BUTLER BOARD OF EDUCATION

RICHARD BUTLER SCHOOL

30 PEARL PLACE
BUTLER, NJ 07405

FACILITY ENERGY REPORT

TABLE OF CONTENTS

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:	Butler Municipal Power & Light (BMP&L)
Electric Utility Rate Structure:	Commercial Base Rate
Third Party Supplier:	N/A

Natural Gas Utility Provider:	PSE&G
Utility Rate Structure:	Large Volume Gas (LVG)
Third Party Supplier:	ACES (Direct Energy)

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: Butler Municipal Power & Light
Rate: Commercial Base Rate
Meter No:
Account No: #1912-0
Third Party Utility Provider: N/A
TPS Meter / Acct No:

MONTH OF USE	CONSUMPTION KWH	DEMAND KW	TOTAL BILL
Oct-14	29,760	0.0	$4,206
Nov-14	36,480	0.0	$5,143
Dec-14	32,000	0.0	$4,519
Jan-15	35,840	0.0	$4,881
Feb-15	35,520	0.0	$4,838
Mar-15	34,560	0.0	$4,709
Apr-15	30,880	0.0	$4,163
May-15	27,680	0.0	$3,738
Jun-15	25,600	0.0	$3,461
Jul-15	14,080	0.0	$1,908
Aug-15	14,720	0.0	$1,992
Sep-15	22,400	0.0	$3,001
Totals	**339,520**	**0.0 Max**	**$46,558**

AVERAGE DEMAND **0.0 KW average**
AVERAGE RATE **$0.137** **$/kWh**

Figure 1
Electricity Usage Profile

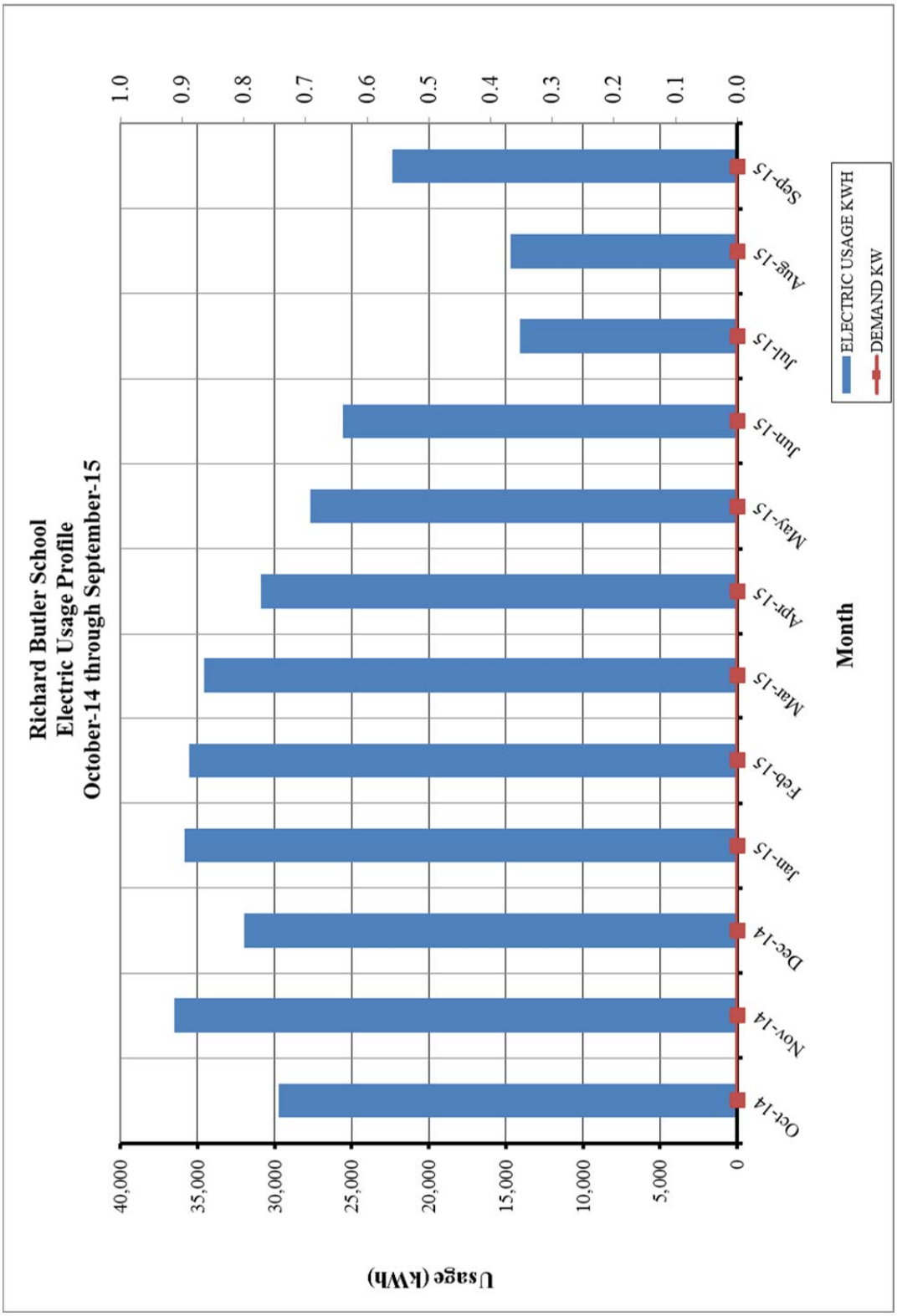
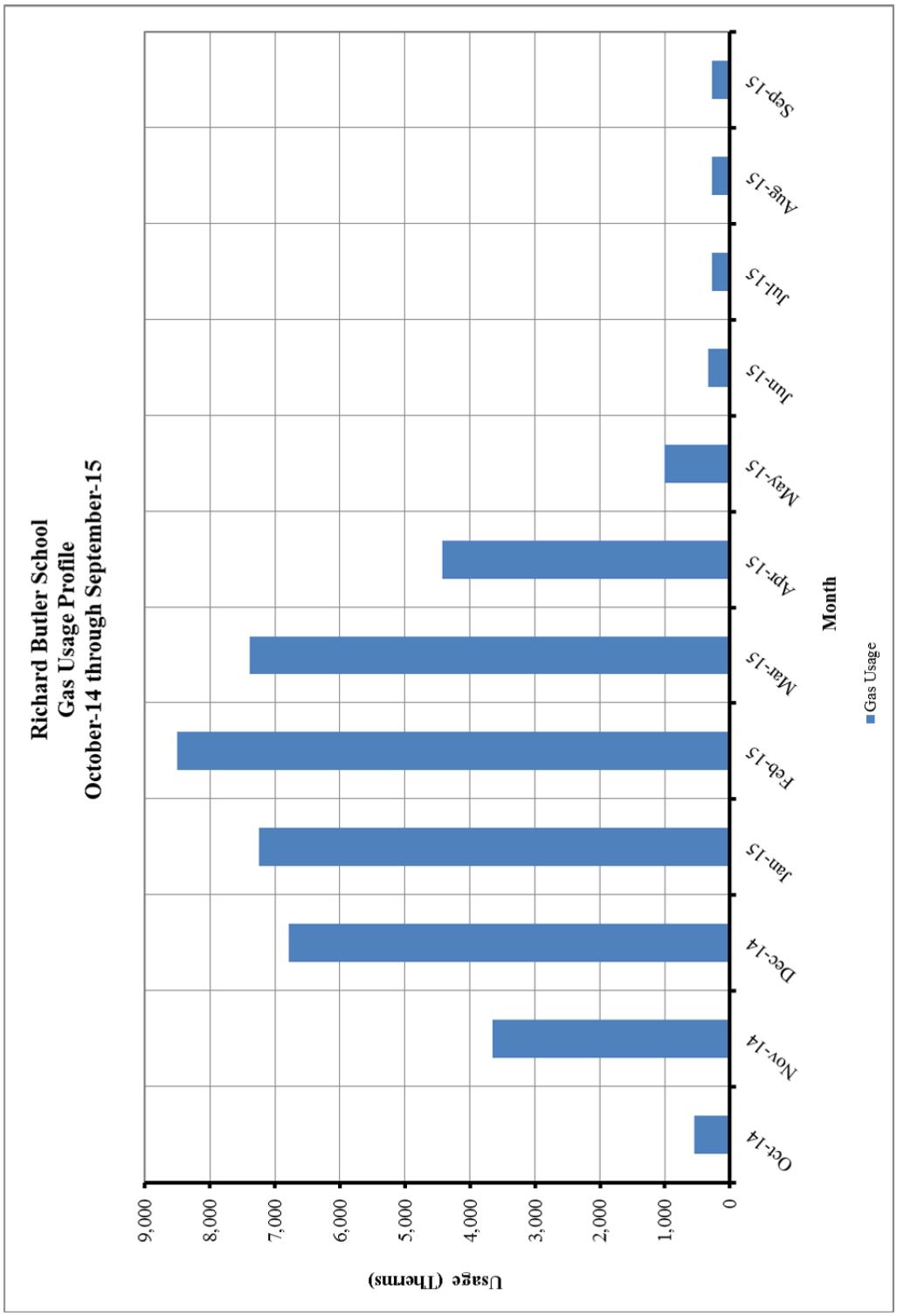


Table 2
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider: PSE&G		
Rate: LVG		
Meter No: 2540081		
Account No: 67 079 581 00		
Third Party Utility Provider: Direct Energy		
TPS Meter No: -		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Oct-14	550.97	$423.24
Nov-14	3,658.47	$3,240.98
Dec-14	6,779.84	$5,529.29
Jan-15	7,239.63	$6,421.98
Feb-15	8,505.97	$7,007.80
Mar-15	7,384.48	$6,021.74
Apr-15	4,425.77	$2,502.31
May-15	1,000.00	$699.18
Jun-15	328.04	$135.64
Jul-15	283.01	$131.20
Aug-15	278.00	$130.71
Sep-15	278.60	$132.61
TOTALS	**40,712.79**	**$32,376.68**
AVERAGE RATE:	**$0.80**	**$/THERM**

Figure 2
Natural Gas Usage Profile



II. FACILITY 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. Building Benchmarking data is collected and analyzed within the Commercial Building Energy Consumption Survey (CBECS), performed by the Energy and Information Administration (EIA). Building data is grouped by function types and tabulated, from which a median site and source energy intensity is determined. The national median or PEER Group Comparable in this instance is the middle value of the national population meaning half the buildings use more energy, and half use less. The PEER Group EUI allows us to compare the relative efficiency of the audited building to that of an average building with the same or similar primary function (i.e. group type).

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:

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

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

Table 3
Energy Use Index Summary

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	**BUILDING USE**			**SITE ENERGY**	**SITE-SOURCE RATIO**	**SOURCE ENERGY**
	kWh	**Therms**	**Gallons**	**kBtu**		**kBtu**
ELECTRIC	339,520.0			1,159,121	3.140	3,639,641
NATURAL GAS		40,712.8		4,071,279	1.050	4,274,843
TOTAL				5,230,400		7,914,484

*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document.

	AUDITED BUILDING		**PEER COMPARISON**	
BUILDING TYPE	Education		Education	
BUILDING AREA	48,102	SQUARE FEET		
BUILDING SITE EUI	*108.74*	kBtu/SF/YR	58.2	kBtu/SF/YR
BUILDING SOURCE EUI	*164.54*	kBtu/SF/YR	141.5	kBtu/SF/YR

16%	Less Efficient than PEER Comparison

III. FACILITY DESCRIPTION

The Richard Butler School is located at 30 Pearl Place in Butler, New Jersey. This 48,100 SF facility was originally built in 1954 with a wing addition in 1968. The building is a 1-story facility that is comprised of the principal's office, the main office, conference rooms, faculty room, MDF's, IDF's, small group study rooms, guidance offices, child study team offices, computer lab, teacher work room, all-purpose room/stage, cafeteria, gym/lockers, media center, nurse's office, art room, serving kitchen, boiler room, various storage/utility rooms, etc.

Occupancy Profile

The typical hours of operation for the school are Monday through Friday between 6:30 AM – 5:00 PM. The building is staffed until 11:30 PM but the occupancy shuts down at 5:00 PM except where an activity is scheduled. Those individual areas are programmed to run as needed while the rest of the facility would be on a night time setback schedule. Summer hours are from 7:00 AM – 4:30 PM. Approximate enrollment is 270 students with a staff of 47 people.

Building Envelope

Exterior walls for the building are masonry brick faced with a concrete block construction with structural steel framing. The windows throughout the original 1954 building were upgraded to double-pane 1/8 inch glazing with interior blinds and aluminum frames. Exterior doors in the 1954 building are double-pane with aluminum frames.

The windows in the 1968 wing addition are single-pane with aluminum frames and in poor condition. Some of the aluminum frames have deteriorated from corrosion caused by sunlight and water leakage. Some of these window units have failed window seals, corroded spacers, and no weep holes in the window frame. Also, there is a failure of the caulking around some of the window frames.

Concord strongly recommends the replacement of the single pane windows and deteriorated frames/window seals in the 1968 wing addition with high-efficiency, double pane low-E glass with thermal break spacers, insulated glass and new aluminum window frames.

The roof is a 4-ply asphalt and gravel built-up roof system with organic felts over 1 inch of fiberboard insulation over a rosin paper barrier over a wood deck.

HVAC Systems

In general, the school HVAC system consists of four (4) modular, condensing boilers; a fire-tube hot water boiler; nine (9) heating hot water pumps; six (6) large heating & ventilating units; numerous rooftop exhaust fans; vertical unit ventilators with fin-tube radiators along all of the perimeter walls; and numerous hot water unit heaters, hot water convectors, and ceiling cabinet heaters in the entrances, vestibules, corridors, stairwells, restrooms, etc.

