EAST HANOVER TOWNSHIP SCHOOL DISTRICT

FRANK J. SMITH SCHOOL

27 GREEN DRIVE
EAST HANOVER, NJ 07936

FACILITY ENERGY REPORT

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I. HISTORIC ENERGY CONSUMPTION/COST

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.

Electric Utility Provider:	Jersey Central Power & Light
Electric Utility Rate Structure:	General Service Secondary
Third Party Supplier:	First Energy Solutions & Direct Energy Business

Natural Gas Utility Provider:	Public Service Electric & Gas
Utility Rate Structure:	General Service Gas (GSG)
Third Party Supplier:	Hess Corporation

The electric usage profile represents the actual electrical usage for the facility. 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 within each facility report shows the actual natural gas energy usage for the facility. 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.

Table 1
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: JCP&L
Rate: General Service Secondary 3 Phase
Meter No: G28408098
Account # 100 005 100 340
Third Party Utility Provider: Direct Energy Business & Fir
TPS Meter / Acct No: -

MONTH OF USE	CONSUMPTION KWH	DEMAND KW	TOTAL BILL
Dec-12	26,132	71.7	$2,702
Jan-13	27,732	72.8	$2,826
Feb-13	29,492	72.5	$2,972
Mar-13	25,812	73.3	$2,667
Apr-13	28,532	74.9	$2,906
May-13	22,452	109.6	$2,932
Jun-13	22,932	101.3	$2,920
Jul-13	15,252	57.1	$1,854
Aug-13	25,492	94.4	$3,138
Sep-13	24,532	116.2	$3,105
Oct-13	22,612	65.9	$2,615
Nov-13	26,612	86.4	$3,134
Totals	**297,584**	**116.2 Max**	**$33,771**

AVERAGE DEMAND **83.0 KW average**
AVERAGE RATE **$0.113** **$/kWh**

Figure 1
Electricity Usage Profile

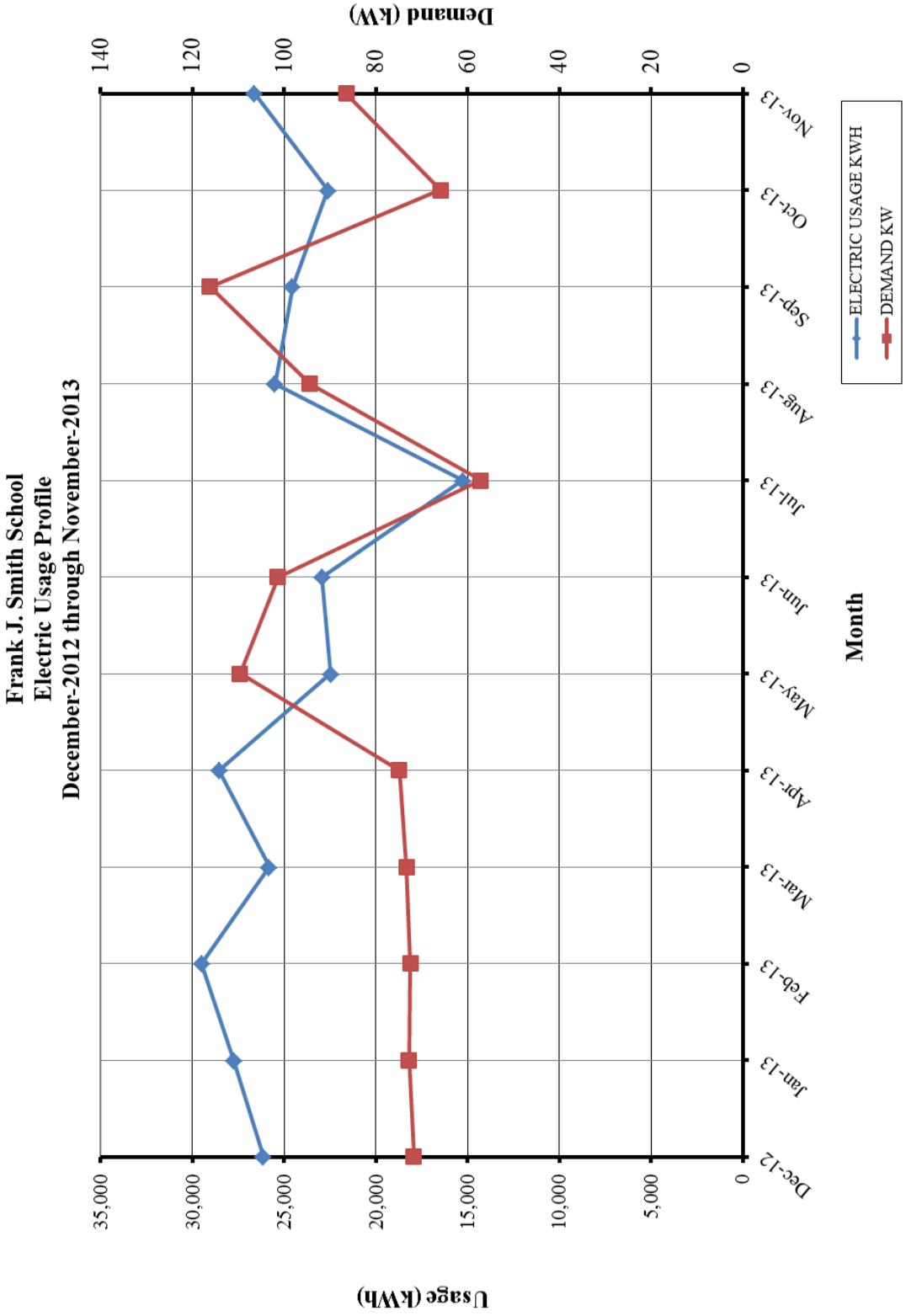
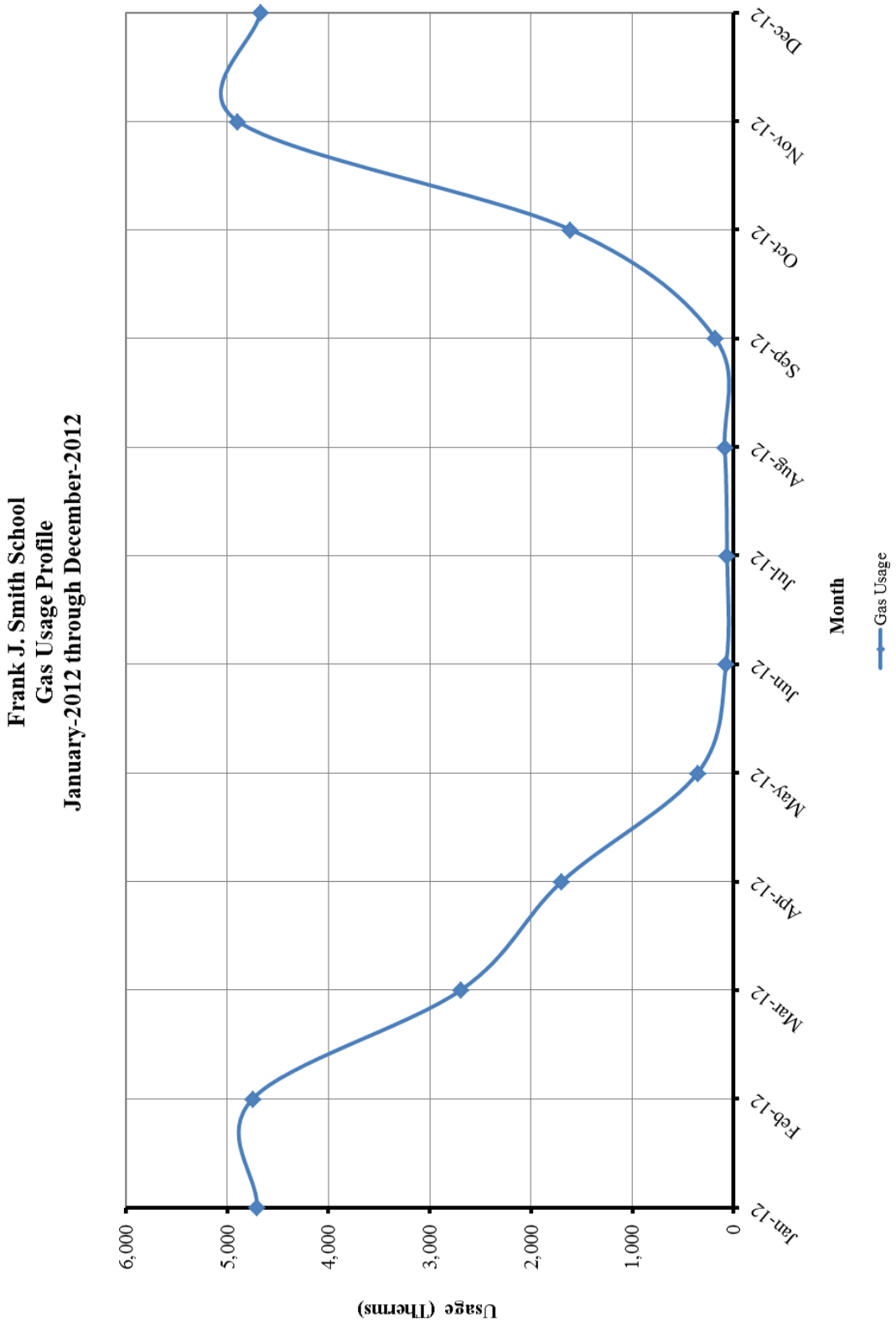


