LOCAL GOVERNMENT ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT

PREPARED FOR: **LEARNING COMMUNITY CHARTER SCHOOL**

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JERSEY CITY, NJ, 07304
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TABLE OF CONTENTS

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I. EXECUTIVE SUMMARY

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

Learning Community Charter School
2495 Kennedy Blvd
Jersey City, NJ, 07304

Facility Contact Person: Michael D. Steinmetz
School Business Administrator

This audit is performed in connection with the New Jersey Clean Energy - Local Government Energy Audit Program. The energy audit is conducted to promote the mission of the office of Clean Energy, which is to use innovation and technology to solve energy and environmental problems in a way that improves the State's economy. This can be achieved through the wiser and more efficient use of energy.

The annual energy costs at this facility are as follows:

Electricity	$30,823
Natural Gas	$39,431
Total	$70,254

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

Table 1
Financial Summary Table

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Boiler Replacement	$215,000	$6,597	32.6	7.4%
ECM #2	Library Lighting Equipment Upgrade	$4,070	$764	5.3	181.6%
ECM #3	Cafeteria Lighting Equipment Upgrade	$490	$771	0.6	2258.7%
ECM #4	Gymnasium and Auditorium Lighting Equipment Upgrade	$2,520	$1,415	1.8	742.4%
ECM #5	Lighting Equipment Upgrade (Other Spaces)	$38,160	$6,914	5.5	171.8%
ECM #6	Thermostatic Control Valves on Radiators	$52,500	$6,266	8.4	79.0%
ECM #7	Digital Energy Management System (DDC EMS)	$304,000	$7,516	40.4	-62.9%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	Solar Photovoltaic Panels	$387,090	$26,211	14.8	1.6%

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

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

Table 2
Estimated Energy Savings Summary Table

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	Boiler Replacement	0.0	0	6,405
ECM #2	Library Lighting Equipment Upgrade	2.6	4,289	0
ECM #3	Cafeteria Lighting Equipment Upgrade	2.7	4,586	0
ECM #4	Gymnasium and Auditorium Lighting Equipment Upgrade	14.0	8,424	0
ECM #5	Lighting Equipment Upgrade (Other Spaces)	24.7	38,877	0
ECM #6	Thermostatic Control Valves on Radiators	0.0	0	6,083
ECM #7	Digital Energy Management System (DDC EMS)	0.0	7,532	6,083
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	Solar Photovoltaic Panels	34.9	50,796	0

Recommended Energy Conservation Measures (ECMs)

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

- **ECM #2:** Library Lighting Equipment Upgrade
- **ECM #3:** Cafeteria Lighting Equipment Upgrade
- **ECM #4:** Gymnasium and Auditorium Lighting Equipment Upgrade
- **ECM #5:** Lighting Equipment Upgrade (Other Spaces)
- **ECM #6:** Thermostatic Control Valves on Radiators

ECM #2: Library Lighting Equipment Upgrade

Currently, the library lighting is provided with old and inefficient 4-lamp fixtures with T12 lamps. Upgraded fixtures with higher efficiency T8 lamps will provide the same amount of light output with reduced number of lamps per fixture. The retrofit will result in not only reduced energy consumption but also reduced maintenance costs due to reduced number of lamps per fixture and longer burn hours of T8 lamps compared to T12 lamps. This ECM provides approximately five (5) years payback.

ECM #3: Cafeteria Lighting Equipment Upgrade

The school cafeteria is equipped with pendant direct light fixtures with high wattage incandescent lamps. It is recommended to simply replace these lamps with Compact Fluorescent lamps (CFL). The light output of a CFL is approximately 3 to 4 times greater compared to incandescent lamps at the same wattage. In addition, CFLs provide 10 to 15 times longer burn-hours compared to incandescent lamps. This ECM provides less than one (1) year payback.

ECM #4: Gymnasium and Auditorium Lighting Equipment Upgrade

Similar to the cafeteria, the gymnasium and the auditorium lighting is provided with incandescent light fixtures. The fixtures in the gymnasium and the auditorium are recessed. Similar to ECM #3, it is recommended to retrofit these fixtures with Compact Fluorescent lamps (CFL). This ECM has a less than two (2) year payback term.

ECM #5: Lighting Equipment Upgrade (Other Spaces)

The ECM #5 summarizes the lighting upgrade opportunities in the rest of the school building. It was observed that there are many areas lit with either older fixtures with T12 lamps and magnetic ballasts or incandescent lamps. A comprehensive list of areas and the recommended upgrades are summarized in this ECM. It should be noted that some of the upgrades have a shorter payback periods than the others. Therefore, CEG recommends prioritizing the upgrades.

ECM #6: Thermostatic Control Valves on Radiators

It was observed that the steam and hot water radiators in the classrooms do not have adequate and/or convenient control valves. In addition, the building has limited number of heating zones, which results in over-heated and under-heated spaces within the zones. It is recommended to install thermostatic controls valves for the radiators to adjust heat in these spaces accurately. This will increase occupancy comfort and reduce energy consumption. This ECM provides approximate eight (8) years payback.

Other Energy Conservation Measures (ECMs)

ECM #1: Boiler Replacement

The existing cast-iron steam boiler appears to be in good condition and it is still within its useful life of 35 years based on industry standard and guidelines. Although replacing this boiler with a new fire-tube steam boiler generates energy savings and a positive return on investment, CEG recommends utilizing the full economical life of the existing boiler before the replacement.

ECM #7: DDC Energy Management System

Direct Digital Control Systems can provide accurate controls over the HVAC and lighting systems in buildings. Typically the savings can be maximized if the facility has both heating and air conditioning. The Learning Community Charter School building is mainly a heating only facility. Therefore, it will not able to obtain the full benefit of a digital energy management system thus the long payback term. CEG does not recommend pursuing with this ECM at this time due to long payback term. However, a DDC System is strongly recommended if a central air conditioning system will be installed for the facility.

Operations and Maintenance Considerations

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

1. Maintain all weather stripping on entrance doors and windows
2. Clean all light fixtures to maximize light output
3. Clean windows to maximize daylight input
4. Clean condenser and evaporator coils on split AC units
5. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

Renewable Energy Analysis

Renewable Energy Measures (REMs) were also reviewed for implementation at the Learning Community Charter School. CEG utilized a roof mounted solar array to house a substantial PV system. The recommended 43 kW PV system will produce approximately 51,000 kWh of electricity annually and will reduce the schools electrical consumption from the grid by 27%. The system's calculated simple payback of 14.8 years is past the standard 10 year simple payback threshold; however, with alternative funding this payback could be lessened. CEG recommends the Owner review all funding options before deciding to not implement this renewable energy measure.

Retro-Commissioning

In addition to the above recommendations, based on the review of the facility's energy bills and discussions with the School District, the energy audit team recommends Retro-Commissioning of this facility to meet the following objectives:

- Bring existing HVAC equipment to its proper operational state including air and water distribution and exhaust systems
- Reduce energy use and energy costs
- Improve indoor air quality
- Verify the installation and performance of identified system upgrades
- Address overall building energy use and demand and identify areas of highest energy use and demand
- Identify the location of the most comfort problems or trouble spots in the building
- Review current O&M practices

Through the implementation of a Retro-Commissioning Plan, the School will be able to continue with their vision of reducing energy usage and operating efficient facilities.

Conclusion

The building energy use intensity of the school building is 58.9 kBtu/SF/Yr which is 70% compared with the average "Elementary School Building" in the region (70% of building's are less efficient than LCCS). This rating represent that the Learning Community Charter School appears to be operating at a higher efficiency level compared to other schools in the region. However, with the implementation of the above recommended measures a further energy savings can be realized.

II. INTRODUCTION

The comprehensive energy audit covers the 76,000 square foot Learning Community Charter School Building, which includes the following spaces: classrooms, office spaces, kitchen, cafeteria, gymnasium, auditorium, storage spaces and mechanical spaces.

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

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

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

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

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

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

III. METHOD OF ANALYSIS

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

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

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

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

ECM Calculation Equations:

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

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

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

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

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

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

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

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

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

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

The gas usage profile shows the actual natural gas energy usage for the facility. Public Service Electric and Gas (PSE&G) provides natural gas to the facility under the Large Volume Gas (LVG) rate structure. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

Description	Average
Electricity	16.6¢ / kWh
Natural Gas	$1.03 / Therm

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: PSEG
Rate: GLP
Meter No: G78001450
Customer ID No: PE000009436186240
Third Party Utility None
TPS Meter / Acct No: -

MONTH OF USE	CONSUMPTION	DEMAND	TOTAL BILL
May-09	1,080	32.0	$339
Jun-09	2,655	32.0	$1,011
Jul-09	7,065	45.0	$1,784
Aug-09	8,910	34.2	$1,945
Sep-09	5,220	34.2	$1,572
Oct-09	11,475	34.2	$2,056
Nov-09	40,770	83.3	$5,504
Dec-09	21,150	80.1	$3,229
Jan-10	22,950	84.2	$3,484
Feb-10	23,040	85.5	$3,501
Mar-10	20,610	81.5	$3,198
Apr-10	*20,610*	*81.5*	*$3,198*
Totals	**185,535**	**85.5 Max**	**$30,823**

AVERAGE DEMAND **59.0 KW average**
AVERAGE RATE **$0.166 $/kWh**

Utility information for April 2010 was estimated.

