ENERGY AUDIT – FINAL REPORT

RUTHERFORD BOARD OF EDUCATION
LINCOLN ELEMENTARY SCHOOL

414 MONTROSS AVENUE
RUTHERFORD, NJ 07070
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CEG PROJECT NO. 9C09074

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I. EXECUTIVE SUMMARY

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

Rutherford Board of Education
Lincoln Elementary School
414 Montross Avenue
Rutherford, NJ 07070

School District Contact Person: *Robert R. Brown*

This audit was performed in connection with the New Jersey Clean Energy Local Government Energy Audit Program. These energy audits are conducted to promote the Office of Clean Energy's mission, 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	$ 93,566
Natural Gas	$ 61,955
Total	$155,521

The potential annual energy cost savings are shown below in Table 1. Be aware that the measures are not additive because of the interrelation of several of the measures. The cost of each measure for this level of auditing is ± 20% until detailed engineering, specifications, and hard proposals are obtained.

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	Dual Technology Lighting Controls	$2,405	$383	6.3	138.9%
ECM #2	Install Thermostatic Radiator Valves	$19,200	$3,098	6.2	142.0%
ECM #3	Convert Pneumatic Controls to DDC	$64,000	$5,388	11.9	-8.9%
ECM #4	High-Efficiency Steam Boiler	$136,559	$18,953	7.2	173.7%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	Solar Array on New Roof	$925,290	$62,015	14.9	-44.8%

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 are shown below in Table 2. The information in this table corresponds to the ECM's 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	Dual Technology Lighting Controls		2,227	
ECM #2	Install Thermostatic Radiator Valves			1,833
ECM #3	Convert Pneumatic Controls to DDC		11,302	1,150
ECM #4	High-Efficiency Steam Boiler			8,848
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	Solar Array on New Roof		118,802	

Concord Engineering Group (CEG) strongly recommends the implementation of all ECM's that provide a calculated simple payback at or under ten (10) years. The potential energy and cost savings from these ECM's are too great to pass upon. The following Energy Conservation Measures are recommended for the Lincoln Elementary School:

- **ECM #1: Dual Technology Lighting Controls**
- **ECM #2: Install Thermostatic Radiator Valves**
- **ECM #4: High Efficiency Steam Boiler**

II. INTRODUCTION

This comprehensive energy audit covers the 46,695 square foot Lincoln Elementary School facility that includes classrooms, a multi-purpose room, pantry, library media center, administrative offices, nurse's office, mechanical/electrical rooms, faculty work room, etc.

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

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

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

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

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

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

III. METHOD OF ANALYSIS

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

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

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

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

ECM Calculation Equations:

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

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

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

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

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

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

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

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

Table 3 and Figure 1 represent the electrical usage for the surveyed facility from January-08 to December-08. The School District was able to gather the information for the above-reference period for our review and analysis. During 2008, Public Service Electric & Gas (PSE&G) provided electricity to the facility under their Large Power & Light Service (LPLS) rate. This electric rate has a component for consumption that is measured in kilowatt-hours (kWh). It is calculated by multiplying the wattage of the equipment times the hours that it operates. For example, a 1,000 Watt lamp operating for 5 hours would measure 5,000 Watt-hours. Since one kilowatt is equal to 1,000 Watts, the measured consumption would be 5 kWh. 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 most current rate structure available.

Table 4 and Figure 2 show the natural gas energy usage for the surveyed facility from January, 08 to December, 08. Hess Corporation supplies the natural gas from the wellhead to the PSE&G™ pipelines. PSE&G™ charges a rate per therm for delivery of the natural gas via their pipelines to the burners.

Based on the utility data provide by the School District, the average cost for utilities at this facility is as follows:

Description	Average
Electricity	17.2¢ / kWh
Natural Gas	$1.69 / Therm

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: PSE&G
Rate: Large Power & Light Service (LPLS)
Meter No: 778013384
Customer ID No: -
Third Party Utility -
TPS Meter / Acct No: -

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Jan-08	45,240	126.0	$5,772
Feb-08	46,920	122.4	$6,157
Mar-08	51,360	122.4	$6,675
Apr-08	44,520	120.0	$5,894
May-08	35,400	190.8	$5,131
Jun-08	39,120	205.2	$7,631
Jul-08	51,480	270.0	$11,717
Aug-08	51,840	223.2	$11,277
Sep-08	42,240	307.2	$11,073
Oct-08	43,200	213.6	$8,090
Nov-08	46,680	121.2	$7,272
Dec-08	45,000	122.4	$6,877
Totals	**543,000**	**307.2 Max**	**$93,566**