Table 2
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider: PSE&G		
Rate: LVG		
Meter No: 1828170		
Account Number 66 298 794 04		
Third Party Utility Provider: HESS		
TPS Account No: 526148/526154		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Jan-12	4,703	$4,254
Feb-12	4,748	$4,192
Mar-12	2,693	$1,704
Apr-12	1,695	$914
May-12	353	$277
Jun-12	75	$141
Jul-12	64	$137
Aug-12	88	$152
Sep-12	184	$204
Oct-12	1,613	$1,853
Nov-12	4,902	$4,305
Dec-12	4,672	$4,153
TOTALS	**25,789**	**$22,286**
AVERAGE RATE:	**$0.86**	**$/THERM**

Note: The most recent billing data for 2013 appears to be erroneous as the meter is not processing usage, therefore the 2012 data for this facility is being utilized to exhibit the proper annual usage.

Figure 2
Natural Gas Usage Profile



II. FACILITY DESCRIPTION

The Frank J. Smith Elementary School is located at 27 Green Drive Avenue in East Hanover, New Jersey. This 39,200 SF facility is used as a public school for grades Pre-K through 2nd grade and also a facility for the Before and After School Program. The original building was built in 1962 with the C-Wing added in 2007. The facility is a single-story building comprised of a main office, general classrooms, two (2) multi-purpose rooms, a kitchen, a library, SGI classrooms, a nurse's office, restrooms, a boiler room and utility/storage rooms.

Occupancy Profile

The typical hours of operation for the Frank J. Smith Elementary School are Monday through Friday between 8:00 am and 4:00 pm, with custodial staff on site afterhours till approximately 9:00 pm. Additional events occur throughout the year after hours in the facility. The school's normal operations span 10 months, with summer programs and community activities occurring during July and August. The school has an enrollment of 309 students and 30 staff.

Building Envelope

Exterior walls are masonry brick faced with concrete block interior walls. The windows throughout the school are in good condition and are double pane, operable, ¼" glass with aluminum frames. The roof is a flat, built up rubber roof where most of the mechanical rooftop equipment is placed. The amount of insulation below the roof is unknown.

HVAC Systems

The facility is heated by a central hot water boiler plant located in the boiler room. Heating hot water is provided by two H.B. Smith Model 28A cast-iron, sectional, gas-fired boilers, each rated for an input capacity of 2,836 MBH and an output capacity of 2,246 MBH for a rated thermal efficiency of 79.2%. The boilers were manufactured in 2007 and are in good condition. The hot water boiler plant includes an Exhausto variable speed combustion air fan system. The building has (2) sets of hot water pumps that pump hot water to various coils and fin-tube radiators. P-1 & P-2 consist of two Armstrong base-mounted, end suction pumps with 5 HP motors. Each pump is rated for 100 GPM at 65 feet of head. The other set of pumps consist of two (2) base-mounted, end suction pumps with 3 HP motors.

The new C-Wing is cooled by a McQuay Model RFS045 packaged rooftop unit rated at 45-Tons with a 7.5 HP evaporator fan and a 3 HP return/exhaust fan. Numerous ductless split units condition the library, computer room, and main office. The rooftop condensing units range in size from 1-Ton to 2.5-Tons and have a SEER ranging from 16.5 to 20.

Exhaust System

Toilet exhaust air is relieved through roof mounted exhaust fans with small horsepower fan motors. The kitchen also has one general exhaust fan and one exhaust fan dedicated to the hood.

HVAC System Controls

The HVAC systems within the building are controlled through ATC with pneumatics and a small portion of the school is on Johnson Metasys DDC. The hot water boilers, hot water pumps, and 3-way valves are controlled by a DX-9100 controller. The large rooftop unit has a unitary controller as well as the VAV boxes. These individual HVAC systems are tied into a Metasys N-30 network control module and can be addressed by a remote access. The system has thermostats in every classroom that allow the local user limited temperature control for warmer or cooler. Typical global set point for occupied mode throughout the school is 72^{o}F with night setback.

Domestic Hot Water

Domestic hot water for the facility is provided by a Rheem-Ruud Model G91-200 91 gallon gas-fired hot water heater rated at 200 MBH.