Figure 1
Electricity Usage Profile

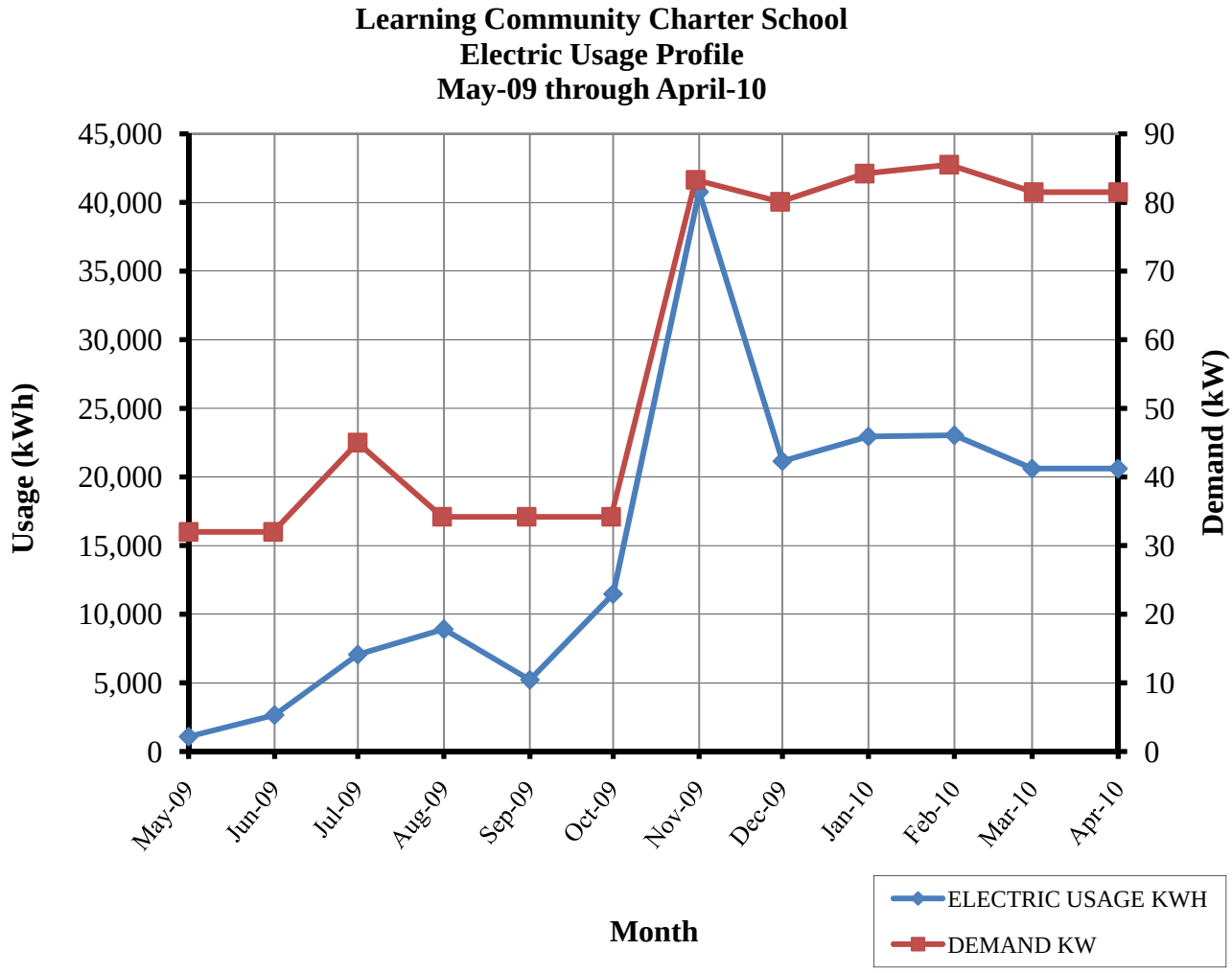
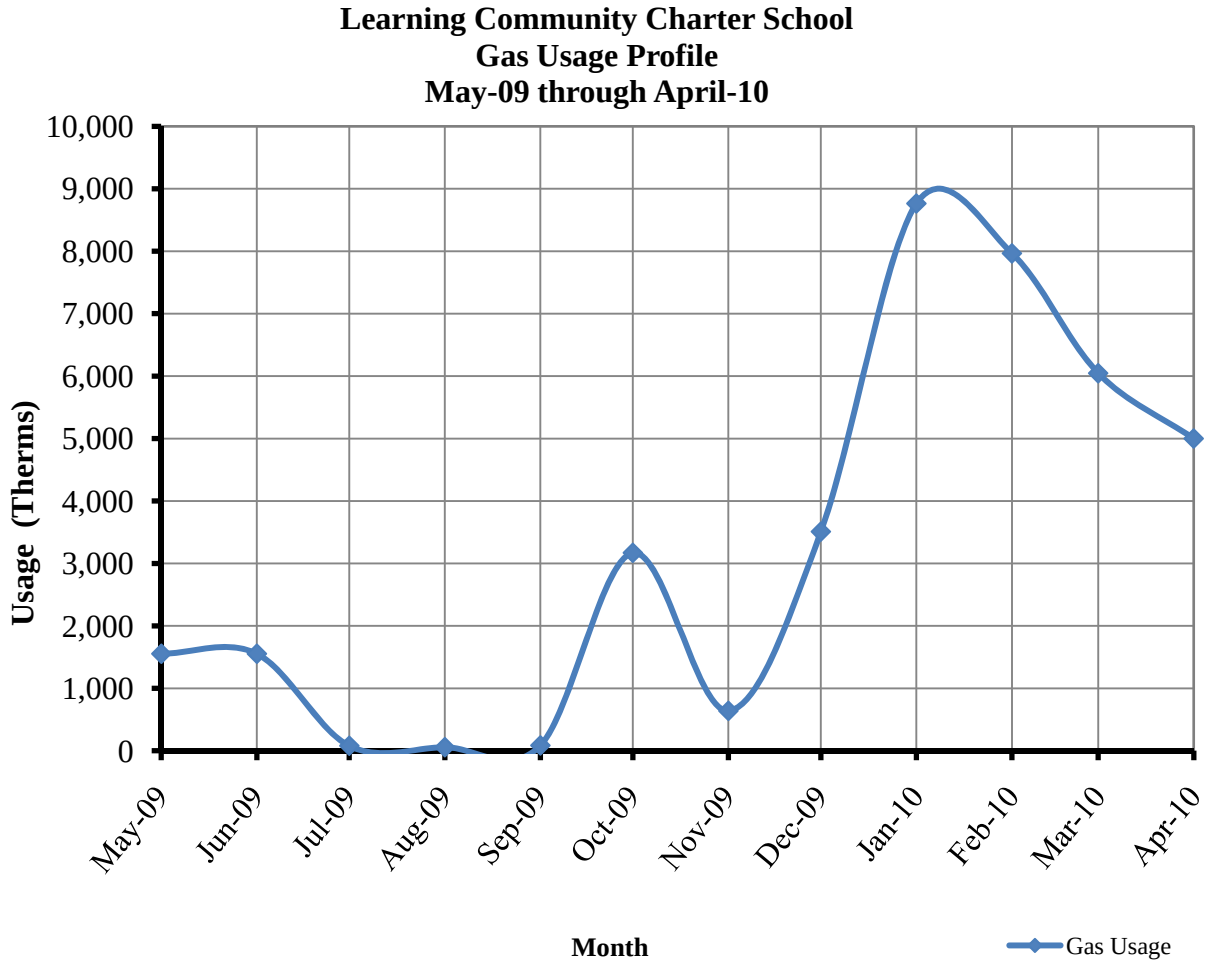


Table 4
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider:	PSEG	
Rate:	LVG	
Meter No:	2679342	
Point of Delivery ID:	PE000009436186240582	
Third Party Utility Provider:	None	
TPS Meter No:	-	
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
May-09	1,555	$1,113
Jun-09	1,555	$1,113
Jul-09	80	$151
Aug-09	57	$135
Sep-09	86	$150
Oct-09	3,171	$2,143
Nov-09	640	$726
Dec-09	3,510	$3,524
Jan-10	8,765	$9,334
Feb-10	7,966	$9,106
Mar-10	6,047	$6,788
Apr-10	*5,000*	*$5,150*
TOTALS	**38,431**	**$39,431**
AVERAGE RATE:	**$1.03**	**$/THERM**

Utility information for April 2010 was estimated.

Figure 2
Natural Gas Usage Profile



B. Energy Use Index (EUI)

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

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

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

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

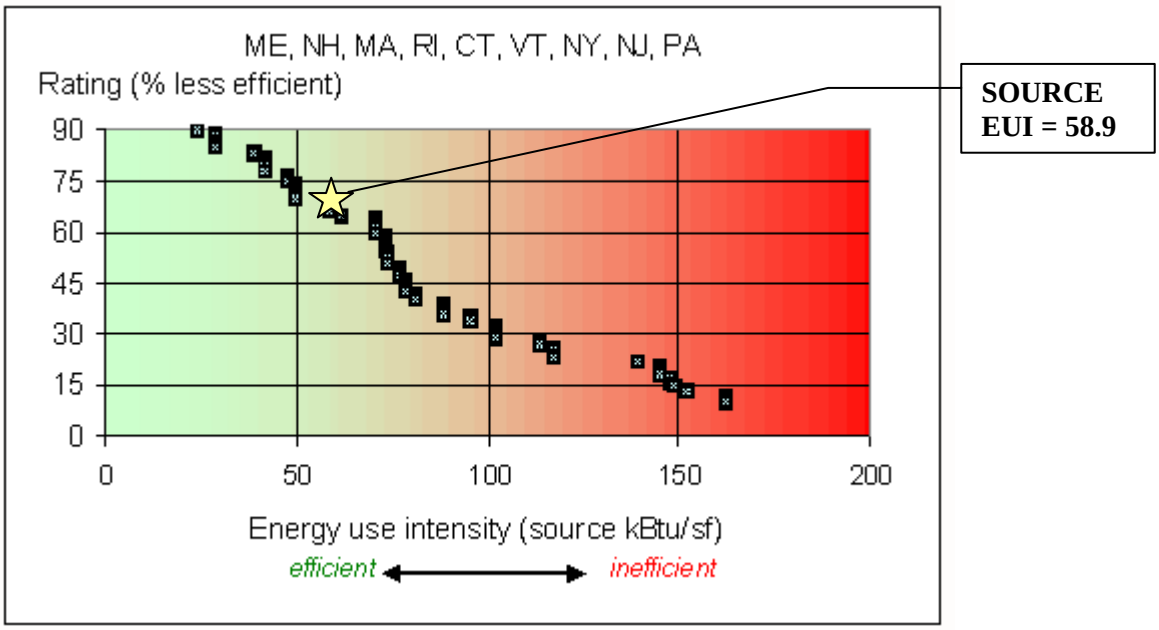
$$\text{Building Source EUI} = \frac{(\text{Electric Usage in kBtu X SS Ratio} + \text{Gas Usage in kBtu X SS Ratio})}{\text{Building Square Footage}}$$

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	185535.0			633,416	3.340	2,115,611
NATURAL GAS		38430.8		3,843,078	1.047	4,023,703
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				4,476,495		6,139,314
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		76,000	SQUARE FEET			
BUILDING SITE EUI		*58.90*	kBtu/SF/YR			
BUILDING SOURCE EUI		*80.78*	kBtu/SF/YR			

Figure 3 below depicts a national EUI grading for the source use of Elementary School buildings.

Figure 3
Source Energy Use Intensity Distributions: Elementary School Buildings



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: LearningCommunity
Password: lgeaceg2010

Security Question: What is your birth city?
Security Answer: jerseycity

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

Table 6
ENERGY STAR Performance Rating

ENERGY STAR PERFORMANCE RATING		
FACILITY DESCRIPTION	**ENERGY PERFORMANCE RATING**	**NATIONAL AVERAGE**
School K-12	68	50

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

V. FACILITY DESCRIPTION

The 76,000 SF Learning Community Charter School is a three (3) story facility with a basement comprised of classrooms, office spaces, kitchen, cafeteria, gymnasium, auditorium, storage spaces and mechanical spaces.

The typical hours of operation for this facility are between 7:00 am and 3:00 pm Monday through Friday. Occasionally, the building holds weekend events which occupy the building for a portion of the day. Exterior walls are brick construction with minimal insulation typical of the current time period. The windows throughout the facility are old and in fair condition. Typical windows throughout the facility are single pane, ¼" clear glass with aluminum frames. Window shades are utilized in the eastern and southern perimeter spaces per occupant comfort. The shades are valuable because they help to reduce heat loss in the winter and reduce solar heat in the summer.

The building originally had a built up roof with rubber membrane covering. Later a slate roof with asphalt shingles was built over the existing roof. The amount of insulation below the roofing could not be verified. The building was built in 1924.

HVAC Systems

The building consists of one (1) Weil Mclean boiler which supply steam to the steam radiators, fan coil units and hot water converters. The boiler has an input heating capacity of 5,250 MBH with a rated gross thermal efficiency of 80%. The boiler was installed in 1981 and it is within its ASHRAE service life of 35 years. Steam is used directly in the steam radiators and fan-coil units in the classrooms and corridors. In addition, steam is used to generate heating hot water via a converter for the hot water radiators in the classrooms on the south and east wing. There are three main heating zones in the school. A total of three (3) 3-way control valves modulate heating to the east, south and the west wings of the building. Majority of the west wing is heated with steam radiators. The steam supply is modulated with a 3-way control valve located in the boiler room. The east and the south wings are heated with hot water radiators. Hot water supply is controlled with two (2) 3-way control valves located in the boiler room and the first floor corridor. 3-way control valves are controlled with three (3) digital thermostats located in various parts of the building. Steam boiler pressure is controlled via a boiler sequencer made by Heat-Timer. The Heat-Timer provides night-time setback and steam supply pressure reset controls based on outside air temperature. It is reported that due to balancing issues in the system, lower floors will overheat while supplying enough steam or hot water for the upper floors. This can be eliminated by creating additional heating zones or installing radiator control valves within each wing of the building.

Majority of the Learning Community Charter School does not have air conditioning. It was observed that there are a couple of window air conditioning units serving administrative offices. The music room is conditioned with two (2) 3-ton ductless split air conditioning units made by Mitsubishi. The computer server and telephone room is conditioned with a 27,400 BTU portable air conditioner made by Air Rover. The rejected heat from the unit is directed to outside through window via a flexible duct. The unit operates 24/7 and it is in good condition. The gymnasium has one (1) Buffalo air handling unit in the mezzanine. The unit provides ventilation air.

Exhaust System

Air is exhausted from the bathrooms, locker rooms and common areas in each of the building's wings through local exhaust fans. The bathroom exhaust fans are interlocked with the light while the other exhaust fans are either on schedule or manually controlled.

HVAC System Controls

There is currently no central HVAC control system in this facility. The heating to the building is controlled via electronic thermostats. It is reported that the lower floors overheat when the third floor is at acceptable temperatures.

Domestic Hot Water

Domestic hot water for the restrooms, showers and the cafeteria areas is provided by an 85 gallon, 365 MBH A.O.Smith gas-fired hot water heater. The domestic hot water is circulated throughout the building by a hot water circulation pump. The domestic hot water heater is approximately three (3) years old and it is within its service life of 12 years. The domestic hot water piping insulation appeared to be in good condition.

Lighting

Typical lighting throughout building is fluorescent tube lay-in fixtures with T-12 lamps and magnetic ballasts. Some of the spaces in the first floor are upgraded to higher efficiency T8 fixtures with electronic ballasts. Lighting for the gymnasium, auditorium, cafeteria and boiler room is provided with 300W incandescent bulbs.