AVERAGE DEMAND 178.7 KW average
AVERAGE RATE $0.172 $/kWh

Figure 1
Electricity Usage Profile

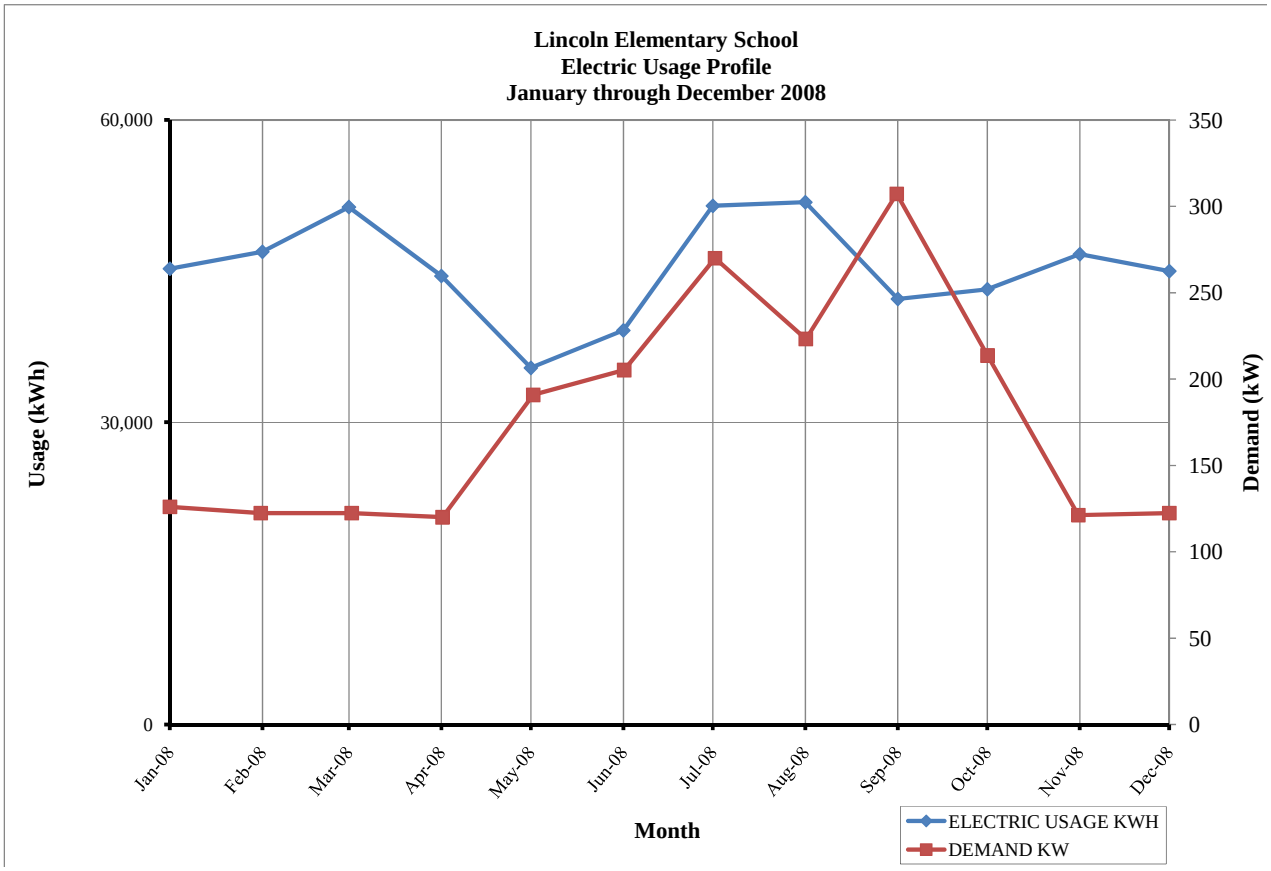


Table 4
Natural Gas Billing Data

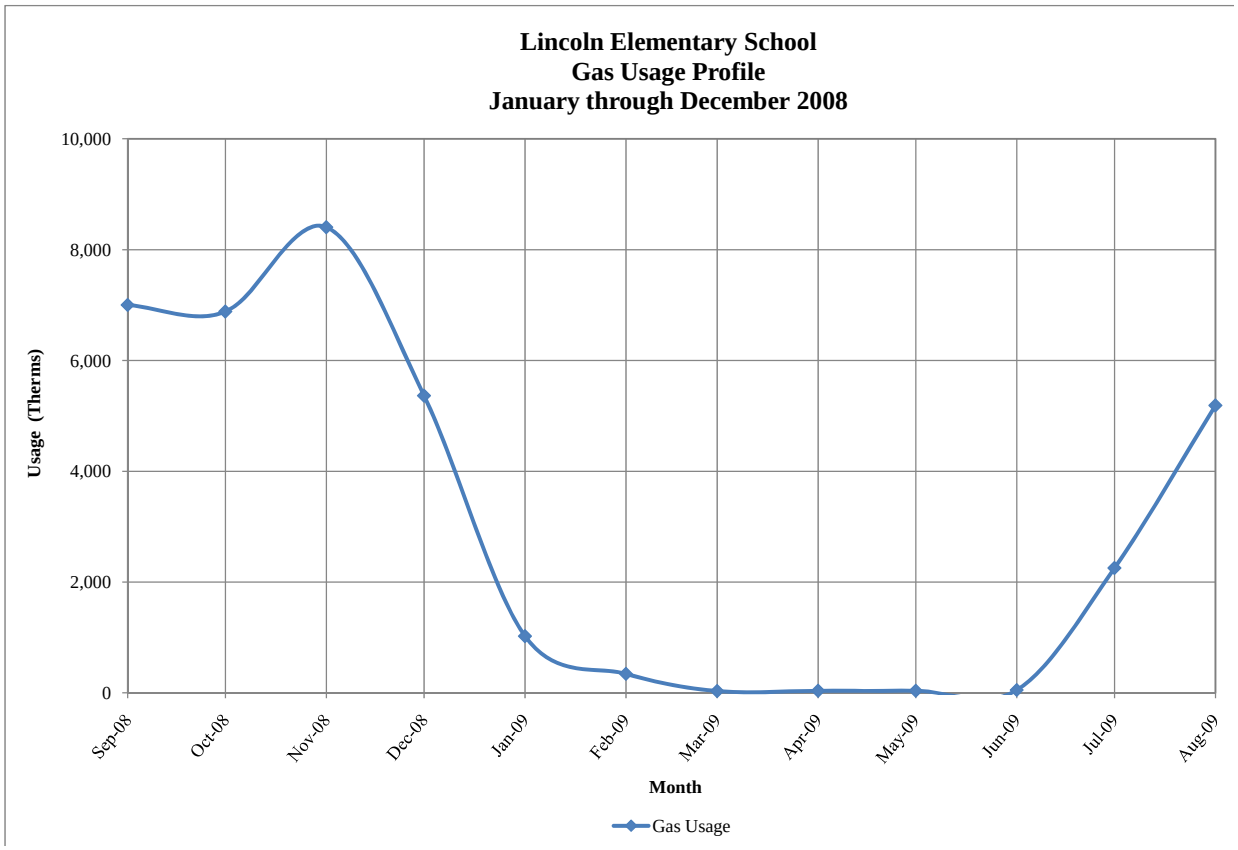
NATURAL GAS USAGE SUMMARY

Utility Provider: PSE&G
Rate: LVG
Meter No: 2808591
Point of Delivery ID: PE000009595919354421
Third Party Utility Provider: Hess
TPS Meter No: 21-145-043-28-2808591

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
Sep-08	6,999.42	$12,142.41
Oct-08	6,880.71	$11,953.28
Nov-08	8,403.26	$9,586.27
Dec-08	5,361.73	$8,167.04
Jan-09	1,023.31	$1,651.51
Feb-09	342.90	$621.47
Mar-09	33.04	$149.23
Apr-09	37.42	$156.46
May-09	37.49	$144.28
Jun-09	51.31	$160.97
Jul-09	2,252.00	$4,161.66
Aug-09	5,185.97	$8,187.74
TOTALS	**36,608.57**	**$57,082.32**

AVERAGE RATE: **$1.559** **$/THERM**

Figure 2
Natural Gas Usage Profile



B. Energy Use Index (EUI)

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

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

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

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

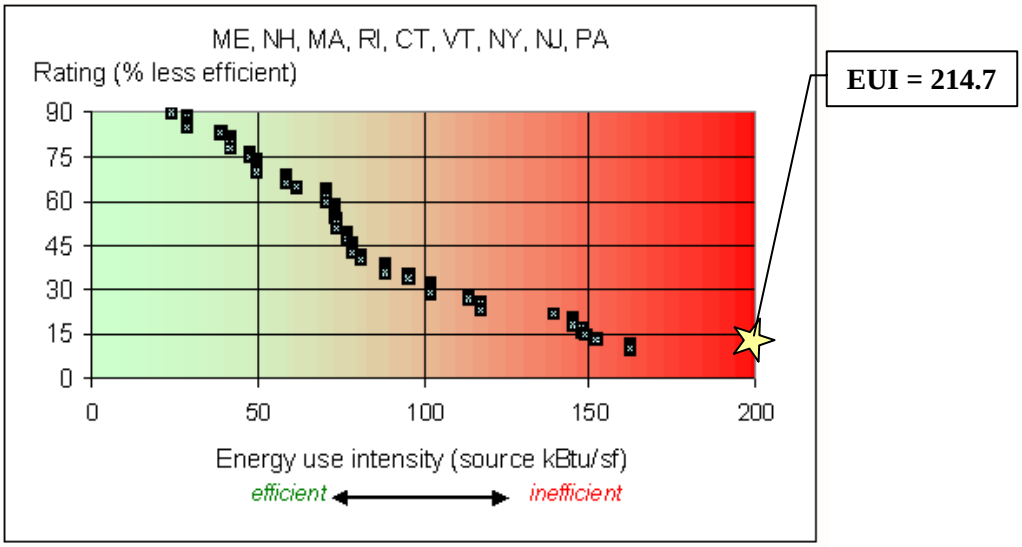
$$Building\ \ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ \ X\ \ SS\ \ Ratio + Gas\ Usage\ in\ kBtu\ \ X\ \ SS\ \ Ratio)}{Building\ \ Square\ \ Footage}$$

Table 5
Facility Energy Use Index (EUI) Calculation

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	**BUILDING USE**			**SITE ENERGY**	**SITE-SOURCE RATIO**	**SOURCE ENERGY**
	kWh	**Therms**	**Gallons**	**kBtu**		**kBtu**
ELECTRIC	543000.0			1,853,802	3.340	6,191,699
NATURAL GAS		36608.6		3,660,857	1.047	3,832,918
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				5,514,659		10,024,616
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		46,695	SQUARE FEET			
BUILDING SITE EUI		*118.10*	kBtu/SF/YR			
BUILDING SOURCE EUI		*214.68*	kBtu/SF/YR			

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

Figure 3
Energy Use Intensity Distributions: 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 government municipalities is becoming more important as utility costs continue to increase and emphasis is being placed on carbon reduction, greenhouse gas emissions and other environmental impacts.

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

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

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

User Name: rutherfordtwp
Password: lgeaceg2009

Security Question: What city were you born in?
Security Answer: "Rutherford"

Utilizing the utility bills and other information gathered during the energy audit process, CEG entered the respective data into Portfolio Manager and the following is a summary of the results:

Table 6
ENERGY STAR Performance Rating

ENERGY STAR PERFORMANCE RATING		
FACILITY DESCRIPTION	**ENERGY PERFORMANCE RATING**	**NATIONAL AVERAGE**
Lincoln School	13	50

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

V. FACILITY DESCRIPTION

The 46,695 ft^2 Lincoln School is a Kindergarten through Grade 3 learning facility that is comprised of classrooms, a multi-purpose room, pantry, library media center, administrative offices, nurse's office, mechanical/electrical rooms, faculty work room, etc. The building is identical to the Washington School with a similar addition in 2005.

The original building is 3-story structure comprised of brick/block construction and has a flat concrete slab roof. The original construction was completed in 1912, and a renovation in 2005 tripled the area of the Lincoln School with the addition of a new 2-story addition and gymnasium. There are two separate boiler rooms on the ground floor of the building, one in the new section and one in the old section. Each boiler room contains the equipment for the HVAC systems of their respective building section.

Heating System

The new section and the old section of the Lincoln School are conditioned by two separate heating systems. The original section of the building utilizes a 1963 H.B. Smith Mills 450, steam boiler that is rated at 60 BHP (2,070 lb/hr steam @ 212º F). A condensate pump returns condensate to the make-up water system. The classrooms, offices, storage rooms, lobby, etc. in the old section are heated/ventilated by older Trane unit ventilators with steam heating coils.

The 2005 building addition is heated by a primary/secondary system via three (3) A. O. Smith modular hot water heaters with a rated input of 750,000 MBH and output of 675,000 MBH. The primary hot water pumps are Bell & Gossett Model 60 units rated at 65 GPM and 1 HP motors. The hot water is delivered to various hot water coils via two (2) Bell & Gossett 1510 Series secondary hot water pumps rated at 310 GPM and 20 HP premium efficiency motors with Danfoss VLT 6000 variable frequency drives. There is a McQuay heating & ventilating unit (in the new addition mechanical room) Model #CAH010FHAC that heats and ventilates the 1st and 2nd floor corridors with a range of 2,900 to 7,700 CFM. The unit includes a hot water coil, a 15 HP supply air fan motor and a variable speed drive.

Two (2) McQuay 7,500 CFM units heat and ventilate the multi-purpose room (gym) and include a 15 HP supply air fan motor, a 7.5 HP exhaust air fan motor, energy recovery wheel, and a 300 MBH hot water coil.

Cooling System

The new 2005 Addition is cooled by a Trane Series R RTAC 1554 (155-Ton) rotary air-cooled chiller with nine (9) 1.5 HP condenser fans. The chilled water is pumped to various coils using the dual temperature pumps from the heating system. The new addition classrooms have hot water and chilled water unit ventilators by McQuay with the following features:

UV Type	Rated CFM	Fan HP	HW Coil	CW Coil
UV-A	1,450	¼	130.9 MBH	45.2 MBH

UV-B	1,100	¼	99.7 MBH	31.7 MBH
UV-C	750 CFM	160 Watts	67.1 MBH	26 MBH

The library (old section) is heated & cooled by a 2,650 CFM unit with DX coil rated at 107.2 MBH, a steam reheat coil rated at 121.7 MBH, and a 3 HP supply air fan motor. The nurse's office along with one classroom is heated & cooled by a 2,975 CFM unit with a DX coil rated at ____ MBH, a hot water coil rated at 113.1 MBH, and a 2 HP supply air fan motor. The main offices, conference room and a 2nd floor room (old section) are heated & cooled by a 2,200 CFM unit with a DX coil rated at 103.3 MBH, a steam heating coil rated at 163.7 MBH, and a 3 HP supply air fan motor.

The individual classrooms of the old section are cooled via a variety of window unit air conditioners.

Exhaust System

Air is exhausted from the building through a plethora of roof-top exhaust fans manufactured by Penn Barry. The fans vary in size, horsepower, and model numbers.

Domestic Hot Water

The domestic hot water system for the old section of the facility consists of a gas-fired Rheem hot water heater Model # 21X40-7 rated at 34,000 BTUH with a 40-gallon capacity. The 2005 addition has an A. O. Smith Preferred Model # BTH 300A 970 gas-fired hot water heater rated at 300,000 BTUH with a capacity of 130 gallons. An additional 200-gallon A. O. Smith Custom storage tank sits next to the DHW heater.

Lighting

The old section of the Lincoln School underwent a lighting retrofit in 2007. All of the 2' and 4' fixtures have been fitted with super T-8 lamps that have a total input of 28 Watts. There are a limited number of storage closets with compact fluorescent fixtures.

The new 2005 addition is lit by 2' x 4' & 2' x 2' - 2, 3, & 4-lamp fixtures with standard T-8 lamps and ballasts. The gym is lit by 2' x 2' ceiling fixtures with Pulse Start HID 320-Watt lamps. Many areas are lit by compact fluorescent lamps. The library media center is lit by 8' pendant mounted direct/indirect T-5 fixtures with 54-Watt High-Output lamps along with 42-Watt compact fluorescent lamps.

