

BUTLER BOARD OF EDUCATION

BUTLER HIGH SCHOOL

**38 BARTHOLDI AVENUE
BUTLER, NJ 07405**

FACILITY ENERGY REPORT

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I. HISTORIC ENERGY CONSUMPTION/COST

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

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:	GSG (HTG) and Large Volume Gas (LVG)
Third Party Supplier:	ACES (Direct Energy)

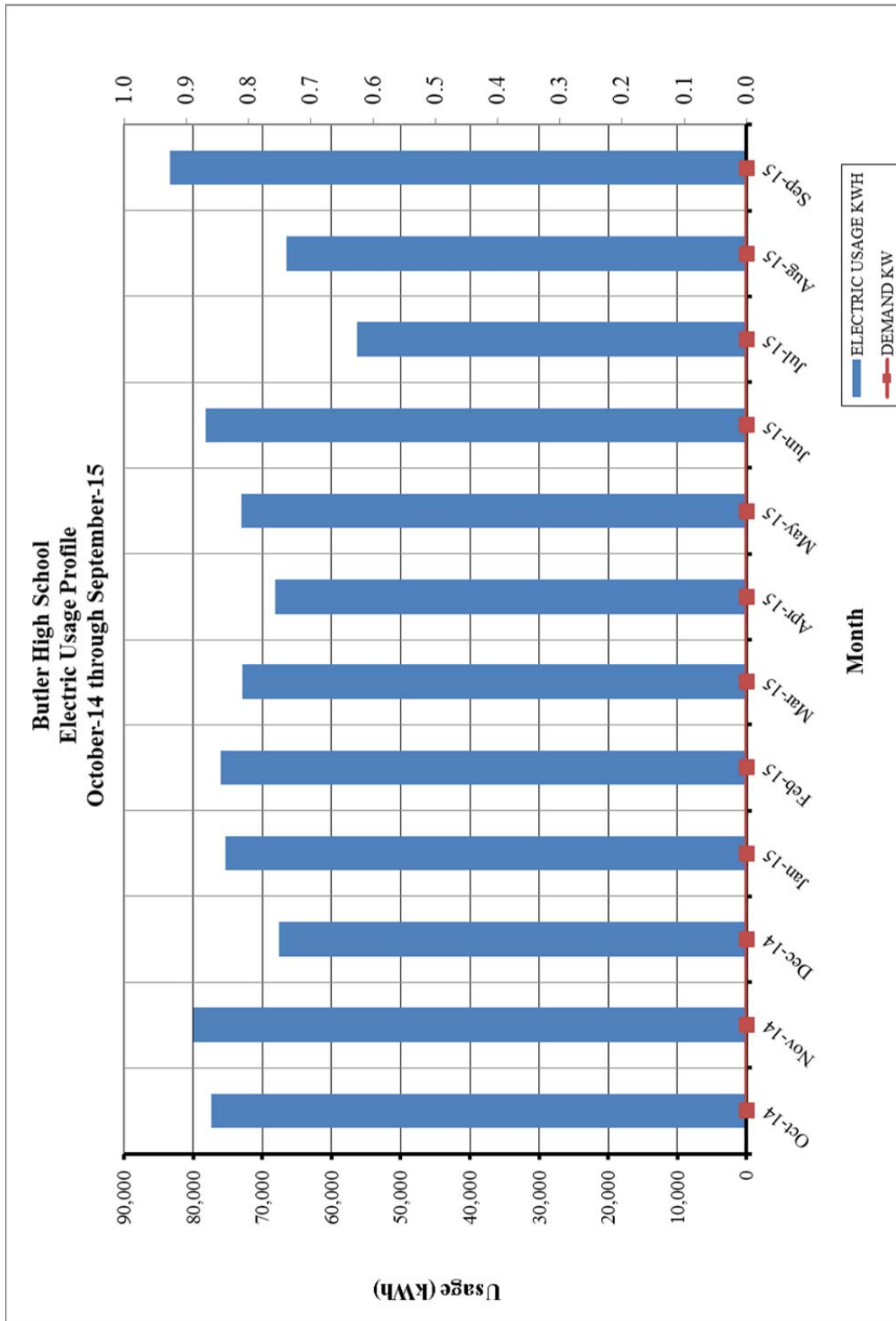
The electric usage profile represents the actual electrical usage for the facility. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts 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 Power & Light			
Rate: Commercial Base Rate			
Meter No: N/A			
Account No: #823-7, #823-8, #823-9			
Third Party Utility Provider: N/A			
TPS Meter / Acct No: N/A			
MONTH OF USE	CONSUMPTION KWH	DEMAND KW	TOTAL BILL
Oct-14	77,320	0.0	\$10,952
Nov-14	80,000	0.0	\$11,326
Dec-14	67,660	0.0	\$9,606
Jan-15	75,360	0.0	\$10,315
Feb-15	75,980	0.0	\$10,399
Mar-15	72,840	0.0	\$9,976
Apr-15	68,160	0.0	\$9,235
May-15	73,040	0.0	\$9,883
Jun-15	78,260	0.0	\$10,577
Jul-15	56,300	0.0	\$7,571
Aug-15	66,540	0.0	\$8,916
Sep-15	83,360	0.0	\$11,126
Totals	874,820	0.0 Max	\$119,881
AVERAGE DEMAND		0.0 KW average	
AVERAGE RATE		\$0.137 \$/kWh	

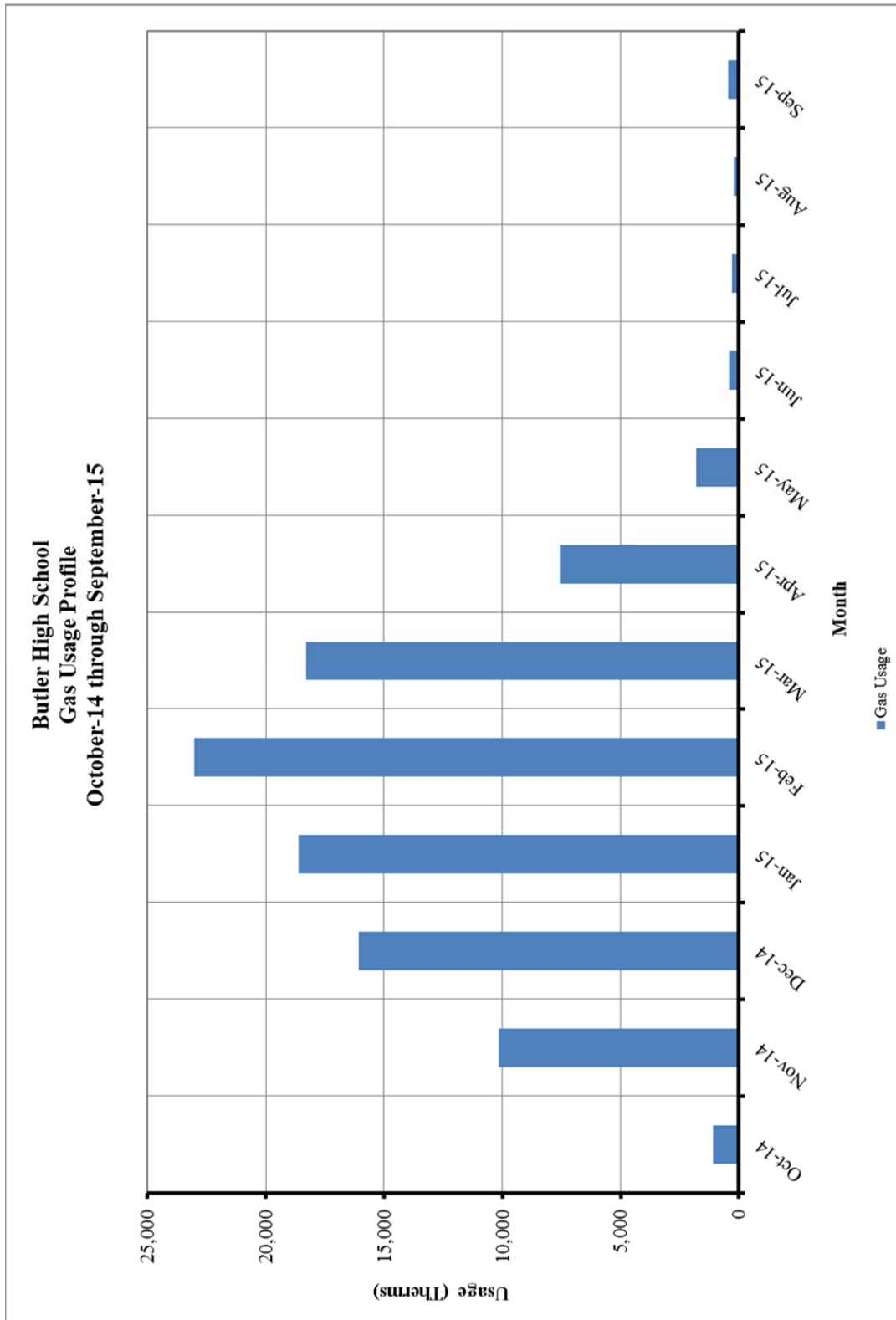
Figure 1
Electricity Usage Profile



**Table 2
Natural Gas Billing Data**

NATURAL GAS USAGE SUMMARY		
Utility Provider: PSE&G		
Rate: GSG(HTG) / LVG		
Meter No: 3227855 / 2344533 / 3566484		
Account No: 65 728 472 09		
Third Party Utility Provider: South Jersey Energy Company		
TPS Meter No: -		
MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
Oct-14	1,095.34	\$899.97
Nov-14	10,147.12	\$9,036.43
Dec-14	16,049.71	\$13,719.23
Jan-15	18,616.48	\$16,900.56
Feb-15	23,015.28	\$19,139.60
Mar-15	18,284.23	\$15,143.29
Apr-15	7,574.90	\$4,525.56
May-15	1,811.00	\$1,271.12
Jun-15	396.11	\$249.93
Jul-15	307.03	\$220.76
Aug-15	222.29	\$200.56
Sep-15	469.70	\$300.39
TOTALS	97,989.19	\$81,607.40
AVERAGE RATE:	\$0.83	\$/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	874,820.0			2,986,635	3.140	9,378,035
NATURAL GAS		97,989.2		9,798,919	1.050	10,288,865
TOTAL				12,785,554		19,666,900
*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	101,921	SQUARE FEET				
BUILDING SITE EUI	125.45	kBtu/SF/YR		58.2	kBtu/SF/YR	
BUILDING SOURCE EUI	192.96	kBtu/SF/YR		141.5	kBtu/SF/YR	
				36%	Less Efficient than PEER Comparison	

III. FACILITY DESCRIPTION

The Butler High School Campus is located at 38 Bartholdi Avenue in Butler, New Jersey. The campus is comprised of the Annex (1906), the original Main High School Building (1922) and the Art Building (1964) that all total to 101,980 SF building with additions in 1912 (Annex) and in 1938 (Main Building-High School). The campus is comprised of main offices, classrooms, science rooms, computer rooms, IT office, gymnasium, cafeteria, kitchen, faculty dining, auditorium/stage, locker rooms, food lab, weight room, auxiliary gym, guidance offices, library, nurse's office, music room, band room, faculty rooms, restrooms, Board of Education offices, boiler rooms and other utility/storage rooms.

Occupancy Profile

The typical hours of operation for the school are Monday through Friday between 6:00 am and 9:30 pm, with custodial staff on site afterhours till approximately 11 pm. For approximately half of the year, one-half of the building is used on Saturdays from 7:30 am to 5:30 pm since this facility is also a community center. Additional events occur throughout the year after hours in the facility. The school has an enrollment of approximately 497 students and 95 staff.

Building Envelope

Exterior walls for the high school building are masonry brick faced with a concrete block construction with structural steel framing. The windows throughout the main high school building facility were replaced and are in good condition with double pane, 1/4" coated glass interior blinds and aluminum frames. Doors are double-pane with aluminum frames.

The windows in the 1964 art building addition are single-pane, operable, 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 1964 Art Building Addition with high-efficiency, double pane low-E glass with thermal break spacers, insulated glass, interior blinds and new aluminum window frames.

The roofing systems for the high school buildings are 4-ply asphalt and gravel built-up roofs with organic felts over 1 inch of fiberboard insulation over a rosin paper barrier over concrete decking. The Annex building has a pitched roof with asphalt shingles.

HVAC Systems

In general, the high school HVAC systems consist of two (2) gas-fired, fire-tube hot water boilers; two (2) heating hot water pumps; six (6) cooling only packaged rooftop units; eleven (11) large heating & ventilating units; four (4) large horizontal unit ventilators; numerous rooftop

exhaust fans; vertical/horizontal unit ventilators with fin-tube radiators along all of the perimeter walls; air-cooled split condensers; and numerous hot water unit heaters, hot water radiators, hot water convectors, and ceiling cabinet heaters in the entrances, vestibules, main corridors, stairwells, restrooms, basement hallways, etc.

The heating hot water system located in the Art Building boiler room includes two (2) Cleaver-Brooks Model CB428-250 gas-fired fire-tube boilers rated at 10,461 MBH input with a thermal efficiency of 67% (present age and condition). The heating hot water is pumped to the various hot water coils throughout both high school buildings by two (2) Weinman Model 4095CV base-mounted, double-suction, centrifugal pumps. Each of these pumps has a flow of 480 GPM at 60 feet of TDH and a 10-HP Baldor motor with an efficiency of 91.7%.

The Annex is heated by a Weil-McLain Model 680 cast-iron sectional steam boiler rated at 634 MBH and a fuel-to-steam efficiency of 80.5%. Other equipment includes a Fulton flash tank, numerous steam traps, and steam radiators throughout the Annex building.

The Main Building Auditorium/Stage is heated and ventilated by five (5) large hot water unit ventilators and fin-tube radiators around the perimeter walls. The various offices, classrooms, faculty room, etc. by various sizes of Nesbitt unit ventilators ranging in size from 2,000 to 750 CFM and rated at from 20.5 MBH to 74.7 MBH. The larger unit ventilators are rated from 112.3 MBH to 147.4 MBH. The Cafeteria is heated and ventilated by two (2) large vertical unit ventilators located at the window perimeter wall. The Auxiliary Gym, Boy's and Girl's Locker Rooms, Art Building basement, Music Rooms, etc. are heated and ventilated by central heating & ventilating units manufactured by Buffalo Forge that are located in various equipment rooms and closets. These H&V units are each rated from 112.3 to 147.5 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 each.

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-2000 vertical unit ventilators that have hot water heating. These unit ventilators are rated from 750 CFM to 2,000 CFM with heating capacity from 20 to 115 MBH each.

The stairwells, entrance vestibules, and corridors are heated by various hot water convectors, hot water radiators, and ceiling unit heaters rated at 14.8 MBH to 44.9 MBH of heating capacity. 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 each.

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 auditorium, music rooms, aux gym, locker rooms, art building basement, etc. receive fresh air from the heating & ventilating unit located in the various equipment rooms.

Most of the original main high school building is cooled by six (6) Trane Model SACA-753-B packaged cooling only rooftop units with direct expansion cooling coils. These rooftop units are each rated at 7.5 tons of cooling with a cooling efficiency of 8.9 EER when new. There are also numerous window air conditioning units that cool smaller offices, classrooms, etc. There is also a LG Model LUU427HV split heat pump unit that cools the server room.

The Nurse's office in the Art Building is heated and cooled by a Trane Model YSC048 packaged rooftop unit that is rated at 96 MBH output, a thermal efficiency of 80% and a cooling capacity of 4 tons with efficiency of 14 SEER.

The Annex is cooled by three (3) Carrier Model 38CK split, air handling units with air-cooled condensers set on pads outdoors on the ground. These split air handling units are rated at 5 tons of cooling and have an efficiency of 8.5 EER in their present condition and age.

Exhaust System

General and toilet exhaust air is removed through roof-mounted down blast fans manufactured by Penn Ventilators. There are numerous other smaller down-blast exhaust fans on the roof. Most of the nameplate information is unobtainable. Half of these exhaust fans are over 50 years old, have badly corroded due to weather and are very inefficient. The two (2) kitchen exhaust hood fans information was also not obtainable.

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

HVAC System Controls

Most of the HVAC equipment within the two (2) high school buildings is over 40 years old and controlled by Honeywell on-off-auto pneumatic air system which includes an air compressor in the boiler room along with a $\frac{3}{4}$ HP motor and an air dryer. The boiler controller includes outside air temperature reset, on/off timers for occupied and un-occupied hours, and equipment timers. The pneumatic controllers along with the pneumatic valves, actuators, pressure regulators, etc. that control the unit ventilators, unit heaters, large ceiling mounted cabinet heaters, heating & ventilating units, etc. seem to be well maintained with no detectable air leaks.

The valves and actuators for some of the unit ventilators, heating and ventilating central air handlers, and 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 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 four (4) Trane rooftop units that cool the auditorium and stage are controlled by a Honeywell controller. The other two (2) rooftops are controlled by thermostats in the main office and guidance suite. The Annex building split air handlers are controlled by local thermostats in the various spaces.

Domestic Hot Water

The domestic hot water heater located in the Art Building boiler room is a LAARS Model RHCV1600 gas-fired water heater that is rated at 1,600 MBH input, feeds two (2) 1,000 gallon capacity storage tanks and has a thermal efficiency of 85% based on its present age and condition. The Annex Building has a Bradford White Model LD50S33G060 electric water heater with a 50 gallon storage capacity and rated at 6 kW of electric heating capacity.

Plumbing systems

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 Equipment

The full cooking kitchen includes a Master-Bilt walk-in refrigerator and walk-in freezer with associated refrigeration units on the roof; 8-burner gas range manufactured by Garland; two (2) commercial refrigerators manufactured by Traulsen; a Goen electric steamer; a Blodgett pizza oven; a Vulcan deep fryer; a Vulcan grille; Metro warming ovens; ice machine; two (2) kitchen exhaust hoods with rooftop exhaust fans; and a Traulsen reach-in commercial freezer.