VI. MAJOR EQUIPMENT LIST

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

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

VII. ENERGY CONSERVATION MEASURES

ECM #1: Steam Boiler Replacement

Description:

The heating for the school buildings is provided via a Weil McLean gas fired, cast iron steam boilers located in the basement. The boiler is near end of its expected useful (ASHRAE) service life of thirty-five (35) years. Current average combustion efficiency of the boiler is estimated to be 70% due to limited turn down ratio, age of the equipment, rusting and sediment build-up on the heat transfer surfaces, partly deteriorated or missing insulation and outdated controls.

CEG recommends replacing the boiler with a 125 BHP high-efficiency fire tube steam boiler. The natural gas to steam efficiency for a 125 BHP steam boiler with digital burner controls is approximately 84% over its operating range and with the advanced digital controls will have a 12:1 turn down ratio.

This energy conservation measure includes replacement of the gas fired, sectional cast iron steam boiler serving the facility. Calculations are based on Cleaver Brooks CBLE 125 model boiler or equivalent.

Energy Savings Calculations:

Gas consumption of the steam boiler plant is gathered in order to calculate an estimated steam production of the boiler plant. Then, the steam production info is used in a reverse calculation to obtain proposed annual gas consumption based on improved efficiency.

$$\text{Steam Production, Lb} = \frac{\text{Gas Consumption (Therms)} \times 100{,}000\,\frac{\text{BTU}}{\text{Therm}} \times \text{ Boiler Efficiency}}{1000\,\frac{\text{BTU}}{\text{Lbs}}}$$

$$\text{Gas Consumption, Therms} = \frac{\text{Steam Production (Lbs)} \times 1000\,\frac{\text{BTU}}{\text{Lbs}}}{100{,}000\,\frac{\text{BTU}}{\text{Therm}} \times \text{ Boiler Efficiency}}$$

Results of the calculations are summarized in the table below.

Estimated installed cost of a 125 BHP steam boiler with advanced controls is $215,000.

Currently, there is no direct incentive from NJ Smart Start® Program for a boiler of this size. CEG recommends owner to review Smart Start® Custom Measure Incentives before pursuing with the boiler replacement.

Energy savings calculations

ENERGY SAVINGS CALCULATIONS					
MONTH OF USE	**MONTHLY USAGE**	**STEAM PRODUCTION at 70% EFCY, (Lbs)**	**GAS CONSUMPTION IF EFCY =84%, THERMS**	**GAS SAVINGS, THERMS**	**ENERGY COST SAVINGS @ $1.03/THERM**
May-09	1,555	108,815	1,295	259	$267
Jun-09	1,555	108,815	1,295	259	$267
Jul-09	80	5,618	67	13	$14
Aug-09	57	4,013	48	10	$10
Sep-09	86	5,989	71	14	$15
Oct-09	3,171	221,953	2,642	528	$544
Nov-09	640	44,786	533	107	$110
Dec-09	3,510	245,700	2,925	585	$603
Jan-10	8,765	613,555	7,304	1,461	$1,505
Feb-10	7,966	557,620	6,638	1,328	$1,367
Mar-10	6,047	423,290	5,039	1,008	$1,038
Apr-10	5,000	350,000	4,167	833	$858
TOTALS	**38,431**	**2,690,155**	**32,026**	**6,405**	**$6,597**

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$215,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$215,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$6,597
Total Yearly Savings ($/Yr):	$6,597
Estimated ECM Lifetime (Yr):	35
Simple Payback	32.6
Simple Lifetime ROI	7.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$230,905
Internal Rate of Return (IRR)	0%
Net Present Value (NPV)	($73,242.70)

ECM #2: Library Lighting Equipment Upgrade

Description:

The lighting throughout the school library is provided with older 4-lamp T12 fixtures with magnetic ballasts. It is recommended to replace all of the T12 fixtures in this area with higher efficiency fluorescent T8 fixtures with electronic ballasts lamps.

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

Hours of Operation:

40 Hrs per week, 42 weeks per year – 1680 Hrs per year

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix** outlines the hours of operation, proposed retrofits, costs, savings, and payback periods for each set of fixtures in the each building.

The estimated cost of this ECM is $5,180.

There are incentives available from NJ Smart Start® Program for these retrofits. Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, the retrofit of a T-12 fixture to a T-5 or T-8 fixture warrants the following incentive: T-5 or T-8 (1-4 lamp) = $15 per fixture.

$$\text{SmartStart® } Incentive = (\#\ of\ 3-4\ lamp\ fixtures \times \$30) = 37 \times \$30 = \$1110$$

Replacement and Maintenance Savings are calculated as follows:

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

$$Savings = 6.2 \times (\$2\ per\ lamp + \$5\ per\ lamp) = \$44$$

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$5,180
NJ Smart Start Equipment Incentive ($):	$1,110
Net Installation Cost ($):	$4,070
Maintenance Savings ($/Yr):	$44
Energy Savings ($/Yr):	$721
Total Yearly Savings ($/Yr):	$764
Estimated ECM Lifetime (Yr):	15
Simple Payback	5.3
Simple Lifetime ROI	181.6%
Simple Lifetime Maintenance Savings	$653
Simple Lifetime Savings	$11,461
Internal Rate of Return (IRR)	17%
Net Present Value (NPV)	$5,051.43

ECM #3: Cafeteria Lighting Equipment Upgrade

Description:

The lighting throughout the school cafeteria is provided with direct light fixtures with 300 Watt incandescent lamps. It is recommended to retrofit all of these fixtures with compact fluorescent lamps.

The ECM includes replacement of all incandescent lamps in the cafeteria with compact fluorescent lamps. The energy usage of an incandescent compared to a compact fluorescent is approximately 3 to 4 times greater. In addition to the energy savings, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours.

Hours of Operation:

40 Hrs per week, 42 weeks per year – 1680 Hrs per year

Energy Savings Calculations:

The estimated light output of the existing 300W bulbs is 5800 lumens. The equivalent replacement for these units is 105W Compact fluorescent bulb, which produces approximately 6000 lumens. The installed cost of a 105W CFL bulb is $35.

Total cost of this ECM is $490.

The **Investment Grade Lighting Audit Appendix** outlines the hours of operation, proposed retrofits, costs, savings, and payback periods for the fixtures in this space.

There is currently no incentive available from NJ Smart Start® Program for this retrofit.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$490
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$490
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$771
Total Yearly Savings ($/Yr):	$771
Estimated ECM Lifetime (Yr):	15
Simple Payback	0.6
Simple Lifetime ROI	2258.7%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$11,558
Internal Rate of Return (IRR)	157%
Net Present Value (NPV)	$8,708.36

ECM #4: Gymnasium and Auditorium Lighting Equipment Upgrade

Description:

The lighting throughout the Gymnasium and the Auditorium is provided with direct light fixtures with 300 Watt incandescent lamps. It is recommended to retrofit all of the fixtures with compact fluorescent lamps.

The ECM includes replacement of all incandescent lamps in the cafeteria with compact fluorescent lamps. The energy usage of an incandescent compared to a compact fluorescent is approximately 3 to 4 times greater. In addition to the energy savings, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours.

Hours of Operation:

Gymnasium:	15 Hrs per week, 40 weeks per year – 600 Hrs per year
Auditorium:	15 Hrs per week, 40 weeks per year – 600 Hrs per year

Number of Fixtures in the Gymnasium: 32
Number of Fixtures in the Auditorium: 40
Total Number of Lamps to be retrofitted: 72

Energy Savings Calculations:

The estimated light output of the existing 300W bulbs is 5800 lumens. The equivalent replacement for these units is 105W Compact fluorescent bulb, which produces approximately 6000 lumens. The installed cost of a 105W CFL bulb is $35.

The **Investment Grade Lighting Audit Appendix** outlines the hours of operation, proposed retrofits, costs, savings, and payback periods for each set of fixtures in each of these spaces.

There is currently no incentive available from NJ Smart Start® Program for these retrofits.

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$2,520
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$2,520
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,415
Total Yearly Savings ($/Yr):	$1,415
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.8
Simple Lifetime ROI	742.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$21,228
Internal Rate of Return (IRR)	56%
Net Present Value (NPV)	$14,374.95

ECM #5: Lighting Equipment Upgrade (Common Areas, Offices and Classrooms)

Description:

This ECM outlines lighting equipment upgrades for the spaces other than the spaces mentioned in the ECM #2, 3 and #4, which includes classrooms, utility rooms, offices and common areas. The lighting for these areas provided with older T12 fixtures with magnetic ballasts. It is recommended to replace all of the T12 fixtures in these areas with higher efficiency fluorescent T8 fixtures with electronic ballasts lamps. In addition, there are incandescent light fixtures providing lighting for parts of the utility rooms, classrooms and common areas as well. It is recommended to retrofit all of these fixtures with compact fluorescent lamps.

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

In addition, this ECM includes retrofit of all incandescent light fixtures in the building compact fluorescent lamps except for the cafeteria, gymnasium and the auditorium. The energy usage of an incandescent lamp compared to a compact fluorescent lamp is approximately 3 to 4 times greater. In addition, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours. However, this does not generate significant lamp replacement and maintenance savings due to fractional cost of the incandescent lamps compared to CFL's.

Hours of Operation:

Classrooms:	40 Hrs per week, 42 weeks per year – 1680 Hrs per year
Common Areas:	50 Hrs per week, 42 weeks per year – 2100 Hrs per year
Utility Areas:	5 Hrs per week, 52 weeks per year – 260 Hrs per year
Stairwells:	168 per week, 52 weeks per year – 8760 Hrs per year

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix** outlines the hours of operation, proposed retrofits, costs, savings, and payback periods for each set of fixtures in each of these spaces.

Total cost of this ECM is $43,395.

From the **Smart Start Incentive Appendix**, the retrofit (re-lamp and re-ballast) of a T-12 fixture to a T-5 or T-8 fixture warrants the following incentive: T-5 or T-8 (1-4 lamp) = $15 per fixture.

$$\text{SmartStart® Incentive} = (\#\text{ of } 1-4 \text{ lamp fixtures} \times \$15) = 349 \times \$15 = \$5{,}235$$

There is currently no incentive available from NJ Smart Start® Program for incandescent lamp replacements.

Replacement and Maintenance Savings based on T12 fixture retrofits are calculated as follows:

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

$$\text{Savings} = 54.64 \times (\$2 \text{ per lamp} + \$5 \text{ per lamp}) = \$382.51$$

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$43,395
NJ Smart Start Equipment Incentive ($):	$5,235
Net Installation Cost ($):	$38,160
Maintenance Savings ($/Yr):	$383
Energy Savings ($/Yr):	$6,531
Total Yearly Savings ($/Yr):	$6,914
Estimated ECM Lifetime (Yr):	15
Simple Payback	5.5
Simple Lifetime ROI	171.8%
Simple Lifetime Maintenance Savings	$5,738
Simple Lifetime Savings	$103,709
Internal Rate of Return (IRR)	16%
Net Present Value (NPV)	$44,377.72

ECM #6: Install Thermostatic Control Valves for Radiators

Description:

Space heating for the building is provided with cast iron radiators and fin tube convectors throughout the building. These units have manual shut off valves, most of which have deteriorated and therefore inoperable. Individual radiator controls is crucial in this building since there is only three (3) heating zones in the entire facility.

Manual shut off valves on older radiators cause energy waste. Because, manual valves require continual adjustment as conditions change. In addition, manual valves are usually unstable hence harder to operate at low outputs. Therefore, occupants tend to leave the valves at fully open position and open windows instead of adjusting the valve.

In addition to inefficiencies due to the nature of the manual valves, most of the valves in this building are inaccessible or inoperable due to age and sediment buildup. Inoperable manual shut off valves and the lack of smaller heating zones in this building causes temperature control issues. The lower floors of the building overheat as the upper floors reach to acceptable temperatures.

These problems can be solved by installing thermostatic valves in place of the manual valves. The thermostatic valves follow the fluctuations in space load and radiator output, keeping space temperature stable.

CEG recommends replacing the manual shut off valves with thermostatic valves on the radiators throughout the building. Thermostatic control valves provide temperature controls within the spaces by modulating the flow through the valve with respect to surrounding temperature. These valves typically have a self contained thermostatic element.

This energy conservation measure includes installation of thermostatic radiator control on each radiator or convector throughout the building. The basis for this ECM is Danfoss self contained TRV.