All exit signs are of the latest LED lamp design.

See **Appendix E** for a detailed listing of the lighting in this facility.

VI. MAJOR EQUIPMENT LIST

Following the completion of the field survey a detailed equipment list was created. The equipment within this list is considered major energy consuming equipment whose replacement could yield substantial energy savings. In addition, the list shows the major equipment in the facility and all pertinent information utilized in energy savings calculations. An approximate age was assigned to the equipment if a manufactures date was not shown on the equipment's nameplate. The ASHRAE service life for the equipment along with the remaining useful life is also shown in the Appendix.

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

VII. ENERGY CONSERVATION MEASURES

ECM #1: Dual Technology Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. Many times this is due to the idea that it is better to keep the lights on rather than to continuously switch them on and off. The on/off dilemma was studied and it was found that the best option is to turn the lights off whenever possible. Although this does reduce the lamp life, the energy savings far outweigh the lamp replacement costs. The cutoff for when to turn the lights off is around two minutes. If the lights can be off for only a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is all it would take. Occupancy sensors detect motion/infrared heat and will switch the lights on when the room is occupied. They can either be mounted in place of the current wall switch, or they can be mounted on the ceiling to cover large areas. Lastly, photocells are a lighting control that sense light levels and will turn the lights off when there is adequate daylight. These are mostly used outside, but they are becoming much more popular in energy-efficient interior building designs as well.

Numerous studies by the US Department of Energy have shown that occupancy sensors have an energy savings potential of 20-30% for daytime occupancies. We recommend the installation of dual technology occupancy sensors in all private offices, conference rooms, faculty room, small mechanical rooms, storage rooms, etc.

CEG would recommend wall switches for individual rooms, ceiling mount sensors for larger rooms, office areas, and fixture mount lighting sensors for some applications as manufactured by Sensorswitch, Watt Stopper or equivalent. There are approximately 13 sensors required for this project (4,000 SF of space).

Energy Savings Calculations:

From Appendix E of this report, we calculated the lighting power density (Watts/ft^2) of the existing offices, conferences rooms, file rooms, copy rooms, storage rooms, equipment rooms, etc. to be 1.03 Watts/SF. Thirty percent of this value is the resultant energy savings due to installation of occupancy sensors:

$$Energy\ Savings = \left(30\% \times\ Watts/SF \times Building\ SF \times Operating\ Hours \times \$/kWh\right)$$

$$Energy\ Savings = \left(30\% \times\ 1.03\, Watts/SF \times 4{,}000\ SF \times 1{,}800 hrs/yr \times \$0.172/kWh\right) = \underline{\$383\ per\ year}$$

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is $165 / unit including material and labor.

$$Installation\ Cost = (\#\ of\ \ sensors \times\ \ \$\ \ per\ \ sensor) = (13 \times \$165) = \$2{,}145$$

NJ Smart Start® Program Incentives are calculated as follows:

From **Appendix B**, the incentive for installing a lighting control is $20 per controller.

$$\text{Smart Start®}\ Incentive = (\#\ of\ \ controller \times\ \ \$\ 20) = (13 \times \$\ 20) = \underline{\$}260$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$2,145
NJ Smart Start Equipment Incentive ($):	$260
Net Installation Cost ($):	$2,405
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$383
Total Yearly Savings ($/Yr):	$383
Estimated ECM Lifetime (Yr):	15
Simple Payback	6.3
Simple Lifetime ROI	138.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$5,745
Internal Rate of Return (IRR)	14%
Net Present Value (NPV)	$2,167.23

ECM #2: Install Thermostatic Radiator Valves

Description:

The Lincoln School has steam unit ventilators and convectors on the perimeter of the 1st thru 3rd floors in the older section of the building. Due to the equipment age, old pneumatic, manual, thermostatic control valves, and the characteristics of steam, the rooms are often overheated and the teachers are forced to use the windows to control the heat further increasing energy costs. During our site survey, we counted a total of 24 existing valves that would be excellent candidates for replacement with these new steam valves.

This measure would install the newest generation of thermostatic radiator valves on the steam coils which would improve control of the heating in the older sections of the school. Thermostatic controls are self-contained, non-electric and are suitable for radiators, fin-tubes, baseboards or convector units. These new thermostatic valves have the capability of setting an upper limit to prevent overheating of the spaces. The valves include a remote sensor for accurately measuring the return air temperature for better heating control.

Energy Savings Calculations:

In our experience, we have seen a 10% to 15% reduction in energy use from installation of thermostatic radiator valves. The energy cost to heat this portion of the building is estimated to be approximately 1/3 of $61,955 per year in total natural gas costs which equates to approximately $20,652 per year. Therefore, the annual energy cost savings would be approximately 15% of $20,652 or $3,098 per year.

The basis of design is the ISTEC 2000 Series Thermostatic Radiator Valve or equal which has a total installation cost (including valve, sensor, calibration, piping changes, etc.) of $800 per unit. 24 existing valves x $800/unit = $19,200.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$19,200
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$19,200
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$3,098
Total Yearly Savings ($/Yr):	$3,098
Estimated ECM Lifetime (Yr):	15
Simple Payback	6.2
Simple Lifetime ROI	142.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$46,470
Internal Rate of Return (IRR)	14%
Net Present Value (NPV)	$17,783.72

ECM #3: Convert Pneumatic Controls to DDC (Older Section of the School)

Description:

Throughout the older section of the building there are pneumatic manual wall thermostats for various HVAC units and local pneumatic controls with adjustable settings on the heating units. These indoor temperature controls are inaccurate due to temperature drift, age, cost of maintenance of pneumatics and not having been re-calibrated. These units also do not have night time setback features. In addition, the pneumatic controllers don't have the ability to maintain the temperature at setpoint under changing load conditions.

This energy conservation measure would replace the existing pneumatic temperature control system with a Direct Digital Control System. The Direct Digital Control System will consist of multiple controllers networked over an Ethernet system that will display data at a standard PC via a web browser to allow the School District remote control and monitoring of the HVAC equipment. The advantages of a DDC system include deleting the air compressor, air dryer, and controls along with the maintenance costs of pneumatic systems. With a DDC system, it is possible to develop historical records on the operating characteristics of a building; identifying trends which can lead to better performance.

Energy Savings Calculations:

Studies have shown that the installation of a full DDC system could save an estimated 10% of the total energy costs for this portion of the facility which is approximately 1/4 of $155,521 per year or approximately $38,880.

Annual Savings = 10% x $38,880 = $3,888.

Assuming one-half of the total energy savings is natural gas and the other half is electric savings, this equates to 11,302 kWh and 1,150 therms saved. We have also assumed a maintenance savings of $1,500 per year for the pneumatic devices.

The cost of a full DDC system with new field devices, thermostats, controllers, computer, software, engineering, etc. is approximately $4 per SF based on recent project cost data and a control contractor's budget pricing. The estimated cost of a DDC system for the older section of this facility is approximately $64,000 (based on 16,000 SF).

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$64,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$64,000
Maintenance Savings ($/Yr):	$1,500
Energy Savings ($/Yr):	$3,888
Total Yearly Savings ($/Yr):	$5,388
Estimated ECM Lifetime (Yr):	15
Simple Payback	11.9
Simple Lifetime ROI	-8.9%
Simple Lifetime Maintenance Savings	$22,500
Simple Lifetime Savings	$58,320
Internal Rate of Return (IRR)	3%
Net Present Value (NPV)	$321.59

ECM #4: Install a High-Efficiency Steam Boiler

Description:

Various areas of the older section of the school are heated by a 1963, H B Smith, Mills 450 steam boiler that is rated (when new) at 60 HP (2,070 lb/hr steam @ 212º F). This steam boiler is beyond its expected service life as outlined in Chapter 36 of the 2007 ASHRAE Applications Handbook. Due to escalating owning and maintenance costs, this steam boiler should be replaced.

Note: Owner should have a Professional Engineer verify the steam heating loads for the portion of the building still using steam heat prior to moving forward with this ECM.

This measure would install a much more efficient, 60 HP Cleaver Brooks Model CB Steam Boiler with a 10:1 turndown, DDC controller, and more efficient burner. This steam boiler is rated at 2,070 lbs steam/hr @ 212ºF. The existing boiler/piping insulation would need to be removed before this ECM could be implemented.

Energy Savings Calculations:

It is assumed that the existing steam boiler is approximately 50% efficient (fuel-to-steam efficiency) due its age, various steam leaks detected, and condition of the boiler & burner. This 60 BHP, steam boiler can currently only operate with a 4:1 turndown ratio.
CEG recommends that the existing steam boiler be replaced by a 60 BHP, high-efficiency steam boiler that would carry the steam load in the winter months. The natural gas to steam efficiency for a 60 BHP steam boiler with digital burner controls is approximately 84.5% over its operating range and with the advanced controls will have a 10:1 turndown ratio for better efficiency in the shoulder months.

Existing 60 BHP Steam Boiler:

Net Rated Capacity = 2,070 lbs/hr steam @ 212ºF

Estimated Fuel-to-Steam Efficiency = 50% as calculated at 15 psig operating pressure. Currently there is no metering of steam output, condensate return, or make-up water to verify actual base conditions of operation and efficiency.

Replacement 60 BHP High-Efficiency Steam Boiler:

Net Rated Capacity = 2,070 lbs/hr steam @ 212ºF

Fuel-to-Steam Efficiency = 84.5% (Cleaver Brooks performance data)

Operating Data:

Existing Steam Boiler Fuel Consumption = 21,670 Therms

(Based on gas billing and boiler performance data)

Average Cost of Natural Gas = $1.69/Therm

Energy Savings = Old Boiler Energy Input * [(New Boiler Efficiency – Old Boiler Efficiency) / New Boiler Efficiency)]

Annual Energy Savings = 21,670 Therms x $\frac{(0.845-0.50)}{(0.845)}$ = 8,848 Therms

Energy Cost Savings = Annual Energy Savings * $/Therm = 8,848 Therms * $1.69/Therm

= $14,953 / yr.

The total installed cost of a high-efficiency 60 BHP (1,559 MBH) steam boiler including demolition & removal of existing steam boiler = $135,000 (budget equipment costs obtained from Cleaver Brooks). The salvage value of the removed boiler is expected to cover the cost of rigging sections of the old boiler out through the existing old boiler room. Allowance is made for piping, controls and the installation of a new feedwater pump.