Lighting

Refer to the Investment Grade lighting Audit Appendix for a detailed list of the lighting throughout the facility and estimated operating hours per space.

III. 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.

IV. ENERGY CONSERVATION MEASURES

Energy Conservation Measures are developed specifically for this facility. The energy savings and calculations are highly dependent on the information received from the site survey and interviews with operations personnel. The assumptions and calculations should be reviewed by the owner to ensure accurate representation of this facility. The following ECMs were analyzed:

Table 1
ECM Financial Summary

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Lighting Upgrade - General	$60,060	$5,102	11.8	27.4%
ECM #2	Lighting Upgrade - Exterior	$6,510	$2,555	2.5	488.7%
ECM #3	Lighting Controls Upgrade	$9,430	$769	12.3	22.3%
ECM #4	Domestic Hot Water Heater Upgrade	$19,341	$402	48.1	-75.1%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	146.88 kW PV System	$644,777	$51,611	12.5	20.1%

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

Table 2
ECM Energy Summary

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	**DESCRIPTION**	**ANNUAL UTILITY REDUCTION**		
		ELECTRIC DEMAND (KW)	**ELECTRIC CONSUMPTION (KWH)**	**NATURAL GAS (THERMS)**
ECM #1	Lighting Upgrade - General	16.5	45,147	0
ECM #2	Lighting Upgrade - Exterior	5.3	22,612	0
ECM #3	Lighting Controls Upgrade	0.0	6,804	0
ECM #4	Domestic Hot Water Heater Upgrade	0.0	0	468
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	**DESCRIPTION**	**ANNUAL UTILITY REDUCTION**		
		ELECTRIC DEMAND (KW)	**ELECTRIC CONSUMPTION (KWH)**	**NATURAL GAS (THERMS)**
REM #1	146.88 kW PV System	146.9	169,727	0

Table 3
ECM Emissions Summary

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	GREENHOUSE GAS EMISSIONS REDUCTION		
		CO_2 EMISSIONS (LBS)	NO_X EMISSIONS (LBS)	SO_2 EMISSIONS (LBS)
ECM #1	Lighting Upgrade - General	68,623	126	293
ECM #2	Lighting Upgrade - Exterior	34,371	63	147
ECM #3	Lighting Controls Upgrade	10,342	19	44
ECM #4	Domestic Hot Water Heater Upgrade	5,476	4	0

Notes: A. Emissions Reduction based on NJCEP published factors for electric & gas.

Table 4
Facility Project Summary

FACILITY PROJECT SUMMARY TABLE					
ENERGY CONSERVATION MEASURES	**ANNUAL ENERGY SAVINGS ($)**	**PROJECT COST ($)**	**SMART START INCENTIVES**	**CUSTOMER COST**	**SIMPLE PAYBACK**
Lighting Upgrade - General	$5,102	$60,500	$440	$60,060	11.8
Lighting Upgrade - Exterior	$2,555	$8,110	$1,600	$6,510	2.5
Lighting Controls Upgrade	$769	$10,300	$870	$9,430	12.3
Domestic Hot Water Heater Upgrade	$402	$19,641	$300	$19,341	48.1
Total Project	**$8,828**	**$98,551**	**$3,210**	**$95,341**	**10.8**

Note the measure totals in this table do not take into account interactive effects of measures; see Method of Analysis Section III in Executive Report for further explanation.

This project does not qualify for additional incentives through the Pay for Performance Program; please see the Installation Funding Options section for additional program options.

ECM #1: Lighting Upgrade – General

Description:

The majority of the interior lighting throughout the Frank J. Smith School is provided with fluorescent fixtures with older generation, 32W T8 lamps and electronic ballasts, indoor metal halide fixtures and incandescent fixtures. These can be retrofitted to LED style lamps.

This ECM includes retrofitting the interior lighting with new LED type lamps and fixtures. It is recommended the District consult with a professional engineer prior to retrofitting fixtures to ensure code required minimum light levels will be met.

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.

LIGHTING UPGRADE SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Demand Savings (kW)	16.5
Electric Usage Savings (kWh)	45,147
Electric Cost Savings ($)	$5,102

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$60,500
NJ Smart Start Equipment Incentive ($):	$440
Net Installation Cost ($):	$60,060
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$5,102
Total Yearly Savings ($/Yr):	$5,102
Estimated ECM Lifetime (Yr):	15
Simple Payback	11.8
Simple Lifetime ROI	27.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$76,530
Internal Rate of Return (IRR)	3%
Net Present Value (NPV)	$847.34

ECM #2: Lighting Upgrade – Exterior Lighting

Description:

The exterior lighting at the Frank J. Smith School is currently lit by metal halide and quartz fixtures. The exterior would be better served with more efficient LED lighting system. Concord Engineering recommends upgrading the lighting to an energy-efficient LED lighting system that includes LED lamps and fixtures for the existing exterior lighting.

This ECM would replace the existing exterior lamps and fixtures with equivalent LED lamps and fixtures.

Energy Savings Calculations:

A detailed Investment Grade Lighting Audit can be found in **Investment Grade Lighting Audit Appendix** that outlines the proposed retrofits, costs, savings, and payback periods.

LIGHTING UPGRADE SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Demand Savings (kW)	5.3
Electric Usage Savings (kWh)	22,612
Electric Cost Savings ($)	$2,555

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$8,110
NJ Smart Start Equipment Incentive ($):	$1,600
Net Installation Cost ($):	$6,510
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,555
Total Yearly Savings ($/Yr):	$2,555
Estimated ECM Lifetime (Yr):	15
Simple Payback	2.5
Simple Lifetime ROI	488.7%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$38,325
Internal Rate of Return (IRR)	39%
Net Present Value (NPV)	$23,991.42

ECM #3: Lighting Controls Upgrade – Occupancy Sensors

Description:

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

Lighting controls come in many forms. Sometimes an additional switch is adequate to provide reduced lighting levels when full light output is not needed. Occupancy sensors detect motion and will switch the lights on when the room is occupied. Occupancy sensors can either be mounted in place of a current wall switch, or on the ceiling to cover large areas.

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

- Occupancy Sensors for Lighting Control 20% - 28% energy savings.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 20% of the total light energy controlled by occupancy sensors.

This ECM includes installation of ceiling or switch mount sensors for mostly classrooms, restrooms, and offices. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent. The **Investment Grade Lighting Audit Appendix** of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by the applicable percent savings for each area that includes lighting controls.