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	\$261,000	\$17,818	14.6	2.4%
ECM #2	Interior Lighting Controls	\$41,500	\$1,992	20.8	-28.0%
ECM #3	Exterior Lighting Upgrade	\$9,000	\$2,570	3.5	328.3%
ECM #4	Modular Condensing Boilers	\$366,666	\$16,429	22.3	-10.4%
ECM #5	Replace HW Unit Ventilators	\$506,000	\$7,808	64.8	-69.1%
ECM #6	Rooftop Unit Replacements	\$95,000	\$5,311	17.9	-16.1%
ECM #7	Split AHU and CU Replacement	\$37,500	\$1,289	29.1	-31.3%
ECM #8	H&V Unit Replacements	\$220,000	\$12,155	18.1	10.5%
ECM #9	VFD on Hot Water Piping Insulation	\$28,000	\$2,792	10.0	49.6%
ECM #10	Heating Hot Water Piping Insulation	\$4,800	\$550	8.7	71.9%
ECM #11	New and EC Motors for Rooftop EFs	\$74,600	\$2,755	27.1	-44.6%
ECM #12	Destratification Fans for the Gym	\$14,000	\$1,050	13.3	12.5%
ECM #13	DDC System Upgrade	\$407,900	\$11,752	34.7	-56.8%
ECM #14	Thermostatic Controllers and Radiator Valves	\$71,000	\$3,860	18.4	-18.5%
ECM #15	Vending Miser Controls	\$3,800	\$941	4.0	271.3%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	DESCRIPTION	NET INSTALLATION COST	ANNUAL SAVINGS	SIMPLE PAYBACK (Yrs)	SIMPLE LIFETIME ROI
REM #1	176 kW Solar Array	\$820,000	\$60,424	13.6	10.5%

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	88.6	130,059	0
ECM #2	Interior Lighting Controls	0.0	14,542	0
ECM #3	Exterior Lighting Upgrade	4.7	18,760	0
ECM #4	Modular Condensing Boilers	0.0	0	19,795
ECM #5	Replace HW Unit Ventilators	0.0	0	9,407
ECM #6	Rooftop Unit Replacements	34.3	38,765	0
ECM #7	Split AHU and CU Replacement	5.6	9,409	0
ECM #8	H&V Unit Replacements	0.0	3,080	14,250
ECM #9	VFD on Hot Water Piping Insulation	0.0	20,379	0
ECM #10	Heating Hot Water Piping Insulation	0.0	0	1
ECM #11	New and EC Motors for Rooftop EFs	0.0	20,115	0
ECM #12	Destratification Fans for the Gym	0.0	-185	1,295
ECM #13	DDC System Upgrade	0.0	30,618	9,105
ECM #14	Thermostatic Controllers and Radiator Valves	0.0	0	4,652
ECM #15	Vending Miser Controls	0.0	6,867	0
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	176 kW Solar Array	160.6	209,438	0

Table 3
ECM Emissions Summary

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	GREENHOUSE GAS EMISSIONS REDUCTION		
		CO₂ EMISSIONS (LBS)	NO_x EMISSIONS (LBS)	SO₂ EMISSIONS (LBS)
ECM #1	Interior Lighting Upgrade	197,690	364	845
ECM #2	Interior Lighting Controls	22,104	41	95
ECM #3	Exterior Lighting Upgrade	28,515	53	122
ECM #4	Modular Condensing Boilers	231,602	182	0
ECM #5	Replace HW Unit Ventilators	110,062	87	0
ECM #6	Rooftop Unit Replacements	58,923	109	252
ECM #7	Split AHU and CU Replacement	14,302	26	61
ECM #8	H&V Unit Replacements	171,407	140	20
ECM #9	VFD on Hot Water Piping Insulation	30,976	57	132
ECM #10	Heating Hot Water Piping Insulation	8	0	0
ECM #11	New and EC Motors for Rooftop EFs	30,575	56	131
ECM #12	Destratification Fans for the Gym	14,870	11	(1)
ECM #13	DDC System Upgrade	153,068	169	199
ECM #14	Thermostatic Controllers and Radiator Valves	54,428	43	0
ECM #15	Vending Miser Controls	10,438	19	45

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	\$17,818	\$261,000	\$0	\$261,000	14.6
Interior Lighting Controls	\$1,992	\$41,500	\$0	\$41,500	20.8
Exterior Lighting Upgrade	\$2,570	\$9,000	\$0	\$9,000	3.5
Modular Condensing Boilers	\$16,429	\$390,666	\$24,000	\$366,666	22.3
Replace HW Unit Ventilators	\$7,808	\$506,000	\$0	\$506,000	64.8
Rooftop Unit Replacements	\$5,311	\$95,000	\$0	\$95,000	17.9
Split AHU and CU Replacement	\$1,289	\$37,500	\$0	\$37,500	29.1
H&V Unit Replacements	\$12,155	\$220,000	\$0	\$220,000	18.1
VFD on Hot Water Piping Insulation	\$2,792	\$28,000	\$0	\$28,000	10.0
Heating Hot Water Piping Insulation	\$550	\$4,800	\$0	\$4,800	8.7
New and EC Motors for Rooftop EEs	\$2,755	\$74,600	\$0	\$74,600	27.1
Destratification Fans for the Gym	\$1,050	\$14,000	\$0	\$14,000	13.3
DDC System Upgrade	\$11,752	\$407,900	\$0	\$407,900	34.7
Thermostatic Controllers and Radiator Valves	\$3,860	\$71,000	\$0	\$71,000	18.4
Vending Miser Controls	\$941	\$3,800	\$0	\$3,800	4.0
Total Project	\$49,039	\$748,100	\$0	\$748,100	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.

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

ECM #1: Interior Lighting Upgrade

Description:

A majority of the interior lighting throughout the Butler High School Campus 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. The 6-lamp biaxial fluorescent lighting fixtures in the gym would be replaced by new LED high-bay luminaires which would improve the lighting.

A portion of the interior lighting throughout the high school is provided with fluorescent fixtures with older generation, 700 series and 741/ECO 32W T8 lamps and electronic ballasts. Although these T8 lamps are considered fairly efficient, further energy savings can be achieved by replacing the existing T8 lamps with LED direct replacement T8 ballast compatible lamps.

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 lamp wattages.

Energy Savings Calculations:

LIGHTING UPGRADE SAVINGS SUMMARY	
DESCRIPTION	SAVINGS
Electric Demand Savings (kW)	88.6
Electric Usage Savings (kWh)	130,059
Electric Cost Savings (\$)	\$17,818

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 (\$):	\$261,000
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$261,000
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$17,818
Total Yearly Savings (\$/Yr):	\$17,818
Estimated ECM Lifetime (Yr):	15
Simple Payback	14.6
Simple Lifetime ROI	2.4%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$267,272
Internal Rate of Return (IRR)	0%
Net Present Value (NPV)	(\$48,288.08)

ECM #2: Interior Lighting Controls Upgrade – Occupancy Sensors

Description:

Some of the lights in the Butler High School Campus 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)	14,542
Electric Cost Savings (\$)	\$1,992

Rebates and Incentives:

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

Smart Start Incentive

$$= (\# \text{ Wall mount sensors} \times \$20 \text{ per sensor})$$

$$+ (\# \text{ Ceiling mount sensors} \times \$35 \text{ per sensor})$$

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$41,500
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$41,500
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$1,992
Total Yearly Savings (\$/Yr):	\$1,992
Estimated ECM Lifetime (Yr):	15
Simple Payback	20.8
Simple Lifetime ROI	-28.0%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$29,880
Internal Rate of Return (IRR)	-4%
Net Present Value (NPV)	(\$17,719.63)

ECM #3: Exterior Lighting Upgrade

Description:

Exterior lighting throughout the Butler High School Campus is provided by various types, sizes and wattages of metal halide wall-mounted fixtures, canopy 72-watt incandescent lamp fixtures, covered walkway 60-watt incandescent lamp fixtures, 90-Watt flood lamps, 70 Watt PAR lamps, 60-Watt jelly jar lighting fixtures, etc. This ECM includes the replacement of existing fixtures with new high-efficiency LED lighting fixtures and retrofit LED lamp kits for canopy, walkway, 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)	4.7
Electric Usage Savings (kWh)	18,760
Electric Cost Savings (\$)	\$2,570

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 (\$):	\$9,000
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$9,000
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$2,570
Total Yearly Savings (\$/Yr):	\$2,570
Estimated ECM Lifetime (Yr):	15
Simple Payback	3.5
Simple Lifetime ROI	328.3%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$38,550
Internal Rate of Return (IRR)	28%
Net Present Value (NPV)	\$21,680.49

ECM #4: Modular Condensing Boilers

Description:

The Butler High School has two (2) Cleaver-Brooks Model CB428-250 fire-tube hot water boilers that are 51 years old, have surpassed their ASHRAE useful life expectancy and are less efficient than newer condensing boilers. These two (2) boilers have a total rated input capacity of approximately 20,922 MBH with an estimated thermal efficiency of 67% due to their age and condition. This equates to a maximum output of 14,018 MBH.

These existing boilers are oversized and Concord Engineering strongly recommends that detailed heat load calculations be performed to correctly size the boilers required for this facility. Concord Engineering has estimated that the heating load is closer to 10,000 MBH and has used this estimate for the energy savings calculations and cost of new condensing boilers.

This ECM would install four (4) new condensing style boilers each rated at 3,000 MBH with an average thermal efficiency of 92% for a maximum output of 11,040 MBH. The new boilers 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	97,989
Domestic Hot Water	6,235
Kitchen Gas Usage	700
Heating Boilers - Annex	18,210
Heating Boilers - Main	72,844

Energy Savings Calculations:

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

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 Boilers	
Existing Nat Gas (Therms)	72,844		
Boiler Efficiency (%)	67.0%	92.0%	25%
Nat Gas Heat Value (BTU/Therm)	100,000	100,000	
Equivalent Building Heat Usage (MMBTUs)	4,881	4,881	
Gas Cost (\$/Therm)	\$0.83	\$0.83	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Natural Gas Usage (Therms)	72,844	53,049	19,795
Energy Cost (\$)	\$60,461	\$44,031	\$16,429
COMMENTS:	Boiler Efficiency Based on age of boiler and IBR Rating		

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$390,666
NJ Smart Start Equipment Incentive (\$):	\$24,000
Net Installation Cost (\$):	\$366,666
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$16,429
Total Yearly Savings (\$/Yr):	\$16,429
Estimated ECM Lifetime (Yr):	20
Simple Payback	22.3
Simple Lifetime ROI	-10.4%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$328,580
Internal Rate of Return (IRR)	-1%
Net Present Value (NPV)	(\$122,243.97)

ECM #5: Replace Hot Water Unit Ventilators

Description:

There are ninety-two (92) hot water unit ventilators in the High School Campus that are over 50 years old and long past their service life of 20 years as per ASHRAE standards. These ninety-two (92) unit ventilators have an average air flow capacity of 1,250 CFM each. Due to present age/condition, escalating owning and maintenance costs, these unit ventilators should be replaced.

This ECM would install new hot water supply/return piping, replace the unit ventilators with newer hot water units that feature a face and bypass damper to allow a variable portion of the mixed return and ventilation air to flow over a hot water coil (such as AAF-Herman Nelson Model AV Unit Ventilator). This method of capacity control also allows for free cooling when the outdoor air is relatively cool. These unit ventilators would be equipped with hot water modulating valves, hot water coils, EC fan motors, DDC controllers that would communicate with the room thermostats and other equipment such as the boilers indicating when to supply hot water for heating demand.

The outside air intake opening would need to be enlarged to comply with the latest ventilation codes. This would require brick/block work, larger outside air louver, and reworking of the shelving.

Energy Savings Calculations:

During the occupied hours of the classroom, internal heat gains from people, lights, and computer (9,500 BTUH) effectively lowers the heating requirements by 17°F. When the thermostat is set to 70°F, the classroom does not need heat until the outside temperature drops to 53°F (assuming no gains from solar heating). During unoccupied hours, the thermostat should be set to 55°F, but there are no heat gains to lower the heating requirement, hence the classroom space needs heating whenever the outside temperature drops below 55°F.

Using these assumptions, the existing 1,250 CFM hot water unit ventilator uses approximately 332 therms during occupied hours and 77 Therms during unoccupied hours. This equates to a total unit ventilator thermal consumption of 409 therms/unit/year. By installing a hot water unit ventilator with a DDC controller, EC motor, a digital thermostat and an unoccupied setpoint of 55°F, it is estimated that the energy savings per unit ventilator would be approximately 25% of the existing hot water cost for each unit ventilator.

Total energy savings = 25% x (409 therms x 92 units) = 9,407 therms

Total cost savings = 9,407 therms x \$0.83/therm = \$7,808

The installed cost of a new 1,250 CFM hot water unit ventilator including architectural work, new outside air louver, piping, insulation, controls, etc. = \$5,500/unit.

Total project cost = \$5,500 x 92 = \$506,000

Maintenance Savings and Project Costs:

No maintenance cost savings were estimated for this measure.

Project Costs are based upon RS Means Unit Cost data.

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$506,000
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$506,000
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$7,808
Total Yearly Savings (\$/Yr):	\$7,808
Estimated ECM Lifetime (Yr):	20
Simple Payback	64.8
Simple Lifetime ROI	-69.1%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$156,160
Internal Rate of Return (IRR)	-9%
Net Present Value (NPV)	(\$389,836.68)

ECM #6: Replace Rooftop Units with Ultra-High Efficiency Units

Description:

The original Main Building of the high school campus is cooled by six (6) packaged cooling only rooftop units that are 1978 vintage. These units have surpassed their ASHRAE useful life expectancy and are less efficient than newer packaged rooftops. These units are standard efficiency units and can be replaced with new high-efficiency rooftop units. New units provide higher full load and part load efficiencies due to advances in inverter motor technologies, heat exchangers and higher efficiency refrigerants such as R410A.

This ECM includes replacement of these six (6) older rooftop units with new higher efficiency systems. It is recommended to fully evaluate the capacity needed for all new systems prior to moving forward with this ECM. A summary of the unit replacement for this ECM can be found in the table below:

IMPLEMENTATION SUMMARY					
ECM INPUTS		NUMBER OF UNITS	COOLING CAPACITY, BTU/HR	TOTAL CAPACITY, TONS	REPLACE UNIT WITH
Existing Units Trane Model SACA-753		6	90,000	45.0	Carrier 48LC Ultra-High Efficiency Unit
Total		6	90,000	45.0	

The manufacturer used as the basis for the calculation is Carrier. The unit pricing and install cost were estimated based on current rates quotes and labor rates. The payback may change based on actual unit pricing and installed costs if this ECM is implemented.

Energy Savings Calculations:

Cooling Energy Savings:

Seasonal energy consumption of the air conditioners at the cooling mode is calculated with the equation below:

$$\text{Energy Savings, kWh} = \text{Cooling Capacity, } \frac{\text{BTU}}{\text{Hr}} \times \left(\frac{1}{\text{SEER}_{\text{Old}}} - \frac{1}{\text{SEER}_{\text{New}}} \right) \times \frac{\text{Operation Hours}}{1000 \frac{\text{W}}{\text{kWh}}}$$

$$\text{Demand Savings, kW} = \frac{\text{Energy Savings (kWh)}}{\text{Hours of Cooling}}$$

$$\text{Cooling Cost Savings} = \text{Energy Savings, kWh} \times \text{Cost of Electricity} \left(\frac{\$}{\text{kWh}} \right)$$

ENERGY SAVINGS CALCULATIONS							
ECM INPUTS	COOLING CAPACITY, BTU/Hr	ANNUAL COOLING HOURS	EXISTING UNITS EER	PROPOSED UNITS EER	# OF UNITS	ENERGY SAVINGS kWh	DEMAND SAVINGS kW
	90,000	1,131	8.2 EER	17.1 EER	6	38,765	34.3
Total	90,000				6	38,765	34.3

Note: Due to the age and overall condition of the units, the existing efficiency was estimated to be lower than the nameplate EER.

Project Cost and Maintenance Savings

The manufacturers used as the basis for the calculation is Carrier. The unit pricing and install cost were estimated based on RS Means unit cost data and vendor quotes. The payback may change based on actual unit pricing and install costs if the ECM is implemented.

No maintenance savings were estimated for this measure.

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$95,000
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$95,000
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$5,311
Total Yearly Savings (\$/Yr):	\$5,311
Estimated ECM Lifetime (Yr):	15
Simple Payback	17.9
Simple Lifetime ROI	-16.1%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	\$79,665
Internal Rate of Return (IRR)	-2%
Net Present Value (NPV)	(\$31,597.63)

ECM #7: Split Air Handling Unit Replacements (One for One Replacement)

Description:

The Annex Building (BOE Offices) has three (3) Carrier Model 38CK060 split cooling systems that are past the end of their useful life expectancy and should be replaced with new much more efficient cooling systems. The units currently installed have lower efficiencies compared to modern high-efficiency units. New 5-ton cooling units provide higher full load and part load efficiencies due to advances in inverter motor technologies, higher efficiency refrigerants such as R410A which would be used in place of R22 that is currently used in these units.

This ECM includes replacement of the 5-Ton split indoor air handlers along with the older condensing units with new higher efficiency cooling systems. It is recommended to fully evaluate the capacity needed for the new units prior to moving forward with this ECM. A summary of the unit replacement for this ECM can be found in the table below:

IMPLEMENTATION SUMMARY					
ECM INPUTS	SERVICE FOR	NUMBER OF UNITS	COOLING CAPACITY, BTU/HR	TOTAL CAPACITY, TONS	REPLACE UNIT WITH
Split System Cooling	AH-1	1	60,000	5.0	Trane 4TTA4 w/4TEH3C Air Handler
Split System Cooling	AH-2	1	60,000	5.0	Trane 4TTA4 w/4TEH3C Air Handler
Split System Cooling	AH-3	1	60,000	5.0	Trane 4TTA4 w/4TEH3C Air Handler
Total		3	180,000	15.0	

Some unit sizes are estimated. See Major Equipment List Appendix.

Energy Savings Calculations:

Cooling Energy Savings:

Seasonal energy consumption of the air conditioners at the cooling mode is calculated with the equation below:

$$\text{Energy Savings, kWh} = \text{Cooling Capacity, } \frac{\text{BTU}}{\text{Hr}} \times \left(\frac{1}{\text{SEER}_{\text{Old}}} - \frac{1}{\text{SEER}_{\text{New}}} \right) \times \frac{\text{Operation Hours}}{1000 \frac{\text{W}}{\text{kWh}}}$$

Demand Savings, kW

$$= \text{Cooling Capacity, } \frac{\text{BTU}}{\text{Hr}} \times \left(\frac{1}{\text{SEER}_{\text{Old}}} - \frac{1}{\text{SEER}_{\text{New}}} \right) \times \frac{\text{Demand Factor (0.67)}}{1000 \frac{\text{W}}{\text{kWh}}}$$

$$\text{Cooling Cost Savings} = \text{Energy Savings, kWh} \times \text{Cost of Electricity} \left(\frac{\$}{\text{kWh}} \right)$$

ENERGY SAVINGS CALCULATIONS							
ECM INPUTS	EXISTING COOLING CAPACITY, BTU/Hr	ANNUAL COOLING HOURS	EXISTING UNIT SEER (EER)	NEW UNIT SEER	# OF UNITS	ENERGY SAVINGS kWh	DEMAND SAVINGS kW
Split System Cooling	60,000	1,131	8.5	14	1	3,136	1.9
Split System Cooling	60,000	1,131	8.5	14	1	3,136	1.9
Split System Cooling	60,000	1,131	8.5	14	1	3,136	1.9
Total					3	9,409	5.6

* Hours have been adjusted to take into account part load operation over the cooling season.

** New Cooling Unit SEERs have been adjusted to take into account part load operation over the cooling season.

The high-efficiency air handlers/air-cooled condensing units used as the basis for the calculation are Trane or equal. The unit pricing and installation costs were estimated based on RS Means. The payback may change based on actual unit pricing and installed costs if this ECM is implemented.

Maintenance Savings and Project Costs:

No maintenance cost savings were estimated for this measure.

Project Costs are based off of RS Means Unit Cost data, vendor quotes, and local Mechanical Contractor estimates.

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$37,500
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$37,500
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$1,289
Total Yearly Savings (\$/Yr):	\$1,289
Estimated ECM Lifetime (Yr):	20
Simple Payback	29.1
Simple Lifetime ROI	-31.3%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$25,780
Internal Rate of Return (IRR)	-3%
Net Present Value (NPV)	(\$18,322.93)

ECM #8: Heating and Ventilating Unit Replacements

Description:

The Butler High School buildings (Main and Art Buildings) have nine (9) Nesbitt Heating & Ventilating (H&V) units that serve the Gym, Art Building Basement, Music Rooms, etc. that are rated at 115 MBH of heating capacity each. In addition, there are two (2) Nesbitt Heating & Ventilating (H&V) units that serve the locker rooms in the Art Building that are rated at 147 MBH of heating capacity each. These H&V units are in very poor condition due to their age (+50 years), old pneumatic controls, dirty heating coils, old damper actuators, etc. These units have limited control capabilities with motors that run while the gym and kitchen are 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 these units are obsolete, parts are very difficult and expensive to obtain from the original manufacturer. Replacing these units with newer more efficient units would result in significant energy cost savings.

Concord Engineering strongly recommends that these eleven (11) heating & ventilating units be replaced with new, high-efficiency units that have enhanced direct digital controls, electronic hot water valves, new outside air dampers and demand ventilation control features.

This ECM includes replacement of these eleven (11) heating & ventilating units with new higher efficiency units. These units would include inverter duty, NEMA Premium™ efficiency motors, direct digital controllers, supply fan motor variable speed controllers along with demand control ventilation.

It is recommended that the School District evaluate the capacity needed for these new Heating & Ventilating (HV) units 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 an EC motor, direct digital controller and demand control ventilation features.

The estimated installed cost of these eleven (11) new high-efficiency modular heating and ventilating units is \$220,000.