Energy Savings Calculations:

Based on the interviews with the facility personnel, it was reported that the lower floors get approximately 5 to 10°F overheated and occupants tend to open windows after that. In this calculation, it is assumed that entire building is approximately 5°F overheated.

Heating degree day calculations are used in order to first find the heat load of the building based on 70°F design temperature difference and then energy savings are back calculated based on 65°F design temperature difference.

Heating Season Heating Degree Days (Based on 70°F) = 5,984 °F (April 2009 – March 2010)
Heating Season Heating Degree Days (Based on 65°F) = 4,860 °F (April 2009 – March 2010)

Average Cost of Gas = $1.03 / Therm

Existing Maximum Temperature Difference (TD_E) = 70°F
New Maximum Temperature Difference (TD_N) = 65°F

Note: Degree Days and Full Load Hours referenced from ASHRAE Weather Data for Newark, NJ.

$$\text{Energy Consumption, Therms} = \frac{\text{Heat Load (MBH)} \times \text{HDD (°F)} \times 12\ \text{Hr}}{\text{TD}_\text{E}\ (°\text{F}) \times \text{Heating Sys. Eff \%} \times \text{Fuel Value}\ \left(\frac{\text{MBTU}}{\text{Therm}}\right)}$$

$$\text{Heat Load (MBH)} = \frac{\text{Energy Consumption} \times \text{TD}_\text{E}\ (°\text{F}) \times \text{Heating Sys. Eff \%} \times \text{Fuel Value}\ \left(\frac{\text{MBTU}}{\text{Therm}}\right)}{\times \text{HDD (°F)} \times 12\ \text{Hr}}$$

$$\text{Heat Load (MBH)} = \frac{38{,}431\ \text{Therms} \times 70°\text{F} \times 70\% \times 100\left(\frac{\text{MBTU}}{\text{Therm}}\right)}{\times 5984°\text{F} \times 12\ \text{Hr}} = 2{,}622\ \text{MBH}$$

Energy consumption based on 65°F maximum temperature difference is calculated as follows:

$$\text{Energy Consumption, Therms} = \frac{2{,}622\ (\text{MBH}) \times 4677\ °\text{F} \times 12\ \text{Hr}}{65°\text{F} \times 70\% \times 100\ \left(\frac{\text{MBTU}}{\text{Therm}}\right)} = 32{,}348\ \text{Therms}$$

$$\text{Energy Savings, Therms} = 38{,}431 - 32{,}348 = 6{,}083\ \text{Therms}$$

$$\text{Energy Cost Savings} = 6{,}083\ \text{Therms} \times \frac{\$1.03}{\text{Therm}} = \$6{,}266$$

Estimated installed cost of thermostatic radiator valve for each radiator is $300
Estimated number of radiators and convectors suitable is 175

Total installed cost of this ECM is $52,500

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$52,500
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$52,500
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$6,266
Total Yearly Savings ($/Yr):	$6,266
Estimated ECM Lifetime (Yr):	15
Simple Payback	8.4
Simple Lifetime ROI	79.0%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$93,988
Internal Rate of Return (IRR)	8%
Net Present Value (NPV)	$22,301.85

ECM #7: Digital Energy Management System (DDC EMS)

Description:

The current heating system within the school has three temperature zones controlled by three flow control valves in the facility. Two flow control valves modulate hot water supply temperature to the radiators based on the space temperature near each thermostat and one steam valve controls the steam supply pressure to the steam radiators. Due to the limited number of heating zones, there are temperature control issues throughout the building. It is reported that some of the spaces are overheated to the point that occupants have to open windows, while other spaces are at normal temperatures.

This ECM includes installing a Building Automation system with Direct Digital Controls (DDC) wired through an Ethernet backbone and front end controller within the school building. The system will include new temperature sensors and flow control valves at each space. The system will also include new thermostat controllers for all indoor air-handling systems. Thermostat controllers, temperature sensors and the flow control actuators will be wired back to a front end controller and computer interface. Common area lighting controls will be tied to the system as well. With the communication between the control devices and the front end computer interface, the Owner will be able to take advantage of scheduling for occupied and unoccupied periods based on the actual occupancy of each space in the facility. Due to the fact that the school may have diverse hours of occupancy, including evening and weekend activities, having supervisory control over all of the equipment makes sense. The DDC system will also aid in the response time to service / maintenance issues when the facility is not under normal maintenance supervision, i.e. after-hours.

The new DDC system has the potential to provide significant savings by controlling the HVAC systems as a whole and provide operating schedules and features such as space averaging, night set-back, temperature override control, etc. The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings is based on the "Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways," document posted for public use April 2005. The study has found that commercial buildings have the potential to achieve significant energy savings through the use of building controls. The average energy savings are as follows based on the referenced report:

- Energy Management and Control System Savings: 5%-15%.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 10% of the lighting energy cost for the facility. Savings are calculated below for heating energy costs for the facility.

The cost of a full DDC system with new field devices, controllers, computer, software, programming, etc. is approximately $4.00 per SF in accordance with recent Contractor pricing for systems of this magnitude. Savings from the implementation of this ECM will be from the

reduced energy consumption currently used by the HVAC system by proper control of schedule and temperatures via the DDC system.
Cost of complete DDC System = ($4.00/SF x 76,000 SF) = $304,000

Energy Savings Calculations:

Heating Energy Savings Calculations**:**

Based on the interviews with the facility personnel, it was reported that the lower floors get approximately 5 to 10°F overheated and occupants tend to open windows after that. In this calculation, it is assumed that entire building is approximately 5°F overheated. A DDC system can eliminate overheating in the spaces and provide accurate temperature controls including programmed set-back and re-set based on inside and outside temperatures.

Below calculation is based on eliminating overheating in the building.

Heating degree day calculations are used in order to first find the heat load of the building based on 70°F design temperature difference and then energy savings are back calculated based on 65°F design temperature difference.

Heating Season Heating Degree Days (Based on 70°F) = 5,984 °F (April 2009 – March 2010)
Heating Season Heating Degree Days (Based on 65°F) = 4,860 °F (April 2009 – March 2010)

Average Cost of Gas = $1.03 / Therm

Existing Maximum Temperature Difference (TD_E) = 70°F
New Maximum Temperature Difference (TD_N) = 65°F

Note: Degree Days and Full Load Hours referenced from ASHRAE Weather Data for Newark, NJ.

$$\text{Energy Consumption, Therms} = \frac{\text{Heat Load (MBH)} \times \text{HDD (°F)} \times 12\ \text{Hr}}{\text{TD}_\text{E}\ (°\text{F}) \times \text{Heating Sys. Eff \%} \times \text{Fuel Value}\ \left(\frac{\text{MBTU}}{\text{Therm}}\right)}$$

$$\text{Heat Load (MBH)} = \frac{\text{Energy Consumption} \times \text{TD}_\text{E}\ (°\text{F}) \times \text{Heating Sys. Eff \%} \times \text{Fuel Value}\ \left(\frac{\text{MBTU}}{\text{Therm}}\right)}{\times \text{HDD (°F)} \times 12\ \text{Hr}}$$

$$\text{Heat Load (MBH)} = \frac{38{,}431\ \text{Therms} \times 70°\text{F} \times 70\% \times 100\ \left(\frac{\text{MBTU}}{\text{Therm}}\right)}{\times 5984°\text{F} \times 12\ \text{Hr}} = 2{,}622\ \text{MBH}$$

Energy consumption based on 65°F maximum temperature difference is calculated as follows:

$$\text{Energy Consumption, Therms} = \frac{2{,}622\ (\text{MBH}) \times 4677\ °\text{F} \times 12\ \text{Hr}}{65°\text{F} \times 70\% \times 100\ \left(\frac{\text{MBTU}}{\text{Therm}}\right)} = 32{,}348\ \text{Therms}$$

$$\text{Energy Savings, Therms} = 38{,}431 - 32{,}348 = 6{,}083\ \text{Therms}$$

$$\text{Energy Cost Savings} = 6{,}083\ \text{Therms} \times \frac{\$1.03}{\text{Therm}} = \$6{,}266$$

Lighting Energy Calculations**:**

Estimated total lighting energy consumption: 75,321 kWh (See Investment Grade Lighting Audit Appendix)

It is assumed that the DDC system will save 10% of the lighting energy in the building.

$$\text{Savings.} = \text{Lighting Energy Consumption}(\text{kWh}) \times 10\%\ \text{Savings} \times \text{Ave Elec Cost}\left(\frac{\$}{\text{kWh}}\right)$$

$$\text{Savings.} = 75{,}321\ (\text{kWh}) \times 10\% \times 0.166\left(\frac{\$}{\text{kWh}}\right) = \underline{\$1{,}250/\text{Yr}}$$

Total Annual Energy Savings = $6,266 + $1,250 = $7,516 per year

It should be noted that electric demand savings were not included. Also, incentives for the installation of the DDC system are not currently available.

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$304,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$304,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$7,516
Total Yearly Savings ($/Yr):	$7,516
Estimated ECM Lifetime (Yr):	15
Simple Payback	40.4
Simple Lifetime ROI	-62.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$112,743
Internal Rate of Return (IRR)	-10%
Net Present Value (NPV)	($214,271.81)

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

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

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

CEG has reviewed the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 3052 S.F. can be utilized for a PV system. A depiction of the area utilized is shown in **Renewable / Distributed Energy Measures Calculation Appendix**. Using this square footage it was determined that a system size of 43 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 50,796 KWh annually, reducing the overall utility bill by approximately 27% percent. A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix**. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

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

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

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

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

Direct purchase involves the School paying for 100% of the total project cost upfront via one of the methods noted in the Installation Funding Options section below. Calculations include a utility inflation rate as well as the degradation of the solar panels over time. Based on our calculations the following is the payback period:

Table 7
Financial Summary – Photovoltaic System

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM			
PAYMENT TYPE	**SIMPLE PAYBACK**	**SIMPLE ROI**	**INTERNAL RATE OF RETURN**
Direct Purchase	14.8 Years	6.7%	5.2%

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

Given the large amount of capital required by the school to invest in a solar system through a Direct Purchase CEG does not recommend the school pursue this route. It would be more advantageous for the school to solicit Power Purchase Agreement (PPA) Providers who will own, operate, and maintain the system for a period of 15 years. During this time the PPA

Provider would sell all of the electric generated by Solar Arrays to the School at a reduced rate compared to their existing electric rate.

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

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

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

Electricity:

The Electric Usage Profile demonstrates a fairly flat load profile at two riding levels. The owner moved into the building around May of 2009. The building was not substantially utilized until school season started. Average monthly electricity consumption during this period was approximate 6,000 kWh with a 35 kW peak demand. After the school season started, the load profile elevated to a new level and stayed fairly flat throughout the year. Average monthly usage during the school season was 21,000 kWh with 83 kW peak demand. The reason for flat electric load profile is because the electric load is mainly comprised of lighting and office equipment and the building does not have air conditioning. A flat load profile will allow for more competitive energy prices when shopping for alternative suppliers.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical natural gas heating load profile. The summer months demonstrate very low consumption, May through September. There is an increase in consumption in October through January. The gas fired steam boiler and the gas fired hot water heater is the primary users of the natural gas in the building. A base-load shaping (flat) will secure more competitive energy prices when procuring through an alternative energy source.

Tariff Analysis:

Electricity:

This facility receives electrical service through Public Service Electric and Gas (PSEG) on a GLP (General Lighting and Power) rate. GLP is a Delivery service for general purposes at secondary distribution voltages. This facility's rate is a single or three phase service at secondary voltages. For electric supply (generation), the customer will use the utilities Basic Generation Service (BGS) or a Third Party Supplier (TPS). This facility uses Basic Generation service from the utility. Therefore, they will pay according to the BGS default service. The Delivery Service includes the following charges:

Distribution Kilowatt and Kilowatt-hour Charges, Societal Benefits Charge (SBC), Non-utility Generation Charge, Securitization Transition Charges, System Control Charge (SCC), Customer Account Services Charge, Commercial and Industrial Energy Pricing (CIEP) Standby Fee
Base Rate Distribution Kilowatt-hour Adjustment, Solar Pilot Recovery Charge, RGGI Recovery Charge, Capital Adjustment Charge

Natural Gas:

This facility receives natural gas service through Public Service Electric and Gas Company (PSE&G) on a LVG (Large Volume Gas) rate. The utility tariff rate (LVG) is a firm delivery service for general purposes. Customers may either purchase gas supply from a Third Party Supplier (TPS) or from Public Service's Basic Gas Supply Service default service.