Energy Savings Calculations:

$$\text{Energy Savings} = \left(\%\ \text{Savings} \times \text{Controlled Light Energy}\ \left(\text{kWh/Yr}\right)\right)$$

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

LIGHTING CONTROLS SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Demand Savings (kW)	0.0
Electric Usage Savings (kWh)	6,804
Electric Cost Savings ($)	$769

Rebates and Incentives:

From the **NJ Smart Start® Program Incentives Appendix**, the installation of a lighting control device warrants the following incentive:

Smart Start Incentive
$= (\#\ \text{Wall mount sensors} \times \$20\ \text{per sensor})$
$+ (\#\ \text{Ceiling mount sensors} \times \$35\ \text{per sensor})$

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$10,300
NJ Smart Start Equipment Incentive ($):	$870
Net Installation Cost ($):	$9,430
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$769
Total Yearly Savings ($/Yr):	$769
Estimated ECM Lifetime (Yr):	15
Simple Payback	12.3
Simple Lifetime ROI	22.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$11,535
Internal Rate of Return (IRR)	3%
Net Present Value (NPV)	($249.73)

ECM #4: High-Efficiency Gas-Fired Domestic Hot Water Heater

Description:

Domestic hot water for the entire facility is provided by a single Rheem-Ruud Model G91-200, 91-gallon, gas-fired hot water heater rated at 200 MBH. This unit has a rated thermal efficiency of only 80% and a recovery of 182 gallons per hour at a temperature rise of 120°F.

This ECM will replace the existing gas-fired, domestic water heater with a Bradford White model EF-100T-150E with a 98% thermal efficiency. The new unit is rated at 150 MBH, has a 100-gallon storage tank, and a recovery of 180 gallons per hour at a temperature rise of 120°F.

Energy Savings Calculations:

Energy Density for an Educational building = 5.2 kBtu / SF / year

$$DHW\ \ Heat\ Usage = Energy\ Density\left(\frac{kBtu\ yr}{SF}\right) \times Building\ Square\ Footage\ \ (SF)$$

$$DHW\ Total\ Usage = \frac{Dom\ HW\ \ Heat\ Cons.(Btu)}{Heating\ \ Eff.(\%) \times Fuel\ \ Heat\ Value\left(\frac{BTU}{Fuel\ Unit}\right)}$$

$$Energy\ Cost = Heating\ \ Fuel\ Usage(Fuel\ Units) \times Ave\ \ Fuel\ \ Cost\left(\frac{\$}{Fuel\ Unit}\right)$$

DOM. HOT WATER HEATER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Hot Water Heater	High Efficiency Heater	
Building Type	Education		
Building Square-foot	39,197	39,197	
Domestic Water Usage, kBtu	203,824.40	203,824.40	
DHW Heating Fuel Type	Gas	Gas	
Heating Efficiency	80%	98%	18%
Total Usage (kBTU)	254,781	207,984	46,796
Nat Gas Cost ($/Therm)	$ 0.86	$ 0.86	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	2,548	2,080	468
Energy Cost ($)	$2,191	$1,789	$402
COMMENTS:	Savings are based on Energy Information Administration Commercial Building Energy Consumption Survey 2003 Information		

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$19,641
NJ Smart Start Equipment Incentive ($):	$300
Net Installation Cost ($):	$19,341
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$402
Total Yearly Savings ($/Yr):	$402
Estimated ECM Lifetime (Yr):	12
Simple Payback	48.1
Simple Lifetime ROI	-75.1%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$4,824
Internal Rate of Return (IRR)	-17%
Net Present Value (NPV)	($15,339.15)

REM #1: 146.88 kW Solar System

Description:

The East Hanover Frank J. Smith School has available roof space that could accommodate solar arrays. Based on the available area a 146.88 kilowatt solar array could be installed. The array will produce approximately 169,727 kilowatt-hours annually that will reduce the overall electric usage of the facility by 57.03%. The owner should consult a structural engineer prior to installing any solar array to insure the roof can accommodate the additional weight.

Energy Savings Calculations:

See **Renewable / Distributed Energy Measures Calculations Appendix** for detailed financial summary and proposed solar layout areas. Financial results in table below are based on 100% financing of the system over a fifteen year period.

Energy Savings Summary:

REM #1 - ENERGY SAVINGS SUMMARY	
System Size (KW_{DC}):	146.88
Electric Generation (KWH/Yr):	169,727
Installation Cost ($):	$644,777
SREC Revenue ($/Yr):	$32,432
Energy Savings ($/Yr):	$19,179
Total Yearly Savings ($/Yr):	$51,611
ECM Analysis Period (Yr):	15
Simple Payback (Yrs):	12.5
Analysis Period Electric Savings ($):	$356,711
Analysis Period SREC Revenue ($):	$469,820
Net Present Value (NPV)	($119,305.27)

V. ADDITIONAL RECOMMENDATIONS

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

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

B. Maintain all weather stripping on windows and doors.

C. Clean all light fixtures to maximize light output.

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

E. Turn off computers when not in use. Ensure computers are not running in screen saver mode.

F. Replace any old CRT Monitors with LED/LCD Type Monitors, which can draw as much as a quarter the power of an equivalent CRT monitor.

G. Ensure outside air dampers are functioning properly and only open during occupied mode.

APPENDIX A

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

East Hanover Township School District - Frank J. Smith 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	Lighting Upgrade - General	$31,155	$29,345	$440	$60,060	$5,102	$0	$5,102	15	$76,530	$0	27.4%	11.8	3.19%	$847.34
ECM #2	Lighting Upgrade - Exterior	$5,080	$3,030	$1,600	$6,510	$2,555	$0	$2,555	15	$38,325	$0	488.7%	2.5	38.97%	$23,991.42
ECM #3	Lighting Controls Upgrade	$2,150	$8,150	$870	$9,430	$769	$0	$769	15	$11,535	$0	22.3%	12.3	2.63%	($249.73)
ECM #4	Domestic Hot Water Heater Upgrade	$12,016	$7,625	$300	$19,341	$402	$0	$402	12	$4,824	$0	-75.1%	48.1	-16.79%	($15,339.15)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	146.88 kW PV System	$644,777	$0	$0	$644,777	$19,179	$32,432	$51,611	15	$774,165	$486,480	20.1%	12.5	2.38%	($28,648.23)

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* .