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:

H&V Units with 115 MBH Heating Capacities:

H&V REPLACEMENT			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
Description	Existing H&V Units	New H&V Units	
Quantity of Units	9	9	
Unit Heating Capacity (Btu/h)	115,000	115,000	
Unit Capacity Loss due to Age	25%	0%	
Boiler Plant Efficiency	67%	67%	
Unit Fan Power (HP)	3/4	3/4	
Fan Motor Efficiency	80%	90%	
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)	2,376	1,320	
Heating Energy (kBtu)	1,487,088	743,544	743,544
Elec Cost (\$/kWh)	0.137	0.137	
Gas Cost (\$/therm)	0.830	0.830	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Electric Energy (kWh)	2,376	1,320	1,056
Natural Gas Energy (therm)	22,195	11,098	11,098
Total Energy Cost (\$)	\$18,748	\$9,392	\$9,356
COMMENTS:	One-for-One H&V Replacement		

H&V Units with 147 MBH Heating Capacities:

H&V REPLACEMENT			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
Description	Existing H&V Units	New H&V Units	
Quantity of Units	2	2	
Unit Heating Capacity (Btu/h)	147,000	147,000	
Unit Capacity Loss due to Age	25%	0%	
Boiler Plant Efficiency	67%	67%	
Unit Fan Power (HP)	1	1	
Fan Motor Efficiency	82%	90.0%	
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)	3,091	1,760	
Heating Energy (kBtu)	422,419	211,210	211,210
Elec Cost (\$/kWh)	0.137	0.137	
Gas Cost (\$/therm)	0.83	0.83	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Electric Energy (kWh)	3,091	1,760	1,331
Natural Gas Energy (therm)	6,305	3,152	3,152
Electric Energy Cost (\$)	\$5,656	\$2,858	\$2,799
COMMENTS:	One-for-One H&V Replacement		

Energy Savings Summary:

ECM #8 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$220,000
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$220,000
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$12,155
Total Yearly Savings (\$/Yr):	\$12,155
Estimated ECM Lifetime (Yr):	20
Simple Payback	18.1
Simple Lifetime ROI	10.5%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$243,100
Internal Rate of Return (IRR)	1%
Net Present Value (NPV)	(\$39,164.29)

ECM #9: Install VFD on Hot Water Pumps

Description:

The Butler High School currently has a 10-horsepower hot water pump to distribute heating water to the heating & ventilating units for the large open spaces and unit ventilators for the classroom and office spaces (second pump is a standby unit). The existing pumps operate at constant flow and ride the pump curve only.

This ECM includes the installation of Variable Frequency Drives on the two (2) 10-horsepower existing hot water pumps. The VFD control is based on a differential pressure sensor in the heating hot water loop to measure demand for water.

Energy Savings Calculations:

$$\text{Pump Power HP} = \frac{\text{Flow}_{\text{GPM}} \times \text{Head}_{\text{ft-hd.}}}{3650 \times \eta_{\text{Pump}} \times \eta_{\text{motor}}}$$

$$\text{Energy Consumption (kWh)} = \text{Motor HP} \times 0.746 \frac{\text{kW}}{\text{HP}} \times \text{Hours of operation (Hr)} \times \frac{1}{\eta_{\text{motor}}}$$

$$\text{Total Energy Consumption (kWh)} = \sum \text{Energy Consumption of Each Motor}$$

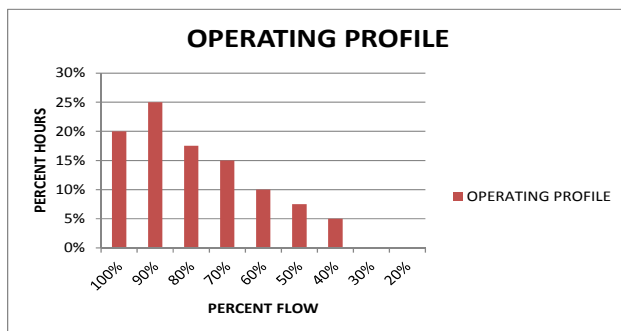
$$\text{Energy Cost (\$)} = \text{Total Consumption (kWh)} \times \text{Average Cost of Electric} \left(\frac{\$}{\text{kWh}} \right)$$

Affinity Laws are used in order to calculate energy savings by calculating the reduced power consumption requirement based a reduction in flow. Affinity laws, are as following:

Q = Flow, n = RPM, p = total pressure

$$\frac{Q_2}{Q_1} = \frac{n_2}{n_1} \quad \frac{p_2}{p_1} = \left(\frac{n_2}{n_1} \right)^2 \quad \frac{HP_2}{HP_1} = \left(\frac{n_2}{n_1} \right)^3$$

Estimated Operating Profile with VFD:



HW PUMPS VFD CALCULATION			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
ECM INPUTS	CV Pumps	VFD Pumps	
Flow Control	Throttle	VFD	-
Motor Nameplate HP	10	10	
Flow* (GPM)	480	480	-
Head* (Ft)	60	60	-
Pump Efficiency (%)	67.0%	67.0%	-
Motor Efficiency (%)	91.7%	91.7%	
Operating Hrs	4000	4000	-
Estimated Power (HP)	11.8	11.8	
Elec Cost (\$/kWh)	0.137	0.137	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Electric Energy (kWh)	38,520	18,141	20,379
Electric Energy Cost (\$)	\$5,277	\$2,485	\$2,792

Energy Savings Summary:

ECM #9 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$28,000
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$28,000
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$2,792
Total Yearly Savings (\$/Yr):	\$2,792
Estimated ECM Lifetime (Yr):	15
Simple Payback	10.0
Simple Lifetime ROI	49.6%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$41,880
Internal Rate of Return (IRR)	6%
Net Present Value (NPV)	\$5,330.71

ECM #10: Insulation for Heating Hot Water Piping

Description:

The existing Cleaver-Brooks boilers deliver 180°F hot water to various hot water coils and fin-tube radiation units throughout the facility. During the site inspection, numerous sections of hot water piping in the boiler room were observed to be un-insulated or the insulation has failed due to leakage/deterioration of the insulating material. The high temperature of the hot water (180°F) causes more heat transfer to occur between the piping un-insulated surfaces and the surrounding space resulting in excess fuel usage at the hot water boiler.

This ECM would insulate all bare heating hot water piping and failed heating hot water piping insulation in the boiler room.

Energy Savings Calculations:

$$Q = K (\Delta T) / L + (K/Ht)$$

$$Q = \text{Heat Loss (BTU/Hr. / Sq. Ft.)}$$

$$K = \text{Thermal Conductivity (25)}$$

$$L = \text{Insulation Thickness}$$

$$\Delta T = \text{Surface Temp} - \text{Ambient Temp}$$

$$Ht = \text{Combined Coefficients (3.2) for Radiation, Convection \& Conduction}$$

$$\text{Fuel Oil Savings} = (Q \times \text{Sq. Ft.} \times \text{Operating Hours} \times \text{\$/Therm}) / (139,000 \text{ BTU/Therm})$$

An Excel spreadsheet was developed to calculation the energy savings from insulating the bare/failed insulation hot water piping as follows:

Piping Insulation Savings

Fuel Cost (\$/mmBTU):	\$8.30
Operating Hours per Year:	2918
Insulation Thickness:	1"
Amb. Temp:	80

Qty.	Size	Description	Surface Temp.	Area (Ea.) (Sq.ft.)	Bare Heat Loss (BTU/Hr/SF)	Bare Heat Loss (BTU/Hr)	Bare Heat Loss mmBtu	Insulated Heat Loss (BTU/Hr/SF)	Insulated Heat Loss (BTU/Hr)	Insulated Heat Loss mmBtu	Fuel Savings mmBtu/yr	Fuel Savings \$/yr
Cleaver Brooks Boiler Plant												
95	4	Supply HW Piping	180	78.00	28.00	207,480.00	605.43	26.00	192,691.38	562.27	43.15	\$358.17
85	4	Return HW Piping	160	78.00	22.00	145,860.00	425.62	20.80	137,935.44	402.50	23.12	\$191.93
TOTAL											66.3	\$550

The cost of insulating 180 lineal feet of 4-inch piping with 1-inch insulation is approximately \$4,800. Project costs were obtained from a local Insulation Contractor.

Energy Savings Summary:

ECM #10 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$4,800
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$4,800
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$550
Total Yearly Savings (\$/Yr):	\$550
Estimated ECM Lifetime (Yr):	15
Simple Payback	8.7
Simple Lifetime ROI	71.9%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$8,250
Internal Rate of Return (IRR)	8%
Net Present Value (NPV)	\$1,765.86

ECM #11: 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 commutator 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 five (5) 1/2 HP exhaust fans, eight (8) 1/3 HP, fifteen (15) 1/4 HP and thirteen (13) 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 CALCULATION			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
ECM INPUTS	PSC	ECM	
Quantity of Motors	13	13	
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)	12,301	7,381	4,920
Electric Energy Cost (\$)	\$1,685	\$1,011	\$674
COMMENTS:	Rooftop Exhaust Fans		

ELECTRONICALLY COMMUTATED MOTOR CALCULATION			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
ECM INPUTS	PSC	ECM	
Quantity of Motors	15	15	
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)	18,709	11,226	7,484
Electric Energy Cost (\$)	\$2,563	\$1,538	\$1,025
COMMENTS:	Rooftop Exhaust Fan		

ELECTRONICALLY COMMUTATED MOTOR CALCULATION			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
ECM INPUTS	PSC	ECM	
Quantity of Motors	8	8	
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)	8,744	5,246	3,497
Electric Energy Cost (\$)	\$1,198	\$719	\$479
COMMENTS:	Rooftop Exhaust Fan		

ELECTRONICALLY COMMUTATED MOTOR CALCULATION			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
ECM INPUTS	PSC	ECM	
Quantity of Motors	5	5	
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)	10,537	6,322	4,215
Electric Energy Cost (\$)	\$1,444	\$866	\$577
COMMENTS:	Rooftop Exhaust Fans		

Total Energy Cost Savings = \$674 + \$1,025 + \$479 + \$577 = \$ 2,755

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 #11 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$74,600
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$74,600
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$2,755
Total Yearly Savings (\$/Yr):	\$2,755
Estimated ECM Lifetime (Yr):	15
Simple Payback	27.1
Simple Lifetime ROI	-44.6%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$41,325
Internal Rate of Return (IRR)	-7%
Net Present Value (NPV)	(\$41,710.99)

ECM #12: 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 (%)	67%	67%	
Heating Degree Days (65 F)	5062	5062	
Degree Day Adjustment Factor	0.45	0.45	
Space Ceiling Height (ft)	25	25	
Ceiling-Floor ΔT ($^{\circ}F$)	12.5	12.5	
Percent Energy Savings	-	22%	
Destrat Fan Power (kWh)	-	185	
Heating Energy (kBtu)	588,774	459,244	
Electric Rate (\$/kWh)	\$0.137	\$0.137	
Natural Gas (\$/Therm)	\$0.83	\$0.83	
ENERGY SAVINGS CALCULATIONS			
Electric Usage (kWh)	0	185	(185)
Natural Gas (Therms)	5,888	4,592	1,295
Energy Cost (\$)	\$4,887	\$3,837	\$1,050
COMMENTS:	Ceiling-Floor Temperature Differential Based on 0.5 F per Foot		

Energy Savings Summary:

ECM #12 - 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):	\$1,050
Total Yearly Savings (\$/Yr):	\$1,050
Estimated ECM Lifetime (Yr):	15
Simple Payback	13.3
Simple Lifetime ROI	12.5%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$15,750
Internal Rate of Return (IRR)	2%
Net Present Value (NPV)	(\$1,465.17)

ECM #13: Digital Energy Management System (DDC EMS)

Description:

The HVAC systems within the high school buildings are over 50 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 $\frac{3}{4}$ 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, convectors, fin-tube radiators, 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 dampers are 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 SYSTEM CALCULATIONS			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
ECM INPUTS	Pneumatic Controls	Full DDC Controls	
Existing Gas Usage (Therms)	91,054	-	
Existing Electricity Usage for HVAC (kWh)	306,180	-	
Energy Savings, Gas	-	10%	
Energy Savings, Electricity	-	10%	
Gas Cost (\$/Therm)	\$0.83	\$0.83	
Electricity Cost (\$/kWh)	\$0.137	\$0.137	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Gas Usage (Therms)	91,054	81,949	9,105
Electricity Usage (kWh)	306,180	275,562	30,618
Gas Cost (\$)	\$75,575	\$68,017	\$7,557
Electricity Cost (\$)	\$41,947	\$37,752	\$4,195
Energy Cost (\$)	\$117,521	\$105,769	\$11,752
COMMENTS:			

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 #13 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$407,900
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$407,900
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$11,752
Total Yearly Savings (\$/Yr):	\$11,752
Estimated ECM Lifetime (Yr):	15
Simple Payback	34.7
Simple Lifetime ROI	-56.8%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$176,280
Internal Rate of Return (IRR)	-9%
Net Present Value (NPV)	(\$267,605.39)

ECM #14: New Thermostatic Hot Water Valves/Control**Description:**

The high school buildings have numerous hot water radiators, convectors, fin-tube radiators, unit heaters, cabinet heaters, etc. throughout the facility. These units are controlled by manual valves. Due to the equipment age and condition of the valves, it is recommended to replace these valves. During our site survey, we counted a total of seventy-one (71) existing hot water control valves that would be excellent candidates for replacement with newer electronically actuated 2-way control valves.

This measure would install the newest generation of thermostatic valves on the hot water pipe feeding each unit which would improve control of the heating. Thermostatic controls are self-contained and are suitable for radiators, fin-tubes, baseboards or convector units. These new thermostatic valves have the capability of setting an upper limit to prevent overheating of the spaces. The valves include a remote sensor for accurately measuring the return air temperature for better heating control.

Energy Savings Calculations:

In our experience, we have seen an average of 10% reduction in heating cost from installation of new thermostatic valves/controls. Based on heating degree day analysis, the energy used to heat the spaces controlled by these valves is estimated to be approximately 46,520 Therms.

10% x 46,520 Therms = 4,652 Therms of gas saved

At an average cost of \$0.83/Therm, the annual heating energy cost savings is \$3,860.

The basis of design is the ISTEK 2000 Series Thermostatic Valve/Control or equal which has a total installation cost (including valve, sensor, calibration, piping changes, etc.) of \$1,000 per unit. Replacement of seventy-one (71) existing older control valves x \$1,000/unit for the new thermostatic valves/controls = \$71,000.

Final quantities and sizes would be confirmed during the engineering phase of the project.

Maintenance Savings and Project Costs:

No maintenance cost savings were estimated for this measure.

Project Costs are based upon RS Means Unit Cost data.

Energy Savings Summary:

ECM #14 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$71,000
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$71,000
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$3,860
Total Yearly Savings (\$/Yr):	\$3,860
Estimated ECM Lifetime (Yr):	15
Simple Payback	18.4
Simple Lifetime ROI	-18.5%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$57,900
Internal Rate of Return (IRR)	-2%
Net Present Value (NPV)	(\$24,919.57)

ECM #15: Vending Miser Controls

Description:

The High School buildings currently utilize vending machines in select areas within the building. Vending machines are located in the faculty lounges, the snack area of the kitchen and the main entrance lobby which can be in use for a limited time during the day. The installation of the Vending Miser system will help reduce the operating hours of the vending machines. Cold beverage machines regularly operate inefficiently trying to maintain a constant cold temperature within the machine and snack machines with no cooling usually have lights that operate 24/7. The VendingMiser® system incorporates innovative energy-saving technology into a small plug-and-play device that in conjunction with a passive infrared sensor regulate the operation of the cold beverage and snack machines based on occupancy and room temperatures.

This ECM approximates the installation of two (2) systems for the cold beverage machines and four (4) systems for the snack machines.

Energy Savings Calculations:

Cold Drink and Snack Vending Machine Energy Conservation Project			
		Input Variables	
Energy Analysis Prepared For:	Energy Costs (\$0.000 per kwh)		\$0.137
	Facility Occupied Hours per Week		40
Butler High School	Number of Cold Drink Vending Machines		2
	Number of Uncooled Snack Machines		4
	Power Requirements of Cold Drink Machine (avg watts)		427
	Power Requirements of Snack Machine (avg watts)		80
	VendingMiser Sale Price (for cold drink machines)		\$800.00
	OfficeMiser Sale Price (for snack machines)		\$550.00
Savings Analysis			
	Before	After	
Cold Drink Machines	\$1,025.60	\$376.66	Cost of Operation
	7,486	2,749	kWh
		63%	% Energy Savings
Snack Machines	\$382.99	\$91.19	Cost of Operation
	2,796	666	kWh
		76%	% Energy Savings
Project Summary			
Present kWh	Projected kWh	kWh Savings per Year	
10,282	3,415	6,867	
Present Cost	Projected Costs	Annual Savings	Per Cent Savings
\$1,408.59	\$467.84	\$940.75	67%
			Total Project Cost
			\$3,800.00
			Break Even (Months)
			48.5

Energy Savings Summary:

ECM #15 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$3,800
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$3,800
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$941
Total Yearly Savings (\$/Yr):	\$941
Estimated ECM Lifetime (Yr):	15
Simple Payback	4.0
Simple Lifetime ROI	271.3%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$14,111
Internal Rate of Return (IRR)	24%
Net Present Value (NPV)	\$7,430.61

REM #1: 147 kW Solar System**Description:**

The Butler High School has available roof space and parking lot area that could accommodate solar arrays. Based on the available area a 176 kilowatt solar array could be installed. The array will produce approximately 209,438 kilowatt-hours annually that will reduce the overall electric usage of the facility by 24%. 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 (\$):	\$820,000
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$820,000
SREC Revenue (\$/Yr):	\$31,731
Energy Savings (\$/Yr):	\$28,693
Total Yearly Savings (\$/Yr):	\$60,424
Estimated ECM Lifetime (Yr):	15
Simple Payback	13.6
Simple Lifetime ROI	10.5%
Simple Lifetime Maintenance Savings	\$475,959
Simple Lifetime Savings	\$906,354
Internal Rate of Return (IRR)	1.3%
Net Present Value (NPV)	(\$98,667.17)

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. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.
- B. Maintain all weather stripping on windows and doors.
- C. Clean all light fixtures to maximize light output.
- D. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.
- E. Turn off computers when not in use. Ensure computers are not running in screen saver mode.
- F. Replace any old CRT Monitors with LED/LCD Type Monitors, which can draw as much as a quarter the power of an equivalent CRT monitor.
- G. Ensure outside air dampers are functioning properly and only open during occupied mode.