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

This rate schedule has a Delivery Charge Mechanism which includes: Service Charge, Demand Charge (Applicable in the months of November through March), Distribution Charges, Balancing Charge, Societal Benefits Charge, Realignment Adjustment Charge, Margin Adjustment Charge, RGGI Recovery Charge, Capital Adjustment Charge and Customer Account Services Charge.

The customer can elect to have the Supply Charge (Commodity Charge) serviced through the utility or by a Third Party Supplier (TPS). Note: Should the TPS not deliver, the customer may receive service from PSE&G under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service. Should the TPS un-deliver to the utility on behalf of the client, the utility will automatically supply this default service to the client.

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

Recommendations:

CEG recommends an approach that will be opportunistic for utility cost savings to coincide with the Charter School's direction of saving energy. Our recommendation is for the Charter School to review opportunities to purchase their natural gas and electricity commodity via a "consortium" based contract as the Charter School's base load is not large enough to be a major player on its own. It is estimated that approximately a 15% savings can be achieved on electricity commodity costs and approximately a 20% savings can be achieved on natural gas commodity costs based on current market pricing. However, actual estimated savings would be calculated and verified while obtaining a Third Party Supplier or Local Distribution Company. CEG highly recommends the Charter School utilize a consultant to ensure "best practice" is utilized when joining into a fixed term pricing contract for commodity. CEG further

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

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

Finally, if the Charter School frequently changes its supplier for energy, CEG recommends it closely monitor balancing, particularly when the contract is close to termination.

X. INSTALLATION FUNDING OPTIONS

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

i. *Energy Savings Improvement Program (ESIP)* – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and 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. *Direct Install Program* – The New Jersey Clean Energy's Direct Install Program is a state funded program that targets small commercial and industrial facilities with peak demand of less than 200 kW. This turnkey program is aimed at providing owners a seamless, comprehensive process for analysis, equipment replacement and financial incentives to reduce consumption, lower utility costs and improve profitability. The program covers up to 80% of the cost for eligible upgrades including lighting, lighting controls, refrigeration, HVAC, motors, variable speed drives, natural gas and food service. Participating contractors (refer to www.njcleanenergy.com) conduct energy assessments in addition to your standard local government energy audit and install the cost-effective measures.

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

XI. ADDITIONAL RECOMMENDATIONS

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

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

B. Maintain all weather stripping on windows and doors.

C. Clean all light fixtures to maximize light output.

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

In addition to the recommendations above, implementing Retro-Commissioning would be beneficial for this facility. Retro-Commissioning is a means to verify your current equipment is operating at its designed efficiency, capacity, airflow, and overall performance. Retro-Commissioning provides valuable insight into systems or components not performing correctly or efficiently. The commissioning process defines the original system design parameters and recommends revisions to the current system operating characteristics.

XII. ENERGY AUDIT ASSUMPTIONS

The assumptions utilized in this energy audit include but are not limited to following:

A. Cost Estimates noted within this report are based on industry accepted costing data such as RS Means™ Cost Data, contractor pricing and engineering estimates. All cost estimates for this level of auditing are +/- 20%. Prevailing wage rates for the specified region has been utilized to calculate installation costs. The cost estimates indicated within this audit should be utilized by the owner for prioritizing further project development post the energy audit. Project development would include investment grade auditing and detailed engineering.
B. Energy savings noted within this audit are calculated utilizing industry standard procedures and accepted engineering assumptions. For this level of auditing, energy savings are not guaranteed.
C. Information gathering for each facility is strongly based on interviews with operations personnel. Information dependent on verbal feedback is used for calculation assumptions including but not limited to the following:
    a. operating hours
    b. equipment type
    c. control strategies
    d. scheduling
D. Information contained within the major equipment list is based on the existing owner documentation where available (drawings, O&M manuals, etc.). If existing owner documentation is not available, catalog information is utilized to populate the required information.
E. Equipment incentives and energy credits are based on current pricing and status of rebate programs. Rebate availability is dependent on the individual program funding and applicability.
F. Equipment (HVAC, Plumbing, Electrical, & Lighting) noted within an ECM recommendation is strictly noted as a **basis for calculation** of energy savings. The owner should use this equipment information as a benchmark when pursuing further investment grade project development and detailed engineering for specific energy conservation measures.
G. Utility bill annual averages are utilized for calculation of all energy costs unless otherwise noted. Accuracy of the utility energy usage and costs are based on the information provided. Utility information including usage and costs is estimated where incomplete data is provided.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Learning Community Charter School

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY														
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	Boiler Replacement	$76,585	$138,415	$0	$215,000	$6,597	$0	$6,597	35	$230,905	$0	7.4%	32.6	0.40%	($73,242.70)
ECM #2	Library Lighting Equipment Upgrade	$2,072	$3,108	$1,110	$4,070	$721	$44	$764	15	$11,461	$653	181.6%	5.3	16.99%	$5,051.43
ECM #3	Cafeteria Lighting Equipment Upgrade	$420	$70	$0	$490	$771	$0	$771	15	$11,558	$0	2258.7%	0.6	157.25%	$8,708.36
ECM #4	Gymnasium and Auditorium Lighting Equipment Upgrade	$2,160	$360	$0	$2,520	$1,415	$0	$1,415	15	$21,228	$0	742.4%	1.8	56.09%	$14,374.95
ECM #5	Lighting Equipment Upgrade (Other Spaces)	$15,982	$27,413	$5,235	$38,160	$6,531	$383	$6,914	15	$103,709	$5,738	171.8%	5.5	16.22%	$44,377.72
ECM #6	Thermostatic Control Valves on Radiators	$21,000	$31,500	$0	$52,500	$6,266	$0	$6,266	15	$93,988	$0	79.0%	8.4	8.35%	$22,301.85
ECM #7	Digital Energy Management System (DDC EMS)	$304,000	$0	$0	$304,000	$7,516	$0	$7,516	15	$112,743	$0	-62.9%	40.4	-10.43%	($214,271.81)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	Solar Photovoltaic Panels	$387,090	$0	$0	$387,090	$8,432	$17,779	$26,211	15	$393,165	$266,685	1.6%	14.8	0.20%	($74,184.78)

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 February, 2010:

Electric Chillers

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

Energy Efficiency must comply with ASHRAE 90.1-2004

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
Occupancy Controlled Thermostat (Hospitality & Institutional Facility)	$75 per thermostat

Energy Efficiency must comply with ASHRAE 90.1-2004

Ground Source Heat Pumps

Closed Loop & Open Loop	$450 per ton, EER ≥ 16 $600 per ton, EER ≥ 18 $750 per ton, EER ≥ 20

Energy Efficiency must comply with ASHRAE 90.1-2004

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, AFUE ≥ 92%

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
Gas Fired Tankless Water Heaters	$300 per unit

Premium Motors

Three-Phase Motors	$45 - $700 per motor
Fractional HP Motors Electronic Communicated Motors (replacing shaded pole motors in refrigerator/freezer cases)	$40 per electronic communicated motor

Prescriptive Lighting

T-5 and T-8 Lamps w/Electronic Ballast in Existing Facilities	$15 per fixture (1-4 lamps)
T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	$10 per fixture
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
HID ≥ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	$50 per fixture
HID ≥ 100w Replacement with new HID ≥ 100w	$70 per fixture
LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	$42 per 5 foot $65 per 6 foot

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
Daylight Dimming - office	$50 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
Custom Measures	$0.16 KWh and $1.60/Therm of 1st year savings, or a buy down to a 1 year payback on estimated savings. Minimum required savings of 75,000 KWh or 1,500 Therms and a IRR of at least 10%.
Multi Measures Bonus	15%

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Learning Community Charter School

Building ID: 2291750
For 12-month Period Ending: March 31, 2010[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: April 27, 2010

Facility
Learning Community Charter School
2495 Kennedy Blvd
Jersey City, NJ 07304

Facility Owner
Learning Community Charter School
2495 Kennedy Blvd
Jersey City, NJ 07304

Primary Contact for this Facility
Michael Steinmetz
2495 Kennedy Blvd
Jersey City, NJ 07304

Year Built: 1924
Gross Floor Area (ft²): 76,000

Energy Performance Rating[2] (1-100) 68

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	613,117
Natural Gas (kBtu)[4]	3,642,591
Total Energy (kBtu)	4,255,708

Energy Intensity[5]

Site (kBtu/ft²/yr)	56
Source (kBtu/ft²/yr)	77

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	287

Electric Distribution Utility
Public Service Elec & Gas Co

National Average Comparison

National Average Site EUI	66
National Average Source EUI	92
% Difference from National Average Source EUI	-16%
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
Ersin Gercek
520 S. Burnt Mill Rd.
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	Learning Community Charter 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	2495 Kennedy Blvd , Jersey City, NJ 07304	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		☐
School (K-12 School)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	76,000 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?	No	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	20	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	0	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	Yes	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	10 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	9(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: Public Service Elec & Gas Co

Fuel Type: Electricity

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

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
03/01/2010	03/31/2010	20,610.00
02/01/2010	02/28/2010	23,040.00
01/01/2010	01/31/2010	22,950.00
12/01/2009	12/31/2009	21,150.00
11/01/2009	11/30/2009	40,770.00
10/01/2009	10/31/2009	11,475.00
09/01/2009	09/30/2009	5,220.00
08/01/2009	08/31/2009	8,910.00
07/01/2009	07/31/2009	7,065.00
06/01/2009	06/30/2009	2,655.00
05/01/2009	05/31/2009	1,080.00

Electric Meter Consumption (kWh (thousand Watt-hours))	**164,925.00**
Electric Meter Consumption (kBtu (thousand Btu))	**562,724.10**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))	**562,724.10**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?	☐

Fuel Type: Natural Gas

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

Start Date	End Date	Energy Use (therms)
03/01/2010	03/31/2010	6,047.00
02/01/2010	02/28/2010	7,966.00
01/01/2010	01/31/2010	8,765.00
12/01/2009	12/31/2009	3,510.00
11/01/2009	11/30/2009	640.00
10/01/2009	10/31/2009	3,171.00
09/01/2009	09/30/2009	86.00
08/01/2009	08/31/2009	57.00
07/01/2009	07/31/2009	80.00
06/01/2009	06/30/2009	1,555.00
05/01/2009	05/31/2009	1,555.00

Gas Meter Consumption (therms)	**33,432.00**
Gas Meter Consumption (kBtu (thousand Btu))	**3,343,200.00**
Total Natural Gas Consumption (kBtu (thousand Btu))	**3,343,200.00**
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
Learning Community Charter School
2495 Kennedy Blvd
Jersey City, NJ 07304

Facility Owner
Learning Community Charter School
2495 Kennedy Blvd
Jersey City, NJ 07304

Primary Contact for this Facility
Michael Steinmetz
2495 Kennedy Blvd
Jersey City, NJ 07304

General Information

Learning Community Charter School	
Gross Floor Area Excluding Parking: (ft^2)	76,000
Year Built	1924
For 12-month Evaluation Period Ending Date:	March 31, 2010

Facility Space Use Summary

School	
Space Type	K-12 School
Gross Floor Area(ft^2)	76,000
Open Weekends?	No
Number of PCs	20
Number of walk-in refrigeration/freezer units	0
Presence of cooking facilities	Yes
Percent Cooled	10
Percent Heated	100
Months[o]	9
High School?	No
School District[o]	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 03/31/2010)	**Baseline** (Ending Date 03/31/2010)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	68	68	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	56	56	52	N/A	66
Source (kBtu/ft^2)	77	77	72	N/A	92
Energy Cost					
$/year	$ 61,906.00	$ 61,906.00	$ 57,439.92	N/A	$ 73,458.10
$/$ft^2$/year	$ 0.81	$ 0.81	$ 0.75	N/A	$ 0.96
Greenhouse Gas Emissions					
$MtCO_2e$/year	287	287	266	N/A	341
$kgCO_2e/ft^2$/year	4	4	4	N/A	5

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.