The heating hot water system located in the Boiler Room #1 includes three (3) Aerco Model BMK2.0 GWB gas-fired modular condensing boilers each rated at 2,000 MBH input with a thermal efficiency of 88% (present age and condition). The primary hot water pumps are two (2) base-mounted, double-suction, centrifugal pumps. Each of these pumps has a flow of 800 GPM at 30 feet of TDH and a 7.5-HP motor with an efficiency of 89.5%. In addition, there are five (5) zone pumps that are rated from 60 to 120 GPM with ½ to 2 HP motors.

The heating hot water system located in the Boiler Room #2 includes a Cleaver-Brooks Model CB801-80 gas-fired fire-tube boiler rated at 2,678 MBH input with a thermal efficiency of 70% (present age and condition). The heating hot water is pumped to the various hot water coils throughout the 1968 wing addition by two (2) base-mounted, double-suction, centrifugal pumps. Each of these pumps has a flow of 100 GPM at 50 feet of TDH and a 3-HP U. S. Electric motor with an efficiency of 78.5%.

The all-purpose room is heated and ventilated by a central air handling unit located in the rooftop penthouse unit that is rated at approximately 289 MBH of heating capacity. The kitchen is heated and ventilated by a ceiling mounted unit that is rated at approximately 115 MBH of heating capacity. The gym is heated and ventilated by four (4) unit ventilators mounted at the ceiling and rated at 115 MBH of heating capacity. The kitchen is heated and ventilated by a unit rated at 115 MBH of heating capacity.

All of the classrooms, faculty room, main office, nurse's office, principal's office, conference room, media center, etc. are all heated and ventilated by Nesbitt Model TW-750 to TW-1500 and vertical unit ventilators that have hot water heating. These unit ventilators are rated from 750 CFM to 1,500 CFM with heating capacity from 39 to 115 MBH.

The stairwells, entrance vestibules, and corridors are heated by various hot water convectors and ceiling unit heaters. The various restrooms have hot water convectors to heat the perimeter walls. Storage rooms, mechanical rooms, etc. are heated by propeller type hot water unit heaters rated at 12.2 to 60.9 MBH of heating capacity.

Fresh air is supplied to most of the spaces via roof-mounted air intake housings and by unit ventilators located in the classrooms, offices, etc. Outside air intake louvers provide fresh air for the boiler room. The gym and cafeteria receive fresh air via the heating and ventilation units mounted in the spaces. The all purpose room receives fresh air from the heating & ventilating unit located in the rooftop penthouse.

Exhaust System

There are numerous down-blast exhaust fans on the roof. Most of the nameplate information is unobtainable. Half of these exhaust fans are over 45 years old, have badly corroded due to weather and are very inefficient. The kitchen exhaust fan information was also not obtainable.

Concord strongly recommends the replacement of these exhaust fans that have surpassed their service life and are very inefficient.

HVAC System Controls

Most of the HVAC equipment within the building is 47 years old and controlled by a Powers on-off-auto pneumatic air system which includes an air compressor in the boiler room with a ¾ HP motor. Some of the Powers pneumatic controllers no longer work and the pneumatic valves, actuators, pressure regulators, etc. that control the unit ventilators, unit heaters, large ceiling mounted cabinet heaters, heating & ventilating units, etc. have air leaks.

The valves and actuators for all of the above equipment are not closing/opening fully due to the age of the units. The outside air damper is not fully closing which could cause hot water coil freezing during the coldest months of the winter and allow humidity into the space during the hot humid days of the summer. Also, the thermostats that control these units are out of calibration and are not reading the correct space temperature.

Due to the age and condition of the pneumatic systems, Concord Engineering strongly recommends the replacement of the entire pneumatic system and pneumatic valves/actuators with Direct Digital Control (DDC) components and electronic valves that can communicate directly with a Building Management System.

The Aerco boilers in boiler room #2 are controlled by an Aerco Boiler Management System that includes outside air temperature reset and sequences the four (4) modular condensing boilers to match the heating hot water demand.

Domestic Hot Water

The domestic hot water heater located in the boiler room is a LAARS Model PNCV1000N automatic circulating tank water heater that is rated at 200 MBH input, has a 200 gallon capacity and a thermal efficiency of 80% based on its present age and condition.

Plumbing System

The school utilizes sinks rated at 0.5 gallons per minute. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

Kitchen

The serving kitchen includes a double-stack convection oven, a Metro double door warming cabinet, a Traulsen 1-door and 2-door reach-in refrigerator, a Powers Equipment milk cooler, and a two by four foot exhaust hood.

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.

IV. 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.

V. 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	Interior Lighting Upgrade	$95,072	$11,764	8.1	85.6%
ECM #2	Interior Lighting Controls	$14,450	$773	18.7	-19.8%
ECM #3	Exterior Lighting Upgrade	$4,343	$600	7.2	107.3%
ECM #4	Modular Condensing Boilers	$103,392	$2,464	42.0	-52.3%
ECM #5	H&V Unit Replacement	$30,000	$2,408	12.5	60.5%
ECM #6	Domestic Water Heater Upgrade	$15,293	$549	27.9	-46.2%
ECM #7	Window Replacement	$158,700	$4,695	33.8	-40.8%
ECM #8	Destratification Fans for the Gym	$14,000	$967	14.5	3.6%
ECM #9	New and EC Motors for Rooftop Exhaust Fans	$63,104	$1,750	36.1	-58.4%
ECM #10	DDC System Upgrades	$192,400	$4,572	42.1	-64.4%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	147 kW Solar Array	$705,000	$50,870	13.9	8.2%

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	Interior Lighting Upgrade	53.9	85,869	0
ECM #2	Interior Lighting Controls	0.0	5,644	0
ECM #3	Exterior Lighting Upgrade	1.2	4,380	0
ECM #4	Modular Condensing Boilers	0.0	0	3,080
ECM #5	H&V Unit Replacement	0.0	3,796	2,359
ECM #6	Domestic Water Heater Upgrade	0.0	0	686
ECM #7	Window Replacement	0.0	0	5,869
ECM #8	Destratification Fans for the Gym	0.0	-185	1,240
ECM #9	New and EC Motors for Rooftop Exhaust Fans	0.0	12,770	0
ECM #10	DDC System Upgrades	0.0	11,883	3,680
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	147 kW Solar Array	134.0	176,324	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	Interior Lighting Upgrade	130,521	240	558
ECM #2	Interior Lighting Controls	8,579	16	37
ECM #3	Exterior Lighting Upgrade	6,658	12	28
ECM #4	Modular Condensing Boilers	36,036	28	0
ECM #5	H&V Unit Replacement	33,370	32	25
ECM #6	Domestic Water Heater Upgrade	8,026	6	0
ECM #7	Window Replacement	68,667	54	0
ECM #8	Destratification Fans for the Gym	14,227	11	(1)
ECM #9	New and EC Motors for Rooftop Exhaust Fans	19,410	36	83
ECM #10	DDC System Upgrades	61,118	67	77
	Total Emissions Savings	**386,612**	**503**	**807**

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**
Interior Lighting Upgrade	$11,764	$95,072	$0	$95,072	8.1
Interior Lighting Controls	$773	$14,450	$0	$14,450	18.7
Exterior Lighting Upgrade	$600	$4,343	$0	$4,343	7.2
~~Modular Condensing Boilers~~	~~$2,464~~	~~$107,792~~	~~$4,400~~	~~$103,392~~	~~42.0~~
H&V Unit Replacement	$2,408	$30,000	$0	$30,000	12.5
Domestic Water Heater Upgrade	$549	$17,293	$2,000	$15,293	27.9
Window Replacement	$4,695	$158,700	$0	$158,700	33.8
Destratification Fans for the Gym	$967	$14,000	$0	$14,000	14.5
~~New and EC Motors for Rooftop Exhaust Fans~~	~~$1,750~~	~~$63,104~~	~~$0~~	~~$63,104~~	~~36.1~~
~~DDC System Upgrades~~	~~$4,572~~	~~$192,400~~	~~$0~~	~~$192,400~~	~~42.1~~
Total Project	**$21,756**	**$333,858**	**$2,000**	**$331,858**	**15.3**

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.

The facility peak electrical demand and total project savings meet the qualifications for the Pay for Performance Program. If the owner were to pursue this program option they would receive an estimated $47,467 in incentive dollars, see the Installation Funding Options Section for more detail.

ECM #1: Interior Lighting Upgrade

Description:

A majority of the interior lighting throughout the Richard Butler School is provided by older generation T12 fixtures with magnetic ballasts. These lamps would be replaced with Light Emitting Diode (LED) retrofit lamps by bypassing the magnetic ballast without compromising light output.

This ECM also includes replacement of any incandescent lamps with Phillips Endura LED lamps which can be retrofit into existing incandescent A-lamp fixtures. LED lamps provide equivalent lumens and much longer burn hours with reduced wattages.

The existing exit signs with and without battery-powered emergency lights would be replaced by LED exit signs or exit signs with LED emergency lights.

The Gymnasium will be retrofitted from the existing 400 watt metal halide high bay fixtures with a 100 watt LED retrofit kit.

Energy Savings Calculations:

LIGHTING UPGRADE SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Demand Savings (kW)	53.9
Electric Usage Savings (kWh)	85,869
Electric Cost Savings ($)	$11,764

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.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$95,072
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$95,072
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$11,764
Total Yearly Savings ($/Yr):	$11,764
Estimated ECM Lifetime (Yr):	15
Simple Payback	8.1
Simple Lifetime ROI	85.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$176,460
Internal Rate of Return (IRR)	9%
Net Present Value (NPV)	$45,365.87

ECM #2: Interior Lighting Controls Upgrade – Occupancy Sensors

Description:

Some of the lights in the Richard Butler 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 (The majority of the savings is expected to be after hours when rooms are left with lights on)

This ECM includes installation of ceiling or switch mount sensors for offices, large storage rooms, conference rooms, and restrooms. The larger rooms/spaces will have multiple sensors that will automatically turn off lights when the spaces are unoccupied. These new sensors will contain the latest dual-sensor technology (passive infrared and ultrasonic activated).

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:

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

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

LIGHTING CONTROLS SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Demand Savings (kW)	0.0
Electric Usage Savings (kWh)	5,644
Electric Cost Savings ($)	$773

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
= (# Wall mount sensors × $20 per sensor)
+ (# Ceiling mount sensors × $35 per sensor)

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$14,450
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$14,450
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$773
Total Yearly Savings ($/Yr):	$773
Estimated ECM Lifetime (Yr):	15
Simple Payback	18.7
Simple Lifetime ROI	-19.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$11,595
Internal Rate of Return (IRR)	-3%
Net Present Value (NPV)	($5,221.98)

ECM #3: Exterior Lighting Upgrade

Description:

Exterior lighting throughout the Richard Butler School is provided by various types, sizes and wattages of metal halide wall-mounted fixtures and canopy 72-watt incandescent lamp fixtures. This ECM includes the replacement of existing fixtures with new high-efficiency LED lighting fixtures and retrofit LED lamp kits for canopy and jar fixtures that require a lower energy use for the same light output. LED bulbs and diodes have an operational life time expectancy of 100,000 hours which equates to 22 years at 50% operation. This results in substantial savings in bulb replacement.

Exterior lighting is controlled via time clock and typically operates from dusk to dawn or less.

Energy Savings Calculations:

LIGHTING UPGRADE SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Demand Savings (kW)	1.2
Electric Usage Savings (kWh)	4,380
Electric Cost Savings ($)	$600

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

Maintenance Savings and Project Costs:

Maintenance savings have not been included in the energy savings summary.

Project Costs were obtained from lighting vendor quotes and a local lighting contractor.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$4,343
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$4,343
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$600
Total Yearly Savings ($/Yr):	$600
Estimated ECM Lifetime (Yr):	15
Simple Payback	7.2
Simple Lifetime ROI	107.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$9,000
Internal Rate of Return (IRR)	11%
Net Present Value (NPV)	$2,820.26

ECM #4: Modular Condensing Boiler (1968 Wing Addition)

Description:

The Richard Butler Middle School 1968 Wing Addition is heated by a Cleaver-Brooks fire-tube hot water boiler that is 47 years old, has surpassed its ASHRAE useful life expectancy, and is less efficient than newer modular condensing style boilers. This gas-fired, fire-tube boiler has a rated input capacity of approximately 2,678 MBH with an estimated thermal efficiency of 70% due to its present age and condition.

This existing fire-tube boiler is oversized and Concord Engineering strongly recommends that detailed heat load calculations be performed to correctly size the boiler required for the 1968 Wing Addition. Concord Engineering has estimated that the heating load is closer to 1,600 MBH and has used this estimate for the energy savings calculations and cost of a new 2,000 MBH modular condensing boiler.

This ECM would install one (1) new modular condensing style boiler rated at 2,000 MBH with an average thermal efficiency of 92%. The new boiler would include hot water reset and outdoor air reset controls to reduce heating water temperature during low load periods.