APPENDIX A

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING

Butler Board of Education - Butler High School

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN	NET PRESENT VALUE
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Saving * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^N \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^N \frac{C_n}{(1+DR)^n}$
		(\$)	(\$)	(\$)	(\$)	(\$/yr)	(\$/yr)	(\$/yr)		(Yr)	(\$)	(\$)	(%)	(Yr)	(\$)
ECM #1	Interior Lighting Upgrade	\$131,000	\$130,000	\$0	\$261,000	\$17,818	\$0	\$17,818	15	\$267,272	\$0	2.4%	14.6	0.30%	(\$48,288.08)
ECM #2	Interior Lighting Controls	\$31,000	\$10,500	\$0	\$41,500	\$1,992	\$0	\$1,992	15	\$29,880	\$0	-28.0%	20.8	-3.85%	(\$17,719.63)
ECM #3	Exterior Lighting Upgrade	\$6,000	\$3,000	\$0	\$9,000	\$2,570	\$0	\$2,570	15	\$38,550	\$0	328.3%	3.5	27.84%	\$21,680.49
ECM #4	Modular Condensing Boilers	\$184,777	\$205,889	\$24,000	\$366,666	\$16,429	\$0	\$16,429	20	\$328,580	\$0	-10.4%	22.3	-1.02%	(\$122,243.97)
ECM #5	Replace HW Unit Ventilators	\$253,000	\$253,000	\$0	\$506,000	\$7,808	\$0	\$7,808	20	\$156,160	\$0	-69.1%	64.8	-9.28%	(\$389,836.68)
ECM #6	Rooftop Unit Replacements	\$48,000	\$47,000	\$0	\$95,000	\$5,311	\$0	\$5,311	15	\$79,665	\$0	-16.1%	17.9	-2.12%	(\$31,597.63)
ECM #7	Split AHU and CU Replacement	\$18,750	\$18,750	\$0	\$37,500	\$1,289	\$0	\$1,289	20	\$25,780	\$0	-31.3%	29.1	-3.33%	(\$18,322.93)
ECM #8	H&V Unit Replacements	\$110,000	\$110,000	\$0	\$220,000	\$12,155	\$0	\$12,155	20	\$243,100	\$0	10.5%	18.1	0.97%	(\$39,164.29)
ECM #9	VFD on Hot Water Piping Insulation	\$9,400	\$18,600	\$0	\$28,000	\$2,792	\$0	\$2,792	15	\$41,880	\$0	49.6%	10.0	5.51%	\$5,330.71
ECM #10	Heating Hot Water Piping Insulation	\$2,400	\$2,400	\$0	\$4,800	\$550	\$0	\$550	15	\$8,250	\$0	71.9%	8.7	7.68%	\$1,765.86
ECM #11	New and EC Motors for Rooftop EFs	\$32,730	\$41,870	\$0	\$74,600	\$2,755	\$0	\$2,755	15	\$41,325	\$0	-44.6%	27.1	-6.61%	(\$41,710.99)
ECM #12	Destratification Fans for the Gym	\$8,000	\$6,000	\$0	\$14,000	\$1,050	\$0	\$1,050	15	\$15,750	\$0	12.5%	13.3	1.51%	(\$1,465.17)
ECM #13	DDC System Upgrade	\$203,950	\$203,950	\$0	\$407,900	\$11,752	\$0	\$11,752	15	\$176,280	\$0	-56.8%	34.7	-9%	(\$267,605.39)
ECM #14	Thermostatic Controllers and Radiator Valves	\$35,500	\$35,500	\$0	\$71,000	\$3,860	\$0	\$3,860	15	\$57,900	\$0	-18.5%	18.4	-2.45%	(\$24,919.57)
ECM #15	Vending Miser Controls	\$1,900	\$1,900	\$0	\$3,800	\$941	\$0	\$941	15	\$14,111	\$0	271.3%	4.0	23.74%	\$7,430.61
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	176 kW Solar Array	\$480,000	\$340,000	\$0	\$820,000	\$28,693	\$31,731	\$60,424	15	\$906,354	\$475,959	10.5%	13.6	1.28%	(\$98,667.17)

- 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
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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 \geq 16
	\$600 per ton, EER \geq 18
	\$750 per ton, EER \geq 20

Energy Efficiency must comply with ASHRAE 90.1-2007

Variable Frequency Drives

Variable Air Volume	\$65 - \$155 per hp
Chilled-Water Pumps \geq 20 hp	\$60 per VFD rated hp
Rotary Screw Air Compressors \geq 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 \geq 10 hp	\$60 per VFD rated hp
Boiler Fans \geq 5 HP	\$65 to \$155 per hp
Boiler Feed Water Pumps \geq 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 \geq 100w Replace with new induction fixture. (must be 30% less watts/fixture than HID system)	\$70 per fixture
HID \geq 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
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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



LEARN MORE AT
energystar.gov

ENERGY STAR[®] Statement of Energy Performance

15

ENERGY STAR[®]
Score¹

Butler High School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 101,921
Built: 1906

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

Butler High School
38 Bartholdi Avenue
Butler, New Jersey 07405

Property Owner

Butler Board of Education
38 Bartholdi Ave
Butler, NJ 07405
(____)____-____

Primary Contact

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

Property ID: 4778599

Energy Consumption and Energy Use Intensity (EUI)

Site EUI

123 kBtu/ft²

Annual Energy by Fuel

Natural Gas (kBtu)	9,764,069 (78%)
Electric - Grid (kBtu)	2,773,861 (22%)

National Median Comparison

National Median Site EUI (kBtu/ft ²)	87.4
National Median Source EUI (kBtu/ft ²)	132.2
% Diff from National Median Source EUI	41%

Source EUI

186 kBtu/ft²

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO ₂ e/year)	890
---	-----

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

Rooftops

Rooftop Units

Tag	RTU-1	RTU-2	RTU-3
Unit Type	Self-Contained, DX Cooling, No Heat	Self-Contained, DX Cooling, No Heat	Self-Contained, DX Cooling, No Heat
Qty	1	1	1
Location	Roof of Main Bldg.	Roof of Main Bldg.	Roof of Main Bldg.
Area Served	Auditorium	Auditorium	Auditorium
Manufacturer	Trane	Trane	Trane
Model No.	SACA-753-B	SACA-753-B	SACA-753-B
Serial No.	78D-15766	78D-15767	C78E-15651
Cooling Type	Packaged DX	Packaged DX	Packaged DX
Cooling Capacity (Tons)	7.5 tons	7.5 tons	7.5 tons
Cooling Efficiency (SEER/EER)	8.9 EER (New)	8.9 EER (New)	8.9 EER (New)
Heating Type	N/A	N/A	N/A
Heating Input (MBH)	N/A	N/A	N/A
Efficiency	N/A	N/A	N/A
Supply Fan (HP)	2	2	2
Supply Fan VFD	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
Return/Exhaust Fan (HP)	N/A	N/A	N/A
Return/Exhaust Fan VFD	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Approx Age	37	37	37
ASHRAE Service Life	15	15	15
Remaining Life	0	0	0
Comments	Two (2) Condenser Fans @ 2 HP	Two (2) Condenser Fans @ 2 HP	Two (2) Condenser Fans @ 2 HP

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Rooftops

Rooftop Units

Tag	RTU-4	RTU-5	RTU-6
Unit Type	Self-Contained, DX Cooling, No Heat	Self-Contained, DX Cooling, No Heat	Self-Contained, DX Cooling, No Heat
Qty	1	1	1
Location	Roof of Main Bldg.	Roof of Main Bldg.	Roof of Main Bldg.
Area Served	Auditorium	Main Offices	Guidance Suite
Manufacturer	Trane	Trane	Trane
Model No.	SACA-753-B	SACA-753-B	SACA-753-B
Serial No.	C78E-15650	78D-15764	78D-15772
Cooling Type	Packaged DX	Packaged DX	Packaged DX
Cooling Capacity (Tons)	7.5 tons	7.5 tons	7.5 tons
Cooling Efficiency (SEER/EER)	8.9 EER (New)	8.9 EER (New)	8.9 EER (New)
Heating Type	N/A	N/A	N/A
Heating Input (MBH)	N/A	N/A	N/A
Efficiency	N/A	N/A	N/A
Supply Fan (HP)	2	2	2
Supply Fan VFD	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
Return/Exhaust Fan (HP)	N/A	N/A	N/A
Return/Exhaust Fan VFD	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Approx Age	37	37	37
ASHRAE Service Life	15	15	15
Remaining Life	0	0	0
Comments	Two (2) Condenser Fans @ 2 HP	Two (2) Condenser Fans @ 2 HP	Two (2) Condenser Fans @ 2 HP

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Rooftops

Rooftop Units

Tag	RTU-7
Unit Type	Packaged Rooftop
Qty	1
Location	Roof of Art Building
Area Served	Nurse's Office
Manufacturer	Trane
Model No.	YSC048E3EHA1...
Serial No.	143011130L
Cooling Type	Packaged DX
Cooling Capacity (Tons)	4
Cooling Efficiency (SEER/EER)	14 SEER
Heating Type	Gas Furnace
Heating Input (MBH)	120
Efficiency	80%
Supply Fan (HP)	1
Supply Fan VFD	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
Return/Exhaust Fan (HP)	N/A
Return/Exhaust Fan VFD	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Approx Age	1
ASHRAE Service Life	15
Remaining Life	14
Comments	1/3 HP Condenser Fan Motor

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

H&V Units

Concord Engineering

Heating & Ventilating Units

Tag	HV-1 thru HV-4	HV-5
Unit Type	Heating & Ventilating	Heating & Ventilating
Qty	4	1
Location	Ceiling Mounted	Equipment Room
Area Served	Gym	Basement Locker Rooms
Manufacturer	Nesbitt	Buffalo Forge
Model	-	-
Type	HV	HV
Size	TX-2000	G-183C
Heating Type	Hot Water	Hot Water
Heating Output (MBH)	4 @ 115 = 460 MBH	147.4 MBH
Supply Fan (HP)	3/4	1
Supply Fan VFD	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
Return Fan (HP)	N/A	N/A
Return Fan VFD	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Approx Age	51	51
ASHRAE Service Life	20	20
Remaining Life	0	0
Comments	2,000 CFM Each	7,320 CFM

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Heating & Ventilating

Tag	HV-6	HV-7
Unit Type	Heating & Ventilating	Heating & Ventilating
Qty	1	1
Location	Mechanical Closet	Mechanical Closet
Area Served	Boy's Locker Rooms	Aux Gym
Manufacturer	Buffalo Forge	Buffalo Forge
Model	-	-
Type	HV	HV
Size	G-183C	G-122
Heating Type	Hot Water	Hot Water
Heating Output (MBH)	147.4 MBH	115 MBH
Supply Fan (HP)	1	3/4
Supply Fan VFD	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
Return Fan (HP)	N/A	N/A
Return Fan VFD	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Approx Age	51	51
ASHRAE Service Life	20	20
Remaining Life	0	0
Comments	7,320 CFM	5,000 CFM

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Heating & Ventilating

Tag	HV-8	HV-9
Unit Type	Heating & Ventilating	Heating & Ventilating
Qty	1	1
Location	Mechanical Closet	Basement of Art Bldg.
Area Served	Girl's Locker Rooms	Basement of Art Bldg.
Manufacturer	Buffalo Forge	Buffalo Forge
Model	-	
Type	HV	HV
Size	G-121	G-122
Heating Type	Hot Water	Hot Water
Heating Output (MBH)	115 MBH	115 MBH
Supply Fan (HP)	3/4	3/4
Supply Fan VFD	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
Return Fan (HP)	N/A	N/A
Return Fan VFD	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Approx Age	51	51
ASHRAE Service Life	20	20
Remaining Life	0	0
Comments	4,840 CFM	5,000 CFM

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

H&V Units

Concord Engineering

Heating & Ventilating

Tag	AHU-1	AHU-2
Unit Type	Split Air Handling Unit	Split Air Handling Unit
Qty	1	1
Location	Annex	Annex
Area Served	BOE Offices	BOE Offices
Manufacturer	Carrier	Carrier
Model	-	-
Type	-	-
Size	5-ton	5-ton
Heating Type	Hot Water	Hot Water
Heating Output (MBH)		
Supply Fan (HP)		
Supply Fan VFD	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
Return Fan (HP)	N/A	N/A
Return Fan VFD	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Approx Age	51	51
ASHRAE Service Life	20	20
Remaining Life	0	0
Comments		

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

H&V Units

Concord Engineering

Heating & Ventilating

Tag	AHU-3	H&V-1-P
Unit Type	Split Air Handling Unit	Heating & Ventilating
Qty	1	1
Location	Annex	Main Bldg.
Area Served	BOE Offices	Music & Practice Rooms
Manufacturer	Carrier	Nesbitt
Model	-	-
Type	-	HV
Size	5-ton	-
Heating Type	Hot Water	Hot Water
Heating Output (MBH)		115 MBH
Supply Fan (HP)		3/4
Supply Fan VFD	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
Return Fan (HP)	N/A	N/A
Return Fan VFD	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Approx Age	51	51
ASHRAE Service Life	20	20
Remaining Life	0	0
Comments		4,000 CFM

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

H&V Units

Concord Engineering

Heating & Ventilating

Tag	H&V-2-P
Unit Type	Heating & Ventilating
Qty	1
Location	Main Bldg.
Area Served	Music & Practice Rooms
Manufacturer	Nesbitt
Model	-
Type	HV
Size	-
Heating Type	Hot Water
Heating Output (MBH)	115 MBH
Supply Fan (HP)	3/4
Supply Fan VFD	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
Return Fan (HP)	N/A
Return Fan VFD	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Approx Age	51
ASHRAE Service Life	20
Remaining Life	0
Comments	4,000 CFM

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Boilers

Boilers

Tag		
Unit Type	Cast-Iron Sectional (Steam)	Fire-Tube (Water)
Qty	1	2
Location	Annex Basement	Arts Building Boiler Room
Area Served	Annex (BOE Offices)	Entire Facility Except Annex Bldg.
Manufacturer	Weil-McLain	Cleaver Brooks
Model No.	Model 680	CB428-250
Serial No.	CP6959855	L32555 & L32656
Input Capacity (MBH)	787	10,461
Output Capacity (MBH)	634	7,009
Approx. Efficiency %	80.5%	67%
Fuel Type	Natural Gas	Natural Gas
Approx Age	3	51
ASHRAE Service Life	30	25
Remaining Life	27	0
Comments	Power Flame Burner M/N: WCR1-G-10 with 1/2 HP Blower Motor Fulton Flash Tank	

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Terminal Units

Terminal Units

Tag	Convectors	Unit Ventilators
Unit Type	Console Unit	Unit Ventilator
Qty	12	92
Location	Perimeter Walls/Windows	Perimeter Walls/Windows
Area Served	Annex Offices	Main Bldg and Art Building
Manufacturer	Nesbitt	Nesbitt
Model No.	-	TX-750 to TX-2,000
Serial No.	-	-
Cooling Type	No Cooling	No Cooling
Cooling Capacity (Tons)	N/A	N/A
Cooling Efficiency	N/A	N/A
Heating Type	Steam	Hot Water
Heating Input (MBH)	28.7 to 44.9 MBH	20.5 to 115 MBH
Heating Efficiency	80.5% (Boiler)	67% (Boilers)
Approx Age	51	51
ASHRAE Service Life	20	20
Remaining Life	0	0
Comments	Steam Coils	Hot Water Coils

Note:

"N/A" = Not Applicable.

"- " = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Terminal Units

Terminal Units

Tag	Ceiling Cabinet Unit Heaters	Hot Water Unit Heaters
Unit Type	Unit Heater	Unit Heater
Qty	28	12
Location	Ceilings	Hung from Ceilings
Area Served	Corridors, Vestibules, Stairwells, etc.	Mechanical rooms, Garage, Basement
Manufacturer	Nesbitt	Nesbitt
Model No.	-	-
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)	14.8 to 36.7 MBH	20.8 to 44.5 MBH
Heating Efficiency	67% (Boilers)	67% (Boilers)
Approx Age	51	51
ASHRAE Service Life	20	20
Remaining Life	0	0
Comments	Hot Water Coils	Hot Water Coils

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Terminal Units

Terminal Units

Tag	Hot Water Radiators	Fin-Tube Radiators
Unit Type	Console Unit	Linear Wall Units
Qty	14	Various Lengths
Location	Underneath each perimeter window	Classrooms at Perimeter Windows
Area Served	Hallways/Basement	Classrooms, etc.
Manufacturer	Nesbitt	Nesbitt
Model No.	-	-
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)	-	-
Heating Efficiency	67% (Boilers)	67% (Boilers)
Approx Age	51	51
ASHRAE Service Life	20	20
Remaining Life	0	0
Comments	Hot Water Coils	Hot Water Coils

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Dom HWH

Concord Engineering

Domestic Water Heaters

Tag		
Unit Type	Electric Storage Tank Water Heater	Gas-Fired, Modulating Water Heater
Qty	1	1
Location	Annex Building Boiler Room	Arts Building Boiler Room
Area Served	Annex Building	Entire Facility Except Annex Bldg.
Manufacturer	Bradford White	LAARS (Bradford White)
Model #	LD50S33G060	RHCV1600NACF2EXN
Serial #	-	A 09 214139
Storage Size (Gal)	50	Feeds Several Storage Tanks
Input Capacity (MBH/KW)	3.0 kW upper/lower	1,600 MBH
Recovery (Gal/Hr)	N/A	Feeds two 1,000 gallon storage tanks
Efficiency %	97%	85%
Fuel	Electric	Natural Gas
Approx Age	6	6
ASHRAE Service Life	15	15
Remaining Life	9	9
Comments	1/6 HP Circulating Pump	1/3 HP Circulating Pump

Note:

"N/A" = Not Applicable.

"- " = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Pumps

Pumps

Tag	HWP-1, 2
Unit Type	Base-mounted
Qty	2
Location	Arts Building Boiler Room
System Served	Entire Facility Except Annex Bldg.
Manufacturer	Weinman
Model #	4095CV
Serial #	-
Horse Power	10
Flow Rate (GPM)	480 GPM
Head Pressure (FTHD)	60 Feet TDH
Motor Manufacturer	Baldor
Motor Frame	215T
Electrical Power (V/P/HZ)	230-460/3/60
Motor RPM	1770
Motor Efficiency %	91.7%
Pump VFD	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
Pump Approx Age	17
ASHRAE Service Life	18
Remaining Life	1
Comments	

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Condensing Units

Condensing Units

Tag		
Unit Type	Standard Air-Cooled	Ductless Heat Pump Inverter Condenser
Qty	3	1
Location	Annex	Arts Building Roof
Area/Unit Served	Annex (Special Services, Conference Room, BOE Offices)	-
Manufacturer	Carrier	LG
Model No.	38CK060540	LUU427HV
Serial No.	5093E10293	301KAYR00050
Refrigerant Type	R-22	R-22
Cooling Capacity	5 tons	3.5 tons
Cooling Efficiency	8.5 EER	10.3 EER
Volts / Phase / Hz	208-230/3/60	208-230/1/60
Approx Age	22	12
ASHRAE Service Life	20	20
Remaining Life	0	8
Comments	1/4 HP Condenser Fan	Indoor Cassette

Note:

"N/A" = Not Applicable.

"- " = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Condensing Units

Condensing Units

Tag		
Unit Type	Ductless Heat Pump Inverter Condenser	Ductless Heat Pump Inverter Condenser
Qty	1	1
Location	Arts Building Roof	Ground-Mounted on Pad
Area/Unit Served	-	-
Manufacturer	LG	LG
Model No.	LUU427HV	LUU427HV
Serial No.	301KATM00057	301KATM00057
Refrigerant Type	R-22	R-22
Cooling Capacity	3.5 tons	3.5 tons
Cooling Efficiency	10.3 EER	10.3 EER
Volts / Phase / Hz	208-230/1/60	208-230/1/60
Approx Age	12	12
ASHRAE Service Life	20	20
Remaining Life	8	8
Comments	Indoor Cassette	Indoor Cassette

Note:

"N/A" = Not Applicable.

"- " = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Exhaust Fans

Exhaust Fans

Tag			
Unit Type	Down Blast	Down Blast	Down Blast
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	Dishwashing Room	Kitchen Exhaust Hood	Food Lab
Manufacturer	Penn Ventilator	Penn Ventilator	Penn Ventilator
Model #	CB 051	QB 360	BB 35
Motor (HP)	-	-	-
Electrical (V/H/P)	-	-	-
Approx Age	-	-	-
ASHRAE Service Life	20	20	20
Remaining Life	-	-	-
Comments			

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Kitchen / Misc.

Tag			
Unit Type	Kitchen Exhaust Hood	Pizza Oven	Range
Qty	2	1	1
Location	Kitchen	Kitchen	Kitchen
Manufacturer	-	Blodgett	Garland
Model No.	-	-	-
Fuel	Electric	Gas	Gas
Comments	20'x5'		8 Burners

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Kitchen / Misc.

Tag			
Unit Type	Grille	Deep Fryer	Steam Kettle
Qty	1	1	1
Location	Kitchen	Kitchen	Kitchen
Manufacturer	Vulcan	Vulcan	Groen
Model No.	-	-	-
Fuel	Gas	Gas	Electric
Comments		Double	HyPer Steam

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Kitchen-Misc

Concord Engineering

Kitchen / Misc.

Tag			
Unit Type	Convection Oven	Warming Cabinet	Heated Serving Tray
Qty	2	4	1
Location	Kitchen	Kitchen	Kitchen
Manufacturer	Metro	Metro	Universal Products
Model No.	-	5495 039	-
Fuel	Gas	Electric	Electric
Comments	Double Stack		4000 Watts

Note:

"N/A" = Not Applicable.

"- " = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Kitchen / Misc.

Tag			
Unit Type	Reach-in Refrigerator	Ice Machine	Walk-In Cooler/Freezer
Qty	1	1	2
Location	Kitchen	Kitchen	Kitchen
Manufacturer	Traulsen	-	Master-Bilt
Model No.	-	-	-
Fuel	Electric	Electric	Electric
Comments	Double Door		

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Kitchen / Misc.

Tag			
Unit Type	Ice Cream Cooler	Snapple Reach in Refrigerator	Reach-in Freezer
Qty	1	1	1
Location	Kitchen	Kitchen	Storage
Manufacturer	-	-	Traulsen
Model No.	-	-	-
Fuel	Electric	Electric	Electric
Comments			Double Stack

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Kitchen / Misc.