Note: Cost does not include removal of boiler insulation nor any piping/valve insulation.

The NJ SmartStart equipment incentive is $1 per MBH = $1,559. We have assumed a maintenance savings of $4,000 per year.

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$135,000
NJ Smart Start Equipment Incentive ($):	$1,559
Net Installation Cost ($):	$136,559
Maintenance Savings ($/Yr):	$4,000
Energy Savings ($/Yr):	$14,953
Total Yearly Savings ($/Yr):	$18,953
Estimated ECM Lifetime (Yr):	25
Simple Payback	7.2
Simple Lifetime ROI	173.7%
Simple Lifetime Maintenance Savings	$100,000
Simple Lifetime Savings	$373,825
Internal Rate of Return (IRR)	13%
Net Present Value (NPV)	$193,472.39

REM #1: Solar Array on New Roof

Description:

Solar electric (photovoltaic or "PV") technology is a proven and highly dependable means of producing electricity from sunlight. PV modules, the basic building blocks of PV arrays, are warranted for 20-25 years. Most modules are expected to produce electricity for 30-40 years. The arrays are installed on a steel framework that is attached to the new flat roof. Because PV arrays produce direct current (DC), it is necessary to convert to alternating current (AC) used in buildings. Therefore PV systems must incorporate "inverters" to perform this function.

The lowest electrical demand was 120 kW per the utility bills for 2008. This ECM would install a 120 kW PV System on approximately 9,000 SF of open area of the new flat roof.

The School District should consider a solar PPA that could install the PV array with no capital investment (see Section IX of this report).

Solar PPAs are agreements between a provider and a customer to purchase on-going solar power at long-term rates. Solar PPA providers install and maintain solar facilities on customer rooftops or properties. Customers pay only for the power generated by the factility—not solar equipment or installation—greatly reducing the risk and complications of implementing a solar electricity solution.

Energy Savings Calculations:

See **Appendix F** for a detailed analysis.

Energy Savings Summary:

REM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$925,290
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$925,290
Maintenance Savings ($/Yr):	$41,581
Energy Savings ($/Yr):	$20,434
Total Yearly Savings ($/Yr):	$62,015
Estimated ECM Lifetime (Yr):	25
Simple Payback	14.9
Simple Lifetime ROI	-44.8%
Simple Lifetime Maintenance Savings	$1,039,525
Simple Lifetime Savings	$510,850
Internal Rate of Return (IRR)	4%
Net Present Value (NPV)	$154,586.35

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

Globally, renewable energy has become a priority affecting international and domestic energy policy. The State of New Jersey has taken a proactive approach, and has recently adopted in its Energy Master Plan a goal of 30% renewable energy by 2020. To help reach this goal New Jersey created the Office of Clean Energy under the direction of the Board of Public Utilities and instituted a Renewable Energy Incentive Program to provide additional funding to private and public entities for installing qualified renewable technologies. A renewable energy source can greatly reduce a building's operating expenses while producing clean environmentally friendly energy. CEG has assessed the feasibility of installing renewable energy technologies for Rutherford School District, and concluded that there is potential for solar and wind energy generation.

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

CEG has reviewed the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 7,300 S.F. can be utilized for a PV system. A depiction of the area utilized is shown in Appendix F. Using this square footage it was determined that a system size of 102.81 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 118,802 KWh annually, reducing the overall utility bill by approximately 21.8% percent. A detailed financial analysis can be found in Appendix F. 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 20 years. Direct purchase involves the local government paying for 100% of the total project cost upfront via one of the methods noted in Section X, Installation Funding Options. 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**
Self-Finance	14.92 Years	-44.8%	N/A
Direct Purchase	14.92 Years	-44.8%	5.1%

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

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

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

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

Load Profile analysis was performed to determine the seasonal energy usage of the facility. Irregularities in the load profile will indicate potential problems within the facility. Consequently based on the profile a recommendation will be made to remedy the irregularity in energy usage. For this report, the facility's energy consumption data was gathered in table format and plotted in graph form to create the load profile. Refer to 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, a multi-purpose room, pantry, library media center, administrative offices, nurse's office, mechanical electrical rooms and faculty workroom. This building has a 2005 addition.

The Electric Usage Profile demonstrates a fairly typical electric load profile. The summer (May-September) demonstrates increased consumption typical with air conditioning load. Cooling load in the newer 2005 addition is supplied by a Trane rotary air-cooled chiller. The new classrooms have chilled water ventilators present. The Library is cooled by a 2,650 CFM unit with DX coil. The Nurses office, along with one classroom, is cooled by 2,975 CFM unit with DX coil. A conference room, main offices and a second floor room (second floor-old section) is cooled by a 2,200 CFM unit with DX coil. The various classrooms in the older section have various window units for cooling. The profile demonstrates a peaking usage patter throughout the summer coming to a peak in September. The balance of the year is elevated with a very steady load profile. This facility receives its electrical Delivery service from PSE&G (Public Service Electric and Gas Company) on a LPLS rate schedule and its Commodity (electric supply) from South Jersey Energy Company, a Third Party Supplier on the ACES agreement. A flatter load profile will allow for more competitive energy prices when shopping for alternative suppliers.

Natural Gas:

The Natural Gas Usage Profile demonstrates a typical natural gas (heat load) load shape. However the seasonal patterns seem a bit abbreviated. The summer months (March – June) demonstrate very low consumption (complimenting the cooling electric load), but so does the usage in January and February typical heating months. There is an increase in winter consumption (October - December) but that is also present in July through September, typical cooling months. Heating in this facility is split between the new section and the original section. The original section is heated by a steam boiler. The classrooms, offices, storage rooms, lobby etc. in the original section are heated by older Trane unit ventilators with steam heating coils. The new 2005 addition is heated by (3) A.O. Smith modular hot water heaters. (2) CFM units heat the gym. The library, classrooms, nurse's room and other rooms are heated using the equipment mentioned above. The domestic hot water for the original section of the building is supplied by a natural gas-fired Rheem hot water heater with 40 gallon capacity. The 2005 addition has an A.O. Smith natural gas-fired hot water heater with 130 gallons of capacity. There

is also the presence of another A.O. Smith custom storage tank with 200 gallon capacity that sits next to the DHW heater. This facility's natural gas delivery service is provided by PSE&G (Public Service Electric and Gas Company) on a LVG rate schedule. The Commodity service is provided by The Hess Corporation through the ACES agreement. A base-load shaping (flat) will secure more competitive energy prices when procuring energy through an alternative energy source.

Tariff Analysis:

Electricity:

This facility receives electrical Delivery service through the utility Public Service Electric and Gas Company (PSE&G) on a LPLS (Large Power and Lighting Service) rate schedule classification.

The Delivery Service is provided by PSE&G while the Commodity Service (electric supply) is provided by South Jersey Energy Company a Third Party Supplier (TPS) through the ACES (Alliance for Competitive Energy Services) Cooperative Pricing System, agreement.

The LPLS Delivery Service if a for general purposes at secondary distribution voltages where the customer's measured peak demand exceeds 150 kilowatts in any month and also at primary distribution voltages. Customers may either purchase electric supply from a TPS or from PSE&G's Basic Generation Service default service as detailed in the rate schedule. Delivery Charges include the following: Service Charge, Distribution Charges, Societal Benefits Charge, Non-utility Generation Charge, Securitization Transition Charges. System Control Charge, Customer Account Services Charge, CIEP Standby Fee, Base-rate Adjustment Charge, Solar Pilot Recovery Charge, RGGI Recovery Charge and Capital Adjustment Charge.

The customer has the choice to procure the supply from PSE&G on its Basic Generation default supply or a Third Party Supplier (TPS). Currently this facility is provided electric supply from the TPS.

ACES is an alliance composed of the NJSBA and the NJASBO. The Rutherford BOE has stated if they want to procure alternative energy, they must through the ACES agreement. CEG will make a recommendation that is counter to this agreement. The term of the ACES agreement is the first meter read date on or after April 30, 2009 until the last meter read date, May, 2011. The

ACES agreement provides for NJSBA to adopt a resolution for renewal for no more than a (5) consecutive year term. CEG will recommend against such a renewal.

Natural Gas:

This facility receives utility service through Public Service Electric and Gas Company (PSE&G). This facility utilizes the Delivery Service from PSE&G while receiving Commodity service from a Third Party Supplier (TPS), The Hess Corporation.

LVG Rate: This utility tariff is for "firm" delivery service for general purposes. This rate schedule has a Delivery Charge, Balancing Charge, Societal Benefits Charge, Realignment Adjustment Charge, Margin Adjustment Charge, RGGI Charge and Customer Account Service Charge. The customer can elect to have the Commodity Charge serviced through the utility or by a Third Party Supplier (TPS). Note: Should the TPS not deliver, the customer may receive service from PSE&G under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service.

"Firm" delivery service defines the reliability of the transportation segment of the pricing. Much like the telecom industry, natural gas pipelines were un-bundled in the late 1990's and the space was divided up and marketed into reliability of service. Firm Service is said to be the most reliable and last in the pecking order for interruption. This service should not be interrupted.

This facility utilizes the services of a Third Party Supplier, The Hess Corporation. The contract is administered by The Alliance for Competitive Service (ACES). ACES is the energy aggregation program of the New Jersey School Boards Association of School Administrator's. The process was reviewed and approved by the New Jersey Department of Community Affairs. Term of this agreement is June 1, 2006 and expiring on or before May 31, 2009. This agreement is subject to renewal with BOE resolution. The original agreement has been extended for (1) year through May 31, 2010. CEG will not recommend extending this agreement.

Please see CEG recommendations below.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities within the BOE. Potential improvement is observed in both electric and natural gas costs. The average price per kWh (kilowatt hour) for all the LPLS rate schedule based on 1-year historical average price is $.10581 / kWh (this is the average "price to compare" for energy supplied by South Jersey Energy Company). The average price per decatherm for natural gas (as provided by The Hess Corporation as administered by the ACES agreement) is $14.058 / dth (dth, is the common unit of measure). This price is also the "price to compare".

Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. The BOE could see improvement in its energy costs if it were to take advantage of these current market prices quickly, before energy increases. Based on annual historical consumption of this facility (September 2008 through August 2009) and current electric rates, the Lincoln School could see an improvement in its electric costs of up to 15% or up to $14,000 annually. (Note: Savings were calculated using Average Annual Consumption and a variance to a Fixed Average One-Year commodity contract). CEG recommends aggregating the entire electric load to gain the most optimal energy costs. CEG recommends advisement for alternative sourcing and supply of energy on a "managed approach".