NATURAL GAS USAGE BREAKDOWN	
Description	**Therm**
Utility Bill Usage	40,713
Domestic Hot Water	3,291
Kitchen Gas Equipment	627
Hot Water Heating Boilers	36,795
1968 Wing Addition Boiler	**12,878**

Energy Savings Calculations:

Energy Savings were calculated utilizing the New Jersey Board of Public Utilities Protocols to Measure Resource Savings.

$$\text{Building Heat Required} = \text{Natural Gas Usage (therm)} \times \text{Heating Efficiency} \times \text{Fuel Heat Value} \left(\frac{\text{Btu}}{\text{therm}}\right)$$

$$\text{Proposed Gas Usage} = \frac{\text{Building Heat Required (Btu)}}{\text{Heating Efficiency} \times \text{Fuel Heat Value} \left(\frac{\text{Btu}}{\text{therm}}\right)}$$

$$\text{Energy Cost} = \text{Heating Gas Usage (therm)} \times \text{Fuel Cost} \left(\frac{\$}{\text{therm}}\right)$$

CONDENSING BOILER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Fire-Tube (Water)	New Condensing Modular Boiler	
Existing Nat Gas (Therms)	12,878		
Boiler Efficiency (%)	70.0%	92.0%	22%
Nat Gas Heat Value (BTU/Therm)	100,000	100,000	
Equivalent Building Heat Usage (MMBTUs)	901	901	
Gas Cost ($/Therm)	$0.80	$0.80	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	12,878	9,798	3,080
Energy Cost ($)	$10,302	$7,839	$2,464
COMMENTS:	Boiler Efficiency Based on age of boiler and IBR Rating		

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$107,792
NJ Smart Start Equipment Incentive ($):	$4,400
Net Installation Cost ($):	$103,392
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,464
Total Yearly Savings ($/Yr):	$2,464
Estimated ECM Lifetime (Yr):	20
Simple Payback	42.0
Simple Lifetime ROI	-52.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$49,280
Internal Rate of Return (IRR)	-6%
Net Present Value (NPV)	($66,733.90)

ECM #5: Heating and Ventilating Unit Replacements

Description:

The Richard Butler School has a Nesbitt Heating & Ventilating (H&V) central unit located in the penthouse mechanical room that serves the All-Purpose Room (APR). This Model G-1850 H&V unit is in very poor condition due to its age (61 years), old pneumatic controls, dirty heating coils, old damper actuators, etc. This unit has limited control capabilities with a motor that runs while the APR is unoccupied. Failing to keep ventilation systems maintained and controlled properly has the potential to waste large amounts of energy. Bringing in too much cold air in the winter forces a large energy load on the boilers. In addition, since this unit is obsolete, parts are very difficult and expensive to obtain from the original manufacturer. Replacing this unit with a newer more efficient unit would result in significant energy cost savings.

Concord Engineering strongly recommends that this heating & ventilating unit be replaced with a new, high-efficiency unit that has enhanced direct digital controls, electronic hot water valves, new outside air dampers and demand ventilation control features.

This ECM includes replacement of this heating & ventilating unit with a new higher efficiency unit that would include an inverter-duty, NEMA Premium™ efficiency motor, a direct digital controller, and a supply fan motor variable speed controller along with demand control ventilation.

It is recommended that the School District evaluate the capacity needed for this new Heating & Ventilating (HV) unit along with the proper controls for the demand control ventilation features prior to moving forward with this ECM.

The high-efficiency heating & ventilating unit used as the basis for the calculation is a Daikin or equal air handler with a premium efficiency motor, variable speed drive, direct digital controller and demand control ventilation features.

The estimated installed cost of installing a new high-efficiency modular heating and ventilating unit in the penthouse mechanical room is $30,000.

The unit pricing and installed cost were estimated based on vendor quotes, current labor rates and estimates from a local Mechanical Contractor. The payback may change based on actual unit pricing and installed costs if this ECM is implemented.

Energy Savings Calculations:

All-Purpose Room H&V Unit:

H&V REPLACEMENT			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Description	Existing H&V APR Unit	New H&V APR Unit	
Quantity of Units	1	1	
Unit Heating Capacity (Btu/h)	289,000	289,000	
Unit Capacity Loss due to Age	25%	0%	
Boiler Plant Efficiency	88%	88%	
Unit Fan Power (HP)	3	3	
Fan Motor Efficiency	83.5%	89.5%	
Hours at Setpoint (hrs/day)	16	10	
Hours at Setback (hr/day)	8	14	
Operating Days per Year	212	212	
Heating Degree Days (65F)	4939	4939	
Operational Factor	66.7%	41.7%	
Fan Energy (kWh)	9,106	5,310	
Heating Energy (kBtu)	415,235	207,618	207,618
Elec Cost ($/kWh)	0.137	0.137	
Gas Cost ($/therm)	0.80	0.80	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Energy (kWh)	9,106	5,310	3,796
Natural Gas Energy (therm)	4,719	2,359	2,359
Electric Energy Cost ($)	$5,022	$2,615	$2,408
COMMENTS:	One-for-One H&V Replacement		

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$30,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$30,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,408
Total Yearly Savings ($/Yr):	$2,408
Estimated ECM Lifetime (Yr):	20
Simple Payback	12.5
Simple Lifetime ROI	60.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$48,160
Internal Rate of Return (IRR)	5%
Net Present Value (NPV)	$5,824.96

ECM #6: Domestic Water Heater Replacement

Description:

Domestic hot water for the Richard Butler Middle School is provided by a LAARS Model PNCV1000 domestic water heater rated at an input of 1,000 MBH that circulates hot water to a 200 gallon storage tank. This unit has a rated thermal efficiency of only 76% (present age and condition).

This ECM would replace this existing gas-fired domestic water heater with a Bradford White ultra-high efficiency water heater rated at an input of 1,000 MBH, circulating hot water to a 200 gallon storage tank, and having a 96% thermal efficiency.

Energy Savings Calculations:

Energy Density for "Education" type 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 Gas-Fired Water Heater	Ultra-High Efficiency Water Heater	
Building Type	Education		
Building Square-foot	48,100	48,100	
Domestic Water Usage, kBtu	250,120	250,120	
DHW Heating Fuel Type	Gas	Gas	
Heating Efficiency	76%	96%	20%
Total Usage (kBTU)	329,105	260,542	68,564
Nat Gas Cost ($/Therm)	$ 0.80	$ 0.80	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	3,291	2,605	686
Energy Cost ($)	$2,633	$2,084	$549
COMMENTS:	Savings are based on Energy Information Administration Commercial Building Energy Consumption Survey 2003 Information		

Maintenance Savings and Project Costs:

No maintenance cost savings were estimated for this measure.

Project Costs are based off RS Means Unit Cost Data, equipment vendor quote and local Plumbing Contractor pricing.

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$17,293
NJ Smart Start Equipment Incentive ($):	$2,000
Net Installation Cost ($):	$15,293
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$549
Total Yearly Savings ($/Yr):	$549
Estimated ECM Lifetime (Yr):	15
Simple Payback	27.9
Simple Lifetime ROI	-46.2%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$8,235
Internal Rate of Return (IRR)	-7%
Net Present Value (NPV)	($8,739.07)

ECM #7: Window Replacement (1968 Wing Addition)

Description:

In the 1968 Wing Addition of the school the windows are clear single-pane 1/8 inch glass and have aluminum frames. The seals on many of the windows have failed and the moisture infiltration is causing corrosion of the aluminum frames. The window caulking has also separated from the aluminum frames and there are signs of cracking in the shrinking caulk.

The windows account for significant energy use through leakage heat loss and conductive heat loss. The age and failed seal condition of the windows contribute to the air leakage rate. These factors lead to increased energy use in the heating season. New double pane windows with low E glazing will also offer an improvement in thermal performance in the winter months.

This ECM includes the replacement of the single-pane, aluminum-framed windows with Low E glass, double-pane windows and thermal breaks in the frames. The proposed window savings include reduced solar heat gain, conductive losses and outside air leakage.

Below is a list of the older and inefficient windows in the 1968 Wing Addition

WINDOW REPLACEMENT SUMMARY			
ECM INPUTS	**NUMBER OF WINDOWS**	**SIZE**	**AREA**
1968 Wing Addition	87	6' x 4'	2,088
TOTAL	**87**	**-**	**2,088**

Energy Savings Calculations:

$$\text{Infiltration}\left(\frac{\text{Ft}^3}{\text{Min.}}\right) = \text{Window Area}\left(\text{Ft}^2\right) \times \text{Estimated Infiltration per SF of Window}\left(\frac{\text{CFM}}{\text{Ft}^2}\right)$$

$$\text{Heat Load}\left(\frac{\text{Btu}}{\text{Hr.}}\right) = 1.1 \times \text{Infiltration}\left(\frac{\text{Ft}^3}{\text{Min}}\right) \times \text{Design Temperature Difference}\left(^{\circ}\text{F}\right)$$

$$\text{Cooling Load}\left(\text{Ton}\right) = \text{Infiltration}\left(\frac{\text{Ft}^3}{\text{Min}}\right) \times \frac{1\,\text{Ton Cooling}}{400\left(\frac{\text{Ft}^3}{\text{Min}}\right)}$$

$$\text{Heating Leakage Energy}\left(\text{Therms}\right)=\frac{\text{Heat Load}\left(\frac{\text{Btu}}{\text{Hr.}}\right)\times\text{HDD}\left(\text{Day }^{\circ}\text{F}\right)\times 24\left(\frac{\text{Hr.}}{\text{Day}}\right)\times\left(0.60\right)}{65\left(^{\circ}\text{F}\right)\times\text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right)\times\text{Heating Efficiency}\left(\%\right)}$$

$$\text{Cooling Leakage Energy}\left(\text{kWh}\right)=\frac{\text{Cooling Load}\left(\text{Ton}\right)\times\left(\frac{12{,}000\text{ Btu}}{\text{Ton Hr.}}\right)\times\text{Full Load Cooling Hours}}{\frac{1000\text{ W.h}}{\text{kWh}}\times\text{Cooling Efficiency}\left(\text{EER}\right)}$$

$$\text{Conductive Energy}\left(\text{Therms}\right)=\frac{\text{U}-\text{Value}\times\text{Area}\left(\text{Ft}^2\right)\times\text{HDD}\left(\text{Day }^{\circ}\text{F}\right)\times 24\left(\frac{\text{Hr.}}{\text{Day}}\right)\times\left(0.60\right)}{65\left(^{\circ}\text{F}\right)\times\text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right)\times\text{Heating Efficiency}\left(\%\right)}$$

$$\text{Heating Energy Cost} = \text{Total Heating Energy}\left(\text{Therms}\right)\times\text{Ave Fuel Cost}\left(\frac{\$}{\text{Therms}}\right)$$

$$\text{Cooling Energy Cost} = \text{Total Cooling Energy}\left(\text{kWh}\right)\times\text{Ave Fuel Cost}\left(\frac{\$}{\text{kWh}}\right)$$

WINDOW REPLACEMENT CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Description:	Existing Single Pane Windows	Double Pane Low-E Windows	-
Window (SF)	2,088	2,088	-
U-Value (BTU/HR/SF*°F)	0.56	0.32	0.24
Estimated Infiltration, CFM per SF Window	5	2	-
Total Infiltration, CFM	10440	4176	6,264
Heating System Efficiency (%)	92%	92%	-
Heating Degree Days (HDD)	5,073	5,073	-
Design Day Temp Diff (°F)	65	65	-
Heating Hrs Per Day (Hrs)	24	24	-
Natural Gas Cost ($/Therm)	0.80	0.80	-
Gas Heat Value (BTU/Therm)	100,000	100,000	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Heat Load (BTU/Hr)	746,460	298,584	447,876
Leakage Energy (Therms)	9,119	3,647	5,471
Conductive Energy (Therms)	928	531	398
Total Heating Energy (Therms)	10,047	4,178	5,869
Gas Energy Cost ($)	$8,038	$3,342	$4,695
Comments:	1. Proposed window U-value Based on ASHRAE 90.1 - 2011		

The cost basis for this ECM is a window system priced at $76 per SF of window installed. Total estimated cost for replacing the inefficient windows in the 1968 Wing Addition is $158,700.

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$158,700
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$158,700
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$4,695
Total Yearly Savings ($/Yr):	$4,695
Estimated ECM Lifetime (Yr):	20
Simple Payback	33.8
Simple Lifetime ROI	-40.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$93,900
Internal Rate of Return (IRR)	-5%
Net Present Value (NPV)	($88,850.26)

ECM #8: De-Stratification Fans in the Gym

Description:

The Gym has a 25-foot ceiling. In rooms with high ceilings typically stratification of heated air occurs, resulting in air at ceiling level being warmer than the floor. Since temperature at the floor level dictates the comfort of occupants and is typically the location of the thermostat controlling the system, this results in additional operating hours to satisfy space conditions. A de-stratification fan continuously mixes the air, balancing temperatures from ceiling to floor and wall to wall which helps the HVAC system maintain the desired temperature.

This ECM would install four (4) Airius Model A25-SP de-stratification fans with 92% efficient fan motors in the Gym to be suspended from the ceiling, with all required electrical wiring and supports. These fans can be tied into a Building Management System (BMS) or wall-mounted potentiometers. These fans should only operate during heating season to help maintain a higher floor temperature and reduce cycling time.

Energy Savings Calculations:

The calculations are based on the manufacturer's percent savings utilizing the height of the ceiling and associated temperature differential between floor and ceiling. The ceiling-to-floor temperature differential in this case was estimated at 12.5 degrees Fahrenheit.

$$\text{Heating Energy (kBtu)} = 80\%\ \text{Oversize Factor} \times \text{Space Heating Capacity} \times \text{HDD} \times \text{Adj. Factor} \times 24\frac{\text{hr}}{\text{day}} \times \frac{1}{\text{Design } \Delta T} \times \frac{1}{\text{Efficiency}}$$

$$\text{Savings (kBtu)} = \text{Heating Energy} \times \text{Percent Savings}$$

$$\text{Fan Power Penalty (kWh)} = \text{Fan Power (W)} \times \text{Winter Operating Hours} \times \frac{1\ \text{kWh}}{1{,}000\ \text{W}}$$

Each A25 unit has a 35-watt fan motor.

DESTRATIFICATION FAN ANALYSIS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Description	Existing Gym	Proposed Ceiling Destratification Fans	
Space Heating Type	Central Heating & Ventilating Unit	Central Heating & Ventilating Unit	
Space Heating Capacity (MBH)	460	460	
Heating Efficiency (%)	70%	70%	
Heating Degree Days (65 F)	5062	5062	
Degree Day Adjustment Factor	0.45	0.45	
Space Ceiling Height (ft)	25	25	
Ceiling-Floor ΔT (^{o}F)	12.5	12.5	
Percent Energy Savings	-	22%	
Destrat Fan Power (kWh)	-	185	
Heating Energy (kBtu)	563,541	439,562	
Electric Rate ($/kWh)	$0.137	$0.137	
Natural Gas ($/Therm)	$0.80	$0.80	
ENERGY SAVINGS CALCULATIONS			
Electric Usage (kWh)	0	185	(185)
Natural Gas (Therms)	5,635	4,396	1,240
Energy Cost ($)	$4,508	$3,542	$967
COMMENTS:	Ceiling-Floor Temperature Differential Based on 0.5 F per Foot		

Energy Savings Summary:

ECM #8 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$14,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$14,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$967
Total Yearly Savings ($/Yr):	$967
Estimated ECM Lifetime (Yr):	15
Simple Payback	14.5
Simple Lifetime ROI	3.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$14,505
Internal Rate of Return (IRR)	0%
Net Present Value (NPV)	($2,456.02)

ECM #9: New and EC Motors for Rooftop Exhaust Fans

Description:

There are numerous exhaust fans on the roof that are 50 years old and have past their service life of 20 years as per ASHRAE standards. In addition there are some newer fans that have been replaced in the last twenty years. The older fans should be replaced with new units that have Electronically Commutated (EC) Motors, with a dial on motor (potentiometer) control, and a higher turndown. A 1/2 HP EC motor (for example) will consume the same amount of energy as a 1/6 HP for a given load.

