	482.6	$68.52	4	2	Dual Technology Occupancy Sensor	58	0.23	10%	434.304	$61.67	$160.00	$160.00	0.00	48.256	$6.85	23.35
	Rest Rm	2080	1	2	60W Round Inc, Surface Mounting	120	0.12	249.6	$35.44	1	2	Dual Technology Occupancy Sensor	120	0.12	10%	224.64	$31.90	$160.00	$160.00	0.00	24.96	$3.54	45.14
	Test Rm	2080	5	2	4 T8 Vapor 32W, Electronic Ballast, Surface Mounting, Prismatic Lens	109	0.55	1,133.6	$160.97	5	2	Dual Technology Occupancy Sensor	109	0.55	10%	1020.24	$144.87	$160.00	$160.00	0.00	113.36	$16.10	9.94
	Second Flr	2080	6	4	2x4 T8 32W, Electronic Ballast, Recessed Mounting, Prismatic Lens	109	0.65	1,360.3	$193.17	6	4	Dual Technology Occupancy Sensor	109	0.65	10%	1224.288	$173.85	$160.00	$160.00	0.00	136.032	$19.32	8.28
	Office	2080	4	1	13W CFL High Hat, Recessed Mounting	13	0.05	108.2	$15.36	4	1	Dual Technology Occupancy Sensor	13	0.05	10%	97.344	$13.82	$160.00	$160.00	0.00	10.816	$1.54	104.18
	Utility	2080	2	2	T12 34W Magnetic Ballast, Surface Mounting, No Lens	80	0.16	332.8	$47.26	2	2	Dual Technology Occupancy Sensor	80	0.16	10%	299.52	$42.53	$160.00	$160.00	0.00	33.28	$4.73	14.18
		2080	1	2	T12 96W Magnetic Ballast, Surface Mounting, No Lens	222	0.22	461.8	$65.57	1	2		222	0.22	10%	415.584	$59.01		$0.00	0.00	46.176	$6.56	
	Office	2080	3	4	2x4 T8 32W, Electronic Ballast, Recessed Mounting, Prismatic Lens	109	0.33	680.2	$96.58	3	4	Dual Technology Occupancy Sensor	109	0.33	10%	612.144	$86.92	$160.00	$160.00	0.00	68.016	$9.66	16.57
	Totals		26	19			2.31	4,809.0	$682.87	26	19			2.312		4328.064	$614.59		$1,120.00	0.00	480.9	$68.29	16.40

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

Appendix F
Page 1 of 3

Project Name: LGEA Solar PV Project - Brick Township MUA Base 1
Location: Brick Township, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$39,330
Annual kWh Production	5,114
Annual Energy Cost Reduction	$726
Annual SREC Revenue	$1,790
First Cost Premium	**$39,330**
Simple Payback:	**15.63** **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	$39,330	0	0	0	$0	(39,330)	0
1	$0	5,114	$726	$0	$1,790	$2,516	($36,814)
2	$0	5,088	$748	$0	$1,781	$2,529	($34,285)
3	$0	5,063	$770	$0	$1,772	$2,542	($31,743)
4	$0	5,038	$794	$0	$1,763	$2,557	($29,186)
5	$0	5,012	$817	$52	$1,754	$2,520	($26,666)
6	$0	4,987	$842	$51	$1,746	$2,536	($24,130)
7	$0	4,962	$867	$51	$1,737	$2,553	($21,577)
8	$0	4,938	$893	$51	$1,728	$2,570	($19,006)
9	$0	4,913	$920	$51	$1,720	$2,589	($16,418)
10	$0	4,888	$948	$50	$1,711	$2,608	($13,809)
11	$0	4,864	$976	$50	$1,702	$2,628	($11,181)
12	$0	4,840	$1,005	$50	$1,694	$2,649	($8,532)
13	$0	4,815	$1,035	$50	$1,685	$2,671	($5,861)
14	$0	4,791	$1,066	$49	$1,677	$2,694	($3,167)
15	$0	4,767	$1,098	$49	$1,669	$2,718	($449)
16	$0	4,744	$1,131	$49	$1,660	$2,743	$2,294
17	$0	4,720	$1,165	$49	$1,652	$2,769	$5,063
18	$0	4,696	$1,200	$48	$1,644	$2,796	$7,858
19	$0	4,673	$1,236	$48	$1,635	$2,824	$10,682
20	$0	4,649	$1,273	$48	$1,627	$2,853	$13,535
21	$1	4,626	$1,312	$48	$1,619	$2,883	$16,418
22	$2	4,603	$1,351	$47	$1,611	$2,915	$19,332
23	$3	4,580	$1,391	$47	$1,603	$2,947	$22,280
24	$4	4,557	$1,433	$47	$1,595	$2,981	$25,261
25	$5	4,534	$1,476	$47	$1,587	$3,017	$28,277
	Totals:	120,465	$26,476	$1,032	$42,163	$67,607	$67,607
				Net Present Value (NPV)		**$28,302**	
				Internal Rate of Return (IRR)		**4.5%**	

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
Brick Twp. MUA Base 1	300	Sunpower SPR230	19	14.7	279	4.37	5,114	627	15.64

.= Proposed PV Layout

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

PVWatts * * * **AC Energy & Cost Savings**

Cautions for Interpreting the Results

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	4.4 kW
DC to AC Derate Factor:	0.810
AC Rating:	3.5 kW
Array Type:	Fixed Tilt
Array Tilt:	20.0°
Array Azimuth:	220.0°
Energy Specifications	
Cost of Electricity:	0.1 ¢/kWh

Results			
Month	Solar Radiation (kWh/m^2/day)	AC Energy (kWh)	Energy Value ($)
1	2.60	290	0.41
2	3.32	335	0.48
3	4.16	453	0.64
4	4.83	493	0.70
5	5.63	575	0.82
6	5.80	556	0.79
7	5.71	559	0.79
8	5.35	522	0.74
9	4.73	460	0.65
10	3.76	387	0.55
11	2.45	250	0.35
12	2.17	233	0.33
Year	4.21	5114	7.26

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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