CEG's secondary recommendation coincides with the natural gas costs. Based on the current market, The Lincoln School could improve its natural gas costs by up to 32% or up to $18,000 annually. CEG recommends that the BOE receive further advisement on these prices through an

energy advisor. The Township should also consider procuring energy (natural gas) through an alternative supply source.

CEG also recommends that The BOE not renew its energy supply contract with the ACES aggregation and The Hess Corporation, and the ACES agreement with South Jersey Energy 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 ACES agreement has demonstrated that the price is much above market and the BOE has no way of adjusting the price should prices 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 The BOE 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 also recommends that The BOE schedule a meeting with the current utility providers to review their utility charges and current tariff structures for electricity and natural gas. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), the municipality can learn more about the competitive supply process. The BOE can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu. They should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the information for ongoing demand-side management projects. Furthermore, special attention should be given to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with the utility representative. The BOE should ask the utility representative about alternative billing options, such as consolidated billing when utilizing the service of a Third Party Supplier. Finally, if the supplier for energy (natural gas) is changed, closely monitor balancing, particularly when the contract is close to termination. This could be performed with the aid of an "energy advisor".

X. INSTALLATION FUNDING OPTIONS

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

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

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

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

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

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

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

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

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

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

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

XI. ADDITIONAL RECOMMENDATIONS

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

A. Maintain all weather stripping on windows and doors.

B. Use cog-belts instead of v-belts on all belt-driven fans, etc. These can reduce electrical consumption of the motor by 2-5%.

C. Reduce lighting in specified areas where the foot candle levels are above 70 in private offices and above 30 in corridor, lobbies, etc.

D. Provide more frequent air filter changes to decrease overall fan horsepower requirements and maintain better IAQ.

E. Recalibrate existing temperature sensors serving the HVAC control system.

F. Install a Vending Miser system to turn off the vending machines when not in use.

G. Clean all light fixtures to maximize light output.

H. Confirm that outside air economizers are functioning properly to take advantage of free cooling.

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

In addition to the recommendations above, CEG would also like to suggest Retro-Commissioning. Retro-Commissioning is a means to verify your current equipment is operating at its designed capacity, airflow, etc. Commissioning Agents, after defining what the original system design parameters are, would recommend revisions to the current system operating characteristics and utilize an independent testing and balancing company to perform air and water balancing on the existing systems.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Lincoln School

ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT.	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	Dual Technology Lighting Controls	$2,145	$0	260	$2,405	$383	$0	$383	15	$5,745	$0	138.9%	6.3	13.56%	$2,167.23
ECM #2	Install Thermostatic Radiator Valves	$19,200	$0	0	$19,200	$3,098	$0	$3,098	15	$46,470	$0	142.0%	6.2	13.82%	$17,783.72
ECM #3	Convert Pneumatic Controls to DDC	$64,000	$0	0	$64,000	$3,888	$1,500	$5,388	15	$58,320	$22,500	-8.9%	11.9	3.07%	$321.59
ECM #4	High-Efficiency Steam Boiler	$135,000	$0	1,559	$136,559	$14,953	$4,000	$18,953	25	$373,825	$100,000	173.7%	7.2	13.26%	$193,472.39
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	Solar Array on New Roof	$925,290	$0	0	$925,290	$20,434	$41,581	$62,015	25	$510,850	$1,039,525	-44.8%	14.9	4.44%	$154,586.35

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

Concord Engineering Group, Inc.

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

SmartStart Building Incentives

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

Electric Chillers

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

Gas Cooling

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

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

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

Ground Source Heat Pumps

Closed Loop & Open Loop	$370 per ton

Gas Heating

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

Variable Frequency Drives

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

Natural Gas Water Heating

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

Premium Motors

Three-Phase Motors	$45 - $700 per motor

Prescriptive Lighting

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

Lighting Controls – Occupancy Sensors

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

Lighting Controls – HID or Fluorescent Hi-Bay Controls

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

Other Equipment Incentives

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

"LINCOLN Elementary School"

Boiler

Location	Area Served	Manufacturer	Qty.	Model #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life
Basement	Old Section	HB Smith	1	450 MILLS	1,559	2,008	50%	Natural Gas	46	30	-16
	60 Boiler HP	15 PSI Steam		2,070 lbs/hr	-	-	Fuel-to-Steam	-	-	30	-

Boiler - Condensate Pump

Location	Area Served	Manufacturer	Qty.	Model #	HP	RPM	GPM	Ft. Hd	Approx. Age	ASHRAE Service Life	Remaining Life
Basement	Old Section	??	1	-	1/2 HP pump	-	-	-	20	30	10

Hot Water Heaters

Location	Area Served	Manufacturer	Qty.	Model #	Input (BTUH)	Output (BTUH)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life
New Mech Room	2005 Addition	A. O. Smith	3	LB-750 300	750000	675,000	90%	Natural Gas	4	12	8

Hot Water/Chilled Water Pumps

Location	Area Served	Manufacturer	Qty.	Model #	HP	RPM	GPM	Ft. Hd	Approx. Age	ASHRAE Service	Remaining Life
New Mech Room	2005 Addition	Bell & Gossett	2	1510 BF 10.625	20 HP	1800	315	105 TDH	4	20	16
HW/CW Pumps	-	Secondary Pumps		-	-	-	-	-	-	20	-
New Mech Room	2005 Addition	Bell & Gossett 60	3	Primary Pumps	1 HP	1800	65	25 TDH	4	20	16

Domestic Hot Water Heaters

Location	Area Served	Manufacturer	Qty	Model #	Input (BTUH)	Recovery (gal/h)	Capacity (gal)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life
Basement	Old Section	Rheem	1	21X40-7	34,000		40	Natural Gas	10	12	2
New Mech Room	2005 Addition	A O Smith	1	BTH 300A 970	300,000	360	130	Natural Gas	4	12	8

Air-Cooled Rotary Chiller

Location	Area Served	Manufacturer	Qty	Model #	Cooling Capacity	Condenser Fans		Approx. Age	ASHRAE Service	Remaining Life	
Rooftop	2005 Addition	Trane	1	RTAC 1554 UN0N UAFN	155 Tons	9 @ 1.5 HP		4	20	16	

Heating & Ventilating Units

Location	Area Served	Manufacturer	Qty.	Model #	S/A Fan	E/A Fan	HW Capacity	CFM	Approx. Age	ASHRAE Service	Remaining Life
New Mech Rm (HV-1)	1st & 2nd Fl Corr	McQuay	1	CAH010FHAC	7.5 HP	N/A	253.8 MBH	2,900 to 7,700	4	20	16
GYM (HV-2 & 3))	GYM	McQuay	2	Energy Recovery Wheel	15 HP	7.5 HP	299.4 MBH	7,500	4	20	16

DX Coil Units

Location	Area Served	Manufacturer	Qty.	S/A Fan	Heat Type	Heating Capacity	Cooling Capacity	CFM	Approx. Age	ASHRAE Service Life	Remaining Life
AC-1	Library		1	3 HP	Steam	121.7 MBH	107.2 MBH	2,650	4	20	16
AC-2	Nurse's Office		1	2 HP	Hot Water	113.1 MBH		2,975	4	20	16
	& Classroom										
AC-3	Old Section -		1	3 HP	Steam	163.7 MBH	103.3 MBH	2,200	4	20	16
	Main Offices										

STATEMENT OF ENERGY PERFORMANCE
Lincoln School

Building ID: 1797339
For 12-month Period Ending: December 31, 2008[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: November 12, 2009

Facility
Lincoln School
414 Montross Avenue
Rutherford, NJ 07070

Facility Owner
Rutherford Board of Education
176 Park Avenue
Rutherford, NJ 07070

Primary Contact for this Facility
Robert Brown
176 Park Avenue
Rutherford, NJ 07070

Year Built: 1912
Gross Floor Area (ft²): 46,700

Energy Performance Rating[2] (1-100) 13

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	1,852,716
Natural Gas (kBtu)[4]	3,660,850
Total Energy (kBtu)	5,513,566

Energy Intensity[5]

Site (kBtu/ft²/yr)	118
Source (kBtu/ft²/yr)	215

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	477

Electric Distribution Utility
PSE&G - Public Service Elec & Gas Co

National Average Comparison

National Average Site EUI	81
National Average Source EUI	147
% Difference from National Average Source EUI	46%
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 Standards[6] **for Indoor Environmental Conditions:**

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

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

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

ENERGY STAR® Data Checklist for Commercial Buildings

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

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

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Lincoln School	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	K-12 School	Is this an accurate description of the space in question?		☐
Location	414 Montross Avenue, Rutherford, NJ 07070	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐
Lincoln School (K-12 School)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	46,700 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.		☐
Open Weekends?	Yes	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.		☐
Number of PCs	82 (Default)	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	0 (Default)	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	No	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".		☐
Percent Cooled	100 % (Default)	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	90 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	N/A(Optional)	Is this school in operation for at least 8 months of the year?		☐

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'.		

