



Logan Township School District
A TERRIFIC PLACE TO LEARN

ENERGY AUDIT – FINAL REPORT

**LOGAN TOWNSHIP BOARD
OF EDUCATION
CENTER SQUARE SCHOOL
100 PEACHWOOD DRIVE
LOGAN, NJ 08085
ATTN: FREDERICK A. BERG**

CEG PROJECT No. 9C09103

CONCORD ENGINEERING GROUP



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I. EXECUTIVE SUMMARY

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

Logan Township Board of Education
Center Square School
100 Peachwood Drive
Logan, NJ 08085

School District Contact Person: Frederick A. Berg
Facility Contact Person: John Mangino

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	\$ 89,080
Natural Gas	\$ 37,135
Total	\$ 126,215

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 $\pm 20\%$. 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	\$3,780	\$4,541	0.8	1702.0%
ECM #2	Variable Speed Chilled Water Pump Control	\$7,600	\$451	16.9	18.7%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	DESCRIPTION	NET INSTALLATION COST	ANNUAL SAVINGS	SIMPLE PAYBACK (Yrs)	SIMPLE LIFETIME ROI
REM #1	43.70 KW PV System	\$393,300	\$27,844	14.1	77.0%

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	0.0	30478.0	0.0
ECM #2	Variable Speed Chilled Water Pump Control	1.7	3026.8	0.0
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	43.70 KW PV System	43.7	55799.0	0.0

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**

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.

Renewable Energy Measures (REMs) were also reviewed for implementation at the Logan Township – Center Square School. CEG utilized a roof-mounted strategy for the solar array as there was enough room on the roof structure to house the PV system. The recommended 43.7 kW PV system will produce approximately 55,799 kWh of electricity annually and will reduce the facility electrical consumption from the grid by 9.33%. The system's calculated simple payback of 14.1 years is past the standard 10 year simple payback threshold; however, with alternative funding this payback could be lessened. CEG recommends the Owner review all funding options before deciding to not implement this renewable energy measure.

Overall, after reviewing the utility information, existing documentation and conditions minimal energy savings opportunities are available at the Logan Township – Center Square School. With the building being constructed in 2001, all equipment, lighting and controls were specified in order to meet the state energy requirements at that time which are still considered efficient by current standard. As a result of this situation, equipment replacements are non-existent as none of the existing equipment has come close to exceeding its ASHRAE recommended service life as outlined in the 2007 ASHRAE Applications Handbook. CEG recommends the Owner review the implementation of the recommended ECM above as CEG has estimated the lighting consumption for the facility to be approximately 50% of the total electric consumption.

Additionally the owner has consulted CEG about a problem the Center Square School has been having with dehumidification and that during the cooling months, the boiler has been running at full capacity. CEG has recognized the problem to be a system integration mistake. When the school was originally built, the blower coil units serving the classrooms did not have a

dehumidification setup. Within the past few years, Center Square has installed humidity sensors in each classroom to monitor their humidity problem. CEG believes that a controls contractor was consulted and the only way to run a dehumidification system was to run both heating and cooling year round. This problem has two possible solutions; install energy recovery units which connect to each blower coil unit to reduce the load, or install a duct mounted heating coil in the duct after the unit and linking the unit to the building management system to be able to moderate which coils are on at certain times in each season. This is to prevent freezing of the cooling coil during the winter season. Any scenarios the owner wishes to review in regards to the dehumidification should be handled with an engineering feasibility study outside of the energy audit. Specific engineering calculations and analysis need to be conducted which are outside the scope of the energy audit.

Additionally, review of the renewable energy measure recommendation should be completed as well as continuing current maintenance practices and following CEG's recommended maintenance and operation measure references noted above.

II. INTRODUCTION

The comprehensive energy audit covers the 39,900 square foot Logan Center Square School, which includes the following spaces: Classrooms, library, multi-purpose room, mechanical room, kitchen, and offices.

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/ft²/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:

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

$$\text{Simple Lifetime Savings} = (\text{Yearly Savings} \times \text{ECM Lifetime})$$

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

$$\text{Lifetime Maintenance Savings} = (\text{Yearly Maintenance Savings} \times \text{ECM Lifetime})$$

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

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

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. Atlantic City Electric provides electricity to the facility under their Annual General Service (AGS) rate structure. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile shows the actual natural gas energy usage for the facility. South Jersey Gas provides natural gas to the facility under the Basic Gas Supply Service (BGSS) rate structure. Woodruff Energy is the third party supplier. 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.

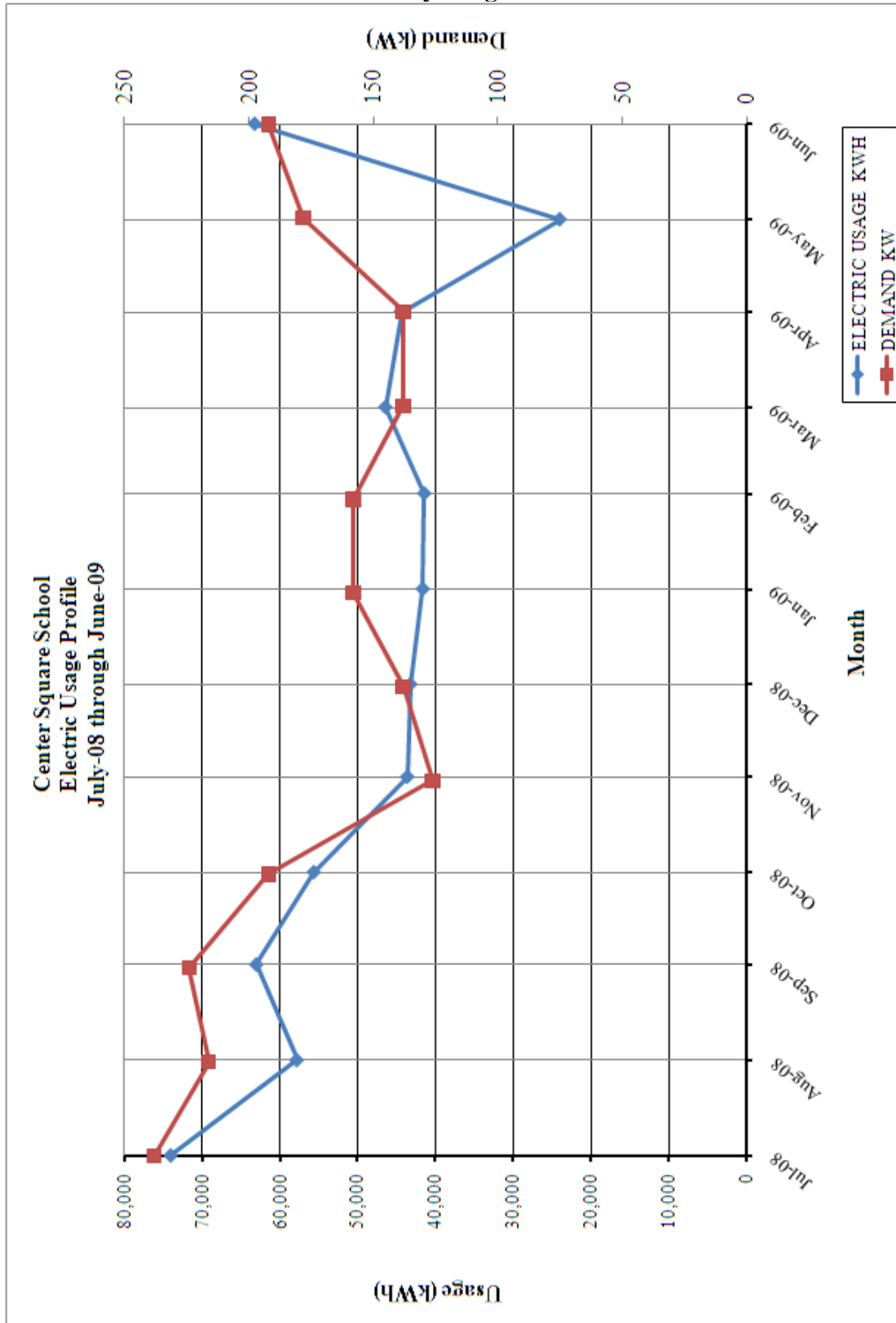
The overall cost for utilities is calculated by dividing the total cost by the total usage. Based on the utility history provided, the average cost for utilities at this facility is as follows:

<u>Description</u>	<u>Average</u>
Electricity	14.9¢ / kWh
Natural Gas	\$1.67 / Therm

**Table 3
Electricity Billing Data**

ELECTRIC USAGE SUMMARY			
Utility Provider: Atlantic City Electric			
Rate: Annual General Service			
Meter No: -			
Customer ID No: -			
Third Party Utility -			
TPS Meter / Acct No: -			
MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Jul-08	74,000	238.0	\$11,694
Aug-08	57,800	216.0	\$9,217
Sep-08	63,000	224.0	\$10,017
Oct-08	55,600	192.0	\$8,190
Nov-08	43,600	126.0	\$6,214
Dec-08	43,200	138.0	\$6,271
Jan-09	41,600	158.0	\$6,314
Feb-09	41,400	158.0	\$6,174
Mar-09	46,400	138.0	\$6,781
Apr-09	44,400	138.0	\$6,506
May-09	24,000	178.0	\$3,276
Jun-09	63,200	192.0	\$8,427
Totals	598,200	238.0 Max	\$89,080
AVERAGE DEMAND 174.7 KW average AVERAGE RATE \$0.149 \$/kWh			

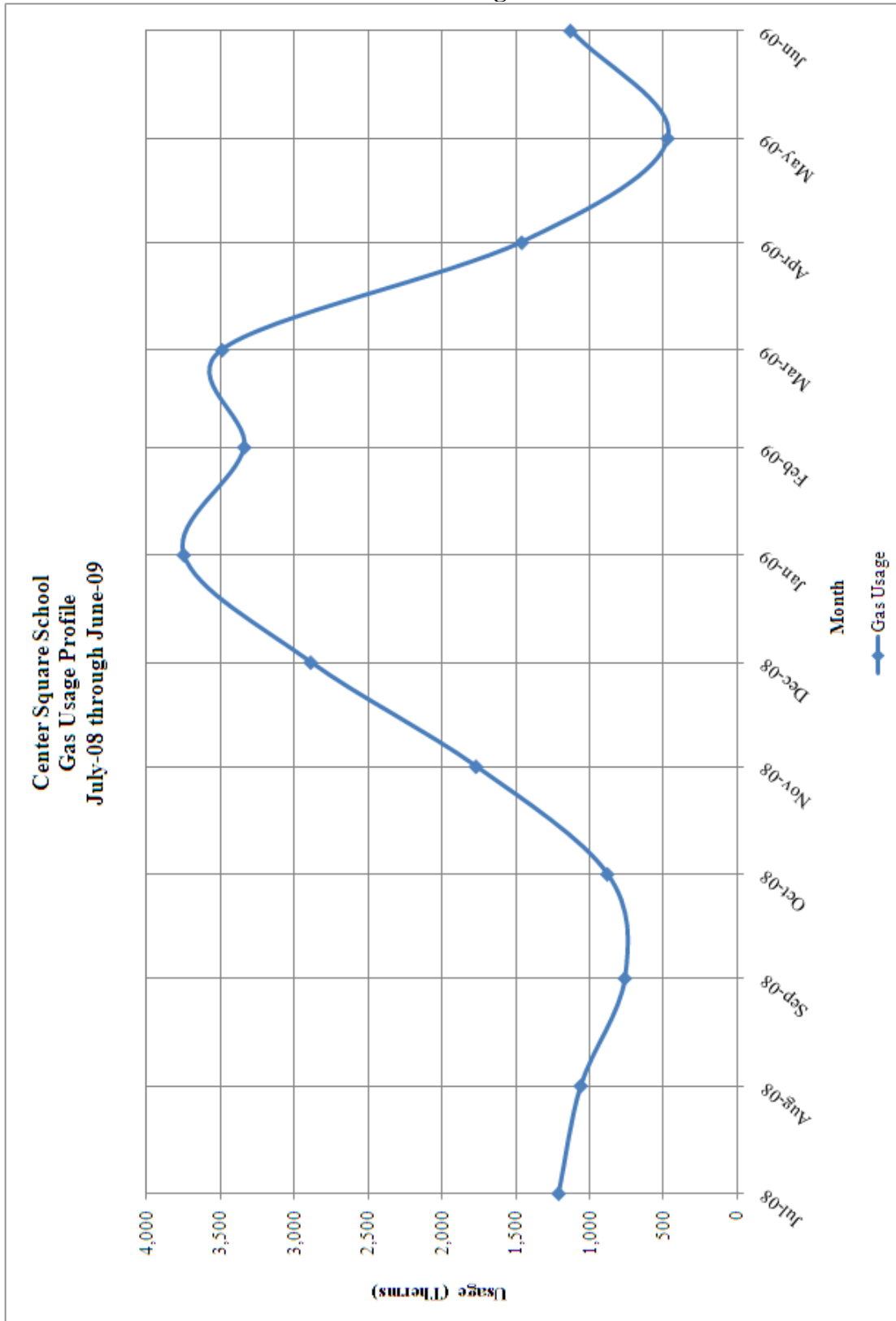
**Figure 1
Electricity Usage Profile**



**Table 4
Natural Gas Billing Data**

NATURAL GAS USAGE SUMMARY		
Utility Provider: South Jersey Gas		
Rate: Basic Gas Supply Service (BGSS)		
Meter No: -		
Point of Delivery ID: -		
Third Party Utility Provider: Woodruff Energy		
TPS Meter No: -		
MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
Jul-08	1,210.00	\$2,606.69
Aug-08	1,060.00	\$1,804.67
Sep-08	761.00	\$1,192.53
Oct-08	880.00	\$1,334.22
Nov-08	1,770.00	\$2,457.21
Dec-08	2,890.00	\$4,804.36
Jan-09	3,750.00	\$6,293.42
Feb-09	3,340.00	\$5,618.51
Mar-09	3,490.00	\$5,849.31
Apr-09	1,460.00	\$2,453.90
May-09	470.00	\$796.32
Jun-09	1,130.00	\$1,923.76
TOTALS	22,211.00	\$37,134.90
AVERAGE RATE:	\$1.672	\$/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:

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

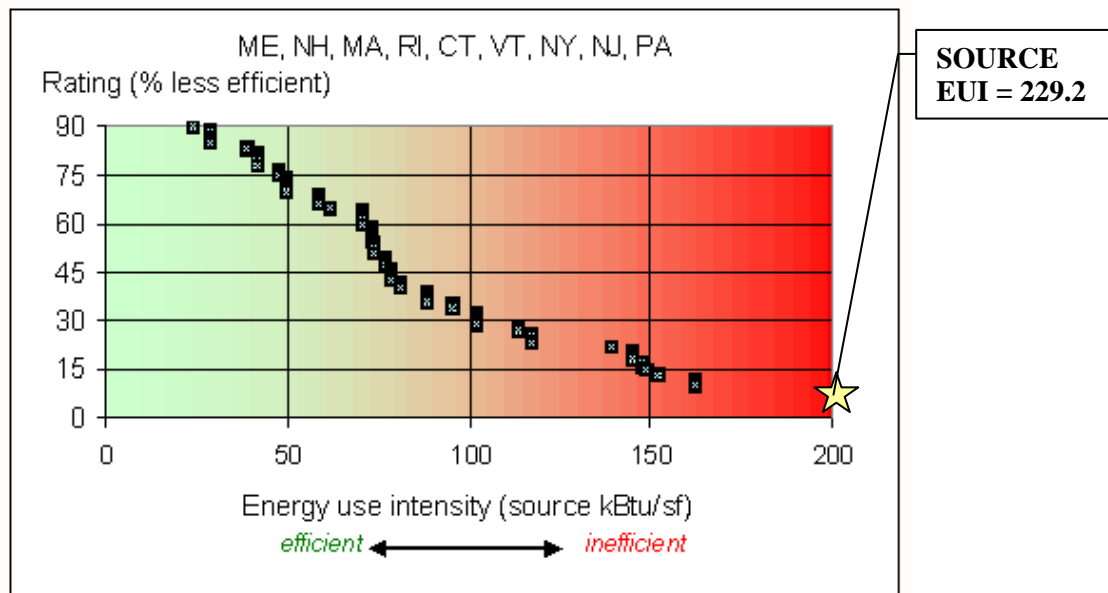
$$\text{Building Source EUI} = \frac{(\text{Electric Usage in kBtu} \times \text{SS Ratio} + \text{Gas Usage in kBtu} \times \text{SS Ratio})}{\text{Building Square Footage}}$$

**Table 5
Facility Energy Use Index (EUI) Calculation**

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	BUILDING USE			SITE ENERGY kBtu	SITE-SOURCE RATIO	SOURCE ENERGY kBtu
	kWh	Therms	Gallons			
ELECTRIC	598200.0			2,042,255	3.340	6,821,131
NATURAL GAS		22211.0		2,221,100	1.047	2,325,492
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				4,263,355		9,146,623
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA	39,900 SQUARE FEET					
BUILDING SITE EUI	106.85 kBtu/SF/YR					
BUILDING SOURCE EUI	229.24 kBtu/SF/YR					

Figure 3 below depicts a national EUI grading for the source use of *Elementary Schools*.

**Figure 3
Source Energy Use Intensity Distributions: Elementary Schools**



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 school districts 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 school districts 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 school district 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: loganboe
 Password: lgeaceg2009

 Security Question: What city were you born in?
 Security Answer: “logan”

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
Logan Center Square School	8	50

Refer to **Statement of Energy Performance Appendix** for the detailed energy summary.

V. FACILITY DESCRIPTION

The 39,900 SF Logan Center Square School is a one story facility comprised of classrooms, library, multi-purpose room, mechanical room, kitchen, and offices. The typical hours of operation for this facility are between 7:00 am and 3:30 pm. On the weekends there are sometimes events which take place at night or during the day which occupy the building from approximately 9:00 am until 1:00 pm. Exterior walls are brick construction with insulation typical of the current time period. The amount of insulation within the wall is unknown. The windows throughout the facility are in good condition and appear to be maintained. Typical windows throughout the facility are double pane, 1/4" clear glass with vinyl frames. Blinds are utilized throughout the facility per occupant comfort. The majority of the roof is made of shingled A-frame roof, while the other part of the roof is flat layered roof system with no stones. The amount of insulation below the roofing is unknown. The building was built in 2001 with no additions since the original construction.

HVAC Systems

The Center Square School is conditioned through the use of a conventional four-pipe system. This system consists of a York Air-Cooled Chiller with semi-hermetic screw compressors. This unit is a high efficiency, R-22 chiller that has a capacity of 130 tons. The York Chiller is in very good condition as it is original to the construction of the building in 2001.

The building is heated by two (2) Weil McLain gas fired boilers. These boilers have power flame burners with a maximum input of 794 MBH and minimum input of 600 MBH. The boilers are original to the building and are in very good condition. Typical thermal efficiency for this boiler is approximately 84%.

The air distribution system throughout the school consists of various types of air-handling units located in mechanical spaces and in the ceiling plenums to provide conditioned air throughout the facility. Two (2) air-handling units (AHU-1 and AHU-2) with chilled water and hot water coils provide heating and cooling throughout the facility. AHU-1 serves the office areas and common corridors. There are single duct variable air volume (VAV) boxes with hot water reheat coils tied-in to the duct distribution system of AHU-1. AHU-2 serves the Multi-Purpose Room and adjacent areas only and operates on a multi-staged occupancy fresh-air ventilation control sequence. Typical classrooms are heated and cooled via blower coil units with chilled water and hot water coils. Various fan-coil units and cabinet heaters are located throughout the facility to provide conditioning to their respective zones.

Exhaust System

Air is exhausted from the classrooms, toilet rooms and other areas through roof exhausters and inline fans located in the building and ducted outside through louvers.

HVAC System Controls

The HVAC systems within the facility are controlled via a Staefa Building Management System (BMS) which takes control of all equipment and can monitor equipment activity on a constant basis.

Domestic Hot Water

Domestic hot water for the restrooms and kitchen areas are provided by two 125 gallon Maxim gas hot water heater, capacity of 270,000 But/h. The domestic hot water is circulated throughout the building by two (2), 1 hp hot water re-circ pumps. The domestic hot water piping insulation appeared to be in good condition.

Lighting

Typical lighting throughout building is fluorescent tube lay-in fixtures with T-8 lamps and electronic ballasts. Exterior lighting is comprised of metal halide fixtures.

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 Controls

Description:

In some areas the lighting is left on unnecessarily. In many cases the lights are left on because of the inconvenience to manually switch lights off when a room is left or on when a room is first occupied. This is common in rooms that are occupied for only short periods and only a few times per day. In some instances lights are left on due to the misconception that it is better to keep the lights on rather than to continuously switch lights on and off. Although increased switching reduces lamp life, the energy savings outweigh the lamp replacement costs. The payback timeframe for when to turn the lights off is approximately two minutes. If the lights are expected to be off for at least a two minute interval, then it pays to shut them off.

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

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

- Occupancy Sensors for Lighting Control - 10%.

Energy savings achieved for “Occupancy Sensors for Lighting Control” average 10%. Savings resulting from the implementation of this ECM for energy management controls are estimated to be 10% of the total light energy controlled by occupancy sensors. The estimated savings is below the average listed above due to the continuous occupancy nature of college educational facilities. The majority of the savings is expected to be after school hours when rooms are left with lights on.

The ECM includes replacement of standard wall switches with sensors wall switches for individual all offices, class rooms, and bathrooms. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent. See the “Investment Grade Lighting Audit” appendix for details.

The **Investment Grade Lighting Audit Appendix** of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings,

and payback periods. The calculations adjust the lighting power usage by 10% for all areas that include occupancy sensors.

Light Energy = 304,781 kWh/Yr. proposed lighting controlled energy

Hours of Operation:

Classrooms and Hallways:
6,760 Hrs per year.

Offices and administration area:
4,706 Hrs per year.