APPENDIX B

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 from July 1, 2013 to June 30, 2014:

Electric Chillers

Water-Cooled Chillers	$16 - $170 per ton
Air-Cooled Chillers	$8 - $52 per ton

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Cooling

Gas Absorption Chillers	$185 - $450 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 - $92 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
A/C Economizing Controls	≤ 5 tons $85/unit; >5 tons $170/unit

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Heating

Gas Fired Boilers < 300 MBH	$2.00 per MBH, but not less than $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	$400 per unit, AFUE ≥ 95%
Boiler Economizing Controls	$1,200 - $2,700
Low Intensity Infrared Heating	$300 - $500 per unit

Ground Source Heat Pumps

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

Energy Efficiency must comply with ASHRAE 90.1-2007

Variable Frequency Drives

Variable Air Volume	$65 - $155 per hp
Chilled-Water Pumps ≥ 20 hp	$60 per VFD rated hp
Rotary Screw Air Compressors ≥ 25 hp	$5,250 to $12,500 per drive
Cooling Towers ≥ 10 hp	$60 per VFD rated hp
Boiler Fans ≥ 5 HP	$65 to $155 per hp
Boiler Feed Water Pumps ≥ 5 HP	$60 to $155 per hp
Commercial Kitchen Hood up to 50 HP	Retrofit $55 – $300 per hp New Hood $55 - $250 per hp

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons, 0.67 energy factor or better	$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

Prescriptive Lighting

T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	$10 per fixture
For retrofit of T-8 fixtures by permanent de-lamping & new reflectors (Electronic ballast replacement required)	$15 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $200 per fixture
Metal Halide w/Pulse Start Including Parking Lot (For fixtures ≥ 150w)	$25 per fixture
HID ≥ 100w Replace with new induction fixture. (must be 30% less watts/fixture than HID system)	$70 per fixture
HID ≥ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	$50 per fixture

Prescriptive Lighting - LED

LED Display Case Lighting	$30 per display case
LED Shelf-Mtd. Display & Task Lights	$15 per linear foot
LED Portable Desk Lamp	$20 per fixture
LED Wall-wash Lights	$30 per fixture
LED Recessed Down Lights	$35 per fixture
LED Outdoor Pole/Arm-Mounted Area and Roadway Luminaries	$175 per fixture
LED Outdoor Pole/Arm-Mounted Decorative Luminaries	$175 per fixture
LED Outdoor Wall-Mounted Area Luminaries	$100 per fixture
LED Parking Garage Luminaries	$100 per fixture
LED Track or Mono-Point Directional Lighting Fixtures	$50 per fixture
LED High-Bay and Low-Bay Fixtures for Commercial & Industrial Bldgs.	$150 per fixture
LED High-Bay-Aisle Lighting	$150 per fixture
LED Stairwell and Passageway Luminaires	$40 per fixture
LED Bollard Fixtures	$50 per fixture
Luminaires for Ambient Lighting of Interior Commercial Spaces (1x4, 2x2, 2x4)	$50 per fixture
LED Fuel Pump Canopy	$100 per fixture
LED Screw-based & Pin-based (PAR, MR, BR, R) Standards (A-Style) and Decorative Lamps	$10 per lamp for R/PAR20,MR/PAR16,Globe,Candelabra or Misc $20 per lamp for R/BR/PAR 30, R/BR/PAR 38-40, A-Lamp
LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	$30 per 4 foot $42 per 5 foot $65 per 6 foot
LED Retrofit Kits	To be evaluated through the customer measure path

Lighting Controls – Occupancy Sensors

Wall Mounted (Existing Facilities Only)	$20 per control
Remote Mounted (Existing Facilities Only)	$35 per control
Daylight Dimming Controls	$45 per fixture controlled
Occupancy Based hi-low Dimming Control	$35 per fixture controlled
Occupancy Sensor Remote Mounted	$35 per control

Refrigeration Doors/Covers

Energy-Efficient Doors/Covers for Installation on Open Refrigerated Cases	$100 per door
Aluminum Night Curtains for Installation on Open Refrigerated Cases	$3.50 per linear foot

Refrigeration Controls

Door Heater Controls	$50 per control
Electric Defrost Controls	$50 per control
Evaporator Fan Controls	$75 per control
Novelty Cooler Shutoff	$50 per control

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2007 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 an IRR of at least 10%.

APPENDIX C

ENERGY STAR® Statement of Energy Performance

98

ENERGY STAR® Score[1]

Frank J. Smith School

Primary Property Function: K-12 School
Gross Floor Area (ft²): 39,197
Built: 1962

For Year Ending: December 31, 2012
Date Generated: April 16, 2014

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
Frank J. Smith School 27 Green Drive East Hanover, New Jersey 07936	East Hanover Township School District 20 School Avenue East Hanover, NJ 07936 (____)____-_____	Deborah Muscara 20 School Avenue East Hanover, NJ 07936 973-887-2112 dmuscara@easthanoverschools.org

Property ID: 4037198

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
68.1 kBtu/ft²

Source EUI
76.2 kBtu/ft²

Annual Energy by Fuel	
Natural Gas (kBtu)	2,578,937 (97%)
Electric - Grid (kBtu)	89,162 (3%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	145.4
National Median Source EUI (kBtu/ft²)	162.8
% Diff from National Median Source EUI	-53%
Annual Emissions	
Greenhouse Gas Emissions (MtCO2e/year)	148

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: _____Date: _____

Licensed Professional

Michael Fischette
520 South Burnt Mill Road
Voorhees, NJ 0843
856-427-0200
mfischette@concord-engineering.com

Professional Engineer Stamp
(if applicable)

APPENDIX D

MAJOR EQUIPMENT LIST

Concord Engineering Group

Frank J. Smith School

Split System Units

Tag	CU-1	CU-2	CU-3
Unit Type	Ductless Split	Ductless Split	Ductless Split
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served			
Manufacturer	Sanyo	Fujitsu	Fujitsu
Model #	C1872	AOU30CLX1	AOU30CLX1
Serial #	00788 93	GEN 000376	GEN 000411
Cooling Type	DX Coil	DX Coil	DX Coil
Cooling Capacity (Tons)	1.5 Tons	2.5 Tons	2.5 Tons
Cooling Efficiency (SEER/EER)	SEER=20	SEER=16.5	SEER=16.5
Heating Type	N/A	N/A	N/A
Heating Input (MBH)	N/A	N/A	N/A
Efficiency	N/A	N/A	N/A
Fuel	Electric	Electric	Electric
Approx Age	4	10	13
ASHRAE Service Life	15	15	15
Remaining Life	11	5	2
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

Split System Units

Tag	CU-4	CU-5	
Unit Type	Ductless Split	Ductless Split	
Qty	1	1	
Location	Roof	Roof	
Area Served			
Manufacturer	Fujitsu	Fujitsu	
Model #	AOU12RLS	AOU30CLX1	
Serial #	HSN 020553	GEN 000410	
Cooling Type	DX Coil	DX Coil	
Cooling Capacity (Tons)	1.0 Ton	2.5 Tons	
Cooling Efficiency (SEER/EER)	SEER=20	SEER=16.5	
Heating Type	N/A	N/A	
Heating Input (MBH)	N/A	N/A	
Efficiency	N/A	N/A	
Fuel	Electric	Electric	
Approx Age	11	11	
ASHRAE Service Life	15	15	
Remaining Life	4	4	
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Frank J. Smith School