Electronically Commutated (EC) Motors are proven to generate substantial savings on small motor applications. These motors currently are available in sizes up to 1 horsepower, and provide efficiencies similar to how NEMA premium efficiency motor would at a large horsepower. The motor works much like a direct current (DC) motor and is without mechanical brushes and the commuter reduces friction losses in the motor. The motors are programmable and can be used for a wide range of applications.

This measure would replace all rooftop exhaust fans over 20 years old with newer units having EC motors and also replace fan motors on units less than 20 years old with EC motor retrofits. In total, there are two (2) 1/2 HP exhaust fans, three (3) 1/3 HP, twelve (12) ¼ HP and ten (10) 1/6 HP exhaust fans. The basis of design is Greenheck exhaust fans with Vari-Green fan motors.

Energy Savings Calculations:

Measured savings for new exhaust fans with EC motors and EC motor retrofits has proven that up to 65% reduction in power can be realized through the installation these new fans/motors.

$$\text{Electric Energy (kWh)} = \frac{(\text{Amps} \times \text{Volts} \times \text{Phase}^{1/2})}{1000} \times \text{Power Factor} \times \text{Operating Hours}$$

$$\text{Energy Savings} = \text{Electric Energy} \times \text{Power Reduction (40\%)}$$

Energy Savings Calculations for Each Size Exhaust Fan Motor:

ELECTRONICALLY COMMUTATED MOTOR CALULATION			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	PSC	ECM	
Quantity of Motors	10	10	
Motor Nameplate HP	1/6	1/6	
Full Load Amps	4.4		
Voltage	115	115	
Phase	1	1	
Power Factor	55%	55%	
Operating Hrs	3400	3400	
Load Reduction	-	40.0%	
Elec Cost ($/kWh)	0.137	0.137	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Energy (kWh)	9,462	5,677	3,785
Electric Energy Cost ($)	$1,296	$778	$519
COMMENTS:	Rooftop Exhaust Fans		

ELECTRONICALLY COMMUTATED MOTOR CALULATION			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	PSC	ECM	
Quantity of Motors	12	12	
Motor Nameplate HP	1/4	1/4	
Full Load Amps	5.8		
Voltage	115	115	
Phase	1	1	
Power Factor	55%	55%	
Operating Hrs	3400	3400	
Load Reduction	-	40.0%	
Elec Cost ($/kWh)	0.137	0.137	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Energy (kWh)	14,967	8,980	5,987
Electric Energy Cost ($)	$2,051	$1,230	$820
COMMENTS:	Rooftop Exhaust Fan		

ELECTRONICALLY COMMUTATED MOTOR CALULATION			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	PSC	ECM	
Quantity of Motors	3	3	
Motor Nameplate HP	1/3	1/3	
Full Load Amps	7.2		
Voltage	115	115	
Phase	1	1	
Power Factor	55%	55%	
Operating Hrs	2400	2400	
Load Reduction	-	40.0%	
Elec Cost ($/kWh)	0.137	0.137	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Energy (kWh)	3,279	1,967	1,312
Electric Energy Cost ($)	$449	$270	$180
COMMENTS:	Rooftop Exhaust Fan		

ELECTRONICALLY COMMUTATED MOTOR CALULATION			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	PSC	ECM	
Quantity of Motors	2	2	
Motor Nameplate HP	1/2	1/2	
Full Load Amps	9.8		
Voltage	115	115	
Phase	1	1	
Power Factor	55%	55%	
Operating Hrs	3400	3400	
Load Reduction	-	40.0%	
Elec Cost ($/kWh)	0.137	0.137	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Energy (kWh)	4,215	2,529	1,686
Electric Energy Cost ($)	$577	$346	$231
COMMENTS:	Rooftop Exhaust Fans		

Total Energy Cost Savings = $519 + $820 + $180 + $231 = $ 1,750

Maintenance Savings and Project Costs:

No maintenance cost savings were estimated for this measure.

Project Costs are based on RS Means Unit Cost Data and local Mechanical Contractor pricing.

Energy Savings Summary:

ECM #9 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$63,104
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$63,104
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,750
Total Yearly Savings ($/Yr):	$1,750
Estimated ECM Lifetime (Yr):	15
Simple Payback	36.1
Simple Lifetime ROI	-58.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$26,250
Internal Rate of Return (IRR)	-9%
Net Present Value (NPV)	($42,212.61)

ECM #10: Digital Energy Management System (DDC EMS)

Description:

The HVAC systems within the building are 49 years old and are controlled by a Honeywell on-off-auto pneumatic air system which includes two (2) air compressors in the boiler room that have lead/lag control and ¾ HP motors. Some of the Honeywell pneumatic controllers no longer work and the pneumatic valves, actuators, pressure regulators, etc. that control the unit ventilators, unit heaters, large ceiling mounted cabinet heaters, heating & ventilating units, etc. have air leaks.

The valves and actuators for most of the above equipment are not closing/opening fully due to the age of the units. The outside air damper is not fully closing which could cause hot water coil freezing during the coldest months of the winter and allow humidity into the space during the hot humid days of the summer. Also, the thermostats that control these units are out of calibration and are not reading the correct space temperature. The installation of a new generation DDC system with updated software and remote access to control the HVAC equipment could yield significant savings through nighttime setback; temperature reset capability, and improved maintenance response time to outages and breakdowns.

This ECM includes installation of newer DDC controls on the HVAC equipment in the facility. With the communication between the control devices and the new updated digital interface/software, the facility manager will be able to take advantage of scheduling for occupied and unoccupied periods based on the actual occupancy of each space in the facility. 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 Central DDC system installation 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, outside temperature reset, 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 public school 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%-10%.

Savings resulting from the implementation of this ECM for energy management controls upgrade are estimated to be 10% of the electricity and 10% of the natural gas utility used to heat and cool the facility.

The basis for the updated DDC system is a Honeywell Energy Management System or similar.

Energy Savings Calculations:

Energy savings for each utility is calculated with the equation below:

$$\text{Energy Savings (Utility)} = \text{Current Energy Consumption} \times \text{Estimated Savings, \%}$$

The following table summarizes energy savings via implementation of a Digital Energy Management System Upgrade:

DDC ENERGY MANAGEMENT SYSYEM CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Pneumatic Controls	Full DDC Controls	
Existing Gas Usage (Therms)	36,795	-	
Existing Electricity Usage for HVAC (kWh)	118,830	-	
Energy Savings, Gas	-	10%	
Energy Savings, Electricity	-	10%	
Gas Cost ($/Therm)	$0.80	$0.80	
Electricity Cost ($/kWh)	$0.137	$0.137	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Gas Usage (Therms)	36,795	33,116	3,680
Electricity Usage (kWh)	118,830	106,947	11,883
Gas Cost ($)	$29,436	$26,492	$2,944
Electricity Cost ($)	$16,280	$14,652	$1,628
Energy Cost ($)	$45,716	$41,144	$4,572

Maintenance Savings and Project Costs:

No maintenance cost savings were estimated for this measure.

Project Costs are based off RS Means Unit Cost data.

Energy Savings Summary:

ECM #10 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$192,400
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$192,400
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$4,572
Total Yearly Savings ($/Yr):	$4,572
Estimated ECM Lifetime (Yr):	15
Simple Payback	42.1
Simple Lifetime ROI	-64.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$68,580
Internal Rate of Return (IRR)	-11%
Net Present Value (NPV)	($137,819.76)

REM #1: 147 kW Solar System

Description:

The Butler School has available roof space and parking lot area that could accommodate solar arrays. Based on the available area a 147 kilowatt solar array could be installed. The array will produce approximately 176,324 kilowatt-hours annually that will reduce the overall electric usage of the facility by 52%. 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	
Installation Cost ($):	$705,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$705,000
SREC Revenue ($/Yr):	$26,714
Energy Savings ($/Yr):	$24,156
Total Yearly Savings ($/Yr):	$50,870
Estimated ECM Lifetime (Yr):	15
Simple Payback	13.9
Simple Lifetime ROI	8.2%
Simple Lifetime Maintenance Savings	$400,706
Simple Lifetime Savings	$763,052
Internal Rate of Return (IRR)	1.0%
Net Present Value (NPV)	($97,715.39)

VI. 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. Adjust the building occupied settings to 70 degrees heating and 75 cooling. Allow for a maximum 2 degree reset by the building occupants for individual comfort control.

B. It was noticed that thermostat scheduling was not consistent throughout the buildings. Winter setbacks ranged from 65 to 69 degrees while summer setbacks ranged from 76 to 80 degrees. Change the night setback temperatures to 60 degrees in the winter and 78 to 80 degrees in the summer, depending on seasonal humidity conditions. Plan for an earlier Monday morning start-up to meet the occupied set points as teachers and students arrive.

C. Maximize summer savings by setting summer vacation daytime cooling set points at 76 to 78 degrees, depending on humidity conditions. The buildings do not have to be operated at 70 to 72 degrees during summer vacation. When classrooms or offices are occupied or need to be cleaned, return to the normal occupied cooling set points for that time period. If the building is positively pressurized (instead of negatively pressurized) there will be no infiltration and the building humidity levels will be kept much lower.

D. Test and air balance the building supply and exhaust air systems so as to always maintain a positive pressure in the building, day and night. If the building is not positively pressurized infiltration into the building will occur. Infiltration is the source of cold drafts in the winter and high building humidity in the summer. Cold drafts and high humidity cause building occupants to feel uncomfortable and adjust the thermostats to compensate for the uncontrolled conditions. This wastes heating and cooling energies.

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

F. Maintain all weather stripping on windows and doors.

G. Clean all light fixtures to maximize light output.

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

I. Turn off computers when not in use. Ensure computers are not running in screen saver mode. Unplug unused appliances during summer vacation.

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

APPENDIX A

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING

Butler Board of Education - Richard Butler School

ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / 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 ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM #1	Interior Lighting Upgrade	$48,047	$47,025	$0	$95,072	$11,764	$0	$11,764	15	$176,460	$0	85.6%	8.1	8.96%	$45,365.87
ECM #2	Interior Lighting Controls	$11,550	$2,900	$0	$14,450	$773	$0	$773	15	$11,595	$0	-19.8%	18.7	-2.63%	($5,221.98)
ECM #3	Exterior Lighting Upgrade	$2,300	$2,043	$0	$4,343	$600	$0	$600	15	$9,000	$0	107.3%	7.2	10.88%	$2,820.26
ECM #4	Modular Condensing Boilers	$42,682	$65,110	$4,400	$103,392	$2,464	$0	$2,464	20	$49,280	$0	-52.3%	42.0	-6.21%	($66,733.90)
ECM #5	H&V Unit Replacement	$15,000	$15,000	$0	$30,000	$2,408	$0	$2,408	20	$48,160	$0	60.5%	12.5	5.00%	$5,824.96
ECM #6	Domestic Water Heater Upgrade	$11,056	$6,237	$2,000	$15,293	$549	$0	$549	15	$8,235	$0	-46.2%	27.9	-6.90%	($8,739.07)
ECM #7	Window Replacement	$79,350	$79,350	$0	$158,700	$4,695	$0	$4,695	20	$93,900	$0	-40.8%	33.8	-4.55%	($88,850.26)
ECM #8	Destratification Fans for the Gym	$8,000	$6,000	$0	$14,000	$967	$0	$967	15	$14,505	$0	3.6%	14.5	0.45%	($2,456.02)
ECM #9	New and EC Motors for Rooftop Exhaust Fans	$28,358	$34,746	$0	$63,104	$1,750	$0	$1,750	15	$26,250	$0	-58.4%	36.1	-9.38%	($42,212.61)
ECM #10	DDC System Upgrades	$96,200	$96,200	$0	$192,400	$4,572	$0	$4,572	15	$68,580	$0	-64.4%	42.1	-10.78%	($137,819.76)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	147 kW Solar Array	$423,000	$282,000	$0	$705,000	$24,156	$26,714	$50,870	15	$763,052	$400,706	8.2%	13.9	1.01%	($97,715.39)

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, 2015 to June 30, 2016, further details including how to apply, forms, and calculated incentive values can be found the Clean Energy Website. (www.njcleanenergy.com)

Electric Chillers

Water-Cooled Chillers	Constant Speed: Base: $8 - $30 per ton Performance Add: $2 - $2.25 per ton Variable Speed: Base: $12 - $44 per ton Performance Add: $2 - $4.00 per ton
Air-Cooled Chillers	Constant Speed: Base: $20 per ton Performance Add: $3.50 per ton Variable Speed: Base: $90 - $92 per ton Performance Add: $4.00 per ton