Closets and Storage Rooms:
(Approximately 25% of regular admin hours) – 1,200 to 1,800 Hrs per year.

Energy Savings Calculations:

$$\text{Energy Savings} = (10\% \times \text{Occupancy Sensed Light Energy (kWh / Yr)})$$

$$\text{Energy Savings} = (10\% \times 304781 \text{ (kWh)}) = 30,478 \text{ (kWh)}$$

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

$$\text{Savings.} = 30,478 \text{ (kWh)} \times 0.149 \left(\frac{\$}{\text{kWh}} \right) = \$4,541$$

Installation cost per dual-technology sensor (Basis: Sensor switch or equivalent) is \$110/unit including material and labor.

$$\text{Installation Cost} = \$110 \times 42 \text{ motion sensors} = \$4,620$$

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

$$\text{SmartStart}^{\circledR} \text{ Incentive} = (\# \text{ of wall mount devices} \times \$20) = (42 \times \$20) = \$840$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$4,620
NJ Smart Start Equipment Incentive (\$):	\$840
Net Installation Cost (\$):	\$3,780
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$4,541
Total Yearly Savings (\$/Yr):	\$4,541
Estimated ECM Lifetime (Yr):	15
Simple Payback	0.8
Simple Lifetime ROI	1702.0%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$68,115
Internal Rate of Return (IRR)	120%
Net Present Value (NPV)	\$50,430.16

ECM #2: Variable Speed Chilled Water Pump Control

Description:

The school is cooled by a 130 ton water cooled chiller. The chilled water is distributed throughout the facility by two (2) 10 HP high efficiency pumps. The chilled water feeds all building unit ventilators and the indoor air handling unit. Each piece of equipment is capable of modulating the chilled water flow, reducing or increasing the total flow as required to satisfy the space. The equipment does not require full flow for the majority of the hours of operation; however the existing pumping system does not have variable speed control, the pumps operate at 100% capacity all the time. The pumping energy of the existing system stays relatively constant, on/off operation, throughout the cooling season.

This ECM includes the installation of two new variable frequency drives (VFDs) for each chilled water pump, although the savings will be for a singular pump (only one pump is needed for system distribution). The reduction in chilled water flow reduces the pumping energy by a significant quantity. As equipment control valves modulate, the VFDs respond by varying the pump motor to match the building's load. This ECM is based on two ABB VFDs model number ACS550, as well as a differential pressure sensor installed in the chilled water piping. This ECM also includes converting the existing 3-way controls valve to 2-way operation by installing an isolation valve in the bypass pipe to the each of the AHU's. 3-way valves would have to be installed before the chilled water enters the chiller to prevent a possibly damaging low flow condition through the chillers.

Energy and cost savings calculations are based on calculation software "PumpSave v4.2," provided by ABB.

Cooling Season Run Hrs.	= 1,800 hrs/yr.
Average Cost of Electricity	= \$0.149/kWh
Motor HP (EA.)	= 10 HP
Total GPM	= 293 GPM
Nominal Piping System Head	= 75 Ft Head
Motor Efficiency	= 91.7%
Pump Efficiency	= 75%

Energy Savings Calculations:

PumpSave 4.2 Energy saving calculator for pumps

System Data
 Liquid density: 62 lb/ft³ Static head: 1 ft

Pump Data
 Nominal volume flow: 293 gpm Efficiency: 75%
 Nominal head: 75 ft Max head: 75 ft

Existing Flow Control
 On/off control

Motor and Supply Data
 Supply voltage: 460 V 440/460/480 V
 Motor power: 10 Hp Required motor power: 8.2 Hp including 10% safety margin
 Motor efficiency: 91.7%

Operating Profile
 Annual running time: 1,800 h

Measurement Units
 Metric US

Improved Control by ABB Drive:
 ACS550
ACS550-U1-015A-4 Copy to clipboard

Results
 Saving percentage: 42.9%
 Annual energy consumption:
 with existing control method: 7 MWh
 with improved control method: 4 MWh
 Annual energy saving: 3 MWh
 Annual CO₂ reduction: 2 t
 CO₂ emission/unit: 0.5 lb/kWh

Economic Data
 Currency unit: \$
 Energy price: 0.149 \$/kWh
 Investment cost: 10,000 \$
 Interest rate: 4%
 Service life: 20 years

Energy Consumption
 Energy Consumed (kWh):
 On-Off: ~7,000 kWh
 VSD: ~4,000 kWh

Power (kW)
 Graph showing Power (kW) vs Flow rate (gpm) for On-Off and VSD methods.

Economic Results
 Annual saving: 451 \$
 Payback period: 22.2 years
 Net present value: -3,877 \$

Buttons: Auto-adjust screen size, Save calculation, Send to default printer, Close program, ABB logo

Installation cost for the two VFDs and bypass valve installation is estimated to be \$10,000 (\$6,000 Materials).

From the NJ Smart Start[®] Program appendix, the unit falls under the category “Variable Frequency Drive” and warrants an incentive based on horsepower. The program incentives are calculated as follows:

$$\text{Smart Start}^{\text{®}} \text{ Incentive} = (\text{HorsePower} \times \$ / \text{HP})$$

$$= (2 \text{ Pumps} \times 10 \text{ HP} \times \$120 / \text{HP}) = \$2,400$$

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$10,000
NJ Smart Start Equipment Incentive (\$):	\$2,400
Net Installation Cost (\$):	\$7,600
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$451
Total Yearly Savings (\$/Yr):	\$451
Estimated ECM Lifetime (Yr):	20
Simple Payback	16.9
Simple Lifetime ROI	18.7%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$9,020
Internal Rate of Return (IRR)	2%
Net Present Value (NPV)	(\$890.26)

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 school district 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 3,100 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 43.70 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 55,799 KWh annually, reducing the overall utility bill by approximately 9.33% 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	14.13 Years	77%	5.5%

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

Given the large amount of capital required by the BOE to invest in a solar system through a Direct Purchase CEG does not recommend the BOE pursue this route. It would be more advantageous for the BOE to solicit Power Purchase Agreement (PPA) Providers who will own, operate, and maintain the system for a period of 15 years. During this time the PPA Provider would sell all of the electric generated by Solar Arrays to the BOE at a reduced rate compared to their existing electric rate.

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 average 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 is comprised of classrooms, library, multi-purpose room, mechanical room, kitchen, and offices. The typical hours of operation for this facility are between 7:00 am and 3:30 pm; however the facility does house weekend activities. This will obviously add to energy consumption. The building was built in 2001 with no additions since the original construction.

The Electric Usage Profile demonstrates a fairly typical load profile for a school. The winter (November – March) has a lower consumption pattern (yet flat and elevated). The summer (April – October) has increased consumption (with May as an exception). The summer increased load is typically due to cooling (air conditioner) load. In this facility cooling is provided through the use of a conventional four-pipe system. This system consists of a York Air-Cooled Chiller with semi-hermetic screw compressors. This facility receives its electric Delivery and Commodity service via Atlantic City Electric (ACE) on an AGS rate schedule. A flat (base-load) shaping is important because it will yield more competitive pricing when shopping for alternative energy supply.