Tag			
Unit Type	Mini-Refrigerator	Drink Vending Machine	Vending Machine
Qty	1	1	2
Location	Faucly Room	Faculty Room	Main Lobby Entrance
Manufacturer	Magic Chef	-	-
Model No.	-	-	-
Fuel	Electric	Electric	Electric
Comments			

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

APPENDIX E

CEG Project #: IC15685
 Facility Name: Butler High School
 Address: 38 Bartholdi Avenue
 City, State, Zip: Butler, NJ 07405

Fixture Reference #	Location	Average Burn Hours	EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS				LIGHTING CONTROLS COST						
			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, kWh	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	Simple Payback
1	157 - Stairwell	1440	4-Lamp 1x4 F40T12 34W Surface Wrap Prismatic Lens	4	119	4	0.48	685	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	4	0.19	276	0.28	409	\$56	0	No New Controls	0	0.0%	0	\$0	\$352.00	\$380.00	\$732.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
2	Elevator Room	200	2-Lamp 1x4 F40T12 34W Surface Wrap Prismatic Lens	2	62	2	0.12	25	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	2	0.05	10	0.08	15	\$2	0	No New Controls	0	0.0%	0	\$0	\$88.00	\$95.00	\$183.00	\$0.00	87.88	\$0.00	\$0.00	\$0.00	-
3	Corridor - Science	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	13	1.55	2,228	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	13	0.62	899	0.92	1,329	\$182	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	2	20.0%	180	\$25	\$1,144.00	\$1,235.00	\$2,379.00	\$0.00	13.07	\$600.00	\$100.00	\$700.00	28.43
4	108 - Science	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	16	1.31	1,889	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	16	0.58	829	0.74	1,060	\$145	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	166	\$23	\$1,056.00	\$1,140.00	\$2,196.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	11.00
4	109 - Science	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	16	1.31	1,889	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	16	0.58	829	0.74	1,060	\$145	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	166	\$23	\$1,056.00	\$1,140.00	\$2,196.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	11.00
4	110 - Prep	200	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	10	0.82	164	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	10	0.36	72	0.46	92	\$13	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	14	\$2	\$660.00	\$712.50	\$1,372.50	\$0.00	108.89	\$50.00	\$50.00	\$100.00	50.69
4	111 - Prep	200	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	10	0.82	164	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	10	0.36	72	0.46	92	\$13	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	14	\$2	\$660.00	\$712.50	\$1,372.50	\$0.00	108.89	\$50.00	\$50.00	\$100.00	50.69
4	112 - Prep	200	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	10	0.82	164	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	10	0.36	72	0.46	92	\$13	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	14	\$2	\$660.00	\$712.50	\$1,372.50	\$0.00	108.89	\$50.00	\$50.00	\$100.00	50.69
4	113 - Prep	200	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	10	0.82	164	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	10	0.36	72	0.46	92	\$13	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	14	\$2	\$660.00	\$712.50	\$1,372.50	\$0.00	108.89	\$50.00	\$50.00	\$100.00	50.69
4	106 - Science	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	16	1.31	1,889	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	16	0.58	829	0.74	1,060	\$145	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	166	\$23	\$1,056.00	\$1,140.00	\$2,196.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	11.00
4	107 - Science	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	16	1.31	1,889	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	16	0.58	829	0.74	1,060	\$145	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	166	\$23	\$1,056.00	\$1,140.00	\$2,196.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	11.00
1	158 - Stairwell	1440	4-Lamp 1x4 F40T12 34W Surface Wrap Prismatic Lens	4	119	4	0.48	685	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	4	0.19	276	0.28	409	\$56	0	No New Controls	0	0.0%	0	\$0	\$352.00	\$380.00	\$732.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
3	114 - Science Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	6	0.71	1,856	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	6	0.29	749	0.43	1,108	\$152	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	150	\$21	\$528.00	\$570.00	\$1,098.00	\$0.00	7.24	\$50.00	\$50.00	\$100.00	4.87
3	104 - Classroom	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic 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	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	\$17	\$792.00	\$855.00	\$1,647.00	\$0.00	13.07	\$200.00	\$50.00	\$250.00	14.67
5	Boy's RR	1440	4-Lamp 2x4 F40T12 34W Surface Wrap Prismatic 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	0	No New Controls	0	0.0%	0	\$0	\$176.00	\$190.00	\$366.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
5	Girl's RR	1440	4-Lamp 2x4 F40T12 34W Surface Wrap Prismatic 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	0	No New Controls	0	0.0%	0	\$0	\$176.00	\$190.00	\$366.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
6	Corridor - Guidance	1440	2-Lamp 1x4 F32T8 32W Pendant-mounted Wrap Lens	2	62	14	0.87	1,250	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	14	0.34	484	0.53	766	\$105	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	2	20.0%	97	\$13	\$616.00	\$665.00	\$1,281.00	\$0.00	12.21	\$600.00	\$100.00	\$700.00	52.80
3	116 - Social Studies	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	6	0.71	1,028	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	6	0.29	415	0.43	613	\$84	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	83	\$11	\$528.00	\$570.00	\$1,098.00	\$0.00	13.07	\$200.00	\$50.00	\$250.00	22.00
3	117 - Storage	200	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	4	0.48	95	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	4	0.19	38	0.28	57	\$8	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	8	\$1	\$352.00	\$380.00	\$732.00	\$0.00	94.07	\$50.00	\$50.00	\$100.00	95.04
3	118 - Classroom	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	4	0.48	685	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	4	0.19	276	0.28	409	\$56	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	55	\$8	\$352.00	\$380.00	\$732.00	\$0.00	13.07	\$200.00	\$50.00	\$250.00	33.00
2	144 - Storage	200	2-Lamp 1x4 F40T12 34W Surface Wrap Prismatic Lens	2	62	2	0.12	25	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	2	0.05	10	0.08	15	\$2	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	2	\$0	\$88.00	\$95.00	\$183.00	\$0.00	87.88	\$50.00	\$50.00	\$100.00	380.17
1	Stairwell opposite Guidance Office	1440	4-Lamp 1x4 F40T12 34W Surface Wrap Prismatic 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	0	No New Controls	0	0.0%	0	\$0	\$264.00	\$285.00	\$549.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
7	Stairwell opposite Guidance Office	1440	2-Lamp 1x8 F96T12 60W Surface Strip, Open	2	109	2	0.22	314	New Fixture	1x8 8-Lamp LED T8 12 Watt	8	96	2	0.19	276	0.03	37	\$5	0	No New Controls	0	0.0%	0	\$0	\$360.00	\$190.00	\$550.00	\$0.00	107.23	\$0.00	\$0.00	\$0.00	-

Fixture Reference #	Location	Average Burn Hours	EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS				PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS				LIGHTING CONTROLS COST					
			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, kWh	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	Simple Payback
3	125 - Guidance Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	12	1.43	3,713	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	12	0.58	1,498	0.85	2,215	\$303	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	300	\$41	\$1,056.00	\$1,140.00	\$2,196.00	\$0.00	7.24	\$200.00	\$50.00	\$250.00	6.09
3	119 - Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	6	0.71	1,856	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	6	0.29	749	0.43	1,108	\$152	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	150	\$21	\$528.00	\$570.00	\$1,098.00	\$0.00	7.24	\$50.00	\$50.00	\$100.00	4.87
3	120 - Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	6	0.71	1,856	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	6	0.29	749	0.43	1,108	\$152	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	150	\$21	\$528.00	\$570.00	\$1,098.00	\$0.00	7.24	\$50.00	\$50.00	\$100.00	4.87
3	121 - Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	6	0.71	1,856	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	6	0.29	749	0.43	1,108	\$152	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	150	\$21	\$528.00	\$570.00	\$1,098.00	\$0.00	7.24	\$50.00	\$50.00	\$100.00	4.87
3	122 - Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	6	0.71	1,856	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	6	0.29	749	0.43	1,108	\$152	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	150	\$21	\$528.00	\$570.00	\$1,098.00	\$0.00	7.24	\$50.00	\$50.00	\$100.00	4.87
3	123 - Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	6	0.71	1,856	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	6	0.29	749	0.43	1,108	\$152	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	150	\$21	\$528.00	\$570.00	\$1,098.00	\$0.00	7.24	\$50.00	\$50.00	\$100.00	4.87
3	124 - Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	6	0.71	1,856	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	6	0.29	749	0.43	1,108	\$152	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	150	\$21	\$528.00	\$570.00	\$1,098.00	\$0.00	7.24	\$50.00	\$50.00	\$100.00	4.87
7	141 - Storage	200	2-Lamp 1x8 F96T12 60W Surface Strip, Open	2	109	1	0.11	22	New Fixture	1x8 8-Lamp LED T8 12 Watt	8	96	1	0.10	19	0.01	3	\$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	4	\$1	\$180.00	\$95.00	\$275.00	\$0.00	772.04	\$50.00	\$50.00	\$100.00	190.09
3	Corridor - Music	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	8	0.95	1,371	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	8	0.38	553	0.57	818	\$112	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	111	\$15	\$704.00	\$760.00	\$1,464.00	\$0.00	13.07	\$300.00	\$50.00	\$350.00	23.10
8	128 - Drop In Center	2600	2-Lamp 1x4 F40T12 34W Surface Parabolic Lens	2	62	3	0.19	484	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	3	0.07	187	0.11	296	\$41	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	37	\$5	\$132.00	\$142.50	\$274.50	\$0.00	6.76	\$50.00	\$50.00	\$100.00	19.50
8	129 - Office	2600	2-Lamp 1x4 F40T12 34W Surface Parabolic Lens	2	62	3	0.19	484	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	3	0.07	187	0.11	296	\$41	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	37	\$5	\$132.00	\$142.50	\$274.50	\$0.00	6.76	\$50.00	\$50.00	\$100.00	19.50
2	Band Office	2600	2-Lamp 1x4 F40T12 34W Surface Wrap Prismatic Lens	2	62	6	0.37	967	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	6	0.14	374	0.23	593	\$81	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	75	\$10	\$264.00	\$285.00	\$549.00	\$0.00	6.76	\$200.00	\$50.00	\$250.00	24.37
3	Music Storage	200	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	2	0.24	48	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	19	0.14	28	\$4	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	4	\$1	\$176.00	\$190.00	\$366.00	\$0.00	94.07	\$50.00	\$50.00	\$100.00	190.09
3	Music Storage	200	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	2	0.24	48	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	19	0.14	28	\$4	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	4	\$1	\$176.00	\$190.00	\$366.00	\$0.00	94.07	\$50.00	\$50.00	\$100.00	190.09
9	Music RR	1440	60W A-Lamp	1	60	2	0.12	173	Re-Lamp	Philips 18W LED A-Lamp	1	18	2	0.04	52	0.08	121	\$17	0	No New Controls	0	0.0%	0	\$0	\$40.00	\$95.00	\$135.00	\$0.00	8.15	\$0.00	\$0.00	\$0.00	-
8	130 - Office	2600	2-Lamp 1x4 F40T12 34W Surface Parabolic Lens	2	62	6	0.37	967	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	6	0.14	374	0.23	593	\$81	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	75	\$10	\$264.00	\$285.00	\$549.00	\$0.00	6.76	\$200.00	\$50.00	\$250.00	24.37
14	101 - Vocal Music	1440	3-Lamp 6"x4" T8 32W "Egg Crate" Surface Lens	3	82	31	2.54	3,660	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	31	1.12	1,607	1.43	2,053	\$281	5	Dual Technology Occupancy Sensor - Remote Mnt.	3	20.0%	321	\$44	\$2,046.00	\$2,208.75	\$4,254.75	\$0.00	15.12	\$600.00	\$150.00	\$750.00	17.03
7	Vocal Music Storage	200	2-Lamp 1x8 F96T12 60W Surface Strip, Open	2	109	1	0.11	22	New Fixture	1x8 8-Lamp LED T8 12 Watt	8	96	1	0.10	19	0.01	3	\$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	4	\$1	\$180.00	\$95.00	\$275.00	\$0.00	772.04	\$50.00	\$50.00	\$100.00	190.09
7	149 - Storage	200	2-Lamp 1x8 F96T12 60W Surface Strip, Open	2	109	2	0.22	44	New Fixture	1x8 8-Lamp LED T8 12 Watt	8	96	2	0.19	38	0.03	5	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	8	\$1	\$360.00	\$190.00	\$550.00	\$0.00	772.04	\$50.00	\$50.00	\$100.00	95.04
15	100 - Instrumental Music	1440	4-Lamp 2x4 T8 32W Recessed Prismatic Lens	4	109	36	3.92	5,651	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	36	1.73	2,488	2.20	3,162	\$433	5	Dual Technology Occupancy Sensor - Remote Mnt.	3	20.0%	498	\$68	\$3,168.00	\$2,565.00	\$5,733.00	\$0.00	13.23	\$600.00	\$150.00	\$750.00	11.00
7	Band Equipment Room	200	2-Lamp 1x8 F96T12 60W Surface Strip, Open	2	109	1	0.11	22	New Fixture	1x8 8-Lamp LED T8 12 Watt	8	96	1	0.10	19	0.01	3	\$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	4	\$1	\$180.00	\$95.00	\$275.00	\$0.00	772.04	\$50.00	\$50.00	\$100.00	190.09
1	Music Rooms Exit Stairwell	1440	4-Lamp 1x4 F40T12 34W Surface Wrap Prismatic Lens	4	119	6	0.71	1,028	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	6	0.29	415	0.43	613	\$84	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	2	20.0%	83	\$11	\$528.00	\$570.00	\$1,098.00	\$0.00	13.07	\$600.00	\$100.00	\$700.00	61.60
5	Music Rooms Exit Stairwell	1440	4-Lamp 2x4 F40T12 34W Surface Wrap Prismatic 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	0	No New Controls	0	0.0%	0	\$0	\$176.00	\$190.00	\$366.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
7	Music Corridor Storage	200	2-Lamp 1x8 F96T12 60W Surface Strip, Open	2	109	1	0.11	22	New Fixture	1x8 8-Lamp LED T8 12 Watt	8	96	1	0.10	19	0.01	3	\$0	0	No New Controls	0	0.0%	0	\$0	\$180.00	\$95.00	\$275.00	\$0.00	772.04	\$0.00	\$0.00	\$0.00	-
1	Music Corridor Stairwell	1440	4-Lamp 1x4 F40T12 34W Surface Wrap Prismatic Lens	4	119	4	0.48	685	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	4	0.19	276	0.28	409	\$56	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	55	\$8	\$352.00	\$380.00	\$732.00	\$0.00	13.07	\$300.00	\$50.00	\$350.00	46.20

Fixture Reference #	Location	Average Burn Hours	EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS				PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS				LIGHTING CONTROLS COST					
			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, kWh	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	Simple Payback
1	Annex Bldg. Entrance	1440	4-Lamp 1x4 F40T12 34W Surface Wrap Prismatic 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	0	No New Controls	0	0.0%	0	\$0	\$176.00	\$190.00	\$366.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
3	Annex Stairwell	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	13	1.55	2,228	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	13	0.62	899	0.92	1,329	\$182	0	No New Controls	0	0.0%	0	\$0	\$1,144.00	\$1,235.00	\$2,379.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
10	163 - Boiler Room	200	4-Lamp 1x8 T12 Pendant-mounted Lens	4	119	2	0.24	48	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	19	0.14	28	\$4	0	No New Controls	0	0.0%	0	\$0	\$176.00	\$190.00	\$366.00	\$0.00	94.07	\$0.00	\$0.00	\$0.00	-
7	163 - Boiler Room	200	2-Lamp 1x8 F96T12 60W Surface Strip, Open	2	109	4	0.44	87	New Fixture	1x8 8-Lamp LED T8 12 Watt	8	96	4	0.38	77	0.05	10	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	15	\$2	\$720.00	\$380.00	\$1,100.00	\$0.00	772.04	\$50.00	\$50.00	\$100.00	47.52
7	164 - Storage	200	2-Lamp 1x8 F96T12 60W Surface Strip, Open	2	109	10	1.09	218	New Fixture	1x8 8-Lamp LED T8 12 Watt	8	96	10	0.96	192	0.13	26	\$4	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	38	\$5	\$1,800.00	\$950.00	\$2,750.00	\$0.00	772.04	\$200.00	\$50.00	\$250.00	47.52
1	164 - Storage	200	4-Lamp 1x4 F40T12 34W Surface Wrap Prismatic Lens	4	119	2	0.24	48	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	19	0.14	28	\$4	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	4	\$1	\$176.00	\$190.00	\$366.00	\$0.00	94.07	\$50.00	\$50.00	\$100.00	190.09
7	166 - Storage	200	2-Lamp 1x8 F96T12 60W Surface Strip, Open	2	109	2	0.22	44	New Fixture	1x8 8-Lamp LED T8 12 Watt	8	96	2	0.19	38	0.03	5	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	8	\$1	\$360.00	\$190.00	\$550.00	\$0.00	772.04	\$50.00	\$50.00	\$100.00	95.04
1	167 - Storage	200	4-Lamp 1x4 F40T12 34W Surface Wrap Prismatic Lens	4	119	6	0.71	143	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	6	0.29	58	0.43	85	\$12	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	12	\$2	\$528.00	\$570.00	\$1,098.00	\$0.00	94.07	\$200.00	\$50.00	\$250.00	158.40
11	Art Bldg. Boiler Room	200	300W A-Lamp, Open	1	300	12	3.60	720	Re-Lamp	Hyperikon LED 54-Watt	1	54	12	0.65	130	2.95	590	\$81	0	No New Controls	0	0.0%	0	\$0	\$1,080.00	\$570.00	\$1,650.00	\$0.00	20.40	\$0.00	\$0.00	\$0.00	-
7	148 - Storage	200	2-Lamp 1x8 F96T12 60W Surface Strip, Open	2	109	2	0.22	44	New Fixture	1x8 8-Lamp LED T8 12 Watt	8	96	2	0.19	38	0.03	5	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	8	\$1	\$360.00	\$190.00	\$550.00	\$0.00	772.04	\$50.00	\$50.00	\$100.00	95.04
3	Annex Bldg. Flr 2 - Stairwell	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	5	0.60	857	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	5	0.24	346	0.36	511	\$70	0	No New Controls	0	0.0%	0	\$0	\$440.00	\$475.00	\$915.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
3	Annex Bldg. Flr 2 - Hallway	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic 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	0	No New Controls	0	0.0%	0	\$0	\$264.00	\$285.00	\$549.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
3	12 - Classroom	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	10	1.19	1,714	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	10	0.48	691	0.71	1,022	\$140	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	138	\$19	\$880.00	\$950.00	\$1,830.00	\$0.00	13.07	\$200.00	\$50.00	\$250.00	13.20
3	13 - Classroom	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	10	1.19	1,714	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	10	0.48	691	0.71	1,022	\$140	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	138	\$19	\$880.00	\$950.00	\$1,830.00	\$0.00	13.07	\$200.00	\$50.00	\$250.00	13.20
3	Annex Bldg. Flr 2 - Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	10	1.19	3,094	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	10	0.48	1,248	0.71	1,846	\$253	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	250	\$34	\$880.00	\$950.00	\$1,830.00	\$0.00	7.24	\$200.00	\$50.00	\$250.00	7.31
3	Annex Bldg. Flr 2 - Storage	200	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	2	0.24	48	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	19	0.14	28	\$4	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	4	\$1	\$176.00	\$190.00	\$366.00	\$0.00	94.07	\$50.00	\$50.00	\$100.00	190.09
3	Annex Bldg. Flr 2 - Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	2	0.24	619	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	250	0.14	369	\$51	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	50	\$7	\$176.00	\$190.00	\$366.00	\$0.00	7.24	\$50.00	\$50.00	\$100.00	14.62
3	10 - Classroom	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	10	1.19	1,714	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	10	0.48	691	0.71	1,022	\$140	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	138	\$19	\$880.00	\$950.00	\$1,830.00	\$0.00	13.07	\$200.00	\$50.00	\$250.00	13.20
3	11 - Classroom	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	10	1.19	1,714	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	10	0.48	691	0.71	1,022	\$140	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	138	\$19	\$880.00	\$950.00	\$1,830.00	\$0.00	13.07	\$200.00	\$50.00	\$250.00	13.20
3	Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	10	1.19	3,094	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	10	0.48	1,248	0.71	1,846	\$253	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	250	\$34	\$880.00	\$950.00	\$1,830.00	\$0.00	7.24	\$200.00	\$50.00	\$250.00	7.31
12	Auditorium	1440	2x2 Ceiling Recessed w/ 250W MH	1	295	16	4.72	6,797	Bypass Ballast/Re-Lamp	54 Watt LED Lamp	1	54	16	0.86	1,244	3.86	5,553	\$761	0	No New Controls	0	0.0%	0	\$0	\$1,920.00	\$2,880.00	\$4,800.00	\$0.00	6.31	\$0.00	\$0.00	\$0.00	-
2	Auditorium	1440	2-Lamp 1x4 F40T12 34W Surface Wrap Prismatic Lens	2	62	31	1.92	2,768	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	31	0.74	1,071	1.18	1,696	\$232	0	No New Controls	0	0.0%	0	\$0	\$1,364.00	\$1,472.50	\$2,836.50	\$0.00	12.21	\$0.00	\$0.00	\$0.00	-
3	Annex Bldg. Flr 3 - Hallway	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	5	0.60	857	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	5	0.24	346	0.36	511	\$70	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	69	\$9	\$440.00	\$475.00	\$915.00	\$0.00	13.07	\$300.00	\$50.00	\$350.00	36.96
3	360 - Offices	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	4	0.48	1,238	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	4	0.19	499	0.28	738	\$101	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	100	\$14	\$352.00	\$380.00	\$732.00	\$0.00	7.24	\$50.00	\$50.00	\$100.00	7.31
3	364 - Offices	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	8	0.95	2,475	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	8	0.38	998	0.57	1,477	\$202	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	200	\$27	\$704.00	\$760.00	\$1,464.00	\$0.00	7.24	\$50.00	\$50.00	\$100.00	3.66