Energy Efficiency must comply with ASHRAE 90.1-2013

Gas Cooling

Gas Absorption Chillers (Indirect & Direct-Fired)	$185 - $450 per ton

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

Hot Water Gas Fired Boilers < 300 MBH	Non-Condensing: $0.95 per MBH, Minimum $400 per unit Condensing: $2.00 per MBH, Minimum $1000 per unit
Hot Water Gas Fired Boilers ≥ 300 - 1500 MBH	Non-Condensing: $1.75 per MBH Condensing: $2.20 per MBH Minimum $1000 per unit
Hot Water Gas Fired Boilers >1500 - ≤ 2500 MBH	Non-Condensing: $1.50 per MBH Condensing: $2.20 per MBH
Hot Water Gas Fired Boilers >2500 - ≤ 4000 MBH	Non-Condensing: $1.30 per MBH Condensing: $2.00 per MBH
Steam, Except Natural Draft, Gas fired Boilers < 300 MBH	$1.40 per MBH, Minimum $400 per unit
Steam, Except Natural Draft, Gas fired Boilers ≥ 300 – 1500 MBH	$1.20 per MBH
Steam, Except Natural Draft, Gas fired Boilers > 1500 – 2500 MBH	$1.20 per MBH
Steam, Except Natural Draft, Gas fired Boilers > 2500 – 4000 MBH	$1.00 per MBH
Steam, Natural Draft < 300 MBH	$1.40 per MBH, Minimum $300 per unit
Steam, Natural Draft ≥ 300 - 1500 MBH	$1.00 per MBH
Steam, Natural Draft >1500 - ≤ 2500 MBH	$0.90 per MBH
Steam, Natural Draft >2500 - ≤ 4000 MBH	$0.70 per MBH
All Types 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

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

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
Centrifugal Fan Applications on Constant Volume HVAC Systems	$80 per VFD rated hp, maximum $6,000 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

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)	$5 per fixture
T-5 and T-8 High Bay Fixtures	$25 - $150 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 Architectural Floor and Spot Luminaires	$50 per fixture
LED Bollard Fixtures	$50 per fixture
LED Display Case Lighting	$30 per display case
LED Fuel Pump Canopy	$100 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 Linear Ambient Luminaires (Indirect, Indirect/Direct, Direct/Indirect, Direct)	2’ Fixtures - $20/fixture 3’ Fixtures - $30/fixture 4’ Fixtures - $45/fixture 6’ Fixtures - $60/fixture 8’ Fixtures - $75/fixture
LED Linear Replacement Lamps (2’ & 4’ only)	$5 per lamp
Luminaires for Ambient Lighting of Interior Commercial Spaces (1x4, 2x2, 2x4 New Fixtures and Retrofit Kits)	1x4 LED - $15 per fixture 2x2 LED - $15 per fixture 2x4 LED - $25 per fixture
LED Outdoor Pole/Arm-Mounted Area and Roadway Luminaries	$100 per fixture
LED Outdoor Pole/Arm-Mounted Decorative Luminaries	$50 per fixture
LED Outdoor Wall-Mounted Area Luminaries	$100 per fixture
LED Parking Garage Luminaries	$100 per fixture
LED Retrofit Kits for Large Outdoor Pole / Arm-Mounted Area and Roadway Luminaires	$150 per fixture
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 Shelf-Mtd. Display & Task Lights	$15 per linear foot

LED Stairwell and Passageway Luminaires	$40 per fixture
LED Track or Mono-Point Directional Lighting Fixtures	$30 per fixture
LED Wall-Wash Lights	$30 per fixture
EnergyStar Commercial Lighting Fixtures	$5 to $10 per fixture
EnergyStar Screw and Pine-Based Bulbs	$5 to $10 per lamp

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 High-Bay (Existing Facilities Only)	$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

Refrigerator / Freezer Case Premium Efficiency Motors

Fraction ECM Motor < 1 HP	$40 per ECM for replacement of existing shaded-pole motor

Food Service Equipment

Combination Oven/Steamer (Electric)	$1,000/oven
Combination Oven/Steamer (Natural Gas)	$750/oven
Convection Oven (Electric)	$350/oven
Convection Oven (Natural Gas)	$500/oven
Rack Oven (Natural Gas)	$1,000/single oven, $2,000/double oven
Conveyor Oven (Natural Gas)	$500/small deck $750/large deck
Fryer (Electric)	$200/vat
Fryer (Natural Gas)	$749/vat
Large Vat Fryer (Electric)	$200/vat
Large Vat Fryer (Natural Gas)	$500/vat
Griddle (Electric)	$300/griddle
Griddle (Natural Gas)	$125/griddle
Steam Cooker (Electric)	$1,250/steamer
Steam Cooker (Natural Gas)	$2,000/steamer
Insulated Holding Cabinets	$200 to $300/unit
Glass Door Refrigerators	$75 to $150/unit
Solid Door Refrigerators	$50 to $200/unit
Glass Door Freezers	$200 to $1,000/unit
Solid Door Freezers	$100 to $600/unit
Ice Machines	$50 to $500/unit
Dishwashers	$400 to $1,500/unit

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

43

ENERGY STAR® Score[1]

Richard Butler School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 48,102
Built: 1954

For Year Ending: August 31, 2015
Date Generated: March 03, 2016

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
Richard Butler School 30 Pearl Place Butler, New Jersey 07405	Butler Board of Education 38 Bartholdi Ave Butler, NJ 07405 (____)____-_____	Barbara Murphy 38 Bartholdi Ave Butler, NJ 07405 973-492-2025 bmurphy@butlerboe.org

Property ID: 4778548

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
107.1 kBtu/ft²

Source EUI
160.3 kBtu/ft²

Annual Energy by Fuel

Electric - Grid (kBtu)	1,101,737 (21%)
Natural Gas (kBtu)	4,051,075 (79%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	100.9
National Median Source EUI (kBtu/ft²)	151.1
% Diff from National Median Source EUI	6%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	363

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

Barbara Murphy
38 Bartholdi Ave
Butler, NJ 07405
973-492-2025
bmurphy@butlerboe.org

Professional Engineer Stamp (if applicable)

APPENDIX D

MAJOR EQUIPMENT LIST

Concord Engineering

Heating & Ventilating Units

Tag	HV-1	HV-2 to HV-5
Unit Type	Central Heating & Ventilating Unit	Vertical Unit Ventilators
Qty	1	4
Location	Rooftop Penthouse	Gym
Area Served	All Purpose Room	Gym
Manufacturer	Nesbitt	Nesbitt
Model No.	G-1850	632
Serial No.	-	-
Cooling Type	No Cooling	No Cooling
Cooling Capacity (Tons)	N/A	N/A
Heating Type	Hot Water	Hot Water
Heating Input (MBH)	289 MBH	115 MBH
Supply Fan (HP)	3	1/4
Supply Fan VFD	☐ Yes ☑ No ☐ N/A	☐ Yes ☑ No ☐ N/A
Return Fan (HP)	N/A	N/A
Return Fan VFD	☐ Yes ☐ No ☑ N/A	☐ Yes ☐ No ☑ N/A
Approx Age	61	61
ASHRAE Service Life	20	20
Remaining Life	0	0
Comments	100% Exhaust	1,500 CFM per HV = 6,000 CFM

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Heating & Ventilating

Tag	HV-6
Unit Type	Vertical Unit Ventilator
Qty	1
Location	Kitchen
Area Served	Kitchen
Manufacturer	Nesbitt
Model No.	632
Serial No.	-
Cooling Type	No Cooling
Cooling Capacity (Tons)	N/A
Heating Type	Hot Water
Heating Input (MBH)	115 MBH
Supply Fan (HP)	1/4
Supply Fan VFD	☐ Yes ☑ No ☐ N/A
Return Fan (HP)	N/A
Return Fan VFD	☐ Yes ☐ No ☑ N/A
Approx Age	61
ASHRAE Service Life	20
Remaining Life	0
Comments	100% Exhaust

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Terminal Units

Tag	UH-1 to UH-6	FT
Unit Type	Unit Heater	Fin-Tube Radiators
Qty	6	Numerous
Location	Locker Rooms	Perimeter Walls
Area Served	Locker Rooms	Perimeter Walls
Manufacturer	Nesbitt	Nesbitt
Model No.	502 & 632	-
Serial No.	-	-
Cooling Type	No Cooling	No Cooling
Cooling Capacity (Tons)	N/A	N/A
Cooling Efficiency	N/A	N/A
Heating Type	Hot Water	Hot Water
Heating Input (MBH)	33.6 to 60.9 MBH	1.9 MBH per Foot
Heating Efficiency	88% (Boilers)	65% to 88%
Approx Age	47	47
ASHRAE Service Life	20	20
Remaining Life	0	0
Comments		Fin-Tube Radiators Mounted at the ceiling

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Terminal Units

Tag	CUH-1 to CUH-8	UV-1 to UV-48
Unit Type	Unit Heater	Unit Ventilator
Qty	8	48
Location	Vestibules, Corridors, Stairwells, etc.	Classrooms, etc.
Area Served	Vestibules, Corridors, Stairwells, etc.	Classrooms, etc.
Manufacturer	Nesbitt	Nesbitt
Model No.	-	TW-750 to TW-1500
Serial No.	-	-
Cooling Type	No Cooling	No Cooling
Cooling Capacity (Tons)	N/A	N/A
Cooling Efficiency	N/A	N/A
Heating Type	Hot Water	Hot Water
Heating Input (MBH)	12.2 to 18.8 MBH	39 to 115 MBH
Heating Efficiency	88% (Boilers)	65% to 88%
Approx Age	47	47
ASHRAE Service Life	20	20
Remaining Life	0	0
Comments		

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Terminal Units

Tag	Convectors
Unit Type	Console Unit
Qty	8
Location	Restrooms
Area Served	Restrooms
Manufacturer	Warren-Webster
Model No.	-
Serial No.	-
Cooling Type	No Cooling
Cooling Capacity (Tons)	N/A
Cooling Efficiency	N/A
Heating Type	Hot Water
Heating Input (MBH)	1.9 MBH per Foot
Heating Efficiency	65% to 88%
Approx Age	47
ASHRAE Service Life	20
Remaining Life	0
Comments	

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Boilers

Tag	B-1 thru B-4	B-5
Unit Type	Condensing (Water)	Fire-Tube (Water)
Qty	4	1
Location	Boiler Room #1	Boiler Room #2
Area Served	Original 1954 School	1968 Wing Addition
Manufacturer	Aerco	Cleaver-Brooks
Model No.	BMK2.0 GWB	CB 801-80
Serial No.	G-04-0735 thru 0738	L25379
Input Capacity (MBH)	2,000	2,678
Output Capacity (MBH)	1,760	1,875
Approx. Efficiency %	88%	70%
Fuel Type	Natural Gas	Natural Gas
Approx Age	11	47
ASHRAE Service Life	24	25
Remaining Life	13	0
Comments	NORMAL OPERATION is Two Units in Standby	80 BHP

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Domestic Water Heaters

Tag	DHW-1
Unit Type	Automatic Circulating Tank Water Heater
Qty	1
Location	Boiler Room #1
Area Served	Entire Facility
Manufacturer	LAARS
Model #	PNCV1000NACN2BJN
Serial #	C04106915
Storage Size (Gal)	200 gallon RBI Storage Tank
Input Capacity	999,960
Recovery (Gal/Hr)	1,017 GPH
Efficiency %	76%
Fuel	Natural Gas
Approx Age	11
ASHRAE Service Life	15
Remaining Life	4
Comments	3/4 HP Bell & Gosset Circulating Pump Feeds RBI Storage Tank M/N: V200J

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Pumps

Tag	P-1 and P-2	P-8
Unit Type	Base-mounted	Pipe-mounted
Qty	2	1
Location	Boiler Room #1	Boiler Room #1
System Served	Heating Hot Water	Heating Hot Water
Manufacturer	Armstrong	Armstrong
Model #	-	H-53-3 BF
Serial #	-	597
Horse Power	7.5	1/2
Flow Rate (GPM)	800	60
Head Pressure (FTHD)	30	19
Motor Manufacturer	Armstrong	Armstrong
Motor Frame	213JP	-
Electrical Power (V/P/HZ)	208/3/60	208/3/60
Motor RPM	1750	1725
Motor Efficiency %	89.5%	-
Pump VFD	☐ Yes ☐ No ☑ N/A	☐ Yes ☐ No ☑ N/A
Approx Age	15	15
ASHRAE Service Life	18	18
Remaining Life	3	3
Comments	Primary Pumps	Office Section

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Pumps

Tag	P-9	P-10
Unit Type	Base-mounted	Base-mounted
Qty	1	1
Location	Boiler Room #1	Boiler Room #1
System Served	Heating Hot Water	Heating Hot Water
Manufacturer	Bell & Gossett	Bell & Gossett
Model #	Series 1531 3126T	Series 1531 3126T
Serial #	-	-
Horse Power	2	2
Flow Rate (GPM)	120	120
Head Pressure (FTHD)	30	30
Motor Manufacturer	Century	Century
Motor Frame	145JM	145JM
Electrical Power (V/P/HZ)	208/3/60	208/3/60
Motor RPM	1730	1745
Motor Efficiency %	86.5%	86.5%
Pump VFD	☐ Yes ☐ No ☑ N/A	☐ Yes ☐ No ☑ N/A
Approx Age	20	20
ASHRAE Service Life	18	18
Remaining Life	(2)	(2)
Comments	Standby Pump	Classrooms - Upper Section

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Pumps

Tag	P-11	P-12
Unit Type	Base-mounted	Base-mounted
Qty	1	1
Location	Boiler Room #1	Boiler Room #1
System Served	Heating Hot Water	Heating Hot Water
Manufacturer	Bell & Gossett	Bell & Gossett
Model #	Series 1531 3126T	Series 1531 3126T
Serial #	-	-
Horse Power	2	1 1/2
Flow Rate (GPM)	120	90
Head Pressure (FTHD)	30	30
Motor Manufacturer	Baldor	Century
Motor Frame	145JM	145JM
Electrical Power (V/P/HZ)	208/3/60	208/3/60
Motor RPM	1725	1740
Motor Efficiency %	78.5%	86.5%
Pump VFD	☐ Yes ☐ No ☑ N/A	☐ Yes ☐ No ☑ N/A
Approx Age	20	20
ASHRAE Service Life	18	18
Remaining Life	(2)	(2)
Comments	Classrooms Lower Section	Lunchroom & Auditorium

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Pumps

Tag	
Unit Type	Base-mounted
Qty	2
Location	Boiler Room #2
System Served	Heating Hot Water
Manufacturer	Peerless
Model #	F1-820AM BF
Serial #	-
Horse Power	3
Flow Rate (GPM)	100
Head Pressure (FTHD)	50
Motor Manufacturer	U. S. Electric
Motor Frame	182T
Electrical Power (V/P/HZ)	208/3/60
Motor RPM	1740
Motor Efficiency %	78.5%
Pump VFD	☐ Yes ☐ No ☑ N/A
Approx Age	15
ASHRAE Service Life	18
Remaining Life	3
Comments	1968 Wing Addition

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Exhaust Fans

Tag			
Unit Type	Down Blast	Down Blast	Down Blast
Qty	8	2	1
Location	Roof	Roof	Roof
Area Served	-	-	Kitchen
Manufacturer	-	-	-
Model No.	-	-	-
Motor (HP)	1/6	1/4	1/2
Electrical (V/H/P)	115/60/1	115/60/1	203/60/3
Approx Age	47	47	47
ASHRAE Service Life	20	20	20
Remaining Life	0	0	0
Comments	Replace with New EF	Replace with New EF	Replace with New EF

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Exhaust Fans

Tag		
Unit Type	Down Blast	Down Blast
Qty	10	4
Location	Roof	Roof
Area Served	-	Various
Manufacturer	-	Penn Berry
Model No.	-	DX11R
Motor (HP)	1/6	1/6
Electrical (V/H/P)	115/60/1	115/60/1
Approx Age	20	20
ASHRAE Service Life	20	20
Remaining Life	0	0
Comments	Install New EC Motor	Install New EC Motor

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

Kitchen / Misc.