Domestic Water Heaters

Tag	DHW-1	
Unit Type	Commercial Gas Water Heater	
Qty	1	
Location	Boiler Room	
Area Served	Entire Facility	
Manufacturer	RHEEM-RUUD	
Model #	G91-200	
Serial #	URNG 0801G01830	
Size (Gallons)	91	
Input Capacity (MBH/KW)	199,900 BTUH	
Recovery (Gal/Hr)	181.8 GPH	
Efficiency %	80%	
Fuel	Natural Gas	
Approx Age	6	
ASHRAE Service Life	15	
Remaining Life	9	
Comments	Two (2) Bell & Gossett Circulation Pumps	

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Frank J. Smith School

Boilers

Tag	B-1	B-2
Unit Type	Cast Iron Sectional	Cast Iron Sectional
Qty	1	1
Location	Boiler Room	Boiler Room
Area Served	Entire Facility	Entire Facility
Manufacturer	H. B. Smith	H. B. Smith
Model #	28A-S/W-9	28A-S/W-09
Serial #	"-"	"-"
Rated Input Capacity (Btu/Hr)	2,836 MBH	2,836 MBH
Rated Output Capacity (Btu/Hr)	2,246 MBH	2,246 MBH
Approx. Efficiency %	79.2%	79.2%
Fuel	Natural Gas	Natural Gas
Approx Age	7	7
ASHRAE Service Life	35	35
Remaining Life	28	28
Comments	Power Flame Burner Model No. LNIC3-G-25 1.5 HP Blower Motor	Power Flame Burner Model No. LNIC3-G-25 1.5 HP Blower Motor

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Frank J. Smith School

Pumps

Tag	P-1 & P-2	P-3 & P-4	P-5 & P-6
Unit Type	Base Mounted End Suction Pump	Base Mounted End Suction Pump	In-Line Centrifugal
Qty	2	2	2
Location	Boiler Room	Boiler Room	Boiler Room
Area Served	Entire Facility	Entire Facility	Entire Facility
Manufacturer	Armstrong	Armstrong	Bell & Gossett
Model #	3x2x8 4030	Series 1510	Series PR-HD-3
Serial #	C573751 & 752	"-"	"-"
Horse Power	5.0	3.0	1/4
Flow	100 GPM @ 65' TDH	"-"	"-"
Motor Info	Baldor	Dayton	B & G
Electrical Power	230/460 V	208-230/460 V	115 V - Single Phase
RPM	1750	1175	1725
Motor Efficiency %	90.2%	87.5%	"-"
Approx Age	7	7	7
ASHRAE Service Life	20	20	20
Remaining Life	13	13	13
Comments		Premium Efficient Inverter Rated Motors	

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Frank J. Smith School

Rooftop Units

Tag	**CU-1**		
Unit Type	Packaged Rooftop		
Qty	1		
Location	Roof		
Area Served	New C-Wing		
Manufacturer	McQuay		
Model #	RFS045CSY		
Serial #	FBOU070601065 02		
Cooling Type	DX Coil		
Cooling (MBH)	45 Tons		
Heating Type	N/A		
Heating (MBH)	N/A		
Evaporator Fan (HP)	7.5 HP		
Return/Exhaust Fan (HP)	3.0 HP		
Approx Age	4		
ASHRAE Service Life	15		
Remaining Life	11		
Comments	With Condenser Model RCS045CYY	ABB VFD on Fan	

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

APPENDIX E

CEG Project #: 1C13496
Facility Name: Frank J Smith ES
Address: 27 Green Drive
City, State, Zip East Hanover, NJ

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS					
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $
242.21	Faculty Room 22	2600	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	4	114	4	0.46	1,186	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 52L 51W840 2 0-10 5 G2	1	51	4	0.20	530	0.25	655	$74	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	106	$12
211.11	Nurse	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	4	0.14	354	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	4	0.07	187	0.06	166	$19	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	37	$4
227.21	Nurse	2600	2x2, 2 Lamp, 32w U T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	2	62	1	0.06	161	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x2 P 32L 31W840 2 0-10 7 G2	1	31	1	0.03	81	0.03	81	$9	0	No New Controls	0	0.0%	0	$0
211.14	Boiler Room	3000	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	1	34	6	0.20	612	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	6	0.11	324	0.10	288	$33	0	No New Controls	0	0.0%	0	$0
242.21	Cafeteria	3000	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	4	114	12	1.37	4,104	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 52L 51W840 2 0-10 5 G2	1	51	12	0.61	1,836	0.76	2,268	$256	5	Dual Technology Occupancy Sensor - Remote Mnt.	2	20.0%	367	$41
601	Cafeteria	8760	(2) 7w CFL Exit Sign	2	16	2	0.03	280	Replace Fixture	LED Exit Sign	1	2	2	0.00	35	0.03	245	$28	0	No New Controls	0	0.0%	0	$0
211.11	Kitchen	3000	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	8	0.27	816	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	8	0.14	432	0.13	384	$43	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	86	$10
211.11	Kitchen Storage	3000	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	2	0.07	204	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	2	0.04	108	0.03	96	$11	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	22	$2
211.11	Kitchen Storage	3000	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	4	0.14	408	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	4	0.07	216	0.06	192	$22	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	43	$5
222.21	Room 16	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	2	0.12	322	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 42L 39W 840 2 0-10 7 G2	1	39	2	0.08	203	0.05	120	$14	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	41	$5
211.11	Library	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	27	0.92	2,387	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	27	0.49	1,264	0.43	1,123	$127	5	Dual Technology Occupancy Sensor - Remote Mnt.	2	20.0%	253	$29
601	Library	8760	(2) 7w CFL Exit Sign	2	16	1	0.02	140	Replace Fixture	LED Exit Sign	1	2	1	0.00	18	0.01	123	$14	0	No New Controls	0	0.0%	0	$0
211.11	Classroom 15	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	15	0.51	1,326	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	15	0.27	702	0.24	624	$71	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	140	$16
221.11	Classroom 14	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	4	0.25	645	Bypass Ballast, Relamp	4' 18w LED Tube	2	36	4	0.14	374	0.10	270	$31	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	75	$8
211.11	Boy's Restroom	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	3	0.10	265	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	3	0.05	140	0.05	125	$14	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	28	$3
55	Boy's Restroom	2600	65w R30 Lamp	1	65	1	0.07	169	Relamp	PHILIPS 120V 11w LED R30	1	11	1	0.01	29	0.05	140	$16	0	No New Controls	0	0.0%	0	$0
222.21	Classroom 13	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	2	0.12	322	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 42L 39W 840 2 0-10 7 G2	1	39	2	0.08	203	0.05	120	$14	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	41	$5
211.11	Classroom 12	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	15	0.51	1,326	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	15	0.27	702	0.24	624	$71	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	140	$16
211.11	Classroom 10	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	18	0.61	1,591	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	18	0.32	842	0.29	749	$85	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	168	$19
211.11	Classroom 8	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	18	0.61	1,591	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	18	0.32	842	0.29	749	$85	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	168	$19