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: PSE&G - Public Service Elec & Gas Co

Fuel Type: Electricity

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

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
12/01/2008	12/31/2008	45,000.00
11/01/2008	11/30/2008	46,680.00
10/01/2008	10/31/2008	43,200.00
09/01/2008	09/30/2008	42,240.00
08/01/2008	08/31/2008	51,840.00
07/01/2008	07/31/2008	51,480.00
06/01/2008	06/30/2008	39,120.00
05/01/2008	05/31/2008	35,400.00
04/01/2008	04/30/2008	44,520.00
03/01/2008	03/31/2008	51,360.00
02/01/2008	02/29/2008	46,920.00
01/01/2008	01/31/2008	45,240.00
Electricity Consumption (kWh (thousand Watt-hours))		**543,000.00**
Electricity Consumption (kBtu (thousand Btu))		**1,852,716.00**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**1,852,716.00**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

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

Start Date	End Date	Energy Use (therms)
12/01/2008	12/31/2008	5,186.00
11/01/2008	11/30/2008	2,252.00
10/01/2008	10/31/2008	51.30
09/01/2008	09/30/2008	37.50
08/01/2008	08/31/2008	37.40
07/01/2008	07/31/2008	33.00
06/01/2008	06/30/2008	342.90
05/01/2008	05/31/2008	1,023.30
04/01/2008	04/30/2008	5,361.70
03/01/2008	03/31/2008	8,403.30

02/01/2008	02/29/2008	6,880.70
01/01/2008	01/31/2008	6,999.40
Gas Consumption (therms)		**36,608.50**
Gas Consumption (kBtu (thousand Btu))		**3,660,850.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**3,660,850.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

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

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

Certifying Professional

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

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

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

Facility
Lincoln School
414 Montross Avenue
Rutherford, NJ 07070

Facility Owner
Rutherford Board of Education
176 Park Avenue
Rutherford, NJ 07070

Primary Contact for this Facility
Robert Brown
176 Park Avenue
Rutherford, NJ 07070

General Information

Lincoln School	
Gross Floor Area Excluding Parking: (ft^2)	46,700
Year Built	1912
For 12-month Evaluation Period Ending Date:	December 31, 2008

Facility Space Use Summary

Lincoln School	
Space Type	K-12 School
Gross Floor Area(ft^2)	46,700
Open Weekends?	Yes
Number of PCs[d]	82
Number of walk-in refrigeration/freezer units[d]	0
Presence of cooking facilities	No
Percent Cooled[d]	100
Percent Heated	90
Months[o]	N/A
High School?	No
School District[o]	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 12/31/2008)	**Baseline** (Ending Date 12/31/2008)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	13	13	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	118	118	63	N/A	81
Source (kBtu/ft^2)	215	215	115	N/A	147
Energy Cost					
$/year	$ 150,647.27	$ 150,647.27	$ 80,772.25	N/A	$ 103,281.30
$/$ft^2$/year	$ 3.23	$ 3.23	$ 1.73	N/A	$ 2.21
Greenhouse Gas Emissions					
$MtCO_2e$/year	477	477	256	N/A	327
$kgCO_2e/ft^2$/year	10	10	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.

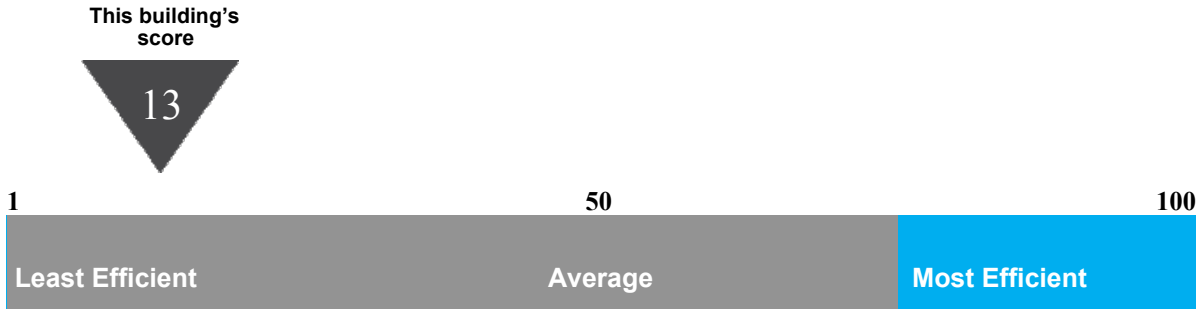
Statement of Energy Performance

2008

Lincoln School
414 Montross Avenue
Rutherford, NJ 07070

Portfolio Manager Building ID: 1797339

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 215 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending December 2008

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

EPA United States Environmental Protection Agency

Date Generated: 11/12/2009

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C09074
Project: Rutherford BOE
Address: 414 Montross Avenue
City: Rutherford, NJ 07070
Building SF: 46,695

"Lincoln Elementary School"

DATE: 11/12/2009
KWH COST: $0.172

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
Line No.		Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
1	A	Classroom	12	2' x 4' 3-Lamp, T8, 32 W lamps	1,800	110	1.32	2376	$408.67	12	No Change Required		0.00	0	$0.00		$0.00	1.32	2376	$408.67	0.00
2	A	Classroom	14	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	1.54	2772	$476.78	14	No Change Required		0.00	0	$0.00		$0.00	1.54	2772	$476.78	0.00
3	A1	Storage	3	2' x 4' 2-Lamp, T8, 32 W lamps	200	70	0.21	42	$7.22	3	No Change Required		0.00	0	$0.00		$0.00	0.21	42	$7.22	0.00
4	A1	Cafetorium	8	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	0.56	1008	$173.38	8	No Change Required		0.00	0	$0.00		$0.00	0.56	1008	$173.38	0.00
5	J1	Stairwell	2	2-Lamp 26 W, Compact Flourescent Light	1800	70	0.14	252	$43.34	2	No Change Required		0.00	0	$0.00		$0.00	0.14	252	$43.34	0.00
6	A2	Boys Restroom	5	2' x 4' 3-Lamp, Ballast Damp Label	1800	90	0.45	810	$139.32	5	No Change Required		0.00	0	$0.00		$0.00	0.45	810	$139.32	0.00
7	A2	Girls Restroom	5	2' x 4' 3-Lamp, Ballast Damp Label	1800	90	0.45	810	$139.32	5	No Change Required		0.00	0	$0.00		$0.00	0.45	810	$139.32	0.00
8	A2	Janitor's Closet	1	2' x 4' 3-Lamp, Ballast Damp Label	400	90	0.09	36	$6.19	1	No Change Required		0.00	0	$0.00		$0.00	0.09	36	$6.19	0.00

9	A	Faculty Room	3	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	0.33	594	$102.17	3	No Change Required		0.00	0	$0.00		$0.00	0.33	594	$102.17	0.00
10	A1	Corridor	11	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	0.77	1386	$238.39	11	No Change Required		0.00	0	$0.00		$0.00	0.77	1386	$238.39	0.00
11	A	Classroom	12	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	1.32	2376	$408.67	12	No Change Required		0.00	0	$0.00		$0.00	1.32	2376	$408.67	0.00
12	A	Classroom	12	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	1.32	2376	$408.67	12	No Change Required		0.00	0	$0.00		$0.00	1.32	2376	$408.67	0.00
13	A	Classroom	12	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	1.32	2376	$408.67	12	No Change Required		0.00	0	$0.00		$0.00	1.32	2376	$408.67	0.00
14	A	Classroom	12	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	1.32	2376	$408.67	12	No Change Required		0.00	0	$0.00		$0.00	1.32	2376	$408.67	0.00
15	D	Elec/Mech Room	26	4' Ind. 2-Lamp, T8, 32 Watt	400	70	1.82	728	$125.22	26	No Change Required		0.00	0	$0.00		$0.00	1.82	728	$125.22	0.00
16	A	Elevator Room	2	2' x 4' 3-Lamp, T8, 32 W lamps	200	110	0.22	44	$7.57	2	No Change Required		0.00	0	$0.00		$0.00	0.22	44	$7.57	0.00
17	A1	Corridor	7	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	0.49	882	$151.70	7	No Change Required		0.00	0	$0.00		$0.00	0.49	882	$151.70	0.00
18	A	Classroom	7	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	0.77	1386	$238.39	7	No Change Required		0.00	0	$0.00		$0.00	0.77	1386	$238.39	0.00
19	A	SGI #1	6	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	0.66	1188	$204.34	6	No Change Required		0.00	0	$0.00		$0.00	0.66	1188	$204.34	0.00
20	A	SGI #2	6	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	0.66	1188	$204.34	6	No Change Required		0.00	0	$0.00		$0.00	0.66	1188	$204.34	0.00
21	A1	Corridor	3	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	0.21	378	$65.02	3	No Change Required		0.00	0	$0.00		$0.00	0.21	378	$65.02	0.00
22	A2	Pantry	3	2' x 4' 3-Lamp, Ballast Damp Label	1800	90	0.27	486	$83.59	3	No Change Required		0.00	0	$0.00		$0.00	0.27	486	$83.59	0.00
23	H	Gym	18	2' x 2' w/ Pulse Start HID 320 W	2000	370	6.66	13320	$2,291.04	18	No Change Required		0.00	0	$0.00		$0.00	6.66	13320	$2,291.04	0.00
24	H1		6	2' x 2' w/ Quart Restrike Lamp	2000	370	2.22	4440	$763.68	6	No Change Required		0.00	0	$0.00		$0.00	2.22	4440	$763.68	0.00
25	F	Stage	11	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	0.77	1386	$238.39	11	No Change Required		0.00	0	$0.00		$0.00	0.77	1386	$238.39	0.00
26	A1	Gym Storage	6	2' x 4' 2-Lamp, T8, 32 W lamps	400	70	0.42	168	$28.90	6	No Change Required		0.00	0	$0.00		$0.00	0.42	168	$28.90	0.00
27	G1	Library	12	8' T5HO54W	1800	180	2.16	3888	$668.74	12	No Change Required		0.00	0	$0.00		$0.00	2.16	3888	$668.74	0.00
28	K		30	9" Diameter Recessed, 1-Lamp, 42 Watt, Compact Flourescent Light	1800	45	1.35	2430	$417.96	30	No Change Required		0.00	0	$0.00		$0.00	1.35	2430	$417.96	0.00
29	A	A.V. Work Room	6	2' x 4' 3-Lamp, T8, 32 W lamps	400	110	0.66	264	$45.41	6	No Change Required		0.00	0	$0.00		$0.00	0.66	264	$45.41	0.00
30	A1	Library	6	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	0.42	756	$130.03	6	No Change Required		0.00	0	$0.00		$0.00	0.42	756	$130.03	0.00
31	A	SGI #3	7	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	0.77	1386	$238.39	7	No Change Required		0.00	0	$0.00		$0.00	0.77	1386	$238.39	0.00
32	A1	Stair #3	8	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	0.56	1008	$173.38	8	No Change Required		0.00	0	$0.00		$0.00	0.56	1008	$173.38	0.00
33	A1	Corridor	14	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	0.98	1764	$303.41	14	No Change Required		0.00	0	$0.00		$0.00	0.98	1764	$303.41	0.00
34	A	Classroom	12	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	1.32	2376	$408.67	12	No Change Required		0.00	0	$0.00		$0.00	1.32	2376	$408.67	0.00
35	A	Classroom	12	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	1.32	2376	$408.67	12	No Change Required		0.00	0	$0.00		$0.00	1.32	2376	$408.67	0.00
36	A	Art/Music	18	2' x 4' 3-Lamp, T8, 32 W lamps	1800	110	1.98	3564	$613.01	18	No Change Required		0.00	0	$0.00		$0.00	1.98	3564	$613.01	0.00
37	K	Closets	15	9" Diameter Recessed, 1-Lamp, 42 Watt, Compact Flourescent Light	400	45	0.68	270	$46.44	15	No Change Required		0.00	0	$0.00		$0.00	0.68	270	$46.44	0.00