Tag			
Unit Type	Warming Cabinet	Reach-in Refrigerator	Reach-in Refrigerator
Qty	1	1	1
Location	Kitchen	Kitchen	Kitchen
Manufacturer	Metro	Traulsen	Traulsen
Model No.	CM2000		
Fuel	Electric	Electric	Electric
Comments		Single Door	Double Door

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

Kitchen / Misc.

Tag		
Unit Type	Convection Oven	Cold Milk Cooler
Qty	2	1
Location	Kitchen	Kitchen
Manufacturer		Powers Equipment
Model No.		780
Fuel	Electric	Electric
Comments	Double Stack	21.4 Cu Ft

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

APPENDIX E

CEG Project #: 1C15685
Facility Name: Richard Butler School
Address: 30 Pearl Place
City, State, Zip Butler, NJ 07405

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS						LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST				
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, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
1	156 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Prismatic Lens	3	86.2	12	1.03	1,490	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	622	0.60	867	$119	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	$17	$792.00	$855.00	$1,647.00	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	12.61
2	156 - Closet	200	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	1	0.08	16	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	5	0.05	11	$1.48	0	No New Controls	0	0.0%	0	$0	$44.00	$47.50	$91.50	$0.00	61.84	$0.00	$0.00	$0.00	FALSE	-
3	156 - RR	1440	60W A-Lamp, Incandescent	1	60	1	0.06	86	Re-Lamp	TCP 13W LED A21 LED	1	13	1	0.01	19	0.05	68	$9	0	No New Controls	0	0.0%	0	$0	$18.00	$23.75	$41.75	$0.00	4.50	$0.00	$0.00	$0.00	FALSE	-
2	156 - Office	2600	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	1	0.08	203	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	62	0.05	140	$19	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	12	$2	$44.00	$47.50	$91.50	$0.00	4.76	$50.00	$50.00	$100.00	FALSE	58.49
1	157 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Prismatic Lens	3	86.2	12	1.03	1,490	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	622	0.60	867	$119	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	$17	$792.00	$855.00	$1,647.00	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	12.61
1	157 - Storage	200	3-Lamp 1x4 F32T8 32W Surface Strip, Prismatic Lens	3	86.2	1	0.09	17	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	1	0.04	7	0.05	10	$1.38	0	No New Controls	0	0.0%	0	$0	$66.00	$71.25	$137.25	$0.00	99.78	$0.00	$0.00	$0.00	FALSE	-
1	158 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Prismatic Lens	3	86.2	12	1.03	1,490	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	622	0.60	867	$119	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	$17	$792.00	$855.00	$1,647.00	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	12.61
2	158 - Closet	200	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	1	0.08	16	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	5	0.05	11	$1.48	0	No New Controls	0	0.0%	0	$0	$44.00	$47.50	$91.50	$0.00	61.84	$0.00	$0.00	$0.00	FALSE	-
3	158 - RR	1440	60W A-Lamp, Incandescent	1	60	1	0.06	86	Re-Lamp	TCP 13W LED A21 LED	1	13	1	0.01	19	0.05	68	$9	0	No New Controls	0	0.0%	0	$0	$18.00	$23.75	$41.75	$0.00	4.50	$0.00	$0.00	$0.00	FALSE	-
2	158 - Office	2600	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	1	0.08	203	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	62	0.05	140	$19	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	12	$2	$44.00	$47.50	$91.50	$0.00	4.76	$50.00	$50.00	$100.00	FALSE	58.49
2	158 - Storage	200	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	1	0.08	16	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	5	0.05	11	$1.48	0	No New Controls	0	0.0%	0	$0	$44.00	$47.50	$91.50	$0.00	61.84	$0.00	$0.00	$0.00	FALSE	-
4	150's Block - Corridor	1440	2-Lamp 2x4 F32T8 32W Recessed Prismatic Lens	2	62	8	0.50	714	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	8	0.19	276	0.30	438	$60	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	55	$8	$352.00	$380.00	$732.00	$0.00	12.21	$300.00	$50.00	$350.00	FALSE	46.20
1	154 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Prismatic Lens	3	86.2	16	1.38	1,986	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	16	0.58	829	0.80	1,157	$158	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	166	$23	$1,056.00	$1,140.00	$2,196.00	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	9.46
1	153 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Prismatic Lens	3	86.2	16	1.38	1,986	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	16	0.58	829	0.80	1,157	$158	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	166	$23	$1,056.00	$1,140.00	$2,196.00	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	9.46
1	152 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Prismatic Lens	3	86.2	16	1.38	1,986	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	16	0.58	829	0.80	1,157	$158	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	166	$23	$1,056.00	$1,140.00	$2,196.00	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	9.46
1	151 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Prismatic Lens	3	86.2	16	1.38	1,986	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	16	0.58	829	0.80	1,157	$158	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	166	$23	$1,056.00	$1,140.00	$2,196.00	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	9.46
1	150 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Prismatic Lens	3	86.2	16	1.38	1,986	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	16	0.58	829	0.80	1,157	$158	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	166	$23	$1,056.00	$1,140.00	$2,196.00	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	9.46
5	Girls' RR	1440	2-Lamp 1x4 F40T12 34W Surface, Parabolic	2	78	3	0.23	337	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	3	0.07	104	0.16	233	$32	0	No New Controls	0	0.0%	0	$0	$132.00	$142.50	$274.50	$0.00	8.59	$0.00	$0.00	$0.00	FALSE	-
5	Boys' RR	1440	2-Lamp 1x4 F40T12 34W Surface, Parabolic	2	78	3	0.23	337	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	3	0.07	104	0.16	233	$32	0	No New Controls	0	0.0%	0	$0	$132.00	$142.50	$274.50	$0.00	8.59	$0.00	$0.00	$0.00	FALSE	-
6	Main Lobby/Hall	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic	4	156	3	0.47	674	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	3	0.14	207	0.32	467	$64	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	41	$6	$264.00	$285.00	$549.00	$0.00	8.59	$300.00	$50.00	$350.00	FALSE	61.60
6	Main Office Hall	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic	4	156	3	0.47	674	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	3	0.14	207	0.32	467	$64	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	41	$6	$264.00	$285.00	$549.00	$0.00	8.59	$300.00	$50.00	$350.00	FALSE	61.60
2	Main Office	2600	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	6	0.47	1,217	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	6	0.14	374	0.32	842	$115	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	75	$10	$264.00	$285.00	$549.00	$0.00	4.76	$200.00	$50.00	$250.00	$35.00	20.96
2	Principal's Office	2600	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	26	4	0.10	270	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	4	0.10	250	0.01	21	$3	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	50	$7	$176.00	$190.00	$366.00	$0.00	128.44	$200.00	$50.00	$250.00	FALSE	36.55

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS						LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST				
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, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
2	Principal's Office - Closet	200	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	1	0.08	16	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	5	0.05	11	$1.48	0	No New Controls	0	0.0%	0	$0	$44.00	$47.50	$91.50	$0.00	61.84	$0.00	$0.00	$0.00	FALSE	-
7	Principal's Office - RR	1440	100W A-Lamp, Incandescent	1	100	1	0.10	144	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	26	0.08	118	$16	0	No New Controls	0	0.0%	0	$0	$20.00	$47.50	$67.50	$0.00	4.17	$0.00	$0.00	$0.00	FALSE	-
2	Guidance Office	2600	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	4	0.31	811	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	4	0.10	250	0.22	562	$77	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	50	$7	$176.00	$190.00	$366.00	$0.00	4.76	$200.00	$50.00	$250.00	$35.00	31.44
7	Guidance Office - RR	200	100W A-Lamp, Incandescent	1	100	1	0.10	20	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	4	0.08	16	$2.25	0	No New Controls	0	0.0%	0	$0	$20.00	$47.50	$67.50	$0.00	30.04	$0.00	$0.00	$0.00	FALSE	-
2	Faculty Office	2600	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	4	0.31	811	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	4	0.10	250	0.22	562	$77	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	50	$7	$176.00	$190.00	$366.00	$0.00	4.76	$200.00	$50.00	$250.00	$35.00	31.44
2	Faculty Office - Storage	200	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	1	0.08	16	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	5	0.05	11	$1.48	0	No New Controls	0	0.0%	0	$0	$44.00	$47.50	$91.50	$0.00	61.84	$0.00	$0.00	$0.00	FALSE	-
8	Boiler Room	200	300W A-Lamp, Incandescent, Pendant-mounted	1	300	4	1.20	240	Re-Lamp	Hyperikon LED 54-Watt	1	54	4	0.22	43	0.98	197	$27	0	No New Controls	0	0.0%	0	$0	$360.00	$190.00	$550.00	$0.00	20.40	$0.00	$0.00	$0.00	FALSE	-
7	Custodian's Office	2600	100W A-Lamp, Incandescent	1	100	1	0.10	260	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	47	0.08	213	$29	0	No New Controls	0	0.0%	0	$0	$20.00	$47.50	$67.50	$0.00	2.31	$0.00	$0.00	$0.00	FALSE	-
2	Custodian's Office	2600	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	2	0.16	406	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	2	0.05	125	0.11	281	$38	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	25	$3	$88.00	$95.00	$183.00	$0.00	4.76	$50.00	$50.00	$100.00	FALSE	29.24
9	120's Block - Corridor	1440	3-Lamp 2x4 F32T8 32W Recessed Prismatic Lens	3	86.2	7	0.60	869	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	7	0.25	363	0.35	506	$69	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	73	$10	$462.00	$498.75	$960.75	$0.00	13.86	$300.00	$50.00	$350.00	FALSE	35.20
9	Girl's RR	1440	3-Lamp 2x4 F32T8 32W Recessed Prismatic Lens	3	86.2	4	0.34	497	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	4	0.14	207	0.20	289	$40	0	No New Controls	0	0.0%	0	$0	$264.00	$285.00	$549.00	$0.00	13.86	$0.00	$0.00	$0.00	FALSE	-
2	Storage	200	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	1	0.08	16	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	5	0.05	11	$1.48	0	No New Controls	0	0.0%	0	$0	$44.00	$47.50	$91.50	$0.00	61.84	$0.00	$0.00	$0.00	FALSE	-
9	Boy's RR	1440	3-Lamp 2x4 F32T8 32W Recessed Prismatic Lens	3	86.2	4	0.34	497	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	4	0.14	207	0.20	289	$40	0	No New Controls	0	0.0%	0	$0	$264.00	$285.00	$549.00	$0.00	13.86	$0.00	$0.00	$0.00	FALSE	-
1	118 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Prismatic Lens	3	86.2	16	1.38	1,986	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	16	0.58	829	0.80	1,157	$158	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	166	$23	$1,056.00	$1,140.00	$2,196.00	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	9.46
1	119 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Prismatic Lens	3	86.2	16	1.38	1,986	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	16	0.58	829	0.80	1,157	$158	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	166	$23	$1,056.00	$1,140.00	$2,196.00	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	9.46
1	120 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Prismatic Lens	3	86.2	16	1.38	1,986	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	16	0.58	829	0.80	1,157	$158	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	166	$23	$1,056.00	$1,140.00	$2,196.00	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	9.46
1	121 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Prismatic Lens	3	86.2	16	1.38	1,986	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	16	0.58	829	0.80	1,157	$158	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	166	$23	$1,056.00	$1,140.00	$2,196.00	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	9.46
1	122 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Prismatic Lens	3	86.2	16	1.38	1,986	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	16	0.58	829	0.80	1,157	$158	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	166	$23	$1,056.00	$1,140.00	$2,196.00	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	9.46
10	123 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Parabolic Lens	3	86.2	18	1.55	2,234	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	18	0.65	933	0.90	1,301	$178	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	187	$26	$1,188.00	$1,282.50	$2,470.50	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	8.41
2	123 - Classroom Storage	200	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	2	0.16	31	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	2	0.05	10	0.11	22	$3	0	No New Controls	0	0.0%	0	$0	$88.00	$95.00	$183.00	$0.00	61.84	$0.00	$0.00	$0.00	FALSE	-
2	Outdoor Storage Closet 1	200	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	1	0.08	16	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	5	0.05	11	$1.48	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	$0	$44.00	$47.50	$91.50	$0.00	61.84	$50.00	$50.00	$100.00	FALSE	760.34
2	Outdoor Storage Closet 2	200	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	1	0.08	16	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	5	0.05	11	$1.48	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	$0	$44.00	$47.50	$91.50	$0.00	61.84	$50.00	$50.00	$100.00	FALSE	760.34
10	124 - Computer Lab	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Parabolic Lens	3	86.2	18	1.55	2,234	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	18	0.65	933	0.90	1,301	$178	5	Dual Technology Occupancy Sensor - Remote Mnt.	2	20.0%	187	$26	$1,188.00	$1,282.50	$2,470.50	$0.00	13.86	$400.00	$100.00	$500.00	$35.00	18.19
10	125 - Library	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Parabolic Lens	3	86.2	24	2.07	2,979	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	24	0.86	1,244	1.20	1,735	$238	5	Dual Technology Occupancy Sensor - Remote Mnt.	2	20.0%	249	$34	$1,584.00	$1,710.00	$3,294.00	$0.00	13.86	$400.00	$100.00	$500.00	$35.00	13.64
4	Main Corridor, by APR	1440	2-Lamp 2x4 F32T8 32W Recessed Prismatic Lens	2	62	2	0.12	179	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	2	0.05	69	0.08	109	$15	0	No New Controls	0	0.0%	0	$0	$88.00	$95.00	$183.00	$0.00	12.21	$0.00	$0.00	$0.00	FALSE	-