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS					
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $
211.11	Classroom 6	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	18	0.61	1,591	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	18	0.32	842	0.29	749	$85	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	168	$19
211.11	Classroom 4	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	18	0.61	1,591	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	18	0.32	842	0.29	749	$85	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	168	$19
211.11	Classroom 2	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	18	0.61	1,591	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	18	0.32	842	0.29	749	$85	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	168	$19
211.11	Classroom 1	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	17	0.58	1,503	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	17	0.31	796	0.27	707	$80	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	159	$18
227.21	Classroom 1	2600	2x2, 2 Lamp, 32w U T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	2	62	3	0.19	484	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x2 P 32L 31W840 2 0-10 7 G2	1	31	3	0.09	242	0.09	242	$27	0	No New Controls	0	0.0%	0	$0
222.21	Classroom 1	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	1	0.06	161	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 42L 39W 840 2 0-10 7 G2	1	39	1	0.04	101	0.02	60	$7	0	No New Controls	0	0.0%	0	$0
222.21	Corridor - Classrm 1-13	3000	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	14	0.87	2,604	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 42L 39W 840 2 0-10 7 G2	1	39	14	0.55	1,638	0.32	966	$109	0	No New Controls	0	0.0%	0	$0
601	Corridor - Classrm 1-14	8760	(2) 7w CFL Exit Sign	2	16	1	0.02	140	Replace Fixture	LED Exit Sign	1	2	1	0.00	18	0.01	123	$14	0	No New Controls	0	0.0%	0	$0
211.11	Classroom 3	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	12	0.41	1,061	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	12	0.22	562	0.19	499	$56	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	112	$13
211.11	Classroom 5	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	18	0.61	1,591	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	18	0.32	842	0.29	749	$85	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	168	$19
211.11	Classroom 7	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	18	0.61	1,591	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	18	0.32	842	0.29	749	$85	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	168	$19
211.11	Classroom 9	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	18	0.61	1,591	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	18	0.32	842	0.29	749	$85	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	168	$19
211.11	Classroom 11	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	18	0.61	1,591	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	18	0.32	842	0.29	749	$85	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	168	$19
211.11	Girl's Restroom	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	3	0.10	265	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	3	0.05	140	0.05	125	$14	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	28	$3
55	Girl's Restroom	2600	65w R30 Lamp	1	65	1	0.07	169	Relamp	PHILIPS 120V 11w LED R30	1	11	1	0.01	29	0.05	140	$16	0	No New Controls	0	0.0%	0	$0
211.14	Electrical Room	1200	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	1	34	2	0.07	82	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	2	0.04	43	0.03	38	$4	0	No New Controls	0	0.0%	0	$0
200	Faculty Restroom	2600	1x2, 2 Lamp, 17w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	2	34	1	0.03	88	Bypass Ballast, Relamp	2' LED 11w; Retrofit	2	22	1	0.02	57	0.01	31	$4	0	No New Controls	0	0.0%	0	$0
227.21	Corridor by E6 & E7	3000	2x2, 2 Lamp, 32w U T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	2	62	4	0.25	744	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x2 P 32L 31W840 2 0-10 7 G2	1	31	4	0.12	372	0.12	372	$42	0	No New Controls	0	0.0%	0	$0
211.11	Boy's Restroom	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	2	0.07	177	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	2	0.04	94	0.03	83	$9	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	19	$2
221.11	Girl's Restroom	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	2	0.12	322	Bypass Ballast, Relamp	4' 18w LED Tube	2	36	2	0.07	187	0.05	135	$15	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	37	$4
242.21	Corridor by Café	3000	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	4	114	6	0.68	2,052	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 52L 51W840 2 0-10 5 G2	1	51	6	0.31	918	0.38	1,134	$128	0	No New Controls	0	0.0%	0	$0
222.21	Corridor - Classrm 18-25	3000	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	10	0.62	1,860	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 42L 39W 840 2 0-10 7 G2	1	39	10	0.39	1,170	0.23	690	$78	0	No New Controls	0	0.0%	0	$0

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS					
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $
222.21	Copy Room	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	1	0.06	161	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 42L 39W 840 2 0-10 7 G2	1	39	1	0.04	101	0.02	60	$7	0	No New Controls	0	0.0%	0	$0
211.11	Classroom 19	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	18	0.61	1,591	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	18	0.32	842	0.29	749	$85	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	168	$19
211.11	Classroom 21	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	18	0.61	1,591	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	18	0.32	842	0.29	749	$85	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	168	$19
211.11	Classroom 23	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	18	0.61	1,591	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	18	0.32	842	0.29	749	$85	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	168	$19
211.11	Classroom 25	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	18	0.61	1,591	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	18	0.32	842	0.29	749	$85	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	168	$19
211.11	Classroom 28	2600	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	34	24	0.82	2,122	Bypass Ballast, Relamp	4' 18w LED Tube	1	18	24	0.43	1,123	0.38	998	$113	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	225	$25
222.21	Main Office	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	3	0.19	484	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 42L 39W 840 2 0-10 7 G2	1	39	3	0.12	304	0.07	179	$20	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	61	$7
222.21	Main Office Copy Room	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	1	0.06	161	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 42L 39W 840 2 0-10 7 G2	1	39	1	0.04	101	0.02	60	$7	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	20	$2
222.21	Main Office Hall	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	1	0.06	161	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 42L 39W 840 2 0-10 7 G2	1	39	1	0.04	101	0.02	60	$7	0	No New Controls	0	0.0%	0	$0
222.21	Principal's Office	2600	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	4	0.25	645	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 42L 39W 840 2 0-10 7 G2	1	39	4	0.16	406	0.09	239	$27	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	81	$9
232.21	Corridor - C Wing	3000	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	94	16	1.50	4,512	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 52L 51W840 2 0-10 5 G2	1	51	16	0.82	2,448	0.69	2,064	$233	0	No New Controls	0	0.0%	0	$0
242.21	Classroom 29	2600	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	4	114	6	0.68	1,778	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 52L 51W840 2 0-10 5 G2	1	51	6	0.31	796	0.38	983	$111	1	Existing Occupancy Controls	0	20.0%	159	$18
242.21	Classroom 30	2600	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	4	114	6	0.68	1,778	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 52L 51W840 2 0-10 5 G2	1	51	6	0.31	796	0.38	983	$111	1	Existing Occupancy Controls	0	20.0%	159	$18
720	Classroom 31	2600	Recessed Down Light, 175w MH	1	205	7	1.44	3,731	Bypass Ballast, Relamp	45w LED	1	45	7	0.32	819	1.12	2,912	$329	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	164	$19
721	Classroom 32	2600	175w MH Wallpack Uplight, White	1	205	4	0.82	2,132	Replace Fixture	RAB 26w LED Wall Pack	1	26	4	0.10	270	0.72	1,862	$210	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	54	$6
242.21	Café 32	3000	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	4	114	32	3.65	10,944	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 52L 51W840 2 0-10 5 G2	1	51	32	1.63	4,896	2.02	6,048	$683	1	Existing Occupancy Controls	0	20.0%	979	$111
227.21	Boy's Restroom	2600	2x2, 2 Lamp, 32w U T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	2	62	1	0.06	161	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x2 P 32L 31W840 2 0-10 7 G2	1	31	1	0.03	81	0.03	81	$9	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	16	$2
227.21	Women's Restroom	2600	2x2, 2 Lamp, 32w U T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	2	62	1	0.06	161	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x2 P 32L 31W840 2 0-10 7 G2	1	31	1	0.03	81	0.03	81	$9	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	16	$2
242.21	Classroom 33	2600	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	4	114	12	1.37	3,557	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 52L 51W840 2 0-10 5 G2	1	51	12	0.61	1,591	0.76	1,966	$222	1	Existing Occupancy Controls	0	20.0%	318	$36
242.21	Classroom 34	2600	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	4	114	11	1.25	3,260	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 52L 51W840 2 0-10 5 G2	1	51	11	0.56	1,459	0.69	1,802	$204	1	Existing Occupancy Controls	0	20.0%	292	$33
227.21	Classroom 34 Restroom	2600	2x2, 2 Lamp, 32w U T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	2	62	1	0.06	161	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x2 P 32L 31W840 2 0-10 7 G2	1	31	1	0.03	81	0.03	81	$9	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	16	$2
242.21	Classroom 35	2600	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	4	114	12	1.37	3,557	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x4 P 52L 51W840 2 0-10 5 G2	1	51	12	0.61	1,591	0.76	1,966	$222	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	318	$36