Fixture Reference #	Location	Average Burn Hours	EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS					PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS				LIGHTING CONTROLS COST				
			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	Simple Payback
3	364 - Offices	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	4	0.48	1,238	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	4	0.19	499	0.28	738	\$101	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	100	\$14	\$352.00	\$380.00	\$732.00	\$0.00	7.24	\$50.00	\$50.00	\$100.00	7.31
3	364 - Offices	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	2	0.24	619	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	250	0.14	369	\$51	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	50	\$7	\$176.00	\$190.00	\$366.00	\$0.00	7.24	\$50.00	\$50.00	\$100.00	14.62
7	364 - Office Storage	200	2-Lamp 1x8 F96T12 60W Surface Strip, Open	2	109	1	0.11	22	New Fixture	1x8 8-Lamp LED T8 12 Watt	8	96	1	0.10	19	0.01	3	\$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	4	\$1	\$180.00	\$95.00	\$275.00	\$0.00	772.04	\$50.00	\$50.00	\$100.00	190.09
3	Office RR	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic 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	26.40
13	Office RR	1440	2-Lamp 1x2 F20T12 Magnetic Ballast Surface Strip	2	42	2	0.08	121	Bypass Ballast/Re-Lamp	Seesmart LED 24" Tube UF-24-7.5-F-35	2	21	2	0.04	60	0.04	60	\$8	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	12	\$2	\$80.00	\$95.00	\$175.00	\$0.00	21.12	\$50.00	\$50.00	\$100.00	60.34
3	370 - Offices	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	15	1.79	4,641	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	15	0.72	1,872	1.07	2,769	\$379	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	374	\$51	\$1,320.00	\$1,425.00	\$2,745.00	\$0.00	7.24	\$200.00	\$50.00	\$250.00	4.87
3	371 - Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	2	0.24	619	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	250	0.14	369	\$51	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	50	\$7	\$176.00	\$190.00	\$366.00	\$0.00	7.24	\$50.00	\$50.00	\$100.00	14.62
3	373 - Offices	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	10	1.19	3,094	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	10	0.48	1,248	0.71	1,846	\$253	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	250	\$34	\$880.00	\$950.00	\$1,830.00	\$0.00	7.24	\$200.00	\$50.00	\$250.00	7.31
19	Electrical Room	200	2-Lamp 1x4 T8 32W Surface, Prismatic Wrap Lens	2	62	2	0.12	25	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	2	0.05	10	0.08	15	\$2	0	No New Controls	0	0.0%	0	\$0	\$88.00	\$95.00	\$183.00	\$0.00	87.88	\$0.00	\$0.00	\$0.00	-
11	150 - Equipment Room	200	300W A-Lamp, Open	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	-
11	149 - Garage	600	300W A-Lamp, Open	1	300	8	2.40	1,440	Re-Lamp	Hyperikon LED 54-Watt	1	54	8	0.43	259	1.97	1,181	\$162	0	No New Controls	0	0.0%	0	\$0	\$720.00	\$380.00	\$1,100.00	\$0.00	6.80	\$0.00	\$0.00	\$0.00	-
16	149 - Garage	600	2-Lamp 1x4 F40T12 32W Open, Ceiling Mounted	2	61.6	24	1.48	887	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	24	0.58	346	0.90	541	\$74	0	No New Controls	0	0.0%	0	\$0	\$1,056.00	\$1,140.00	\$2,196.00	\$0.00	29.60	\$0.00	\$0.00	\$0.00	-
17	155 - Storage	200	75W CFL, Industrial Shade, Open	1	75	4	0.30	60	Existing to Remain	No Change	1	75	0	0.30	60	0.00	0	\$0	5	Dual Technology Occupancy Sensor - Remote Mnt.	2	20.0%	12	\$2	\$0.00	\$0.00	\$0.00	\$0.00	-	\$400.00	\$100.00	\$500.00	304.14
9	155 - Storage	200	60W A-Lamp	1	60	2	0.12	24	Re-Lamp	Philips 18W LED A-Lamp	1	18	2	0.04	7	0.08	17	\$2	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$40.00	\$95.00	\$135.00	\$0.00	58.65	\$50.00	\$50.00	\$100.00	506.89
18	155 - Room A	200	150W A-Lamp	1	150	2	0.30	60	Re-Lamp	LED Replacement Bulb (27-Watt)	1	27	2	0.05	11	0.25	49	\$7	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	2	\$0	\$160.00	\$95.00	\$255.00	\$0.00	37.83	\$50.00	\$50.00	\$100.00	337.93
19	155 - Room B	200	2-Lamp 1x4 T8 32W Surface, Prismatic Wrap Lens	2	62	2	0.12	25	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	2	0.05	10	0.08	15	\$2	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	2	\$0	\$88.00	\$95.00	\$183.00	\$0.00	87.88	\$50.00	\$50.00	\$100.00	380.17
18	155 - Closet	200	150W A-Lamp	1	150	1	0.15	30	Re-Lamp	LED Replacement Bulb (27-Watt)	1	27	1	0.03	5	0.12	25	\$3	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$80.00	\$47.50	\$127.50	\$0.00	37.83	\$50.00	\$50.00	\$100.00	675.86
17	154 - Storage	200	75W CFL, Industrial Shade, Open	1	75	4	0.30	60	Existing to Remain	No Change	1	75	0	0.30	60	0.00	0	\$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	12	\$2	\$0.00	\$0.00	\$0.00	\$0.00	-	\$50.00	\$50.00	\$100.00	60.83
20	156 - Storage	200	2-Lamp 1x4 T8 32W Pendant-hung Egg Crate Lens	2	62	2	0.12	25	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	2	0.05	10	0.08	15	\$2	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	2	\$0	\$88.00	\$95.00	\$183.00	\$0.00	87.88	\$50.00	\$50.00	\$100.00	380.17
21	156 - Storage	200	150W A-Lamp, Industrial Shade, Open Lens	1	150	2	0.30	60	Re-Lamp	LED Replacement Bulb (27-Watt)	1	27	2	0.05	11	0.25	49	\$7	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	2	\$0	\$160.00	\$95.00	\$255.00	\$0.00	37.83	\$50.00	\$50.00	\$100.00	337.93
9	156 - RR	1440	60W A-Lamp	1	60	1	0.06	86	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	26	0.04	60	\$8	0	No New Controls	0	0.0%	0	\$0	\$20.00	\$47.50	\$67.50	\$0.00	8.15	\$0.00	\$0.00	\$0.00	-
22	Art. Bldg. Lower Hall/Stairwell	1440	13W CFL, Open Shade	1	14	3	0.04	60	Existing to Remain	No Change	1	14	0	0.04	60	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	-
5	Main Bldg. 2nd Flr. Hall/Stairwell	1440	4-Lamp 2x4 F40T12 34W Surface Wrap Prismatic 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	0	No New Controls	0	0.0%	0	\$0	\$264.00	\$285.00	\$549.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
23	Corridor - 2nd Floor Classrooms	1440	3-Lamp 2x4 T8 32W Recessed, Prismatic Lens	3	82	10	0.82	1,181	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	10	0.36	518	0.46	662	\$91	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	2	20.0%	104	\$14	\$660.00	\$950.00	\$1,610.00	\$0.00	17.74	\$600.00	\$100.00	\$700.00	49.28
4	213 - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	12	0.98	1,417	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	622	0.55	795	\$109	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	\$17	\$792.00	\$855.00	\$1,647.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	14.67

Fixture Reference #	Location	Average Burn Hours	EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS				PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS				LIGHTING CONTROLS COST					
			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	Simple Payback
4	214 - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	12	0.98	1,417	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	622	0.55	795	\$109	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	\$17	\$792.00	\$855.00	\$1,647.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	14.67
4	211B - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	6	0.49	708	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	6	0.22	311	0.28	397	\$54	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	62	\$9	\$396.00	\$427.50	\$823.50	\$0.00	15.12	\$200.00	\$50.00	\$250.00	29.33
7	211B - Closet A	200	2-Lamp 1x8 F96T12 60W Surface Strip, Open	2	109	1	0.11	22	New Fixture	1x8 8-Lamp LED T8 12 Watt	8	96	1	0.10	19	0.01	3	\$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	4	\$1	\$180.00	\$95.00	\$275.00	\$0.00	772.04	\$50.00	\$50.00	\$100.00	190.09
9	211B - Closet B	200	60W A-Lamp	1	60	1	0.06	12	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	4	0.04	8	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$20.00	\$47.50	\$67.50	\$0.00	58.65	\$50.00	\$50.00	\$100.00	1013.79
4	211A - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	6	0.49	708	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	6	0.22	311	0.28	397	\$54	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	62	\$9	\$396.00	\$427.50	\$823.50	\$0.00	15.12	\$200.00	\$50.00	\$250.00	29.33
4	212 - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	12	0.98	1,417	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	622	0.55	795	\$109	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	\$17	\$792.00	\$855.00	\$1,647.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	14.67
9	212 - Closet	200	60W A-Lamp	1	60	1	0.06	12	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	4	0.04	8	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$20.00	\$47.50	\$67.50	\$0.00	58.65	\$50.00	\$50.00	\$100.00	1013.79
4	209B - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	6	0.49	708	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	6	0.22	311	0.28	397	\$54	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	62	\$9	\$396.00	\$427.50	\$823.50	\$0.00	15.12	\$200.00	\$50.00	\$250.00	29.33
3	209A - Res. Ctr. Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	9	1.07	2,785	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	9	0.43	1,123	0.64	1,661	\$228	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	225	\$31	\$792.00	\$855.00	\$1,647.00	\$0.00	7.24	\$200.00	\$50.00	\$250.00	8.12
4	210 - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	12	0.98	1,417	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	622	0.55	795	\$109	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	\$17	\$792.00	\$855.00	\$1,647.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	14.67
3	Boys Toilet	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	4	0.48	685	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	4	0.19	276	0.28	409	\$56	0	No New Controls	0	0.0%	0	\$0	\$352.00	\$380.00	\$732.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
1	Main Bldg. Stairwell #158	1440	4-Lamp 1x4 F40T12 34W Surface Wrap Prismatic 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	0	No New Controls	0	0.0%	0	\$0	\$176.00	\$190.00	\$366.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
23	Main Bldg. - 2nd Floor Main Corridor	1440	3-Lamp 2x4 T8 32W Recessed, Prismatic Lens	3	82	12	0.98	1,417	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	622	0.55	795	\$109	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	2	20.0%	124	\$17	\$792.00	\$1,140.00	\$1,932.00	\$0.00	17.74	\$600.00	\$100.00	\$700.00	41.07
1	Main Corridor Stairwell	1440	4-Lamp 1x4 F40T12 34W Surface Wrap Prismatic 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	0	No New Controls	0	0.0%	0	\$0	\$176.00	\$190.00	\$366.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
4	208 - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	12	0.98	1,417	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	622	0.55	795	\$109	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	\$17	\$792.00	\$855.00	\$1,647.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	14.67
3	Principal's Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic 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	14.62
3	Main Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	7	0.83	2,166	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	7	0.34	874	0.50	1,292	\$177	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	175	\$24	\$616.00	\$665.00	\$1,281.00	\$0.00	7.24	\$200.00	\$50.00	\$250.00	10.44
23	Copy Room	2600	3-Lamp 2x4 T8 32W Recessed, Prismatic Lens	3	82	3	0.25	640	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	3	0.11	281	0.14	359	\$49	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	56	\$8	\$198.00	\$285.00	\$483.00	\$0.00	9.83	\$50.00	\$50.00	\$100.00	13.00
23	Entrance Corridor	1440	3-Lamp 2x4 T8 32W Recessed, Prismatic Lens	3	82	3	0.25	354	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	3	0.11	156	0.14	199	\$27	0	No New Controls	0	0.0%	0	\$0	\$198.00	\$285.00	\$483.00	\$0.00	17.74	\$0.00	\$0.00	\$0.00	-
4	204 - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	12	0.98	1,417	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	622	0.55	795	\$109	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	\$17	\$792.00	\$855.00	\$1,647.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	14.67
9	204 - Closet	200	60W A-Lamp	1	60	1	0.06	12	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	4	0.04	8	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$20.00	\$47.50	\$67.50	\$0.00	58.65	\$50.00	\$50.00	\$100.00	1013.79
3	Honor Society Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	3	0.36	928	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	3	0.14	374	0.21	554	\$76	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	75	\$10	\$264.00	\$285.00	\$549.00	\$0.00	7.24	\$50.00	\$50.00	\$100.00	9.75
7	Student Council Office	2600	2-Lamp 1x8 F96T12 60W Surface Strip, Open	2	109	2	0.22	567	New Fixture	1x8 8-Lamp LED T8 12 Watt	8	96	2	0.19	499	0.03	68	\$9	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	100	\$14	\$360.00	\$190.00	\$550.00	\$0.00	59.39	\$50.00	\$50.00	\$100.00	7.31
3	VP Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	3	0.36	928	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	3	0.14	374	0.21	554	\$76	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	75	\$10	\$264.00	\$285.00	\$549.00	\$0.00	7.24	\$50.00	\$50.00	\$100.00	9.75
3	202 - Attendance Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic 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	14.62

Fixture Reference #	Location	Average Burn Hours	EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS				PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS				LIGHTING CONTROLS COST					
			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	Simple Payback
3	202A - Closet	200	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	2	0.24	48	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	19	0.14	28	\$4	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	4	\$1	\$176.00	\$190.00	\$366.00	\$0.00	94.07	\$50.00	\$50.00	\$100.00	190.09
4	Tech Office - A	2600	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	3	0.25	640	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	3	0.11	281	0.14	359	\$49	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	56	\$8	\$198.00	\$213.75	\$411.75	\$0.00	8.38	\$50.00	\$50.00	\$100.00	13.00
23	Tech Office - B	2600	3-Lamp 2x4 T8 32W Recessed, Prismatic Lens	3	82	2	0.16	426	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	2	0.07	187	0.09	239	\$33	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	37	\$5	\$132.00	\$190.00	\$322.00	\$0.00	9.83	\$50.00	\$50.00	\$100.00	19.50
3	Main Bldg. Auditorium Corridor	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	5	0.60	857	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	5	0.24	346	0.36	511	\$70	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	69	\$9	\$440.00	\$475.00	\$915.00	\$0.00	13.07	\$300.00	\$50.00	\$350.00	36.96
5	Auditorium Stairwell	1440	4-Lamp 2x4 F40T12 34W Surface Wrap Prismatic 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	0	No New Controls	0	0.0%	0	\$0	\$176.00	\$190.00	\$366.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
3	SENSE ROOM	200	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	2	0.24	48	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	19	0.14	28	\$4	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	4	\$1	\$176.00	\$190.00	\$366.00	\$0.00	94.07	\$50.00	\$50.00	\$100.00	190.09
2	SENSE Room Closet	200	2-Lamp 1x4 F40T12 34W Surface Wrap Prismatic Lens	2	62	1	0.06	12	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	5	0.04	8	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$44.00	\$47.50	\$91.50	\$0.00	87.88	\$50.00	\$50.00	\$100.00	760.34
3	Art Bldg. Main Level Secondary Corridor	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	6	0.71	1,028	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	6	0.29	415	0.43	613	\$84	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	2	20.0%	83	\$11	\$528.00	\$570.00	\$1,098.00	\$0.00	13.07	\$600.00	\$100.00	\$700.00	61.60
16	227 - Public Safety Academy	1440	2-Lamp 1x4 F40T12 32W Open, Ceiling Mounted	2	61.6	26	1.60	2,306	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	26	0.62	899	0.98	1,408	\$193	5	Dual Technology Occupancy Sensor - Remote Mnt.	2	20.0%	180	\$25	\$1,144.00	\$1,235.00	\$2,379.00	\$0.00	12.34	\$400.00	\$100.00	\$500.00	20.31
7	227 - Public Safety Academy	1440	2-Lamp 1x8 F96T12 60W Surface Strip, Open	2	109	4	0.44	628	New Fixture	1x8 8-Lamp LED T8 12 Watt	8	96	4	0.38	553	0.05	75	\$10	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	111	\$15	\$720.00	\$380.00	\$1,100.00	\$0.00	107.23	\$200.00	\$50.00	\$250.00	16.50
24	Transition Room 1	200	2-Lamp 1x4 F40T12 34W Egg Crate, Open	2	62	6	0.37	74	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	6	0.14	29	0.23	46	\$6	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	6	\$1	\$264.00	\$285.00	\$549.00	\$0.00	87.88	\$200.00	\$50.00	\$250.00	316.81
25	Transition Room 2	200	100W A-Lamp	1	100	2	0.20	40	Re-Lamp	Philips 18W LED A-Lamp	1	18	2	0.04	7	0.16	33	\$4	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$40.00	\$95.00	\$135.00	\$0.00	30.04	\$50.00	\$50.00	\$100.00	506.89
9	Transition Room 3	200	60W A-Lamp	1	60	1	0.06	12	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	4	0.04	8	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$20.00	\$47.50	\$67.50	\$0.00	58.65	\$50.00	\$50.00	\$100.00	1013.79
2	Transition Room 3	200	2-Lamp 1x4 F40T12 34W Surface Wrap Prismatic Lens	2	62	1	0.06	12	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	5	0.04	8	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$44.00	\$47.50	\$91.50	\$0.00	87.88	\$50.00	\$50.00	\$100.00	760.34
2	Transition Room 4	200	2-Lamp 1x4 F40T12 34W Surface Wrap Prismatic Lens	2	62	1	0.06	12	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	5	0.04	8	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$44.00	\$47.50	\$91.50	\$0.00	87.88	\$50.00	\$50.00	\$100.00	760.34
26	223 - Weight Room	1440	2-Lamp 1x4 F40T12 34W Pendant-hung, Open	2	62	22	1.36	1,964	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	22	0.53	760	0.84	1,204	\$165	5	Dual Technology Occupancy Sensor - Remote Mnt.	2	20.0%	152	\$21	\$968.00	\$1,045.00	\$2,013.00	\$0.00	12.21	\$400.00	\$100.00	\$500.00	24.00
16	223 - Lower Weight Room	1440	2-Lamp 1x4 F40T12 32W Open, Ceiling Mounted	2	61.6	6	0.37	532	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	6	0.14	207	0.23	325	\$45	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	41	\$6	\$264.00	\$285.00	\$549.00	\$0.00	12.34	\$200.00	\$50.00	\$250.00	44.00
23	223 - Weight Room Office	2600	3-Lamp 2x4 T8 32W Recessed, Prismatic Lens	3	82	2	0.16	426	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	2	0.07	187	0.09	239	\$33	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	37	\$5	\$132.00	\$190.00	\$322.00	\$0.00	9.83	\$50.00	\$50.00	\$100.00	19.50
27	223 - Weight Room Office	2600	4-Lamp 2x4 T12 34W Surface, Egg Crate	4	119	4	0.48	1,238	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	4	0.19	499	0.28	738	\$101	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	100	\$14	\$352.00	\$380.00	\$732.00	\$0.00	7.24	\$50.00	\$50.00	\$100.00	7.31
4	Nurse's Office	2600	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	12	0.98	2,558	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	1,123	0.55	1,435	\$197	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	225	\$31	\$792.00	\$855.00	\$1,647.00	\$0.00	8.38	\$200.00	\$50.00	\$250.00	8.12
28	Classroom	1440	4-Lamp 2x4 T12 34W Recessed, Egg Crate	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	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	\$17	\$792.00	\$855.00	\$1,647.00	\$0.00	13.07	\$200.00	\$50.00	\$250.00	14.67
4	Library	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	35	2.87	4,133	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	35	1.26	1,814	1.61	2,318	\$318	5	Dual Technology Occupancy Sensor - Remote Mnt.	3	20.0%	363	\$50	\$2,310.00	\$2,493.75	\$4,803.75	\$0.00	15.12	\$600.00	\$150.00	\$750.00	15.09
15	Girl's Toilet	1440	4-Lamp 2x4 T8 32W Recessed Prismatic Lens	4	109	2	0.22	314	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	138	0.12	176	\$24	0	No New Controls	0	0.0%	0	\$0	\$176.00	\$142.50	\$318.50	\$0.00	13.23	\$0.00	\$0.00	\$0.00	-
9	Janitor's Closet	200	60W A-Lamp	1	60	1	0.06	12	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	4	0.04	8	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$20.00	\$47.50	\$67.50	\$0.00	58.65	\$50.00	\$50.00	\$100.00	1013.79
15	Boy's Toilet	1440	4-Lamp 2x4 T8 32W Recessed Prismatic Lens	4	109	2	0.22	314	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	138	0.12	176	\$24	0	No New Controls	0	0.0%	0	\$0	\$176.00	\$142.50	\$318.50	\$0.00	13.23	\$0.00	\$0.00	\$0.00	-