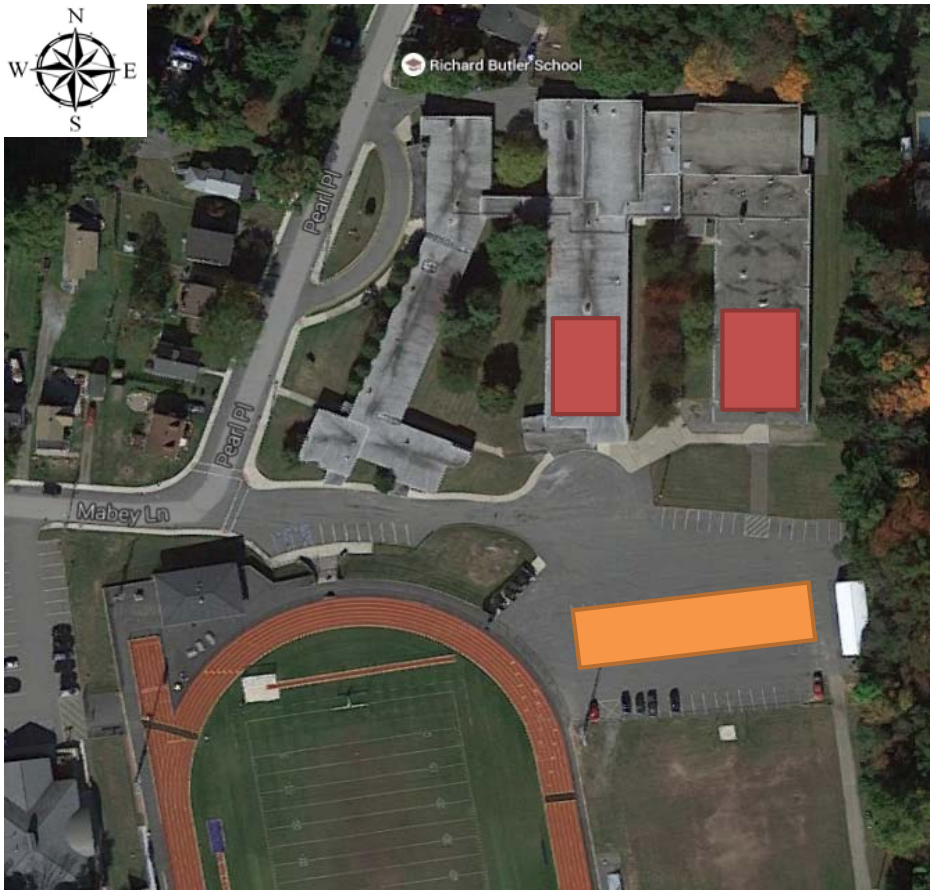
			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST				
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work 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, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
9	Main Corridor, by APR	1440	3-Lamp 2x4 F32T8 32W Recessed Prismatic Lens	3	86.2	2	0.17	248	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	2	0.07	104	0.10	145	$20	0	No New Controls	0	0.0%	0	$0	$132.00	$142.50	$274.50	$0.00	13.86	$0.00	$0.00	$0.00	FALSE	-
11	Main Corridor, by APR	1440	4-Lamp 2x4 F32T8 32W Recessed Prismatic Lens	4	106.7	2	0.21	307	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	138	0.12	169	$23	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	28	$4	$176.00	$142.50	$318.50	$0.00	13.75	$300.00	$50.00	$350.00	FALSE	92.40
1	Cafeteria	2600	3-Lamp 1x4 F32T8 32W Surface Strip, Prismatic Lens	3	86.2	28	2.41	6,275	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	28	1.01	2,621	1.41	3,655	$501	0	No New Controls	0	0.0%	0	$0	$1,848.00	$1,995.00	$3,843.00	$0.00	7.68	$0.00	$0.00	$0.00	FALSE	-
2	Kitchen Hall	1440	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	2	0.16	225	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	2	0.05	69	0.11	156	$21	0	No New Controls	0	0.0%	0	$0	$88.00	$95.00	$183.00	$0.00	8.59	$0.00	$0.00	$0.00	FALSE	-
9	Kitchen	600	3-Lamp 2x4 F32T8 32W Recessed Prismatic Lens	3	86.2	4	0.34	207	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	4	0.14	86	0.20	120	$17	0	No New Controls	0	0.0%	0	$0	$264.00	$285.00	$549.00	$0.00	33.26	$0.00	$0.00	$0.00	FALSE	-
3	Kitchen Storage	200	60W A-Lamp, Incandescent	1	60	2	0.12	24	Re-Lamp	TCP 13W LED A21 LED	1	13	2	0.03	5	0.09	19	$2.58	0	No New Controls	0	0.0%	0	$0	$36.00	$47.50	$83.50	$0.00	32.42	$0.00	$0.00	$0.00	FALSE	-
3	Kitchen Storage	200	60W A-Lamp, Incandescent	1	60	2	0.12	24	Re-Lamp	TCP 13W LED A21 LED	1	13	2	0.03	5	0.09	19	$2.58	0	No New Controls	0	0.0%	0	$0	$36.00	$47.50	$83.50	$0.00	32.42	$0.00	$0.00	$0.00	FALSE	-
12	All-Purpose Room	1440	400W MH, Pendant-mounted, Prismatic Lens	1	460	12	5.52	7,949	By-Pass/Re-Lamp	400 Watt HID LED Retrofit (100 W)	1	100	12	1.20	1,728	4.32	6,221	$852	0	No New Controls	0	0.0%	0	$0	$3,600.00	$1,140.00	$4,740.00	$0.00	5.56	$0.00	$0.00	$0.00	FALSE	-
13	All-Purpose Room	1440	300W A-Lamp, Incandescent	1	300	12	3.60	5,184	Re-Lamp	Hyperikon LED 54-Watt	1	54	12	0.65	933	2.95	4,251	$582	0	No New Controls	0	0.0%	0	$0	$1,080.00	$570.00	$1,650.00	$0.00	2.83	$0.00	$0.00	$0.00	FALSE	-
14	APR Stage	200	300W A-Lamp, Incandescent, Wall-mounted	1	300	4	1.20	240	Re-Lamp	Hyperikon LED 54-Watt	1	54	4	0.22	43	0.98	197	$27	0	No New Controls	0	0.0%	0	$0	$360.00	$190.00	$550.00	$0.00	20.40	$0.00	$0.00	$0.00	FALSE	-
15	Nurse's Office	2600	4-Lamp 1x4 F40T12 34W Surface, Wrap Lens	4	119	5	0.60	1,547	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	5	0.24	624	0.36	923	$126	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	125	$17	$440.00	$475.00	$915.00	$0.00	7.24	$200.00	$50.00	$250.00	$35.00	12.57
3	Nurse's Office - Storage	200	60W A-Lamp, Incandescent	1	60	1	0.06	12	Re-Lamp	TCP 13W LED A21 LED	1	13	1	0.01	3	0.05	9	$1.29	0	No New Controls	0	0.0%	0	$0	$18.00	$23.75	$41.75	$0.00	32.42	$0.00	$0.00	$0.00	FALSE	-
4	Nurse's Office - RR	1440	2-Lamp 2x4 F32T8 32W Recessed Prismatic Lens	2	62	1	0.06	89	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	35	0.04	55	$7.50	0	No New Controls	0	0.0%	0	$0	$44.00	$47.50	$91.50	$0.00	12.21	$0.00	$0.00	$0.00	FALSE	-
2	Girl's Locker Room	1440	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	6	0.47	674	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	6	0.14	207	0.32	467	$64	0	No New Controls	0	0.0%	0	$0	$264.00	$285.00	$549.00	$0.00	8.59	$0.00	$0.00	$0.00	FALSE	-
6	Girl's Shower	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic	4	156	2	0.31	449	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	138	0.22	311	$43	0	No New Controls	0	0.0%	0	$0	$176.00	$190.00	$366.00	$0.00	8.59	$0.00	$0.00	$0.00	FALSE	-
2	Boy's Locker Room	1440	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	6	0.47	674	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	6	0.14	207	0.32	467	$64	0	No New Controls	0	0.0%	0	$0	$264.00	$285.00	$549.00	$0.00	8.59	$0.00	$0.00	$0.00	FALSE	-
6	Boy's Shower	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic	4	156	2	0.31	449	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	138	0.22	311	$43	0	No New Controls	0	0.0%	0	$0	$176.00	$190.00	$366.00	$0.00	8.59	$0.00	$0.00	$0.00	FALSE	-
15	Gym Side-Corridor/Stairs	1440	4-Lamp 1x4 F40T12 34W Surface, Wrap Lens	4	119	9	1.07	1,542	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	9	0.43	622	0.64	920	$126	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	2	20.0%	124	$17	$792.00	$855.00	$1,647.00	$0.00	13.07	$600.00	$100.00	$700.00	FALSE	41.07
16	Gym	2600	400W MH, High-Bay, Pendant-mounted, Prismatic Lens	1	460	24	11.04	28,704	By-Pass/Re-Lamp	400 Watt HID LED Retrofit (100 W)	1	100	24	2.40	6,240	8.64	22,464	$3,078	0	No New Controls	0	0.0%	0	$0	$7,200.00	$2,280.00	$9,480.00	$0.00	3.08	$0.00	$0.00	$0.00	FALSE	-
3	Gym Closet	200	60W A-Lamp, Incandescent	1	60	1	0.06	12	Re-Lamp	TCP 13W LED A21 LED	1	13	1	0.01	3	0.05	9	$1.29	0	No New Controls	0	0.0%	0	$0	$18.00	$23.75	$41.75	$0.00	32.42	$0.00	$0.00	$0.00	FALSE	-
17	Main Corridor, by Gym	1440	4-Lamp 1x8 F96T12 60W Surface, Wrap Prismatic Lens	4	217.4	1	0.22	313	New Fixture	1x8 8-Lamp LED T8 12 Watt	8	96	1	0.10	138	0.12	175	$24	0	No New Controls	0	0.0%	0	$0	$180.00	$95.00	$275.00	$0.00	11.48	$0.00	$0.00	$0.00	FALSE	-
15	Main Corridor, by Gym	1440	4-Lamp 1x4 F40T12 34W Surface, Wrap Lens	4	119	3	0.36	514	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	3	0.14	207	0.21	307	$42	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	41	$6	$264.00	$285.00	$549.00	$0.00	13.07	$300.00	$50.00	$350.00	FALSE	61.60
6	Boy's RR	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic	4	156	3	0.47	674	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	3	0.14	207	0.32	467	$64	0	No New Controls	0	0.0%	0	$0	$264.00	$285.00	$549.00	$0.00	8.59	$0.00	$0.00	$0.00	FALSE	-
3	Janitor's Closet	200	60W A-Lamp, Incandescent	1	60	1	0.06	12	Re-Lamp	TCP 13W LED A21 LED	1	13	1	0.01	3	0.05	9	$1.29	0	No New Controls	0	0.0%	0	$0	$18.00	$23.75	$41.75	$0.00	32.42	$0.00	$0.00	$0.00	FALSE	-
6	Girl's RR	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic	4	156	3	0.47	674	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	3	0.14	207	0.32	467	$64	0	No New Controls	0	0.0%	0	$0	$264.00	$285.00	$549.00	$0.00	8.59	$0.00	$0.00	$0.00	FALSE	-