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS					
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $
721	Entrance Lobby by E11 C Wing	3000	175w MH Wallpack Uplight, White	1	205	3	0.62	1,845	Replace Fixture	RAB 26w LED Wall Pack	1	26	3	0.08	234	0.54	1,611	$182	0	No New Controls	0	0.0%	0	$0
722	Exterior	4400	Round Surface Mount, 2 Lamp 18w PL, White Polycarb Lens, Batt. Backup	2	36	2	0.07	317	existing to remain	no change	2	36	0	0.07	317	0.00	0	$0	0	No New Controls	0	0.0%	0	$0
723	Exterior	4400	Wall Mount, 2 Lamp 13w PL	2	26	1	0.03	114	existing to remain	no change	2	26	0	0.03	114	0.00	0	$0	0	No New Controls	0	0.0%	0	$0
724	Exterior	4400	(2) 90w PAR38 Incand Flood	2	180	6	1.08	4,752	Replace Fixture	RAB 26w LED Wall Pack	1	26	6	0.16	686	0.92	4,066	$459	0	No New Controls	0	0.0%	0	$0
725	Exterior	4400	1x1 Sq. Recessed, 26w CFL, Dropped Opal Lens	1	26	14	0.36	1,602	Relamp	PHILIPS 120V EnduraLED 12.5W A19 2700K	1	12.5	14	0.18	770	0.19	832	$94	0	No New Controls	0	0.0%	0	$0
719	Exterior	4400	175w MH Area Light	1	205	6	1.23	5,412	Replace Fixture	RAB 26w LED Area Light	1	26	6	0.16	686	1.07	4,726	$534	0	No New Controls	0	0.0%	0	$0
705	Exterior	4400	250w MH Area Light	1	295	7	2.07	9,086	Replace Fixture	RAB 52W LED Area Light	1	61	7	0.43	1,879	1.64	7,207	$814	0	No New Controls	0	0.0%	0	$0
715	Exterior	4400	500w Quartz Flood	1	500	2	1.00	4,400	Replace Fixture	RAB 26w LED Flood	1	26	2	0.05	229	0.95	4,171	$471	0	No New Controls	0	0.0%	0	$0
	TOTAL					**610**	**38**	**114,420**					**607**	**16**	**46,661**	**22**	**67,759**	**$7,657**			**43**		**6,804**	**$769**

APPENDIX F

Location Description	Area (Sq FT)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW_{DC}	Total Annual kWh	Total KW_{AC}	Panel Weight (41.9 lbs)	W/SQFT
Frank J. Smith School	15000	SHARP ND-240QCJ	612	17.5	10,735	146.88	169,727	119.0	25,643	13.68

= Proposed PV Roof Layout

Notes:

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

Project Name: LGEA Solar PV Project - Frank J. Smith School
Location:
Description: Photovoltaic System 100% Financing - 15 year

Simple Payback Analysis

	Photovoltaic System 100% Financing - 15 year
Total Construction Cost	$644,777
Annual kWh Production	169,727
Annual Energy Cost Reduction	$19,179
Average Annual SREC Revenue	$32,432

Simple Payback: **12.49** Years

Life Cycle Cost Analysis

Analysis Period (years):	15	Financing %:	100%
Discount Rate:	3%	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.113**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	6.00%	Average SREC Value ($/kWh)	$0.191

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$0	0	0	0	$0	0	0	0	0
1	$0	169,727	$19,179	$0	$42,432	$37,943	$27,349	($3,681)	($3,681)
2	$0	168,878	$19,755	$0	$42,220	$36,256	$29,036	($3,318)	($6,999)
3	$0	168,034	$20,347	$0	$42,008	$34,465	$30,827	($2,936)	($9,935)
4	$0	167,194	$20,958	$0	$41,798	$32,564	$32,728	($2,536)	($12,471)
5	$0	166,358	$21,586	$1,713	$41,589	$30,545	$34,747	($3,830)	($16,301)
6	$0	165,526	$22,234	$1,705	$33,105	$28,402	$36,890	($11,658)	($27,958)
7	$0	164,698	$22,901	$1,696	$32,940	$26,127	$39,165	($11,148)	($39,106)
8	$0	163,875	$23,588	$1,688	$32,775	$23,711	$41,581	($10,617)	($49,723)
9	$0	163,056	$24,296	$1,679	$32,611	$21,146	$44,146	($10,065)	($59,788)
10	$0	162,240	$25,024	$1,671	$24,336	$18,423	$46,868	($17,603)	($77,390)
11	$0	161,429	$25,775	$1,663	$24,214	$15,533	$49,759	($16,965)	($94,355)
12	$0	160,622	$26,548	$1,654	$24,093	$12,464	$52,828	($16,305)	($110,660)
13	$0	159,819	$27,345	$1,646	$23,973	$9,205	$56,087	($15,620)	($126,280)
14	$0	159,020	$28,165	$1,638	$15,902	$5,746	$59,546	($22,863)	($149,143)
15	$0	158,225	$29,010	$1,630	$15,822	$2,073	$63,219	($22,089)	($171,232)
	Totals:	2,458,700	$356,711	$18,384	$469,820	$334,602	$644,777	($171,232)	($955,024)

Net Present Value (NPV) **($119,305)**