38	A2	Girls Restroom	5	2' x 4' 3-Lamp, Ballast Damp Label	1800	90	0.45	810	$139.32	5	No Change Required		0.00	0	$0.00		$0.00	0.45	810	$139.32	0.00
39	A2	Boys Restroom	5	2' x 4' 3-Lamp, Ballast Damp Label	1800	90	0.45	810	$139.32	5	No Change Required		0.00	0	$0.00		$0.00	0.45	810	$139.32	0.00
40	A2	Janitor's Closet	1	2' x 4' 3-Lamp, Ballast Damp Label	400	90	0.09	36	$6.19	1	No Change Required		0.00	0	$0.00		$0.00	0.09	36	$6.19	0.00
41	A	Faculty Workroom	6	2' x 4' 3-Lamp, T8, 32 W lamps	1800		0.00	0	$0.00	6	No Change Required		0.00	0	$0.00		$0.00	0.00	0	$0.00	#DIV/0!
42	A	Kindergarten	12	2' x 4' 3-Lamp, T8, 32 W lamps	1400		0.00	0	$0.00	12	No Change Required		0.00	0	$0.00		$0.00	0.00	0	$0.00	#DIV/0!
	A1	Storage	4	2' x 4' 2-Lamp, T8, 32 W lamps	400	70	0.28	112	$19.26	4	No Change Required		0.00	0	$0.00		$0.00	0.28	112	$19.26	0.00
	A	Kindergarten	12	2' x 4' 3-Lamp, T8, 32 W lamps	1400		0.00	0	$0.00	12	No Change Required		0.00	0	$0.00		$0.00	0.00	0	$0.00	#DIV/0!
43	A	Health Office	6	2' x 4' 3-Lamp, T8, 32 W lamps	1800		0.00	0	$0.00	6	No Change Required		0.00	0	$0.00		$0.00	0.00	0	$0.00	#DIV/0!
44	A2	Toilet	1	2' x 4' 3-Lamp, Ballast Damp Label	400	90	0.09	36	$6.19	1	No Change Required		0.00	0	$0.00		$0.00	0.09	36	$6.19	0.00
45	A	Classroom	13	2' x 4' 3-Lamp, T8, 32 W lamps	1800		0.00	0	$0.00	13	No Change Required		0.00	0	$0.00		$0.00	0.00	0	$0.00	#DIV/0!
46	B	Classroom	2	2' x 2' T8, 32 W, U6-Lamp	1800	70	0.14	252	$43.34	2	No Change Required		0.00	0	$0.00		$0.00	0.14	252	$43.34	0.00
47	D	Mech Room	10	4' Ind. 2-Lamp, T8, 32 Watt	400	70	0.70	280	$48.16	10	No Change Required		0.00	0	$0.00		$0.00	0.70	280	$48.16	0.00
48	A	Office	2	2' x 4' 3-Lamp, T8, 32 W lamps	1800		0.00	0	$0.00	2	No Change Required		0.00	0	$0.00		$0.00	0.00	0	$0.00	#DIV/0!
	A2	Office	1	2' x 4' 3-Lamp, Ballast Damp Label	1800	90	0.09	162	$27.86	1	No Change Required		0.00	0	$0.00		$0.00	0.09	162	$27.86	0.00
49	A	Reception	7	2' x 4' 3-Lamp, T8, 32 W lamps	1800		0.00	0	$0.00	7	No Change Required		0.00	0	$0.00		$0.00	0.00	0	$0.00	#DIV/0!
50	A	Faculty Conference Room	3	2' x 4' 3-Lamp, T8, 32 W lamps	1800		0.00	0	$0.00	3	No Change Required		0.00	0	$0.00		$0.00	0.00	0	$0.00	#DIV/0!
	A2		1	2' x 4' 3-Lamp, Ballast Damp Label	1800	90	0.09	162	$27.86	1	No Change Required		0.00	0	$0.00		$0.00	0.09	162	$27.86	0.00
51	A2	Toilet	1	2' x 4' 3-Lamp, Ballast Damp Label	400	90	0.09	36	$6.19	1	No Change Required		0.00	0	$0.00		$0.00	0.09	36	$6.19	0.00
52	A	CST Office	8	2' x 4' 3-Lamp, T8, 32 W lamps	1800		0.00	0	$0.00	8	No Change Required		0.00	0	$0.00		$0.00	0.00	0	$0.00	#DIV/0!
53	A1	Elevator Lobby	2	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	0.14	252	$43.34	2	No Change Required		0.00	0	$0.00		$0.00	0.14	252	$43.34	0.00
54	A1	Corridor	3	2' x 4' 2-Lamp, T8, 32 W lamps	1800	70	0.21	378	$65.02	3	No Change Required		0.00	0	$0.00		$0.00	0.21	378	$65.02	0.00
55		Main Office	7	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.61	1096.2	$188.55	7	No Change Required		0.00	0	$0.00		$0.00	0.61	1096.2	$188.55	0.00
56		Classroom #1	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$242.42	9	No Change Required		0.00	0	$0.00		$0.00	0.78	1409.4	$242.42	0.00
		Classroom #1	1	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.05	81	$13.93	1	No Change Required		0.00	0	$0.00		$0.00	0.05	81	$13.93	0.00
		Classroom #2	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$242.42	9	No Change Required		0.00	0	$0.00		$0.00	0.78	1409.4	$242.42	0.00
		Classroom #2	1	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.05	81	$13.93	1	No Change Required		0.00	0	$0.00		$0.00	0.05	81	$13.93	0.00
		Classroom #3	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$242.42	9	No Change Required		0.00	0	$0.00		$0.00	0.78	1409.4	$242.42	0.00
		Classroom #3	1	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.05	81	$13.93	1	No Change Required		0.00	0	$0.00		$0.00	0.05	81	$13.93	0.00
		Boys Restroom	2	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.17	313.2	$53.87	2	No Change Required		0.00	0	$0.00		$0.00	0.17	313.2	$53.87	0.00
		Girls Restroom	2	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.17	313.2	$53.87	2	No Change Required		0.00	0	$0.00		$0.00	0.17	313.2	$53.87	0.00
		Classroom #4	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$242.42	9	No Change Required		0.00	0	$0.00		$0.00	0.78	1409.4	$242.42	0.00

		Classroom #4	1	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.05	81	$13.93	1	No Change Required		0.00	0	$0.00		$0.00	0.05	81	$13.93	0.00
		Classroom #5	9	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.78	1409.4	$242.42	9	No Change Required		0.00	0	$0.00		$0.00	0.78	1409.4	$242.42	0.00
		Classroom #5	1	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.05	81	$13.93	1	No Change Required		0.00	0	$0.00		$0.00	0.05	81	$13.93	0.00
		G & T Office	2	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	0.17	313.2	$53.87	2	No Change Required		0.00	0	$0.00		$0.00	0.17	313.2	$53.87	0.00
		Library	12	2' x 4' 4-Lamp, T8, 28 W lamps	1800	87	1.04	1879.2	$323.22	12	No Change Required		0.00	0	$0.00		$0.00	1.04	1879.2	$323.22	0.00
		Maint Closet	2	2' x 4' 2-Lamp, T8, 28 W lamps	400	45	0.09	36	$6.19	2	No Change Required		0.00	0	$0.00		$0.00	0.09	36	$6.19	0.00
		Storage Room	1	2' x 4' 2-Lamp, T8, 28 W lamps	200	45	0.05	9	$1.55	1	No Change Required		0.00	0	$0.00		$0.00	0.05	9	$1.55	0.00
		Maint Office	1	2' x 4' 2-Lamp, T8, 28 W lamps	1800	45	0.05	81	$13.93	1	No Change Required		0.00	0	$0.00		$0.00	0.05	81	$13.93	0.00
		Principal Office	2	2' x 4' 2-Lamp, T8, 28 W lamps	2000	45	0.09	180	$30.96	2	No Change Required		0.00	0	$0.00		$0.00	0.09	180	$30.96	0.00
		Conference Rm	1	2' x 4' 4-Lamp, T8, 28 W lamps	2000	87	0.09	174	$29.93	1	No Change Required		0.00	0	$0.00		$0.00	0.09	174	$29.93	0.00
		Totals	540				48.00	80439	$13,835.51	540			0.00	0	$0.00		$0.00	48.00	80439	$13,835.51	0.00

Project Name: Lincoln School
Location: Rutherford, NJ
Description: Photovoltaic System 95% Financing - 20 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 20 year
Total Construction Cost	$925,290
Annual kWh Production	118,802
Annual Energy Cost Reduction	$20,434
Annual SREC Revenue	$41,581
First Cost Premium	**$925,290**
Simple Payback:	**14.92** Years

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	95%
Financing Term (mths):	300	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.172**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	7.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$46,265	0	0	0	$0	0	0	(46,265)	0
1	$0	118,802	$20,434	$0	$41,581	$61,106	$13,447	($12,539)	($58,803)
2	$0	118,208	$21,047	$0	$41,373	$60,134	$14,420	($12,133)	($70,937)
3	$0	117,617	$21,678	$0	$41,166	$59,091	$15,462	($11,709)	($82,645)
4	$0	117,029	$22,329	$0	$40,960	$57,974	$16,580	($11,264)	($93,910)
5	$0	116,444	$22,999	$1,199	$40,755	$56,775	$17,778	($11,999)	($105,909)
6	$0	115,862	$23,689	$1,193	$40,552	$55,490	$19,063	($11,507)	($117,415)
7	$0	115,282	$24,399	$1,187	$40,349	$54,112	$20,442	($10,993)	($128,408)
8	$0	114,706	$25,131	$1,181	$40,147	$52,634	$21,919	($10,457)	($138,864)
9	$0	114,132	$25,885	$1,176	$39,946	$51,049	$23,504	($9,897)	($148,762)
10	$0	113,562	$26,662	$1,170	$39,747	$49,350	$25,203	($9,315)	($158,076)
11	$0	112,994	$27,462	$1,164	$39,548	$47,528	$27,025	($8,708)	($166,784)
12	$0	112,429	$28,285	$1,158	$39,350	$45,575	$28,978	($8,076)	($174,860)
13	$0	111,867	$29,134	$1,152	$39,153	$43,480	$31,073	($7,418)	($182,278)
14	$0	111,307	$30,008	$1,146	$38,958	$41,234	$33,320	($6,734)	($189,012)
15	$0	110,751	$30,908	$1,141	$38,763	$38,825	$35,728	($6,023)	($195,035)
16	$0	110,197	$31,835	$1,135	$38,569	$36,242	$38,311	($5,284)	($200,319)
17	$0	109,646	$32,790	$1,129	$38,376	$33,473	$41,081	($4,516)	($204,835)
18	$0	109,098	$33,774	$1,124	$38,184	$30,503	$44,050	($3,719)	($208,554)
19	$0	108,552	$34,787	$1,118	$37,993	$27,319	$47,235	($2,891)	($211,444)
20	$0	108,010	$35,831	$1,112	$37,803	$23,904	$50,649	($2,031)	($213,476)
21	$0	107,470	$36,906	$1,107	$37,614	$21,778	$46,562	$5,073	($208,403)
22	$0	106,932	$38,013	$1,101	$37,426	$17,598	$38,316	$18,423	($189,980)
23	$0	106,398	$39,154	$1,096	$37,239	$0	$0	$75,297	($114,683)
24	$0	105,866	$40,328	$1,090	$37,053	$0	$0	$76,291	($38,392)
25	$0	105,336	$41,538	$1,085	$36,868	$0	$0	$77,321	$38,929
	Totals:	2,266,493	$549,068	$18,487	$793,273	$925,796	$565,268	$650,147	($3,562,856)
				Net Present Value (NPV)				**($84,430)**	
				Internal Rate of Return (IRR)				**#NUM!**	