Currently this facility procures its electric Delivery and Commodity service from the utility (Atlantic City Electric Company). CEG will make a recommendation for this task.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical heating load profile, with increasing consumption in the winter months (November – March) and a dramatic drop in consumption in the summer months (April – October). Heating is the obvious reason for the winter consumption and in this facility the primary source for heating is supplied via two (2) Weil McLain gas fired boilers. Domestic hot water for the restrooms and kitchen areas are provided by two 125 gallon Maxim natural gas fired hot water heaters. Natural gas Delivery service in this facility is provided by South Jersey Gas Company on a GSG rate schedule. The natural gas Commodity service is provided by a Third Party Supplier (TPS) Woodruff Energy. A flat load profile will always allow for the most competitive price available when shopping for alternative energy supplies.

Tariff Analysis:Electricity:

This facility receives electrical Delivery Service from Atlantic City Electric on an AGS Secondary (Annual General Service) utility rate. The AGS rate is available at any point of Company's system where facilities of adequate character and capacity exist for the entire electric service requirements of any customer contracting for annual service delivered at one point and metered at or compensated to the voltage of delivery. This delivery service includes the following charges: Delivery Service Charges, Distribution Demand Charges, Reactive Demand Charges, Distribution Rates, Non-Utility Generation Charges, Societal Benefits Charges, Regulatory Assets Recovery Charges, Transition Bond Charges, Market Transition Charge Tax, Transmission Demand Charge, Regional Greenhouse Gas Initiative Recovery Charge, and Infrastructure Investment Surcharge.

Currently the BOE is procuring its electric requirements from the utility Atlantic City Electric Company. CEG will make recommendations (please see below), that are contrary to this.

Natural Gas:

This facility is serviced by South Jersey Gas Company (SJG) on its Firm Delivery rate (GSG) General Service Gas from the utility and BGSS (Basic Generation Supply Service) when not being served by a Third Party Supplier (TPS). Currently The BOE is procuring natural gas Commodity service from a Third Party Supplier (TPS), Woodruff Energy. The Delivery Rate has the following charges: Customer Charge, Delivery Charge, BSC Volume Charge and Commodity Charge under this rate structure. The BGSS Supply rates are designed to recover SJG's cost of gas applicable to customers who purchase gas from SJG. The company earns no profit from BGSS. BGSS consists of (2) two pricing mechanisms: Residential and Commercial customers that use less than 5,000 therms annually and Commercial and Industrial customers that consume at least 5,000 therms annually.

Imbalances occur when Third Party Suppliers (TPS) are used to supply natural gas and full-delivery is not made, and when a new supplier is contracted or the customer returns to the utility. Note: It is important when utilizing a Third Party Supplier, that an experienced regional supplier is used otherwise, imbalances can occur, jeopardizing economics and scheduling. If the supplier does not deliver they can be placed on a very costly rate. A customer can automatically be put on an alternative supply rate by the utility.

A "firm account" refers to the type of interstate pipeline service that the utility has subscribed for and delivered on behalf of the customer. Much like the telecom industry, the pipeline space (capacity) has been deregulated. The pipeline capacity is broken down into reliability of service. "Firm service" is the highest level of reliability and is the last, in pecking order, for interruption.

Please see CEG recommendations below.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities within the scope. Therefore CEG recommends aggregating all energy loads. CEG's observations are seen in both the electric and natural gas costs. The average "price to compare" per kWh (kilowatt hour) for all buildings is \$.1249/ kWh (kWh is the common unit of electric measure). The average "price to compare" per decatherm for natural gas is \$11.893 /Dth (decatherm is the common unit of measure). These Weighted Average Prices for electricity were supplied by Logan and is served via the utility, Atlantic City Electric Company. The average price for natural gas is supplied via a Third Party Supplier (TPS) Woodruff Energy. The price noted was supplied by the Logan BOE. The "price-to-compare" in electricity is the price netting out the utility transmission and distribution (wire) charges. For natural gas, it is the price netting utility transportation charges. This price is said to be the City-Gate price.

Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. The BOE could see significant savings if it were to take advantage of these current market prices quickly, before energy increases. Based on last year's historical consumption (July 2008 – June 2009) and current electric rates, the BOE could see an improvement of up to 23 % or over \$60,000 in its electric costs, annually. (Note: Savings were calculated using an Average Annual Consumption of 1,818,900 kWh and an Average fixed one-year commodity contract). CEG recommends aggregating the entire electric load to gain the most optimal energy costs. CEG recommends that the BOE seek an energy advisor to maximize energy savings and to apply a "managed approach" to procuring energy.

CEG's secondary recommendation coincides with the BOE's natural gas costs. Based on the current market, (which is very competitive), the BOE could see a savings of over 26% or over \$10,000 annually in its natural gas expenditures. Again CEG recommends the use of any *energy advisor* to review alternative energy sourcing strategies and to install a "managed approach" to energy procurement that will be based on the energy budget.

CEG also recommends that The BOE not renew its energy supply contract with the Third Party Supplier and its fixed price contract. The fixed priced contract does not accomplish the needs of the BOE. The BOE needs budget protection and CEG has shown that these energy prices are not competitive to the market. The analysis has demonstrated that the price is above market and the BOE has no way of adjusting the price should the market fall.

CEG further recommends that The BOE create an energy program through a "managed approach". The "managed approach" will take into account creating an "energy budget" that is in line with The BOE's budget year and risk tolerance. Risk tolerance is the appetite that a customer has for risk. Based on the reduced state and local government budgets and the general aversion for risk, the local government is required to manage this risk.

CEG recommends the BOE schedule a meeting with their current utility providers to review their utility charges and current tariff structures for electricity and natural gas. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), they will learn more about the

competitive supply process. They can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu, and should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the data to manage ongoing demand-side management projects. Furthermore, CEG recommends special attention given to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with their utility representative. In addition, they should also ask the utility representative about alternative billing options. Some utilities allow for consolidated billing options when utilizing the service of a Third Party Supplier.

Finally, if the BOE frequently changes its supplier for energy (natural gas), CEG recommends it closely monitor balancing, particularly when the contract is close to termination.

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 pay 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 show 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

Logan Township BOE - Center Square School

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Saving * 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 Controls	\$4,620	\$0	\$840	\$3,780	\$4,541	\$0	\$4,541	15	\$68,115	\$0	1702.0%	0.8	120.13%	\$50,430.16
ECM #2	Variable Speed Chilled Water Pump Control	\$6,000	\$4,000	\$2,400	\$7,600	\$451	\$0	\$451	20	\$9,020	\$0	18.7%	16.9	1.69%	(\$890.26)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	43.70 KW PV System	\$393,300	\$0	\$0	\$393,300	\$8,314	\$19,530	\$27,844	25	\$696,100	\$488,250	77.0%	14.1	4.98%	\$91,551.68

- 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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VOORHEES, NEW JERSEY 08043
PHONE: (856) 427-0200
FAX: (856) 427-6508

SmartStart Building Incentives

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

Electric Chillers

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

Gas Cooling

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

Desiccant Systems

\$1.00 per cfm – gas or electric	
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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
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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
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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

Logan Center Square School

Building ID: 1949671
For 12-month Period Ending: June 30, 2009¹
Date SEP becomes ineligible: N/A

Date SEP Generated: January 26, 2010

Facility
Logan Center Square School
100 Peachwood Drive
Logan, NJ 08085

Facility Owner
Logan Township BOE
110 School Lane
Swedesboro, NJ 08085

Primary Contact for this Facility
Frederick Berg
110 School Road
Swedesboro, NJ 08085

Year Built: 2001
Gross Floor Area (ft²): 39,900

Energy Performance Rating² (1-100) 8

Site Energy Use Summary³

Electricity - Grid Purchase(kBtu)	2,041,058
Natural Gas (kBtu) ⁴	2,221,100
Total Energy (kBtu)	4,262,158