Fixture Reference #	Location	Average Burn Hours	EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS				PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS				LIGHTING CONTROLS COST					
			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, kWh	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	Simple Payback
29	Main Entry/Corridor	1440	6-Lamp 4x4 T12 34W Recessed Prismatic	6	184	8	1.47	2,120	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	6	72	8	0.58	829	0.90	1,290	\$177	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	166	\$23	\$1,056.00	\$1,440.00	\$2,496.00	\$0.00	14.12	\$300.00	\$50.00	\$350.00	15.40
9	Art Bldg. Main Level Stairwell	1440	60W A-Lamp	1	60	1	0.06	86	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	26	0.04	60	\$8	0	No New Controls	0	0.0%	0	\$0	\$20.00	\$47.50	\$67.50	\$0.00	8.15	\$0.00	\$0.00	\$0.00	-
15	Art Bldg. Main Level Corridor	1440	4-Lamp 2x4 T8 32W Recessed Prismatic Lens	4	109	6	0.65	942	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	6	0.29	415	0.37	527	\$72	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	83	\$11	\$528.00	\$427.50	\$955.50	\$0.00	13.23	\$300.00	\$50.00	\$350.00	30.80
30	Cafeteria	2600	2-Lamp 6"x4" T8 32W Pendant-hung Direct/Indirect Lens	2	62	32	1.98	5,158	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	32	0.77	1,997	1.22	3,162	\$433	0	No New Controls	0	0.0%	0	\$0	\$1,408.00	\$1,520.00	\$2,928.00	\$0.00	6.76	\$0.00	\$0.00	\$0.00	-
31	Cafeteria	2600	2-Lamp 13W CFL, Recessed Hi-Hat	2	25	16	0.40	1,040	Existing to Remain	No Change	2	25	0	0.40	1,040	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	-
32	Cafeteria	2600	2-Lamp 23W CFL, Shade Lamp	2	25	12	0.30	780	Existing to Remain	No Change	2	25	0	0.30	780	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	-
34	Cafeteria - Storage	200	4-Lamp 1x4 T12 34W Industrial Shade, Open	4	119	1	0.12	24	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	1	0.05	10	0.07	14	\$2	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	2	\$0	\$88.00	\$95.00	\$183.00	\$0.00	94.07	\$50.00	\$50.00	\$100.00	380.17
4	Faculty Dining	2600	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	6	0.49	1,279	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	6	0.22	562	0.28	718	\$98	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	112	\$15	\$396.00	\$427.50	\$823.50	\$0.00	8.38	\$200.00	\$50.00	\$250.00	16.25
23	Office	2600	3-Lamp 2x4 T8 32W Recessed, Prismatic Lens	3	82	2	0.16	426	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	2	0.07	187	0.09	239	\$33	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	37	\$5	\$132.00	\$190.00	\$322.00	\$0.00	9.83	\$50.00	\$50.00	\$100.00	19.50
35	Kitchen	600	2-Lamp 1x4 T12 34W Industrial Shade, Open, w/ Tube Guards	2	62	32	1.98	1,190	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	32	0.77	461	1.22	730	\$100	0	No New Controls	0	0.0%	0	\$0	\$1,408.00	\$1,520.00	\$2,928.00	\$0.00	29.29	\$0.00	\$0.00	\$0.00	-
38	Kitchen Storage Rooms	200	75W A-Lamp, Pendant, Open	1	75	10	0.75	150	Re-Lamp	Philips 18W LED A-Lamp	1	18	10	0.18	36	0.57	114	\$16	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	7	\$1	\$200.00	\$475.00	\$675.00	\$0.00	43.22	\$200.00	\$50.00	\$250.00	253.45
38	Kitchen RR	1440	75W A-Lamp, Pendant, Open	1	75	2	0.15	216	Re-Lamp	Philips 18W LED A-Lamp	1	18	2	0.04	52	0.11	164	\$22	0	No New Controls	0	0.0%	0	\$0	\$40.00	\$95.00	\$135.00	\$0.00	6.00	\$0.00	\$0.00	\$0.00	-
36	Kitchen Hoods	600	60W Incandescent "Jelly Jars"	1	60	10	0.60	360	Re-Lamp	TCP 13W LED A21 LED	1	13	10	0.13	78	0.47	282	\$39	0	No New Controls	0	0.0%	0	\$0	\$180.00	\$237.50	\$417.50	\$0.00	10.81	\$0.00	\$0.00	\$0.00	-
9	Office w/ Closet	2600	60W A-Lamp	1	60	3	0.18	468	Re-Lamp	Philips 18W LED A-Lamp	1	18	3	0.05	140	0.13	328	\$45	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	28	\$4	\$60.00	\$142.50	\$202.50	\$0.00	4.51	\$50.00	\$50.00	\$100.00	25.99
35	Office	2600	2-Lamp 1x4 T12 34W Industrial Shade, Open, w/ Tube Guards	2	62	1	0.06	161	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	62	0.04	99	\$14	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	12	\$2	\$44.00	\$47.50	\$91.50	\$0.00	6.76	\$50.00	\$50.00	\$100.00	58.49
9	Office	2600	60W A-Lamp	1	60	3	0.18	468	Re-Lamp	Philips 18W LED A-Lamp	1	18	3	0.05	140	0.13	328	\$45	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	28	\$4	\$60.00	\$142.50	\$202.50	\$0.00	4.51	\$50.00	\$50.00	\$100.00	25.99
35	Office	2600	2-Lamp 1x4 T12 34W Industrial Shade, Open, w/ Tube Guards	2	62	2	0.12	322	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	2	0.05	125	0.08	198	\$27	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	25	\$3	\$88.00	\$95.00	\$183.00	\$0.00	6.76	\$50.00	\$50.00	\$100.00	29.24
19	Kitchen Passage	1440	2-Lamp 1x4 T8 32W Surface, Prismatic Wrap Lens	2	62	4	0.25	357	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	4	0.10	138	0.15	219	\$30	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	2	20.0%	28	\$4	\$176.00	\$190.00	\$366.00	\$0.00	12.21	\$600.00	\$100.00	\$700.00	184.81
18	Storage Closets	200	150W A-Lamp	1	150	3	0.45	90	Re-Lamp	LED Replacement Bulb (27-Watt)	1	27	3	0.08	16	0.37	74	\$10	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	3	\$0	\$240.00	\$142.50	\$382.50	\$0.00	37.83	\$50.00	\$50.00	\$100.00	225.29
25	Closet	200	100W A-Lamp	1	100	1	0.10	20	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	4	0.08	16	\$2	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$20.00	\$47.50	\$67.50	\$0.00	30.04	\$50.00	\$50.00	\$100.00	1013.79
23	Girl's Locker Room	1440	3-Lamp 2x4 T8 32W Recessed, Prismatic Lens	3	82	13	1.07	1,535	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	13	0.47	674	0.60	861	\$118	0	No New Controls	0	0.0%	0	\$0	\$858.00	\$1,235.00	\$2,093.00	\$0.00	17.74	\$0.00	\$0.00	\$0.00	-
37	Girl's Locker Room	1440	2-Lamp 2x2 T12 34W U-Tube, Recessed Prismatic Lens	2	62	2	0.12	179	New Fixture	New 2x2 LED Recessed Prismatic Fixture	2	24	2	0.05	69	0.08	109	\$15	0	No New Controls	0	0.0%	0	\$0	\$240.00	\$190.00	\$430.00	\$0.00	28.68	\$0.00	\$0.00	\$0.00	-
9	Girl's Locker Room	1440	60W A-Lamp	1	60	2	0.12	173	Re-Lamp	Philips 18W LED A-Lamp	1	18	2	0.04	52	0.08	121	\$17	0	No New Controls	0	0.0%	0	\$0	\$40.00	\$95.00	\$135.00	\$0.00	8.15	\$0.00	\$0.00	\$0.00	-
23	Girl's Locker Room - Shower	1440	3-Lamp 2x4 T8 32W Recessed, Prismatic Lens	3	82	2	0.16	236	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	2	0.07	104	0.09	132	\$18	0	No New Controls	0	0.0%	0	\$0	\$132.00	\$190.00	\$322.00	\$0.00	17.74	\$0.00	\$0.00	\$0.00	-
9	Custodian's Closet	200	60W A-Lamp	1	60	1	0.06	12	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	4	0.04	8	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$20.00	\$47.50	\$67.50	\$0.00	58.65	\$50.00	\$50.00	\$100.00	1013.79

Fixture Reference #	Location	Average Burn Hours	EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS				PROPOSED LIGHTING CONTROLS						LIGHTING RETROFIT COSTS				LIGHTING CONTROLS COST				
			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, kWh	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	Simple Payback
2	Girl's Locker Room - Office	2600	2-Lamp 1x4 F40T12 34W Surface Wrap Prismatic Lens	2	62	2	0.12	322	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	2	0.05	125	0.08	198	\$27	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	25	\$3	\$88.00	\$95.00	\$183.00	\$0.00	6.76	\$50.00	\$50.00	\$100.00	29.24
36	Office Closet	200	60W Incandescent "Jelly Jars"	1	60	1	0.06	12	Re-Lamp	TCP 13W LED A21 LED	1	13	1	0.01	3	0.05	9	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$18.00	\$23.75	\$41.75	\$0.00	32.42	\$50.00	\$50.00	\$100.00	1403.71
23	Boy's Locker Room	1440	3-Lamp 2x4 T8 32W Recessed, Prismatic Lens	3	82	13	1.07	1,535	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	13	0.47	674	0.60	861	\$118	0	No New Controls	0	0.0%	0	\$0	\$858.00	\$1,235.00	\$2,093.00	\$0.00	17.74	\$0.00	\$0.00	\$0.00	-
37	Boy's Locker Room	1440	2-Lamp 2x2 T12 34W U-Tube, Recessed Prismatic Lens	2	62	2	0.12	179	New Fixture	New 2x2 LED Recessed Prismatic Fixture	2	24	2	0.05	69	0.08	109	\$15	0	No New Controls	0	0.0%	0	\$0	\$240.00	\$190.00	\$430.00	\$0.00	28.68	\$0.00	\$0.00	\$0.00	-
18	Custodian's Closet	200	150W A-Lamp	1	150	1	0.15	30	Re-Lamp	LED Replacement Bulb (27-Watt)	1	27	1	0.03	5	0.12	25	\$3	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$80.00	\$47.50	\$127.50	\$0.00	37.83	\$50.00	\$50.00	\$100.00	675.86
2	Boy's Locker Room - Office	2600	2-Lamp 1x4 F40T12 34W Surface Wrap Prismatic Lens	2	62	2	0.12	322	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	2	0.05	125	0.08	198	\$27	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	25	\$3	\$88.00	\$95.00	\$183.00	\$0.00	6.76	\$50.00	\$50.00	\$100.00	29.24
36	Office Closet	200	60W Incandescent "Jelly Jars"	1	60	1	0.06	12	Re-Lamp	TCP 13W LED A21 LED	1	13	1	0.01	3	0.05	9	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$18.00	\$23.75	\$41.75	\$0.00	32.42	\$50.00	\$50.00	\$100.00	1403.71
33	Gymnasium	2600	6-Lamp FT40W/2G11 Biax Fluorescent Lamp	6	264	48	12.67	32,947	Remove & Replace With New Fixture	CREE High Output Series 24,000 Lumen High-Bay Luminaire CXBP16 WG-AP CXBAHC OR JP 40KSUL10VLS15P	1	240	48	11.52	29,952	1.15	2,995	\$410	0	No New Controls	0	0.0%	0	\$0	\$22,608.00	\$15,840.00	\$38,448.00	\$0.00	93.70	\$0.00	\$0.00	\$0.00	-
23	Gym Lockers	200	3-Lamp 2x4 T8 32W Recessed, Prismatic Lens	3	82	2	0.16	33	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	2	0.07	14	0.09	18	\$3	0	No New Controls	0	0.0%	0	\$0	\$132.00	\$190.00	\$322.00	\$0.00	127.74	\$0.00	\$0.00	\$0.00	-
5	Main Bldg. 3rd Flr. Hall/Stairwell	1440	4-Lamp 2x4 F40T12 34W Surface Wrap Prismatic 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	0	No New Controls	0	0.0%	0	\$0	\$176.00	\$190.00	\$366.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
39	Corridor - 3rd Floor Classrooms	1440	3-Lamp 1x4 T8 32W Pendant, Strip	3	82	15	1.23	1,771	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	15	0.54	778	0.69	994	\$136	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	2	20.0%	156	\$21	\$990.00	\$1,068.75	\$2,058.75	\$0.00	15.12	\$600.00	\$100.00	\$700.00	32.85
4	313 - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	12	0.98	1,417	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	622	0.55	795	\$109	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	\$17	\$792.00	\$855.00	\$1,647.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	14.67
7	313 - Storage	200	2-Lamp 1x8 F96T12 60W Surface Strip, Open	2	109	1	0.11	22	New Fixture	1x8 8-Lamp LED T8 12 Watt	8	96	1	0.10	19	0.01	3	\$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	4	\$1	\$180.00	\$95.00	\$275.00	\$0.00	772.04	\$50.00	\$50.00	\$100.00	190.09
9	313 - Closet	200	60W A-Lamp	1	60	1	0.06	12	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	4	0.04	8	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$20.00	\$47.50	\$67.50	\$0.00	58.65	\$50.00	\$50.00	\$100.00	1013.79
4	314 - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	12	0.98	1,417	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	622	0.55	795	\$109	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	\$17	\$792.00	\$855.00	\$1,647.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	14.67
9	314 - Closets	200	60W A-Lamp	1	60	2	0.12	24	Re-Lamp	Philips 18W LED A-Lamp	1	18	2	0.04	7	0.08	17	\$2	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$40.00	\$95.00	\$135.00	\$0.00	58.65	\$50.00	\$50.00	\$100.00	506.89
4	311 - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	12	0.98	1,417	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	622	0.55	795	\$109	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	\$17	\$792.00	\$855.00	\$1,647.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	14.67
4	312 - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	12	0.98	1,417	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	622	0.55	795	\$109	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	\$17	\$792.00	\$855.00	\$1,647.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	14.67
4	309 - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	12	0.98	1,417	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	622	0.55	795	\$109	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	\$17	\$792.00	\$855.00	\$1,647.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	14.67
4	310 - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	12	0.98	1,417	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	622	0.55	795	\$109	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	\$17	\$792.00	\$855.00	\$1,647.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	14.67
23	Girl's Toilet	1440	3-Lamp 2x4 T8 32W Recessed, Prismatic Lens	3	82	4	0.33	472	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	4	0.14	207	0.18	265	\$36	0	No New Controls	0	0.0%	0	\$0	\$264.00	\$380.00	\$644.00	\$0.00	17.74	\$0.00	\$0.00	\$0.00	-
5	Main Bldg. 3rd Flr. Stairwell #158	1440	4-Lamp 2x4 F40T12 34W Surface Wrap Prismatic 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	0	No New Controls	0	0.0%	0	\$0	\$176.00	\$190.00	\$366.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
23	Main Bldg. 3rd Flr. Main Corridor	1440	3-Lamp 2x4 T8 32W Recessed, Prismatic Lens	3	82	8	0.66	945	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	8	0.29	415	0.37	530	\$73	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	83	\$11	\$528.00	\$760.00	\$1,288.00	\$0.00	17.74	\$300.00	\$50.00	\$350.00	30.80
4	308 - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	12	0.98	1,417	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	622	0.55	795	\$109	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	\$17	\$792.00	\$855.00	\$1,647.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	14.67
7	308 - Closets	200	2-Lamp 1x8 F96T12 60W Surface Strip, Open	2	109	2	0.22	44	New Fixture	1x8 8-Lamp LED T8 12 Watt	8	96	2	0.19	38	0.03	5	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	8	\$1	\$360.00	\$190.00	\$550.00	\$0.00	772.04	\$50.00	\$50.00	\$100.00	95.04