Project Name: **Lincoln School**
Location: **Rutherford, NJ**
Description: **Photovoltaic System - Direct Purchase**

Simple Payback Analysis

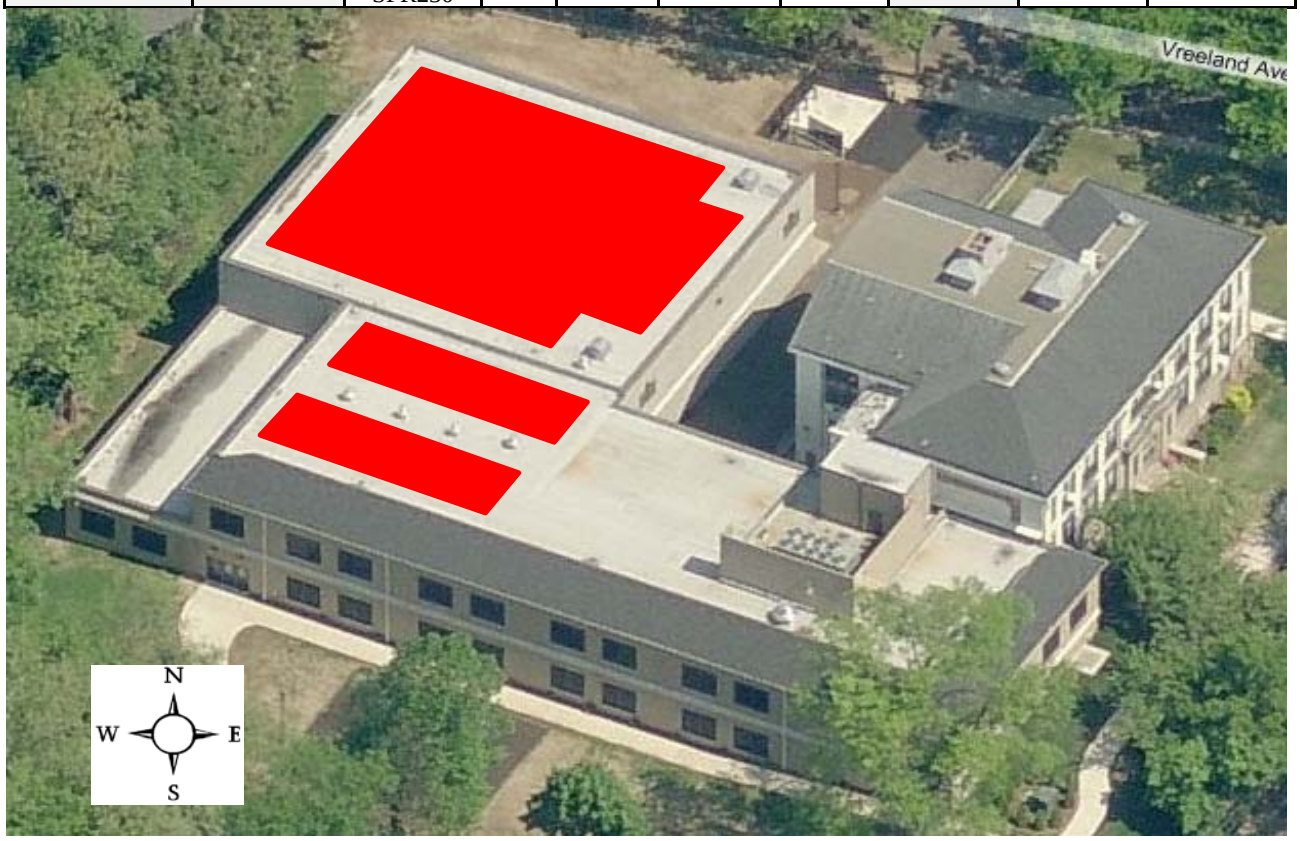
	Photovoltaic System - Direct Purchase
Total Construction Cost	$925,290
Annual kWh Production	118,802
Annual Energy Cost Reduction	$20,434
Annual SREC Revenue	$41,581
First Cost Premium	**$925,290**
Simple Payback:	**14.92** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.172**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$925,290	0	0	0	$0	(925,290)	0
1	$0	118,802	$20,434	$0	$41,581	$62,015	($863,275)
2	$0	118,208	$21,047	$0	$41,373	$62,420	($800,856)
3	$0	117,617	$21,678	$0	$41,166	$62,844	($738,011)
4	$0	117,029	$22,329	$0	$40,960	$63,289	($674,722)
5	$0	116,444	$22,999	$1,199	$40,755	$62,555	($612,168)
6	$0	115,862	$23,689	$1,193	$40,552	$63,047	($549,121)
7	$0	115,282	$24,399	$1,187	$40,349	$63,561	($485,561)
8	$0	114,706	$25,131	$1,181	$40,147	$64,097	($421,464)
9	$0	114,132	$25,885	$1,176	$39,946	$64,656	($356,808)
10	$0	113,562	$26,662	$1,170	$39,747	$65,239	($291,570)
11	$0	112,994	$27,462	$1,164	$39,548	$65,846	($225,724)
12	$0	112,429	$28,285	$1,158	$39,350	$66,477	($159,247)
13	$0	111,867	$29,134	$1,152	$39,153	$67,135	($92,112)
14	$0	111,307	$30,008	$1,146	$38,958	$67,819	($24,293)
15	$0	110,751	$30,908	$1,141	$38,763	$68,530	$44,238
16	$0	110,197	$31,835	$1,135	$38,569	$69,269	$113,507
17	$0	109,646	$32,790	$1,129	$38,376	$70,037	$183,544
18	$0	109,098	$33,774	$1,124	$38,184	$70,835	$254,379
19	$0	108,552	$34,787	$1,118	$37,993	$71,663	$326,042
20	$0	108,010	$35,831	$1,112	$37,803	$72,522	$398,564
21	$1	107,470	$36,906	$1,107	$37,614	$73,413	$471,977
22	$2	106,932	$38,013	$1,101	$37,426	$74,338	$546,315
23	$3	106,398	$39,154	$1,096	$37,239	$75,297	$621,612
24	$4	105,866	$40,328	$1,090	$37,053	$76,291	$697,902
25	$5	105,336	$41,538	$1,085	$36,868	$77,321	$775,223
	Totals:	2,266,493	$549,068	$18,487	$793,273	$1,700,513	$1,323,854
				Net Present Value (NPV)		**$775,248**	
				Internal Rate of Return (IRR)		**5.1%**	

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
Lincoln	7300	Sunpower SPR230	447	14.7	6,573	102.81	118,802	14,751	15.64



.= Proposed PV Layout

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

PVWatts Version 1 Input Screen

PV System Specifications:

DC Rating (kW):	102.81	Inputted From Roof Space Cell "G2" Total KW
DC to AC Derate Factor:	0.81	Inputted From Derate Factor Calculated Below in Cell "B37"
Array Type:	Fixed Tilt 1 - Axis Tracking 2 - Axis Tracking	There are 3 inputs for Array Type in all cases you should be using **Fixed Tilt** as the Selection
Fixed Tilt of Single Axis Tracking System:		
Array Tilt (degrees):	10	Based on Roof Type: For Flat Roof use 10 degrees, For Pitched Roof this is based on roof pitch.
Array Azimuth (degrees):	180	Based on Direction Array is Facing.

PV Watts Derate Factor for AC Power Rating at STC		
Component Derate Factors	PVWatts Default	Range
PV module nameplate DC rating	1.00	0.80–1.05
Inverter and transformer	0.95	0.88–0.96
Mismatch	0.98	0.97–0.995
Diodes and connections	1.00	0.99–0.997
DC wiring	0.98	0.97–0.99
AC wiring	0.99	0.98–0.993
Soiling	0.95	0.30–0.995
System availability	0.95	0.00–0.995
Shading	1.00	0.00–1.00
Sun-tracking	1.00	0.95–1.00
Age	1.00	0.70–1.00
Overall DC-to-AC derate factor	**0.81**	0.96001–0.09999

PVWatts * * * AC Energy & Cost Savings

Cautions for Interpreting the Results

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	102.8 kW
DC to AC Derate Factor:	0.810
AC Rating:	83.3 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	0.2 ¢/kWh

Results			
Month	Solar Radiation (kWh/m^2/day)	AC Energy (kWh)	Energy Value ($)
1	2.39	6168	10.61
2	3.17	7478	12.86
3	4.07	10466	18.00
4	4.83	11596	19.95
5	5.70	13796	23.73
6	5.94	13481	23.19
7	5.77	13376	23.01
8	5.38	12389	21.31
9	4.65	10659	18.33
10	3.61	8774	15.09
11	2.35	5597	9.63
12	2.01	5022	8.64
Year	4.16	118802	204.34

Output Hourly Performance Data * Output Results as Text

About the Hourly Performance Data — Saving Text from a Browser

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

Please send questions and comments regarding PVWATTS to Webmaster

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