Energy Intensity⁵

Site (kBtu/ft ² /yr)	107
Source (kBtu/ft ² /yr)	229

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	429
---	-----

Electric Distribution Utility

Pepco - Atlantic City Electric Co

National Average Comparison

National Average Site EUI	68
National Average Source EUI	146
% Difference from National Average Source EUI	57%
Building Type	K-12 School

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 Standards⁶ for Indoor Environmental Conditions:

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

Certifying Professional

Michael Fischette
520 South Burnt Mill Road
Voorhees, NJ 08043

Notes:

- 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.
- 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.
- Values represent energy consumption, annualized to a 12-month period.
- 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.
- Values represent energy intensity, annualized to a 12-month period.
- 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	<input checked="" type="checkbox"/>
Building Name	Logan Center Square School	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		<input type="checkbox"/>
Type	K-12 School	Is this an accurate description of the space in question?		<input type="checkbox"/>
Location	100 Peachwood Drive, Logan, NJ 08085	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		<input type="checkbox"/>
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		<input type="checkbox"/>
Logan Center Square School (K-12 School)				
CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	<input checked="" type="checkbox"/>
Gross Floor Area	39,900 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.		<input type="checkbox"/>
Open Weekends?	No	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		<input type="checkbox"/>
Number of PCs	70 (Default)	Is this the number of personal computers in the K12 School?		<input type="checkbox"/>
Number of walk-in refrigeration/freezer units	0	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		<input type="checkbox"/>
Presence of cooking facilities	Yes	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		<input type="checkbox"/>
Percent Cooled	90 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		<input type="checkbox"/>
Percent Heated	90 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		<input type="checkbox"/>
Months	10 (Optional)	Is this school in operation for at least 8 months of the year?		<input type="checkbox"/>

High School?	No	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		<input type="checkbox"/>
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ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Pepco - Atlantic City Electric Co

Fuel Type: Electricity		
Meter: Electric Meter (kWh (thousand Watt-hours)) Space(s): Entire Facility Generation Method: Grid Purchase		
Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
06/01/2009	06/30/2009	63,200.00
05/01/2009	05/31/2009	24,000.00
04/01/2009	04/30/2009	44,400.00
03/01/2009	03/31/2009	46,400.00
02/01/2009	02/28/2009	41,400.00
01/01/2009	01/31/2009	41,600.00
12/01/2008	12/31/2008	43,200.00
11/01/2008	11/30/2008	43,600.00
10/01/2008	10/31/2008	55,600.00
09/01/2008	09/30/2008	63,000.00
08/01/2008	08/31/2008	57,800.00
07/01/2008	07/31/2008	74,000.00
Electric Meter Consumption (kWh (thousand Watt-hours))		598,200.00
Electric Meter Consumption (kBtu (thousand Btu))		2,041,058.40
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		2,041,058.40
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		<input type="checkbox"/>

Fuel Type: Natural Gas		
Meter: Gas Meter (therms) Space(s): Entire Facility		
Start Date	End Date	Energy Use (therms)
06/01/2009	06/30/2009	1,130.00
05/01/2009	05/31/2009	470.00
04/01/2009	04/30/2009	1,460.00
03/01/2009	03/31/2009	3,490.00
02/01/2009	02/28/2009	3,340.00
01/01/2009	01/31/2009	3,750.00
12/01/2008	12/31/2008	2,890.00
11/01/2008	11/30/2008	1,770.00
10/01/2008	10/31/2008	880.00
09/01/2008	09/30/2008	761.00

08/01/2008	08/31/2008	1,060.00
07/01/2008	07/31/2008	1,210.00
Gas Meter Consumption (therms)		22,211.00
Gas Meter Consumption (kBtu (thousand Btu))		2,221,100.00
Total Natural Gas Consumption (kBtu (thousand Btu))		2,221,100.00
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		<input type="checkbox"/>

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.	<input type="checkbox"/>

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.	<input type="checkbox"/>

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
Logan Center Square School
100 Peachwood Drive
Logan, NJ 08085

Facility Owner
Logan Township BOE
110 School Lane
Swedesboro, NJ 08085

Primary Contact for this Facility
Frederick Berg
110 School Road
Swedesboro, NJ 08085

General Information

Logan Center Square School	
Gross Floor Area Excluding Parking: (ft ²)	39,900
Year Built	2001
For 12-month Evaluation Period Ending Date:	June 30, 2009

Facility Space Use Summary

Logan Center Square School	
Space Type	K-12 School
Gross Floor Area(ft ²)	39,900
Open Weekends?	No
Number of PCs ^d	70
Number of walk-in refrigeration/freezer units	0
Presence of cooking facilities	Yes
Percent Cooled	90
Percent Heated	90
Months ^o	10
High School?	No
School District ^o	Logan

Energy Performance Comparison

Performance Metrics	Evaluation Periods		Comparisons		
	Current (Ending Date 06/30/2009)	Baseline (Ending Date 06/30/2009)	Rating of 75	Target	National Average
Energy Performance Rating	8	8	75	N/A	50
Energy Intensity					
Site (kBtu/ft ²)	107	107	53	N/A	68
Source (kBtu/ft ²)	229	229	114	N/A	146
Energy Cost					
\$/year	\$ 126,215.90	\$ 126,215.90	\$ 62,753.48	N/A	\$ 80,252.61
\$/ft ² /year	\$ 3.16	\$ 3.16	\$ 1.57	N/A	\$ 2.01
Greenhouse Gas Emissions					
MtCO ₂ e/year	429	429	213	N/A	273
kgCO ₂ e/ft ² /year	11	11	5	N/A	7

More than 50% of your building is defined as K-12 School. Please note that your rating accounts for all of the spaces listed. The National Average column presents energy performance data your building would have if your building had an average rating of 50.

Notes:

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

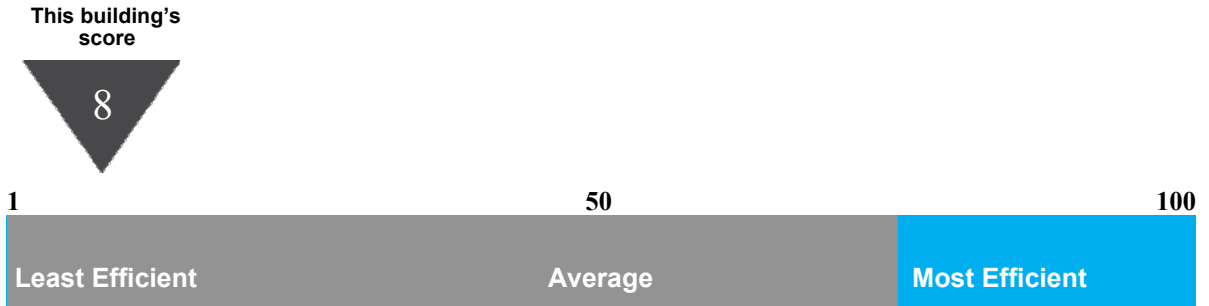
Statement of Energy Performance

2009

Logan Center Square School
100 Peachwood Drive
Logan, NJ 08085

Portfolio Manager Building ID: 1949671

The energy use of this building has been measured and compared to other similar buildings using the Environmental Protection Agency's (EPA's) Energy Performance Scale of 1–100, with 1 being the least energy efficient and 100 the most energy efficient. For more information, visit energystar.gov/benchmark.



This building uses 229 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending June 2009

Buildings with a score of 75 or higher may qualify for EPA's ENERGY STAR.