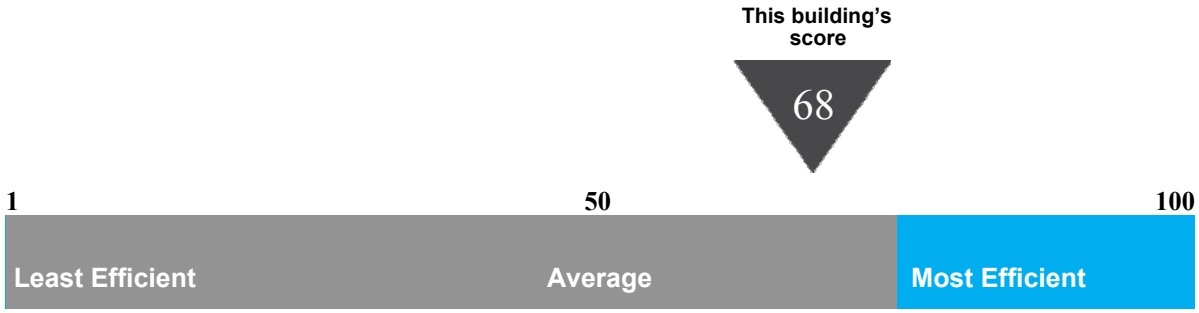
Statement of Energy Performance

2010

Learning Community Charter School
2495 Kennedy Blvd
Jersey City, NJ 07304

Portfolio Manager Building ID: 2291750

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 77 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending March 2010

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: 04/27/2010

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Learning Community Charter School"

Boilers

Tag	Main Boiler	Original Boiler
Unit Type	3 Pass, Low Pressure Sectional Steam/Hot Water Boiler	Original Cast Iron Boiler. Decommissioned
Qty	1	1
Location	Boiler Room	Boiler Room
Area Served	Radiators and HW Converter	None
Manufacturer	Weil McLain	-
Model #	1694	-
Serial #	N/A	-
Input Capacity (MBH)	5,412	-
Rated Output Capacity (MBH)	4,360	-
Approx. Efficiency %	81%	-
Fuel	Nat Gas & #2 Fuel Oil	-
Approx Age	29	-
Ashrae Service Life	35	-
Remaining Life	6	-
Comments	A current boiler model. Provides low pressure steam (10-15 psi). Utilizes Power Flame Constant Speed Burner.	-

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Learning Community Charter School"

Domestic Hot Water Heater

Tag	HW Heater	
Unit Type	Standard Efficiency Gas Fired Hot Water Heater	
Qty	1	
Location	Boiler Room	
Area Served	Bathrooms, cafeteria and showers	
Manufacturer	AO Smith	
Model #	BTR 365A 118	
Serial #	G07M000560	
Input (MBh)	365	
Recovery (gal/h)	354	
Capacity (gal)	85	
Efficiency (%)	81%	
Fuel	Natural Gas	
Approx. Age	3	
ASHRAE Service Life	12	
Remaining Life	9	
Comments	Unit is in good condition.	

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Learning Community Charter School"

Duplex Condensate Pumps

Tag	**Triplex Condensate Return**	
Location	MER #1	
Area Served	Steam Converters, radiators	
Manufacturer	Spirax Sarco	
Qty.	1	
Model #	-	
Serial #	-	
HP	3 x 1 HP	
RPM	3,450	
GPM	-	
Pumping Head (Feet)	-	
Motor Frame Size	48Y	
Volts / Phase	208/3	
Approx. Age	1	
ASHRAE Service Life	15	
Remaining Life	14	
Notes	Unit was recently installed. Unit developed leak at a connection.	

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Learning Community Charter School"

Heat Exchangers

Tag	**Hot Water Converter**	
Location	Boiler Room	
Area Served	Service Hot Water	
Manufacturer	-	
Qty	1	
Model #	-	
Serial #	-	
Input (MBh)	3000 (Est)	
Recovery Gal/h	600 (Est)	
Capacity (Gal)	-	
Efficiency (%)	-	
Fuel	None	
Tube Surface Area (sqft)	-	
Water (GPM)	-	
Steam (lb/hr)	-	
Working pressure	150 (Est)	
Test Pressure	-	
Approx. Age	20 (Est)	
ASHRAE Service Life	24	
Remaining Life	4	
Notes	Converters for heating hot water. Very limited information	

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Learning Community Charter School"

Pumps

Tag	Domestic Water Booster	Main HW Pump	Domestic HW
Location	Boiler Room	Boiler Room	Boiler Room
Area Served	Faucets, cafeteria, showers	Radiators	Faucets, cafeteria, showers
Manufacturer	Grundfos	BG	-
Qty.	2	1	-
Model #	-	-	-
Serial #	-	-	-
HP	7.5	2	Fractional
RPM	3,500	1,725	-
GPM	-	-	-
Ft. Hd	-	-	-
Motor Frame Size	SK184	56CZ	-
Motor Efficiency	Standard	~80%	Standard
Volts / Phase	-	-	-
Approx. Age	15 (Est)	10 (Est)	1
ASHRAE Service Life	20	20	10
Remaining Life	10	10	9
Notes	Standard Efficiency Motors on Pumps		

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Learning Community Charter School"

Fan Coil Units

Tag	Convectors	Unit Heaters	Unit Ventilators
Location	Classrooms, corridors	Classrooms, corridors	Gym, Vestibules
Manufacturer	American Rad. Co. Multifin	Nesbitt	Nesbitt
Qty.	~50	~50	~10
Model #	Various	D Series	580 / 680
Serial #	-	-	-
Heating Type	HW / Steam	HW / Steam	HW / Steam
Heating Capacity (MBH)	5 - 20	25 - 100	73 - 78
CFM	-	-	-
RPM / HP	-	~750	~750
GPM	-	-	
Approx. Age	20	20	20
ASHRAE Service Life	20	20	20
Remaining Life	-	-	-
Notes	Information based on schedules.		

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Learning Community Charter School"

Air Handling Units

Tag	GYM Ventilation Unit	
Location	Gym	
Area Served	Gym	
Manufacturer	Buffalo	
Qty	1	
Model #	805	
Serial #	58J14761	
Cooling Coil	None	
Cooling Eff. (EER)	-	
Cooling Capacity	-	
Heating Type	-	
Input (MBh)	-	
Output (MBh)	-	
Supply Air, CFM	~20,000	
Return Air, CFM	-	
Supply Motor HP	5	
Supply Motor Efficiency	Standard	
Volts / Phase	460/3	
Approx. Age	25	
ASHRAE Service Life	25	
Remaining Life	0	
Notes		

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Learning Community Charter School"

Air Compressor

Tag	Air Compressor	
Location	Gym	
Area Served	HVAC Units	
Manufacturer	Champion	
Qty.	1	
Model #	CFSCCA, Climate Control. 5	
Serial #	D036240	
HP	1	
Pressure, psig	100	
Capacity	~20	
Volts / Phase	208	
Approx. Age	2	
ASHRAE Service Life	20	
Remaining Life	18	
Notes		

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Learning Community Charter School"

Split A/C Systems

Air Handling Unit

Tag	Ductless Split AC Units	
Location	Music Room	
Area Served	Music Room	
Manufacturer	Mitsubishi	
Qty	2	
Model #	-	
Serial #	-	
Cooling Coil	DX	
Cooling Capacity, Mbh	36	
Supply Flow, CFM	-	
Heating Type	None	
Input (MBh)	-	
Ecomonizer	None	
Supply Motor HP	Fractional	
Supply Motor Efficiency	Standard	
Volts / Phase	208/1	
Approx. Age	1	
ASHRAE Service Life	15	
Remaining Life	14	
Notes		

Condensing Units

Qty	2	
Location	Grade	
Manufacturer	Mitsubishi	
Model #	PUY-A36NHA2	
Serial #	81U02420B	
Cooling Capacity, MBH	36	
Cooling Eff., EER		
Refrigerant	R410a	
Volts / Phase / Amps	208/3	
Approx Age	1	
ASHRAE Service Life	15	
Remaining Life	14	
Comments		

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Learning Community Charter School"

Supplemental AC Units

Tag	**Portable AC**	
Unit Type	Portable Network Cooling Equipment	
Location	Server Room	
Area Served	Server Room	
Manufacturer	Air Rover	
Qty.	1	
Model #	XL24BA	
Serial #	71160206	
Cooling Capacity, BTU/h	27400	
Dehumidifier Capacity		
Air Flow, CFM	1000	
Refrigerant	R22	
Volts / Phase	120/1	
Approx. Age	1	
ASHRAE Service Life	15	
Remaining Life	14	
Notes		

Investment Grade Lighting Audit

CEG Job #: 9C10042
Project: Learning Charter Community School
Address: 2495 John F Kennedy Blvd
Jersey City , NJ 07304
Building SF: 76000

Learning Charter Community School

KWH COST: $0.168

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
39	Boiler/Mechanical Room	260	7	1	1-Lamp Incandescent, 300 Watt Bulbs, Surface Mounted, Direct	300	2.10	546.0	$91.73	7	1	105 W CFL Lamp	105	0.74	191.1	$32.10	$35.00	$245.00	1.37	354.9	$59.62	4.11
8	Lower Level Corridor	2100	8	2	1x4, 2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.64	1,344.0	$225.79	8	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.44	924	$155.23	$100.00	$800.00	0.20	420	$70.56	11.34
39	Room B-5	1680	2	1	1-Lamp Incandescent, 300 Watt Bulbs, Surface Mounted, Direct	300	0.60	1,008.0	$169.34	2	1	105 W CFL Lamp	105	0.21	352.8	$59.27	$35.00	$70.00	0.39	655.2	$110.07	0.64
39	Room B-4	1680	6	1	1-Lamp Incandescent, 300 Watt Bulbs, Surface Mounted, Direct	300	1.80	3,024.0	$508.03	6	1	105 W CFL Lamp	105	0.63	1058.4	$177.81	$35.00	$210.00	1.17	1965.6	$330.22	0.64
14	Basement Girls Room	1680	2	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, No Lens	80	0.16	268.8	$45.16	2	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.11	184.8	$31.05	$100.00	$200.00	0.05	84	$14.11	14.17
8	Room B-3	1680	15	2	1x4, 2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	1.20	2,016.0	$338.69	15	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.83	1386	$232.85	$100.00	$1,500.00	0.38	630	$105.84	14.17
31	Music Room B-1	1680	13	2	1x4, 2-Lamp, T8, Electronic Ballast, Pendant Mounted,Direct/Indirect	58	0.75	1,266.7	$212.81	13	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
31	Basement Boys Room	1680	3	2	1x4, 2-Lamp, T8, Electronic Ballast, Pendant Mounted,Direct/Indirect	58	0.17	292.3	$49.11	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
39	Cafeteria	1680	14	1	1-Lamp Incandescent, 300 Watt Bulbs, Surface Mounted, Direct	300	4.20	7,056.0	$1,185.41	14	1	105 W CFL Lamp	105	1.47	2469.6	$414.89	$35.00	$490.00	2.73	4586.4	$770.52	0.64
8	Kitchen	1680	8	2	1x4, 2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.64	1,075.2	$180.63	8	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.44	739.2	$124.19	$100.00	$800.00	0.20	336	$56.45	14.17
14	Room B-2	1680	11	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, No Lens	80	0.88	1,478.4	$248.37	11	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.61	1016.4	$170.76	$100.00	$1,100.00	0.28	462	$77.62	14.17
39	Room B-6	1680	2	1	1-Lamp Incandescent, 300 Watt Bulbs, Surface Mounted, Direct	300	0.60	1,008.0	$169.34	2	1	105 W CFL Lamp	105	0.21	352.8	$59.27	$35.00	$70.00	0.39	655.2	$110.07	0.64