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS						LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST				
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, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
15	Gym Office Hallway	1440	4-Lamp 1x4 F40T12 34W Surface, Wrap Lens	4	119	2	0.24	343	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	138	0.14	204	$28	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	28	$4	$176.00	$190.00	$366.00	$0.00	13.07	$50.00	$50.00	$100.00	FALSE	26.40
2	Gym Storage	200	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	3	0.23	47	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	3	0.07	14	0.16	32	$4	0	No New Controls	0	0.0%	0	$0	$132.00	$142.50	$274.50	$0.00	61.84	$0.00	$0.00	$0.00	FALSE	-
2	Gym Storage	200	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	2	0.16	31	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	2	0.05	10	0.11	22	$3	0	No New Controls	0	0.0%	0	$0	$88.00	$95.00	$183.00	$0.00	61.84	$0.00	$0.00	$0.00	FALSE	-
20	Gym Office	2600	2-Lamp 1x8 F96T12 60 Watt	2	115	2	0.23	598	New Fixture	1x8 8-Lamp LED T8 12 Watt	4	48	2	0.10	250	0.13	348	$48	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	50	$7	$360.00	$190.00	$550.00	$0.00	11.52	$50.00	$50.00	$100.00	$20.00	11.70
20	Gym Office	2600	2-Lamp 1x8 F96T12 60 Watt	2	115	2	0.23	598	New Fixture	1x8 8-Lamp LED T8 12 Watt	4	48	2	0.10	250	0.13	348	$48	0	No New Controls	0	0.0%	0	$0	$360.00	$190.00	$550.00	$0.00	11.52	$0.00	$0.00	$0.00	FALSE	-
18	300 - Classroom	1440	3-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	3	92	16	1.47	2,120	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	16	0.58	829	0.90	1,290	$177	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	166	$23	$1,056.00	$1,140.00	$2,196.00	$0.00	12.42	$200.00	$50.00	$250.00	$35.00	9.46
6	CR 300 Storage	200	4-Lamp 2x4 F40T12 34W Recessed Prismatic	4	156	1	0.16	31	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	1	0.05	10	0.11	22	$2.96	0	No New Controls	0	0.0%	0	$0	$88.00	$95.00	$183.00	$0.00	61.84	$0.00	$0.00	$0.00	FALSE	-
6	Hall Storage	200	4-Lamp 2x4 F40T12 34W Recessed Prismatic	4	156	1	0.16	31	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	1	0.05	10	0.11	22	$2.96	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	2	$0	$88.00	$95.00	$183.00	$0.00	61.84	$50.00	$50.00	$100.00	FALSE	380.17
8	Boiler Room	200	300W A-Lamp, Incandescent, Pendant-mounted	1	300	6	1.80	360	Re-Lamp	Hyperikon LED 54-Watt	1	54	6	0.32	65	1.48	295	$40	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	13	$2	$540.00	$285.00	$825.00	$0.00	20.40	$50.00	$50.00	$100.00	$20.00	45.06
6	300 Block - Corridor	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic	4	156	11	1.72	2,471	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	11	0.53	760	1.19	1,711	$234	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	2	20.0%	152	$21	$968.00	$1,045.00	$2,013.00	$0.00	8.59	$600.00	$100.00	$700.00	FALSE	33.60
19	300 Block - Corridor	1440	2-Lamp 1x3 F30T12 30W Surface, Strip, Prismatic Lens	2	59.8	9	0.54	775	New Fixture	2-Lamp LED T8 12 Watt Fixture	2	24	9	0.22	311	0.32	464	$64	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	3	20.0%	62	$9	$1,215.00	$855.00	$2,070.00	$0.00	32.57	$900.00	$150.00	$1,050.00	FALSE	123.20
2	Faculty Office/ Toilet/Storage	200	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	7	0.55	109	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	7	0.17	34	0.38	76	$10	0	No New Controls	0	0.0%	0	$0	$308.00	$332.50	$640.50	$0.00	61.84	$0.00	$0.00	$0.00	FALSE	-
10	302 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Parabolic Lens	3	86.2	15	1.29	1,862	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	15	0.54	778	0.75	1,084	$149	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	156	$21	$990.00	$1,068.75	$2,058.75	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	10.09
10	304 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Parabolic Lens	3	86.2	15	1.29	1,862	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	15	0.54	778	0.75	1,084	$149	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	156	$21	$990.00	$1,068.75	$2,058.75	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	10.09
10	306 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Parabolic Lens	3	86.2	15	1.29	1,862	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	15	0.54	778	0.75	1,084	$149	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	156	$21	$990.00	$1,068.75	$2,058.75	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	10.09
10	308 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Parabolic Lens	3	86.2	15	1.29	1,862	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	15	0.54	778	0.75	1,084	$149	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	156	$21	$990.00	$1,068.75	$2,058.75	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	10.09
10	310 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Parabolic Lens	3	86.2	15	1.29	1,862	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	15	0.54	778	0.75	1,084	$149	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	156	$21	$990.00	$1,068.75	$2,058.75	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	10.09
10	312 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Parabolic Lens	3	86.2	15	1.29	1,862	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	15	0.54	778	0.75	1,084	$149	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	156	$21	$990.00	$1,068.75	$2,058.75	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	10.09
10	309 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Parabolic Lens	3	86.2	15	1.29	1,862	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	15	0.54	778	0.75	1,084	$149	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	156	$21	$990.00	$1,068.75	$2,058.75	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	10.09
10	307 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Parabolic Lens	3	86.2	15	1.29	1,862	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	15	0.54	778	0.75	1,084	$149	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	156	$21	$990.00	$1,068.75	$2,058.75	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	10.09
10	305 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Parabolic Lens	3	86.2	15	1.29	1,862	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	15	0.54	778	0.75	1,084	$149	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	156	$21	$990.00	$1,068.75	$2,058.75	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	10.09
10	303 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Parabolic Lens	3	86.2	15	1.29	1,862	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	15	0.54	778	0.75	1,084	$149	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	156	$21	$990.00	$1,068.75	$2,058.75	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	10.09
2	303 - Classroom Storage	200	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	1	0.08	16	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	5	0.05	11	$1	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	1	$0	$44.00	$47.50	$91.50	$0.00	61.84	$200.00	$50.00	$250.00	FALSE	1900.85
10	301 - Classroom	1440	3-Lamp 1x4 F32T8 32W Surface Strip, Parabolic Lens	3	86.2	15	1.29	1,862	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	15	0.54	778	0.75	1,084	$149	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	156	$21	$990.00	$1,068.75	$2,058.75	$0.00	13.86	$200.00	$50.00	$250.00	$35.00	10.09
2	301 - Classroom Storage	200	2-Lamp 1x4 F40T12 34W Surface, Wrap Prismatic Lens	2	78	1	0.08	16	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	5	0.05	11	$1.48	0	No New Controls	0	0.0%	0	$0	$44.00	$47.50	$91.50	$0.00	61.84	$0.00	$0.00	$0.00	FALSE	-

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS						LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST				
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, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
19	Emergency Lights	8760	Exit Sign, 2-Lamp 7W CFL	2	14	18	0.25	2,208	New Fixture	LED Exit Sign with LED Emergency lites	1	2	18	0.04	315	0.22	1,892	$259	0	No New Controls	0	0.0%	0	$0	$990.00	$855.00	$1,845.00	$0.00	7.12	$0.00	$0.00	$0.00	FALSE	-
7	Penthouse Mechanical Room	200	100W A-Lamp, Incandescent	1	100	1	0.10	20	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	3.60	0.08	16	$2.25	0	No New Controls	0	0.0%	0	$0	$20.00	$47.50	$67.50	$0.00	30.04	$0.00	$0.00	$0.00	FALSE	-
23	Exterior Wall Packs	4000	RAB 70 Watt MH Wall-Mount	1	93	8	0.74	2,976	Replace	RAB 18W LED Wall Pack	1	18	8	0.14	576	0.60	2,400	$329	0	No New Controls	0	0.0%	0	$0	$2,080.00	$1,520.00	$3,600.00	$0.00	10.95	$0.00	$0.00	$0.00	FALSE	-
21	Canopy Ceiling-Mounted Box Fixture	4000	8"x8" 72 Watt A-Lamp Ceiling Mounted Box Fixture	1	72	2	0.14	576	Re-Lamp	Philips 18W LED A-Lamp	1	18	2	0.04	144	0.11	432	$59	0	No New Controls	0	0.0%	0	$0	$40.00	$95.00	$135.00	$0.00	2.28	$0.00	$0.00	$0.00	FALSE	-
22	Canopy Fixtures	4000	1x1 72Watt Incand Canopy Ceiling Fixture	1	72	6	0.43	1,728	Re-Lamp	Philips 18W LED A-Lamp	1	18	6	0.11	432	0.32	1,296	$178	0	No New Controls	0	0.0%	0	$0	$120.00	$285.00	$405.00	$0.00	2.28	$0.00	$0.00	$0.00	FALSE	-
24	Exterior Wall-MountedFixture	4000	72 Watt A-Lamp Jar	1	72	1	0.07	288	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	72	0.05	216	$30	0	No New Controls	0	0.0%	0	$0	$20.00	$47.50	$67.50	$0.00	2.28	$0.00	$0.00	$0.00	FALSE	-
25	Exterior Wall-MountedFixture	4000	23 Watt CFL Jar	1	23	1	0.02	92	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	72	0.01	20	$2.74	0	No New Controls	0	0.0%	0	$0	$20.00	$47.50	$67.50	$0.00	24.64	$0.00	$0.00	$0.00	FALSE	-
	TOTAL					**739**	**82.88**	**134,421**					**739**	**27.84**	**44,172**	**55.04**	**90,249**	**$12,364**			**58**	**10**	**5,644**	**$773**	**$58,697**	**$52,298**	**$110,995**	**$0**	**8.98**	**$11,550**	**$2,900**	**$14,450**	**$1,160.00**	**17.19**

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
Butler School	12600	SHARP ND-240QCJ	614	17.5	10,770	147.36	176,324	134.0	25,727	13.68



= Proposed PV Roof Layout

= Proposed PV Parking Layout

Notes:

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

Project Name: LGEA Solar PV Project - Butler School
Location: Butler, NJ
Description: Photovoltaic System 100% Financing - 15 year

Simple Payback Analysis

	Photovoltaic System 100% Financing - 15 year
Total Construction Cost	$705,000
Annual kWh Production	176,324
Annual Energy Cost Reduction	$24,156
Average Annual SREC Revenue	$26,714

Simple Payback: **13.86** Years

Life Cycle Cost Analysis

Analysis Period (years):	15	Financing %:	100%
Discount Rate:	3%	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.137**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	6.00%	Average SREC Value ($/kWh)	$0.152

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	176,324	$24,156	$0	$44,081	$41,487	$29,904	($3,153)	($3,153)
2	$0	175,443	$24,881	$0	$43,861	$39,642	$31,748	($2,649)	($5,801)
3	$0	174,565	$25,628	$0	$43,641	$37,684	$33,706	($2,121)	($7,923)
4	$0	173,692	$26,396	$0	$34,738	$35,605	$35,785	($10,255)	($18,178)
5	$0	172,824	$27,188	$1,780	$34,565	$33,398	$37,992	($11,417)	($29,596)
6	$0	171,960	$28,004	$1,771	$34,392	$31,055	$40,336	($10,766)	($40,361)
7	$0	171,100	$28,844	$1,762	$25,665	$28,567	$42,824	($18,644)	($59,005)
8	$0	170,245	$29,709	$1,754	$25,537	$25,926	$45,465	($17,898)	($76,903)
9	$0	169,393	$30,601	$1,745	$25,409	$23,121	$48,269	($17,125)	($94,028)
10	$0	168,546	$31,519	$1,736	$16,855	$20,144	$51,246	($24,753)	($118,781)
11	$0	167,704	$32,464	$1,727	$16,770	$16,983	$54,407	($23,883)	($142,664)
12	$0	166,865	$33,438	$1,719	$16,687	$13,628	$57,762	($22,984)	($165,648)
13	$0	166,031	$34,441	$1,710	$8,302	$10,065	$61,325	($30,358)	($196,006)
14	$0	165,201	$35,475	$1,702	$8,260	$6,283	$65,108	($29,357)	($225,363)
15	$0	164,375	$36,539	$1,693	$8,219	$2,267	$69,123	($28,326)	($253,689)
	Totals:	2,554,268	$449,283	$19,099	$386,981	$365,854	$705,000	($253,689)	($1,437,099)

Net Present Value (NPV) **($177,140)**

PVWatts: Monthly PV Performance Data — Rooftop Array

Requested Location:	30 Pearl Place Butler, New Jersey
Location:	NEWARK, NJ
Lat (deg N):	40.7
Long (deg W):	74.17
Elev (m):	9
DC System Size (kW):	70.56
Module Type:	Standard
Array Type:	Fixed (roof mount)
Array Tilt (deg):	10
Array Azimuth (deg):	180
System Losses:	14
Invert Efficiency:	96
DC to AC Size Ratio:	1.1
Average Cost of Electricity	0.13
Initial Cost	No initial cost defined
Cost of Electricity Generate	not determined

Month	AC System Output(kWh)	Solar Radiation (kWh/m^2/day)	Plane of Array Irradiance (W/m^2)	DC array Output (kWh)	Value ($)
1	4,500	2.39	74.17	4,736	594.05
2	5,338	3.17	88.64	5,600	704.58
3	7,436	4.07	126.24	7,787	981.53
4	8,250	4.83	144.98	8,641	1,088.95
5	9,747	5.70	176.64	10,196	1,286.65
6	9,572	5.94	178.16	10,023	1,263.53
7	9,499	5.77	178.77	9,944	1,253.89
8	8,790	5.38	166.77	9,197	1,160.23
9	7,569	4.65	139.55	7,924	999.12
10	6,266	3.61	112.05	6,569	827.06
11	4,107	2.35	70.54	4,331	542.15
12	3,715	2.01	62.39	3,926	490.38
Total	84,789	49.88	1518.89	88,875	11192.12

PVWatts: Monthly PV Performance Data **Parking Lot Array**

Requested Location:	30 Pearl Place Butler, New Jersey
Location:	NEWARK, NJ
Lat (deg N):	40.7
Long (deg W):	74.17
Elev (m):	9
DC System Size (kW):	76.8
Module Type:	Standard
Array Type:	Fixed (open rack)
Array Tilt (deg):	7.5
Array Azimuth (deg):	180
System Losses:	14
Invert Efficiency:	96
DC to AC Size Ratio:	1.1
Average Cost of Electricity	0.13
Initial Cost	No initial cost defined
Cost of Electricity Generate	not determined

Month	AC System Output(kWh)	Solar Radiation (kWh/m^2/day)	Plane of Array Irradiance (W/m^2)	DC array Output (kWh)	Value ($)
1	4,684	2.29	70.92	4,934	618.25
2	5,646	3.06	85.79	5,926	745.25
3	7,982	3.99	123.66	8,360	1,053.57
4	8,980	4.79	143.58	9,406	1,185.38
5	10,684	5.68	176.06	11,174	1,410.27
6	10,530	5.94	178.09	11,024	1,389.99
7	10,431	5.76	178.41	10,919	1,376.94
8	9,611	5.34	165.51	10,056	1,268.67
9	8,175	4.57	137.13	8,559	1,079.14
10	6,658	3.51	108.69	6,983	878.84
11	4,303	2.26	67.82	4,542	568.01
12	3,851	1.92	59.56	4,076	508.34
Total	91,535	49.10	1495.23	95,958	12082.65