I certify that the information contained within this statement is accurate and in accordance with U.S. Environmental Protection Agency's measurement standards, found at energystar.gov

Date of certification



MAJOR EQUIPMENT LIST

Concord Engineering Group

"Centery Square School"

Liquid Chiller

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Nominal Tons	Service	EWT	LWT	GPM	Efficiency	Volt / Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Roof	School	York	1	YCAS0130EC46XFASDXXXTXLXXX45	RLJM5790AA	122	-	55	45	293	10.2 EER	460/3	9	20	11	

Boiler

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Mech Room	School	Weil McLain	2	BG-678-WF	-	789	643	81	NG	8	30	22	

Boiler - Burner

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Mech Room	School	Power Flame	2	JR30A-10	-	794	80	NG	8	21	13	

Boiler - Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	RPM	GPM	Ft. Hd	Frame Size	Volts / Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Mech Room	HW Loop	B&G	2	M3212T	-	5	1750	28	55	182T	480/3	8	10	2	
Mech Room	CW Loop	B&G	2	388	-	10	1750	293	75	-	480/3	8	10	2	

Domestic Hot Water Heater

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Input (MBh)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Mech Room	School	Maxim	2	27N125A-MXS	1200102994	270	330	125	82	NG	8	12	4	

DHW - Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	Volts / Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Mech Room	Domestic Line	-	2	-	-	1	115/1	-	8	10	2	

Air Handling Units

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Cooling Coil	Cooling Eff. (EER)	Cooling Capacity	Heating Type	Input (MBh)	Output (MBh)	Heating Eff. (%)	Fuel	Volts / Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Roof	Building	York	1	BA0061430.00X070G04CB016S032WH06L	-	Chilled water coil	-	231.6 MBH	Pre-heat coil	402	-	-	-	480/3	-	8	15	7	VFD Installed

CEG Job #: 9C09103
 Project: Center Square School
 Address: 100 Peachwood Dr.
 Logan Twp., NJ 08085
 Building SF: 39,900

"Center Square School"

KWH COST: \$0.149

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING					PROPOSED LIGHTING								SAVINGS									
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly \$ Savings	Yearly Simple Payback
134	619 Mech. Rm	1800	13	2	1x4, 2 Lamp 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.75	1,357.2	\$202.22	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
134	613/617 Elec. Rm.	1800	8	2	1x4, 2 Lamp 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.46	835.2	\$124.44	8	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321	614 Office	4706	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	771.8	\$115.00	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
134	616 Custodial Closet	1800	1	2	1x4, 2 Lamp 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.06	104.4	\$15.56	1	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321	615 Tech. Rm.	6760	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	1,108.6	\$165.19	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
S2	608 APR	6760	10	2	(2) 250w MH, Pendant Mnt., Indirect	590	5.90	39,884.0	\$5,942.72	10	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
S1		6760	13	1	(1) 250w MH, Pendant Mnt., Indirect	295	3.84	25,924.6	\$3,862.77	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
O		6760	6	3	Down Light, (3) 26w PLC, Elect. Ballast	84	0.50	3,407.0	\$507.65	6	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
G		6760	6	2	Down Light, (2) 26w Quads, Elect. Ballast	56	0.34	2,271.4	\$338.43	6	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	610 Storage	1800	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.16	295.2	\$43.98	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	609 Storage	1800	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.16	295.2	\$43.98	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
421	Kitchen	6760	8	4	2x4 4 Lamp 32w T8, Elect. Ballast, Prismatic	112	0.90	6,057.0	\$902.49	8	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321	611 Kitchen Storage	1800	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	295.2	\$43.98	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
G		1800	1	2	Down Light, (2) 26w Quads, Elect. Ballast	56	0.06	100.8	\$15.02	1	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321	601 Work Room	6760	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	1,108.6	\$165.19	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321	Main Office	4706	6	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.49	2,315.4	\$344.99	6	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	Conference Room	4706	3	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.25	1,157.7	\$172.49	3	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321	Office Restroom	4706	1	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.08	385.9	\$57.50	1	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00

322	Prinipal's Office	4706	4	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parbolic	82	0.33	1,543.6	\$229.99	4	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321	603 Nurse	4706	3	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.25	1,157.7	\$172.49	3	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322		4706	3	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parbolic	82	0.25	1,157.7	\$172.49	3	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	624 Classroom	6760	8	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parbolic	82	0.66	4,434.6	\$660.75	8	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321	624 Storage	1800	1	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.08	147.6	\$21.99	1	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	623 Computer Lab	6760	8	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parbolic	82	0.66	4,434.6	\$660.75	8	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	625 Art	6760	13	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parbolic	82	1.07	7,206.2	\$1,073.72	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321	625 Storage	1800	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	295.2	\$43.98	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	622 Classroom	6760	8	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parbolic	82	0.66	4,434.6	\$660.75	8	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321	622 Storage	1800	1	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.08	147.6	\$21.99	1	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	621 Classroom	6760	8	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parbolic	82	0.66	4,434.6	\$660.75	8	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321	621 Storage	1800	1	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.08	147.6	\$21.99	1	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321	Girl's Lav.	4706	3	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.25	1,157.7	\$172.49	3	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321	Boy's Lav.	4706	3	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.25	1,157.7	\$172.49	3	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
133	607 Library	6760	29	2	1x4, 2 Lamp 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	58	1.68	11,370.3	\$1,694.18	29	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
G		6760	9	2	Down Light, (2) 26w Quads, Elect. Ballast	56	0.50	3,407.0	\$507.65	9	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
G	Lobby & Vest.	6760	15	2	Down Light, (2) 26w Quads, Elect. Ballast	56	0.84	5,678.4	\$846.08	15	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
R		6760	3	3	Down Light, (3) 13w PLC, Elect. Ballast	45	0.14	912.6	\$135.98	3	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
133	Library Corridor	6760	18	2	1x4, 2 Lamp 32w T8, Elect. Ballast, Pendant Mnt., Direct/Indirect	58	1.04	7,057.4	\$1,051.56	18	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
R		6760	13	3	Down Light, (3) 13w PLC, Elect. Ballast	45	0.59	3,954.6	\$589.24	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
G		6760	4	2	Down Light, (2) 26w Quads, Elect. Ballast	56	0.22	1,514.2	\$225.62	4	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
121	Corridor	6760	7	2	1x4, 2 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	58	0.41	2,744.6	\$408.94	7	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00

321	Women's Restroom	4706	3	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.25	1,157.7	\$172.49	3	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321	Men's Restroom	4706	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	771.8	\$115.00	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	Faculty Room	4706	6	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	0.49	2,315.4	\$344.99	6	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
121	Corridor B	6760	11	2	1x4, 2 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	58	0.64	4,312.9	\$642.62	11	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
G		6760	9	2	Down Light, (2) 26w Quads, Elect. Ballast	56	0.50	3,407.0	\$507.65	9	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	636 Classroom/ Bathroom/ Storage	6760	13	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.07	7,206.2	\$1,073.72	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321		6760	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	1,108.6	\$165.19	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	637 Classroom/ Bathrm/ Storage	6760	13	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.07	7,206.2	\$1,073.72	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321		6760	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	1,108.6	\$165.19	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	638 Classroom/ Bathroom/ Storage	6760	13	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.07	7,206.2	\$1,073.72	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321		6760	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	1,108.6	\$165.19	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	639 Classroom/ Bathroom/ Storage	6760	13	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.07	7,206.2	\$1,073.72	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321		6760	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	1,108.6	\$165.19	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	640 Classroom/ Bathroom/ Storage	6760	13	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.07	7,206.2	\$1,073.72	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321		6760	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	1,108.6	\$165.19	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	634 Classroom/ Bathroom/ Storage	6760	13	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.07	7,206.2	\$1,073.72	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321		6760	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	1,108.6	\$165.19	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	635 Classroom/ Bathroom/ Storage	6760	13	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.07	7,206.2	\$1,073.72	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321		6760	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	1,108.6	\$165.19	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	641 Classroom/ Bathroom/ Storage	6760	13	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.07	7,206.2	\$1,073.72	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321		6760	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	1,108.6	\$165.19	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00