Investment Grade Lighting Audit

44	Staff Room	1680	1	1	Ceiling Fan with 4x75W incandescent lamps, Direct	300	0.30	504.0	$84.67	1	1	(4) 18 W CFL Lamp	54	0.05	90.72	$15.24	$20.00	$20.00	0.25	413.28	$69.43	0.29
59	Staff Kitchen	1680	3	1	2-Lamp, Round T9, Electronic Ballast, Surface Mount, No Lens	40	0.12	201.6	$33.87	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
41	Refrigerator Closet	420	1	1	1 Lamp Incandescent, 100 Watt Bulbs, Surface Mounted, Direct	100	0.10	42.0	$7.06	1	1	26 W CFL Lamp	26	0.03	10.92	$1.83	$5.00	$5.00	0.07	31.08	$5.22	0.96
8	Auditorium Foyer	600	1	2	1x4, 2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.08	48.0	$8.06	1	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.06	33	$5.54	$100.00	$100.00	0.03	15	$2.52	39.68
39		600	4	1	1-Lamp Incandescent, 300 Watt Bulbs, Surface Mounted, Direct	300	1.20	720.0	$120.96	4	1	105 W CFL Lamp	105	0.42	252	$42.34	$35.00	$140.00	0.78	468	$78.62	1.78
39	Auditorium	600	40	1	1-Lamp Incandescent, 300 Watt Bulbs, Surface Mounted, Direct	300	12.00	7,200.0	$1,209.60	40	1	105 W CFL Lamp	105	4.20	2520	$423.36	$35.00	$1,400.00	7.80	4680	$786.24	1.78
41	Mezzanine	420	5	1	1 Lamp Incandescent, 100 Watt Bulbs, Surface Mounted, Direct	100	0.50	210.0	$35.28	5	1	26 W CFL Lamp	26	0.13	54.6	$9.17	$5.00	$25.00	0.37	155.4	$26.11	0.96
38		420	2	2	2-Lamp, Incandescent, 75 Watt Bulbs, Surface Mounted, Direct	150	0.30	126.0	$21.17	2	1	(2) 18 W CFL Lamp	36	0.07	30.24	$5.08	$10.00	$20.00	0.23	95.76	$16.09	1.24
8	Stair E	8760	6	2	1x4, 2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.48	4,204.8	$706.41	6	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.33	2890.8	$485.65	$100.00	$600.00	0.15	1314	$220.75	2.72
8	Stair C	8760	6	2	1x4, 2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.48	4,204.8	$706.41	6	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.33	2890.8	$485.65	$100.00	$600.00	0.15	1314	$220.75	2.72
39	Gymnasium	600	32	1	1-Lamp Incandescent, 300 Watt Bulbs, Surface Mounted, Direct	300	9.60	5,760.0	$967.68	32	1	105 W CFL Lamp	105	3.36	2016	$338.69	$35.00	$1,120.00	6.24	3744	$628.99	1.78
14	Phys Ed Office	1680	1	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, No Lens	80	0.08	134.4	$22.58	1	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.06	92.4	$15.52	$100.00	$100.00	0.03	42	$7.06	14.17
42		1680	2	1	1 Lamp Incandescent, 60 Watt Bulbs, Surface Mounted, Direct	60	0.12	201.6	$33.87	2	1	18 W CFL Lamp	18	0.04	60.48	$10.16	$5.00	$10.00	0.08	141.12	$23.71	0.42
8	1st Level Corridor	2100	7	2	1x4, 2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.56	1,176.0	$197.57	7	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.39	808.5	$135.83	$100.00	$700.00	0.18	367.5	$61.74	11.34
38	1st Level Girls Room	1680	2	2	2-Lamp, Incandescent, 75 Watt Bulbs, Surface Mounted, Direct	150	0.30	504.0	$84.67	2	1	(2) 18 W CFL Lamp	36	0.07	120.96	$20.32	$10.00	$20.00	0.23	383.04	$64.35	0.31
31	Main Office	1680	8	2	1x4, 2-Lamp, T8, Electronic Ballast, Pendant Mounted,Direct/Indirect	58	0.46	779.5	$130.96	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

31	Classroom 100	1680	10	2	1x4, 2-Lamp, T8, Electronic Ballast, Pendant Mounted,Direct/Indirect	58	0.58	974.4	$163.70	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
31	Classroom 101	1680	10	2	1x4, 2-Lamp, T8, Electronic Ballast, Pendant Mounted,Direct/Indirect	58	0.58	974.4	$163.70	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
31	Classroom 102	1680	10	2	1x4, 2-Lamp, T8, Electronic Ballast, Pendant Mounted,Direct/Indirect	58	0.58	974.4	$163.70	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
31	Classroom 103	1680	10	2	1x4, 2-Lamp, T8, Electronic Ballast, Pendant Mounted,Direct/Indirect	58	0.58	974.4	$163.70	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
31	Classroom 104	1680	10	2	1x4, 2-Lamp, T8, Electronic Ballast, Pendant Mounted,Direct/Indirect	58	0.58	974.4	$163.70	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
38	1st Level Locker Rom	1680	6	2	2-Lamp, Incandescent, 75 Watt Bulbs, Surface Mounted, Direct	150	0.90	1,512.0	$254.02	6	1	(2) 18 W CFL Lamp	36	0.22	362.88	$60.96	$10.00	$60.00	0.68	1149.12	$193.05	0.31
31	Classroom 112	1680	9	2	1x4, 2-Lamp, T8, Electronic Ballast, Pendant Mounted,Direct/Indirect	58	0.52	877.0	$147.33	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
31	Classroom 113	1680	9	2	1x4, 2-Lamp, T8, Electronic Ballast, Pendant Mounted,Direct/Indirect	58	0.52	877.0	$147.33	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
31	1st Level Faculty Restroom	1680	1	2	1x4, 2-Lamp, T8, Electronic Ballast, Pendant Mounted,Direct/Indirect	58	0.06	97.4	$16.37	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
23	Library	1680	37	4	4-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	160	5.92	9,945.6	$1,670.86	37	3	2'x4' 3-Lamp 32W T-8 Prismatic Lens / Elect Ballast; Metalux M/N 2GC8	91	3.37	5656.56	$950.30	$140.00	$5,180.00	2.55	4289.04	$720.56	7.19
31	1st Level Boys Room	1680	2	2	1x4, 2-Lamp, T8, Electronic Ballast, Pendant Mounted,Direct/Indirect	58	0.12	194.9	$32.74	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
31	Principals Office	1680	2	2	1x4, 2-Lamp, T8, Electronic Ballast, Pendant Mounted,Direct/Indirect	58	0.12	194.9	$32.74	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
31	Room 106	1680	1	2	1x4, 2-Lamp, T8, Electronic Ballast, Pendant Mounted,Direct/Indirect	58	0.06	97.4	$16.37	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

31	Kindergarten Room 1	1680	12	2	1x4, 2-Lamp, T8, Electronic Ballast, Pendant Mounted,Direct/Indirect	58	0.70	1,169.3	$196.44	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
8	Kind. Restroom	1680	1	2	1x4, 2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.08	134.4	$22.58	1	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.06	92.4	$15.52	$100.00	$100.00	0.03	42	$7.06	14.17
31	Kindergarten Room 2	1680	5	2	1x4, 2-Lamp, T8, Electronic Ballast,	58	0.29	487.2	$81.85	5	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
42		1680	15	1	1 Lamp Incandescent, 60 Watt Bulbs, Surface Mounted, Direct	60	0.90	1,512.0	$254.02	15	1	18 W CFL Lamp	18	0.27	453.6	$76.20	$5.00	$75.00	0.63	1058.4	$177.81	0.42
13	Classroom 200	1680	10	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	80	0.80	1,344.0	$225.79	10	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.55	924	$155.23	$120.00	$1,200.00	0.25	420	$70.56	17.01
13	Classroom 201	1680	10	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	80	0.80	1,344.0	$225.79	10	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.55	924	$155.23	$120.00	$1,200.00	0.25	420	$70.56	17.01
13	Classroom 202	1680	10	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	80	0.80	1,344.0	$225.79	10	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.55	924	$155.23	$120.00	$1,200.00	0.25	420	$70.56	17.01
13	Classroom 203	1680	10	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	80	0.80	1,344.0	$225.79	10	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.55	924	$155.23	$120.00	$1,200.00	0.25	420	$70.56	17.01
13	Classroom 204	1680	10	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	80	0.80	1,344.0	$225.79	10	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.55	924	$155.23	$120.00	$1,200.00	0.25	420	$70.56	17.01
13	Classroom 205	1680	10	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	80	0.80	1,344.0	$225.79	10	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.55	924	$155.23	$120.00	$1,200.00	0.25	420	$70.56	17.01
13	Classroom 206	1680	10	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	80	0.80	1,344.0	$225.79	10	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.55	924	$155.23	$120.00	$1,200.00	0.25	420	$70.56	17.01
13	Classroom 207	1680	10	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	80	0.80	1,344.0	$225.79	10	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.55	924	$155.23	$120.00	$1,200.00	0.25	420	$70.56	17.01
14	Locker/Coat Room	1680	8	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, No Lens	80	0.64	1,075.2	$180.63	8	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.44	739.2	$124.19	$100.00	$800.00	0.20	336	$56.45	14.17
38	Room 209	1680	1	2	2-Lamp, Incandescent, 75 Watt Bulbs, Surface Mounted, Direct	150	0.15	252.0	$42.34	1	1	(2) 18 W CFL Lamp	36	0.04	60.48	$10.16	$10.00	$10.00	0.11	191.52	$32.18	0.31
8	Room 208	1680	3	2	1x4, 2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.24	403.2	$67.74	3	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.17	277.2	$46.57	$100.00	$300.00	0.08	126	$21.17	14.17
8		2100	7	2	1x4, 2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.56	1,176.0	$197.57	7	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.39	808.5	$135.83	$100.00	$700.00	0.18	367.5	$61.74	11.34

Investment Grade Lighting Audit

39	2nd Level Hallway	2100	2	1	1-Lamp Incandescent, 300 Watt Bulbs, Surface Mounted, Direct	300	0.60	1,260.0	$211.68	2	1	105 W CFL Lamp	105	0.21	441	$74.09	$35.00	$70.00	0.39	819	$137.59	0.51
38		2100	2	2	2-Lamp, Incandescent, 75 Watt Bulbs, Surface Mounted, Direct	150	0.30	630.0	$105.84	2	1	(2) 18 W CFL Lamp	36	0.07	151.2	$25.40	$10.00	$20.00	0.23	478.8	$80.44	0.25
13	2nd Level Boys Room	1680	1	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	80	0.08	134.4	$22.58	1	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.06	92.4	$15.52	$120.00	$120.00	0.03	42	$7.06	17.01
8	Room 210	1680	4	2	1x4, 2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.32	537.6	$90.32	4	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.22	369.6	$62.09	$100.00	$400.00	0.10	168	$28.22	14.17
44	Room 211	1680	1	1	Ceiling Fan with 4x75W incandescent lamps, Direct	300	0.30	504.0	$84.67	1	1	(4) 18 W CFL Lamp	54	0.05	90.72	$15.24	$20.00	$20.00	0.25	413.28	$69.43	0.29
42		1680	3	1	1 Lamp Incandescent, 60 Watt Bulbs, Surface Mounted, Direct	60	0.18	302.4	$50.80	3	1	18 W CFL Lamp	18	0.05	90.72	$15.24	$5.00	$15.00	0.13	211.68	$35.56	0.42
42	Staff Restroom	1680	2	1	1 Lamp Incandescent, 60 Watt Bulbs, Surface Mounted, Direct	60	0.12	201.6	$33.87	2	1	18 W CFL Lamp	18	0.04	60.48	$10.16	$5.00	$10.00	0.08	141.12	$23.71	0.42
38	Room 212	1680	1	2	2-Lamp, Incandescent, 75 Watt Bulbs, Surface Mounted, Direct	150	0.15	252.0	$42.34	1	1	(2) 18 W CFL Lamp	36	0.04	60.48	$10.16	$10.00	$10.00	0.11	191.52	$32.18	0.31
31	Storage Room	1680	1	2	1x4, 2-Lamp, T8, Electronic Ballast, Pendant Mounted,Direct/Indirect	58	0.06	97.4	$16.37	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
17		500	8	2	8 Foot, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic	142	1.14	568.0	$95.42	8	4	(2) 8' Lamps to (4) 4' Lamps; 4 Lamp, 32w T8, Elect. Ballast; retrofit	104	0.83	416	$69.89	$100.00	$800.00	0.30	152	$25.54	31.33
38	2nd Level Girls Room	1680	1	2	2-Lamp, Incandescent, 75 Watt Bulbs, Surface Mounted, Direct	150	0.15	252.0	$42.34	1	1	(2) 18 W CFL Lamp	36	0.04	60.48	$10.16	$10.00	$10.00	0.11	191.52	$32.18	0.31
13	Room 215	1680	4	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	80	0.32	537.6	$90.32	4	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.22	369.6	$62.09	$120.00	$480.00	0.10	168	$28.22	17.01
17	Counselor	1680	1	2	8 Foot, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic	142	0.14	238.6	$40.08	1	4	(2) 8' Lamps to (4) 4' Lamps; 4 Lamp, 32w T8, Elect. Ballast; retrofit	104	0.10	174.72	$29.35	$100.00	$100.00	0.04	63.84	$10.73	9.32
38		1680	1	2	2-Lamp, Incandescent, 75 Watt Bulbs, Surface Mounted, Direct	150	0.15	252.0	$42.34	1	1	(2) 18 W CFL Lamp	36	0.04	60.48	$10.16	$10.00	$10.00	0.11	191.52	$32.18	0.31
31	Nurses Office	1680	18	2	1x4, 2-Lamp, T8, Electronic Ballast, Pendant Mounted,Direct/Indirect	58	1.04	1,753.9	$294.66	18	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
38	Locker Room	1680	8	2	2-Lamp, Incandescent, 75 Watt Bulbs, Surface Mounted, Direct	150	1.20	2,016.0	$338.69	8	1	(2) 18 W CFL Lamp	36	0.29	483.84	$81.29	$10.00	$80.00	0.91	1532.16	$257.40	0.31
13	Classroom 300	1680	10	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	80	0.80	1,344.0	$225.79	10	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.55	924	$155.23	$120.00	$1,200.00	0.25	420	$70.56	17.01

Investment Grade Lighting Audit

13	Classroom 301	1680	10	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	80	0.80	1,344.0	$225.79	10	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.55	924	$155.23	$120.00	$1,200.00	0.25	420	$70.56	17.01
13	Classroom 302	1680	10	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	80	0.80	1,344.0	$225.79	10	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.55	924	$155.23	$120.00	$1,200.00	0.25	420	$70.56	17.01
13	Classroom 303	1680	10	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	80	0.80	1,344.0	$225.79	10	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.55	924	$155.23	$120.00	$1,200.00	0.25	420	$70.56	17.01
13	Classroom 304	1680	10	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	80	0.80	1,344.0	$225.79	10	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.55	924	$155.23	$120.00	$1,200.00	0.25	420	$70.56	17.01
13	Classroom 305	1680	10	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	80	0.80	1,344.0	$225.79	10	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.55	924	$155.23	$120.00	$1,200.00	0.25	420	$70.56	17.01
13	Classroom 306	1680	10	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	80	0.80	1,344.0	$225.79	10	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.55	924	$155.23	$120.00	$1,200.00	0.25	420	$70.56	17.01
13	Classroom 307	1680	10	2	1x4, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	80	0.80	1,344.0	$225.79	10	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.55	924	$155.23	$120.00	$1,200.00	0.25	420	$70.56	17.01
23	Classroom 308	1680	4	4	4-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	160	0.64	1,075.2	$180.63	4	3	2'x4' 3-Lamp 32W T-8 Prismatic Lens / Elect Ballast; Metalux M/N 2GC8	91	0.36	611.52	$102.74	$140.00	$560.00	0.28	463.68	$77.90	7.19
39		1680	1	1	1-Lamp Incandescent, 300 Watt Bulbs, Surface Mounted, Direct	300	0.30	504.0	$84.67	1	1	105 W CFL Lamp	105	0.11	176.4	$29.64	$35.00	$35.00	0.20	327.6	$55.04	0.64
23	Classroom 309	1680	4	4	4-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	160	0.64	1,075.2	$180.63	4	3	2'x4' 3-Lamp 32W T-8 Prismatic Lens / Elect Ballast; Metalux M/N 2GC8	91	0.36	611.52	$102.74	$140.00	$560.00	0.28	463.68	$77.90	7.19
39		1680	1	1	1-Lamp Incandescent, 300 Watt Bulbs, Surface Mounted, Direct	300	0.30	504.0	$84.67	1	1	105 W CFL Lamp	105	0.11	176.4	$29.64	$35.00	$35.00	0.20	327.6	$55.04	0.64
40	Classroom 310	1680	1	4	4 Lamp Incandescent, 75 Watt Bulbs, Surface Mounted, Direct	300	0.30	504.0	$84.67	1	1	(4) 18 W CFL Lamp	72	0.07	120.96	$20.32	$20.00	$20.00	0.23	383.04	$64.35	0.31
40	3rd Level Hallway	2100	2	4	4 Lamp Incandescent, 75 Watt Bulbs, Surface Mounted, Direct	300	0.60	1,260.0	$211.68	2	1	(4) 18 W CFL Lamp	72	0.14	302.4	$50.80	$20.00	$40.00	0.46	957.6	$160.88	0.25
8		2100	7	2	1x4, 2-Lamp, T12, Magnetic Ballast, Surface Mounted, Prismatic Lens	80	0.56	1,176.0	$197.57	7	2	1'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.39	808.5	$135.83	$100.00	$700.00	0.18	367.5	$61.74	11.34
23	3rd Level Boys Room	1680	1	4	4-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	160	0.16	268.8	$45.16	1	3	2'x4' 3-Lamp 32W T-8 Prismatic Lens / Elect Ballast; Metalux M/N 2GC8	91	0.09	152.88	$25.68	$140.00	$140.00	0.07	115.92	$19.47	7.19
38	3rd Level Girls Room	1680	2	2	2-Lamp, Incandescent, 75 Watt Bulbs, Surface Mounted, Direct	150	0.30	504.0	$84.67	2	1	(2) 18 W CFL Lamp	36	0.07	120.96	$20.32	$10.00	$20.00	0.23	383.04	$64.35	0.31

Investment Grade Lighting Audit

17	Room 312	1680	6	2	8 Foot, 2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic	142	0.85	1,431.4	$240.47	6	4	(2) 8' Lamps to (4) 4' Lamps; 4 Lamp, 32w T8, Elect. Ballast; retrofit	104	0.62	1048.32	$176.12	$100.00	$600.00	0.23	383.04	$64.35	9.32
23	Room 313	1680	4	4	4-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	160	0.64	1,075.2	$180.63	4	3	2'x4' 3-Lamp 32W T-8 Prismatic Lens / Elect Ballast; Metalux M/N 2GC8	91	0.36	611.52	$102.74	$140.00	$560.00	0.28	463.68	$77.90	7.19
23	Room 314	1680	39	4	4-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	160	6.24	10,483.2	$1,761.18	39	3	2'x4' 3-Lamp 32W T-8 Prismatic Lens / Elect Ballast; Metalux M/N 2GC8	91	3.55	5962.32	$1,001.67	$140.00	$5,460.00	2.69	4520.88	$759.51	7.19
23	Room 315	1680	27	4	4-Lamp, T12, Magnetic Ballast, Pendant Mounted, Prismatic Lens	160	4.32	7,257.6	$1,219.28	27	3	2'x4' 3-Lamp 32W T-8 Prismatic Lens / Elect Ballast; Metalux M/N 2GC8	91	2.46	4127.76	$693.46	$140.00	$3,780.00	1.86	3129.84	$525.81	7.19
40	Midlevel Bathrroom	840	2	4	4 Lamp Incandescent, 75 Watt Bulbs, Surface Mounted, Direct	300	0.60	504.0	$84.67	2	1	(4) 18 W CFL Lamp	72	0.14	120.96	$20.32	$20.00	$40.00	0.46	383.04	$64.35	0.62
38	Midlevel Hallway	840	7	2	2-Lamp, Incandescent, 75 Watt Bulbs, Surface Mounted, Direct	150	1.05	882.0	$148.18	7	1	(2) 18 W CFL Lamp	36	0.25	211.68	$35.56	$10.00	$70.00	0.80	670.32	$112.61	0.62
38	Midlevel Storage Areas	840	5	2	2-Lamp, Incandescent, 75 Watt Bulbs, Surface Mounted, Direct	150	0.75	630.0	$105.84	5	1	(2) 18 W CFL Lamp	36	0.18	151.2	$25.40	$10.00	$50.00	0.57	478.8	$80.44	0.62
	Totals		712	194			92.40	131,453.7	$22,084.22	712	135			40.459	62018.36	$10,419.08		$51,585.00	44.05	56176.8	$9,437.70	5.47

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.
2. Lamp totals only include T-12 tube replacment calculations

Project Name: LGEA Solar PV Project - Learning Community Charter School
Location: Jersey City, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

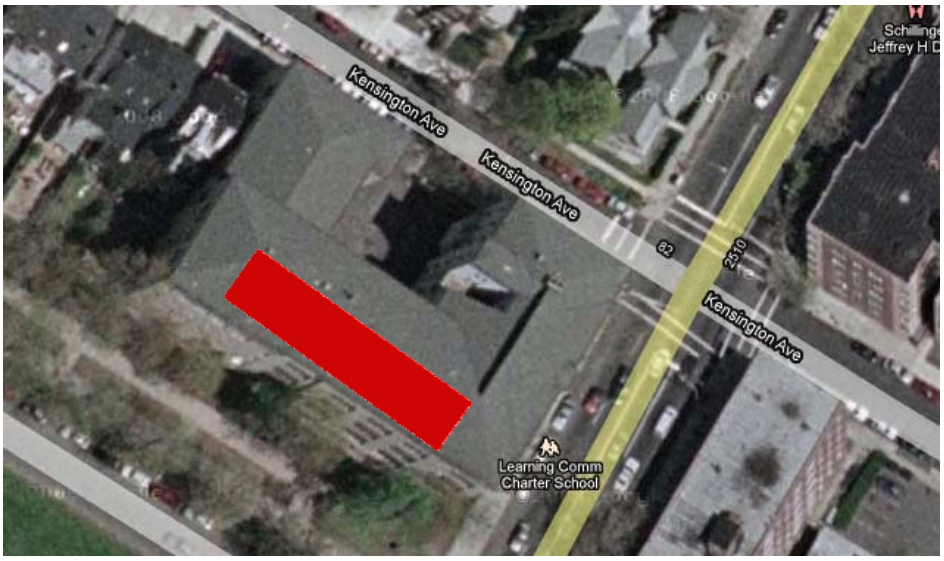
	Photovoltaic System - Direct Purchase
Total Construction Cost	$387,090
Annual kWh Production	50,796
Annual Energy Cost Reduction	$8,432
Annual SREC Revenue	$17,779
First Cost Premium	**$387,090**
Simple Payback:	**14.77** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.166**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$387,090	0	0	0	$0	(387,090)	0
1	$0	50,796	$8,432	$0	$17,779	$26,211	($360,879)
2	$0	50,542	$8,685	$0	$17,690	$26,375	($334,504)
3	$0	50,289	$8,946	$0	$17,601	$26,547	($307,958)
4	$0	50,038	$9,214	$0	$17,513	$26,727	($281,230)
5	$0	49,788	$9,490	$513	$17,426	$26,403	($254,827)
6	$0	49,539	$9,775	$510	$17,339	$26,603	($228,223)
7	$0	49,291	$10,068	$508	$17,252	$26,813	($201,411)
8	$0	49,045	$10,370	$505	$17,166	$27,031	($174,380)
9	$0	48,799	$10,682	$503	$17,080	$27,259	($147,121)
10	$0	48,555	$11,002	$500	$16,994	$27,496	($119,625)
11	$0	48,313	$11,332	$498	$16,909	$27,744	($91,881)
12	$0	48,071	$11,672	$495	$16,825	$28,002	($63,879)
13	$0	47,831	$12,022	$493	$16,741	$28,270	($35,609)
14	$0	47,592	$12,383	$490	$16,657	$28,550	($7,059)
15	$0	47,354	$12,754	$488	$16,574	$28,840	$21,781
16	$0	47,117	$13,137	$485	$16,491	$29,143	$50,924
17	$0	46,881	$13,531	$483	$16,408	$29,457	$80,380
18	$0	46,647	$13,937	$480	$16,326	$29,783	$110,163
19	$0	46,414	$14,355	$478	$16,245	$30,122	$140,285
20	$0	46,182	$14,786	$476	$16,164	$30,474	$170,759
21	$1	45,951	$15,229	$473	$16,083	$30,839	$201,597
22	$2	45,721	$15,686	$471	$16,002	$31,218	$232,815
23	$3	45,492	$16,157	$469	$15,922	$31,611	$264,426
24	$4	45,265	$16,642	$466	$15,843	$32,018	$296,444
25	$5	45,038	$17,141	$464	$15,763	$32,440	$328,884
	Totals:	1,196,548	$307,429	$10,247	$418,792	$715,974	($710,130)
				Net Present Value (NPV)		**$328,909**	
				Internal Rate of Return (IRR)		**5.2%**	

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
LCCS Main Building	3052	Sunpower SPR230	187	14.7	2,750	43.01	50,796	6,171	15.64



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:	43.1 kW
DC to AC Derate Factor:	0.810
AC Rating:	34.9 kW
Array Type:	Fixed Tilt
Array Tilt:	35.0°
Array Azimuth:	220.0°
Energy Specifications	
Cost of Electricity:	16.6 ¢/kWh

Results			
Month	Solar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	2.94	3246	538.84
2	3.60	3569	592.45
3	4.27	4571	758.79
4	4.75	4741	787.01
5	5.38	5390	894.74
6	5.46	5134	852.24
7	5.44	5228	867.85
8	5.21	4972	825.35
9	4.80	4560	756.96
10	3.99	4043	671.14
11	2.66	2706	449.20
12	2.44	2635	437.41
Year	4.25	50796	8432.14

= Proposed PV Layout

Notes:

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