322	632 Classroom/ Bathroom/ Storage	6760	13	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.07	7,206.2	\$1,073.72	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321		6760	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	1,108.6	\$165.19	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	633 Classroom/ Bathroom/ Storage	6760	13	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.07	7,206.2	\$1,073.72	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321		6760	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	1,108.6	\$165.19	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	626 Classroom/ Bathroom/ Storage	6760	13	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.07	7,206.2	\$1,073.72	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321		6760	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	1,108.6	\$165.19	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	627 Classroom/ Bathroom/ Storage	6760	13	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.07	7,206.2	\$1,073.72	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321		6760	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	1,108.6	\$165.19	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	628 Classroom/ Bathroom/ Storage	6760	13	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.07	7,206.2	\$1,073.72	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321		6760	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	1,108.6	\$165.19	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	631 Classroom/ Bathroom/ Storage	6760	13	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.07	7,206.2	\$1,073.72	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321		6760	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	1,108.6	\$165.19	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	629 Classroom/ Bathroom/ Storage	6760	13	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.07	7,206.2	\$1,073.72	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321		6760	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	1,108.6	\$165.19	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
322	630 Classroom/ Bathroom/ Storage	6760	13	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Parabolic	82	1.07	7,206.2	\$1,073.72	13	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
321		6760	2	3	2x4 3 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	82	0.16	1,108.6	\$165.19	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
121	Corridor C	6760	11	2	1x4, 2 Lamp 32w T8, Elect. Ballast, Recessed, Prismatic	58	0.64	4,312.9	\$642.62	11	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
G		6760	9	2	Down Light, (2) 26w Quads, Elect. Ballast	56	0.50	3,407.0	\$507.65	9	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
S3	Exterior	6760	30	1	Wallpack, 70w MH w/100w Quartz Restrike	0	0.00	0.0	\$0.00	30	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
S4		6760	3	1	Down Light, 100w MH, Prismatic Lens	110	0.33	2,230.8	\$332.39	3	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
S5		6760	5	2	Wall Mnt., (2) 26w Quad, White Diffuser	56	0.28	1,892.8	\$282.03	5	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
Totals			63	23			12.34	313,016	#####	63	0			0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	#DIV/0!

NOTES: 1. Simple Pay 4706
2. Lamp totals only include T-12 tube replacment calculations

Project Name: LGEA Solar PV Project - Logan Township BOE							
Location: Logan, NJ							
Description: Photovoltaic System - Direct Purchase							
Simple Payback Analysis							
	Photovoltaic System - Direct Purchase						
Total Construction Cost	\$393,300						
Annual kWh Production	55,799						
Annual Energy Cost Reduction	\$8,314						
Annual SREC Revenue	\$19,530						
First Cost Premium	\$393,300						
Simple Payback:	14.13						Years
Life Cycle Cost Analysis							
Analysis Period (years):	25			Financing %:	0%		
Financing Term (mths):	0			Maintenance Escalation Rate:	3.0%		
Average Energy Cost (\$/kWh)	\$0.149			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	\$393,300	0	0	0	\$0	(393,300)	0
1	\$0	55,799	\$8,314	\$0	\$19,530	\$27,844	(\$365,456)
2	\$0	55,520	\$8,563	\$0	\$19,432	\$27,995	(\$337,461)
3	\$0	55,242	\$8,820	\$0	\$19,335	\$28,155	(\$309,306)
4	\$0	54,966	\$9,085	\$0	\$19,238	\$28,323	(\$280,982)
5	\$0	54,691	\$9,358	\$563	\$19,142	\$27,936	(\$253,046)
6	\$0	54,418	\$9,638	\$561	\$19,046	\$28,124	(\$224,922)
7	\$0	54,146	\$9,927	\$558	\$18,951	\$28,321	(\$196,601)
8	\$0	53,875	\$10,225	\$555	\$18,856	\$28,527	(\$168,075)
9	\$0	53,606	\$10,532	\$552	\$18,762	\$28,742	(\$139,333)
10	\$0	53,338	\$10,848	\$549	\$18,668	\$28,967	(\$110,366)
11	\$0	53,071	\$11,173	\$547	\$18,575	\$29,202	(\$81,165)
12	\$0	52,806	\$11,509	\$544	\$18,482	\$29,447	(\$51,718)
13	\$0	52,542	\$11,854	\$541	\$18,390	\$29,702	(\$22,016)
14	\$0	52,279	\$12,209	\$538	\$18,298	\$29,969	\$7,953
15	\$0	52,018	\$12,576	\$536	\$18,206	\$30,246	\$38,199
16	\$0	51,757	\$12,953	\$533	\$18,115	\$30,535	\$68,734
17	\$0	51,499	\$13,342	\$530	\$18,025	\$30,836	\$99,570
18	\$0	51,241	\$13,742	\$528	\$17,934	\$31,148	\$130,718
19	\$0	50,985	\$14,154	\$525	\$17,845	\$31,474	\$162,192
20	\$0	50,730	\$14,579	\$523	\$17,756	\$31,812	\$194,004
21	\$1	50,476	\$15,016	\$520	\$17,667	\$32,163	\$226,166
22	\$2	50,224	\$15,467	\$517	\$17,578	\$32,528	\$258,694
23	\$3	49,973	\$15,931	\$515	\$17,491	\$32,906	\$291,600
24	\$4	49,723	\$16,408	\$512	\$17,403	\$33,299	\$324,900
25	\$5	49,474	\$16,901	\$510	\$17,316	\$33,707	\$358,607
Totals:	1,064,528	1,064,528	\$223,402	\$8,683	\$372,585	\$751,907	\$587,304
Net Present Value (NPV)						\$358,632	
Internal Rate of Return (IRR)						5.5%	

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
Center Square School	3100	Sunpower SPR230	190	14.7	2,794	43.70	55,799	6,270	15.64



Station Identification	
City:	Atlantic_City
State:	New_Jersey
Latitude:	39.45° N
Longitude:	74.57° W
Elevation:	20 m
PV System Specifications	
DC Rating:	43.7 kW
DC to AC Derate Factor:	0.810
AC Rating:	35.4 kW
Array Type:	Fixed Tilt
Array Tilt:	18.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	0.1 ¢/kWh

Results			
Month	Solar Radiation (kWh m ² /day)	AC Energy (kWh)	Energy Value (\$)
1	2.92	3280	4.89
2	3.64	3696	5.51
3	4.53	4919	7.33
4	5.31	5437	8.10
5	5.85	6079	9.06
6	6.07	5861	8.73
7	6.03	5957	8.88
8	5.61	5565	8.29
9	5.06	4934	7.35
10	4.08	4208	6.27
11	2.97	3093	4.61
12	2.55	2770	4.13
Year	4.56	55799	83.14

 = Proposed PV Layout

Notes:

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