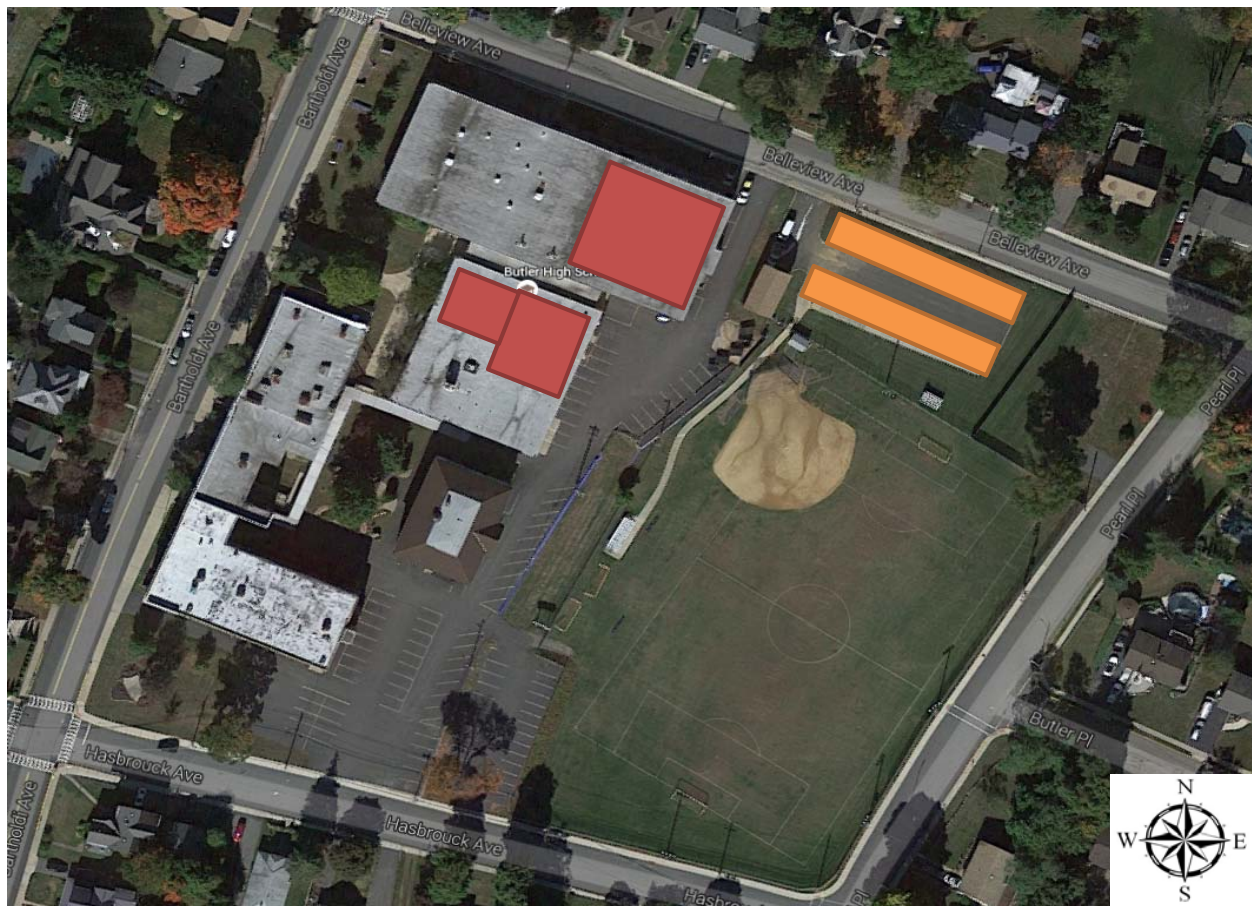
Fixture Reference #	Location	Average Burn Hours	EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS				PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS				LIGHTING CONTROLS COST					
			Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kWh	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	Simple Payback
4	307 - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	7	0.57	827	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	7	0.25	363	0.32	464	\$64	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	73	\$10	\$462.00	\$498.75	\$960.75	\$0.00	15.12	\$200.00	\$50.00	\$250.00	25.14
4	306 - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	7	0.57	827	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	7	0.25	363	0.32	464	\$64	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	73	\$10	\$462.00	\$498.75	\$960.75	\$0.00	15.12	\$200.00	\$50.00	\$250.00	25.14
4	304 - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	7	0.57	827	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	7	0.25	363	0.32	464	\$64	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	73	\$10	\$462.00	\$498.75	\$960.75	\$0.00	15.12	\$200.00	\$50.00	\$250.00	25.14
9	304 - Closet	200	60W A-Lamp	1	60	1	0.06	12	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	4	0.04	8	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$20.00	\$47.50	\$67.50	\$0.00	58.65	\$50.00	\$50.00	\$100.00	1013.79
3	Math Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	4	0.48	1,238	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	4	0.19	499	0.28	738	\$101	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	100	\$14	\$352.00	\$380.00	\$732.00	\$0.00	7.24	\$200.00	\$50.00	\$250.00	18.28
4	302 - Classroom	1440	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	9	0.74	1,063	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	9	0.32	467	0.41	596	\$82	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	93	\$13	\$594.00	\$641.25	\$1,235.25	\$0.00	15.12	\$200.00	\$50.00	\$250.00	19.56
9	302 - Closet	200	60W A-Lamp	1	60	1	0.06	12	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	4	0.04	8	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$20.00	\$47.50	\$67.50	\$0.00	58.65	\$50.00	\$50.00	\$100.00	1013.79
5	Main Bldg. 3rd Flr. Central Stairwell	1440	4-Lamp 2x4 F40T12 34W Surface Wrap Prismatic 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	0	No New Controls	0	0.0%	0	\$0	\$176.00	\$190.00	\$366.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
3	3rd Flr. Auditorium Side Corridor	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	4	0.48	685	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	4	0.19	276	0.28	409	\$56	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	55	\$8	\$352.00	\$380.00	\$732.00	\$0.00	13.07	\$300.00	\$50.00	\$350.00	46.20
3	Faculty Room	600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	4	0.48	286	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	4	0.19	115	0.28	170	\$23	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	23	\$3	\$352.00	\$380.00	\$732.00	\$0.00	31.36	\$200.00	\$50.00	\$250.00	79.20
3	English Office	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	2	0.24	619	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	250	0.14	369	\$51	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	50	\$7	\$176.00	\$190.00	\$366.00	\$0.00	7.24	\$50.00	\$50.00	\$100.00	14.62
7	Storage Room	200	2-Lamp 1x8 F96T12 60W Surface Strip, Open	2	109	1	0.11	22	New Fixture	1x8 8-Lamp LED T8 12 Watt	8	96	1	0.10	19	0.01	3	\$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	4	\$1	\$180.00	\$95.00	\$275.00	\$0.00	772.04	\$50.00	\$50.00	\$100.00	190.09
5	Auditorium Stairwell	1440	4-Lamp 2x4 F40T12 34W Surface Wrap Prismatic 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	0	No New Controls	0	0.0%	0	\$0	\$264.00	\$285.00	\$549.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
3	Art Bldg. 3rd Flr. Corridor	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	7	0.83	1,200	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	7	0.34	484	0.50	716	\$98	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	97	\$13	\$616.00	\$665.00	\$1,281.00	\$0.00	13.07	\$300.00	\$50.00	\$350.00	26.40
2	3rd Flr. End Stairwell	1440	2-Lamp 1x4 F40T12 34W Surface Wrap Prismatic Lens	2	62	4	0.25	357	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	4	0.10	138	0.15	219	\$30	0	No New Controls	0	0.0%	0	\$0	\$176.00	\$190.00	\$366.00	\$0.00	12.21	\$0.00	\$0.00	\$0.00	-
2	3rd Flr. Corner Stairwell	1440	2-Lamp 1x4 F40T12 34W Surface Wrap Prismatic Lens	2	62	4	0.25	357	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	4	0.10	138	0.15	219	\$30	0	No New Controls	0	0.0%	0	\$0	\$176.00	\$190.00	\$366.00	\$0.00	12.21	\$0.00	\$0.00	\$0.00	-
40	332 - Classroom	1440	3-Lamp 1x4 T8 32W Pendant-hung, Direct/Indirect	3	82	12	0.98	1,417	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	12	0.43	622	0.55	795	\$109	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	\$17	\$792.00	\$855.00	\$1,647.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	14.67
35	343 - Aux Gym	2600	2-Lamp 1x4 T12 34W Industrial Shade, Open, w/ Tube Guards	2	62	17	1.05	2,740	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	17	0.41	1,061	0.65	1,680	\$230	5	Dual Technology Occupancy Sensor - Remote Mnt.	2	20.0%	212	\$29	\$748.00	\$807.50	\$1,555.50	\$0.00	6.76	\$400.00	\$100.00	\$500.00	17.20
41	342 - Storage	200	75W A-Lamp, Open	1	75	3	0.23	45	Re-Lamp	Philips 18W LED A-Lamp	1	18	3	0.05	11	0.17	34	\$5	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	2	\$0	\$60.00	\$142.50	\$202.50	\$0.00	43.22	\$50.00	\$50.00	\$100.00	337.93
4	341 - Stor	200	3-Lamp 2x4 F32T8 32W Recessed Parabolic Lens	3	82	2	0.16	33	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	2	0.07	14	0.09	18	\$3	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	3	\$0	\$132.00	\$142.50	\$274.50	\$0.00	108.89	\$50.00	\$50.00	\$100.00	253.45
40	328 - Classroom	1440	3-Lamp 1x4 T8 32W Pendant-hung, Direct/Indirect	3	82	24	1.97	2,834	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	24	0.86	1,244	1.10	1,590	\$218	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	249	\$34	\$1,584.00	\$1,710.00	\$3,294.00	\$0.00	15.12	\$200.00	\$50.00	\$250.00	7.33
31	328 - Classroom	1440	2-Lamp 13W CFL, Recessed Hi-Hat	2	25	4	0.10	144	Existing to Remain	No Change	2	25	0	0.10	144	0.00	0	\$0	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	29	\$4	\$0.00	\$0.00	\$0.00	\$0.00	-	\$200.00	\$50.00	\$250.00	63.36
15	Teacher's Storage Room	200	4-Lamp 2x4 T8 32W Recessed Prismatic Lens	4	109	1	0.11	22	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	1	0.05	10	0.06	12	\$2	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	2	\$0	\$88.00	\$71.25	\$159.25	\$0.00	95.28	\$50.00	\$50.00	\$100.00	380.17
35	Teacher's Storage Room	200	2-Lamp 1x4 T12 34W Industrial Shade, Open, w/ Tube Guards	2	62	2	0.12	25	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	2	0.05	10	0.08	15	\$2	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	2	\$0	\$88.00	\$95.00	\$183.00	\$0.00	87.88	\$50.00	\$50.00	\$100.00	380.17
42	347 - Faculty Room	600	60W Incandescent Globe Fixture	1	60	2	0.12	72	Re-Lamp	TCP 13W LED A21 LED	1	13	2	0.03	16	0.09	56	\$8	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	3	\$0	\$36.00	\$47.50	\$83.50	\$0.00	10.81	\$50.00	\$50.00	\$100.00	233.95

Fixture Reference #	Location	Average Burn Hours	EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS				PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS				LIGHTING CONTROLS COST					
			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	Simple Payback
3	Athletic Director's Offices	2600	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	2	0.24	619	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	250	0.14	369	\$51	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	50	\$7	\$176.00	\$190.00	\$366.00	\$0.00	7.24	\$50.00	\$50.00	\$100.00	14.62
37	Athletic Director's Offices	2600	2-Lamp 2x2 T12 34W U-Tube, Recessed Prismatic Lens	2	62	2	0.12	322	New Fixture	New 2x2 LED Recessed Prismatic Fixture	2	24	2	0.05	125	0.08	198	\$27	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	25	\$3	\$240.00	\$190.00	\$430.00	\$0.00	15.88	\$50.00	\$50.00	\$100.00	29.24
43	Athletic Director's Offices	2600	2-Lamp 1x4 T12 34W Open	2	62	6	0.37	967	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	6	0.14	374	0.23	593	\$81	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	75	\$10	\$264.00	\$285.00	\$549.00	\$0.00	6.76	\$200.00	\$50.00	\$250.00	24.37
42	Athletic Director's Offices - RR	1440	60W Incandescent Globe Fixture	1	60	2	0.12	173	Re-Lamp	TCP 13W LED A21 LED	1	13	2	0.03	37	0.09	135	\$19	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	7	\$1	\$36.00	\$47.50	\$83.50	\$0.00	4.50	\$50.00	\$50.00	\$100.00	97.48
3	Classroom Corridor Loop	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	11	1.31	1,885	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	11	0.53	760	0.78	1,125	\$154	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	13.07	\$600.00	\$100.00	\$700.00	33.60
10	336 - Classroom	1440	4-Lamp 1x8 T12 Pendant-mounted Lens	4	119	6	0.71	1,028	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	6	0.29	415	0.43	613	\$84	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	83	\$11	\$528.00	\$570.00	\$1,098.00	\$0.00	13.07	\$200.00	\$50.00	\$250.00	22.00
10	338 - Food Lab	1440	4-Lamp 1x8 T12 Pendant-mounted Lens	4	119	12	1.43	2,056	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	12	0.58	829	0.85	1,227	\$168	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	166	\$23	\$1,056.00	\$1,140.00	\$2,196.00	\$0.00	13.07	\$200.00	\$50.00	\$250.00	11.00
26	338 - Food Lab	1440	2-Lamp 1x4 F40T12 34W Pendant-hung, Open	2	62	3	0.19	268	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	3	0.07	104	0.11	164	\$22	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	21	\$3	\$132.00	\$142.50	\$274.50	\$0.00	12.21	\$200.00	\$50.00	\$250.00	88.00
10	340 - Classroom	1440	4-Lamp 1x8 T12 Pendant-mounted Lens	4	119	5	0.60	857	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	5	0.24	346	0.36	511	\$70	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	69	\$9	\$440.00	\$475.00	\$915.00	\$0.00	13.07	\$200.00	\$50.00	\$250.00	26.40
26	340 - Classroom	1440	2-Lamp 1x4 F40T12 34W Pendant-hung, Open	2	62	3	0.19	268	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	3	0.07	104	0.11	164	\$22	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	21	\$3	\$132.00	\$142.50	\$274.50	\$0.00	12.21	\$200.00	\$50.00	\$250.00	88.00
10	339 - Classroom	1440	4-Lamp 1x8 T12 Pendant-mounted 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	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	124	\$17	\$792.00	\$855.00	\$1,647.00	\$0.00	13.07	\$200.00	\$50.00	\$250.00	14.67
10	337 - Classroom	1440	4-Lamp 1x8 T12 Pendant-mounted Lens	4	119	12	1.43	2,056	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	12	0.58	829	0.85	1,227	\$168	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	166	\$23	\$1,056.00	\$1,140.00	\$2,196.00	\$0.00	13.07	\$200.00	\$50.00	\$250.00	11.00
26	337 - Classroom	1440	2-Lamp 1x4 F40T12 34W Pendant-hung, Open	2	62	1	0.06	89	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	35	0.04	55	\$7	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	7	\$1	\$44.00	\$47.50	\$91.50	\$0.00	12.21	\$200.00	\$50.00	\$250.00	264.01
3	335 - Classroom	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	12	1.43	2,056	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	12	0.58	829	0.85	1,227	\$168	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	166	\$23	\$1,056.00	\$1,140.00	\$2,196.00	\$0.00	13.07	\$200.00	\$50.00	\$250.00	11.00
3	333 - Art Room	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	6	0.71	1,028	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	6	0.29	415	0.43	613	\$84	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	83	\$11	\$528.00	\$570.00	\$1,098.00	\$0.00	13.07	\$200.00	\$50.00	\$250.00	22.00
9	Custodian's Closet	200	60W A-Lamp	1	60	1	0.06	12	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	4	0.04	8	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$20.00	\$47.50	\$67.50	\$0.00	58.65	\$50.00	\$50.00	\$100.00	1013.79
3	Custodian's Closet	200	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	2	0.24	48	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	2	0.10	19	0.14	28	\$4	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	4	\$1	\$176.00	\$190.00	\$366.00	\$0.00	94.07	\$50.00	\$50.00	\$100.00	190.09
42	Custodian's Closet	200	60W Incandescent Globe Fixture	1	60	1	0.06	12	Re-Lamp	TCP 13W LED A21 LED	1	13	1	0.01	3	0.05	9	\$1	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	1	\$0	\$18.00	\$23.75	\$41.75	\$0.00	32.42	\$50.00	\$50.00	\$100.00	1403.71
3	Girl's Toilet	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	4	0.48	685	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	4	0.19	276	0.28	409	\$56	0	No New Controls	0	0.0%	0	\$0	\$352.00	\$380.00	\$732.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
3	Boy's Toilet	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	4	0.48	685	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	4	0.19	276	0.28	409	\$56	0	No New Controls	0	0.0%	0	\$0	\$352.00	\$380.00	\$732.00	\$0.00	13.07	\$0.00	\$0.00	\$0.00	-
44	Trophy Cases	8760	1-Lamp T12 34W	1	35	6	0.21	1,840	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	1	12	6	0.07	631	0.14	1,209	\$166	0	No New Controls	0	0.0%	0	\$0	\$132.00	\$285.00	\$417.00	\$0.00	2.52	\$0.00	\$0.00	\$0.00	-
29	Main Entrance Lobby	1440	6-Lamp 4x4 T12 34W Recessed Prismatic	6	184	7	1.29	1,855	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	6	72	7	0.50	726	0.78	1,129	\$155	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	2	20.0%	145	\$20	\$924.00	\$1,260.00	\$2,184.00	\$0.00	14.12	\$600.00	\$100.00	\$700.00	35.20
3	Cafeteria Hallway	1440	4-Lamp 2x4 F40T12 34W Recessed Prismatic Lens	4	119	6	0.71	1,028	Bypass Ballast/Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	4	48	6	0.29	415	0.43	613	\$84	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	2	20.0%	83	\$11	\$528.00	\$570.00	\$1,098.00	\$0.00	13.07	\$600.00	\$100.00	\$700.00	61.60
54	Exit Signs	8760	LED Exit Signs	1	2	64	0.13	1,121	Existing to Remain	No Change	1	2	0	0.13	1,121	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	-
45	Annex Bldg. Exterior	4000	RAB LED Slim Wallpack	1	26	2	0.05	208	Existing to Remain	No Change	1	26	0	0.05	208	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	-

Fixture Reference #	Location	Average Burn Hours	EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS				LIGHTING CONTROLS COST						
			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	Simple Payback
46	Annex Bldg. Exterior	4000	100W MH Wall Pack	1	130	1	0.13	520	Replace	RAB LED 26W Slim Wall Pack	1	26	1	0.03	104	0.10	416	\$57	0	No New Controls	0	0.0%	0	\$0	\$270.00	\$95.00	\$365.00	\$0.00	6.40	\$0.00	\$0.00	\$0.00	-
47	Annex Bldg. Exterior	4000	Outdoor Globe Fixture with 60 Watt A Lamp	1	60	4	0.24	960	Re-Lamp	TCP 13W LED A21 LED	1	13	4	0.05	208	0.19	752	\$103	0	No New Controls	0	0.0%	0	\$0	\$72.00	\$95.00	\$167.00	\$0.00	1.62	\$0.00	\$0.00	\$0.00	-
46	General Exterior	4000	100W MH Wall Pack	1	130	15	1.95	7,800	Replace	RAB LED 26W Slim Wall Pack	1	26	15	0.39	1,560	1.56	6,240	\$855	0	No New Controls	0	0.0%	0	\$0	\$4,050.00	\$1,425.00	\$5,475.00	\$0.00	6.40	\$0.00	\$0.00	\$0.00	-
48	General Exterior	4000	90W Flood Light	1	90	4	0.36	1,440	Re-Lamp	14-Watt LED Par 38 Flood Lamp	1	14	4	0.06	224	0.30	1,216	\$167	0	No New Controls	0	0.0%	0	\$0	\$72.00	\$190.00	\$262.00	\$0.00	1.57	\$0.00	\$0.00	\$0.00	-
49	General Exterior	4000	1x1, 100W Incandescent, Canopy Light	1	100	8	0.80	3,200	Re-Lamp	Philips 18W LED A-Lamp	1	18	8	0.14	576	0.66	2,624	\$359	0	No New Controls	0	0.0%	0	\$0	\$160.00	\$380.00	\$540.00	\$0.00	1.50	\$0.00	\$0.00	\$0.00	-
50	General Exterior	4000	100W Incandescent, Wall Mounted	1	100	1	0.10	400	Re-Lamp	Philips 18W LED A-Lamp	1	18	1	0.02	72	0.08	328	\$45	0	No New Controls	0	0.0%	0	\$0	\$20.00	\$47.50	\$67.50	\$0.00	1.50	\$0.00	\$0.00	\$0.00	-
51	General Exterior	4000	RAB LED 52 Watt Wall Pack	1	52	2	0.10	416	Existing to Remain	No Change	1	52	0	0.10	416	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	-
52	General Exterior	4000	Shade with 70 Watt PAR Lamp	1	70	4	0.28	1,120	Re-Lamp	23-Watt LED Par Flood Lamp	1	23	4	0.09	368	0.19	752	\$103	0	No New Controls	0	0.0%	0	\$0	\$80.00	\$190.00	\$270.00	\$0.00	2.62	\$0.00	\$0.00	\$0.00	-
53	General Exterior	4000	400-Watt Mercury Vapor Wall-Mounted	2	454	4	1.82	7,264	Replace	RAB LED 52 Watt Wall Pack	1	52	4	0.21	832	1.61	6,432	\$881	0	No New Controls	0	0.0%	0	\$0	\$1,400.00	\$380.00	\$1,780.00	\$0.00	2.02	\$0.00	\$0.00	\$0.00	-
TOTAL						1,696	166.3	273,211					1,585	73.1	124,391	93.3	148,819	\$20,388			210		14,542	\$1,992	\$136,914	\$133,330	\$270,244	\$0	13.25	\$30,850	\$10,500	\$41,350	20.76

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 High School	16100	SHARP ND-240QCJ	736	17.5	12,910	176.64	209,438	160.6	30,838	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 High School Location: Butler, NJ Description: Photovoltaic System 100% Financing - 15 year										
Simple Payback Analysis										
		Photovoltaic System 100% Financing - 15 year								
Total Construction Cost		\$820,000								
Annual kWh Production		209,438								
Annual Energy Cost Reduction		\$28,693								
Average Annual SREC Revenue		\$31,731								
Simple Payback:		13.57								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	209,438	\$28,693	\$0	\$52,359	\$48,254	\$34,782	(\$1,983)	(\$1,983)	
2	\$0	208,391	\$29,554	\$0	\$52,098	\$46,109	\$36,927	(\$1,384)	(\$3,367)	
3	\$0	207,349	\$30,440	\$0	\$51,837	\$43,831	\$39,205	(\$758)	(\$4,125)	
4	\$0	206,312	\$31,354	\$0	\$41,262	\$41,413	\$41,623	(\$10,420)	(\$14,545)	
5	\$0	205,280	\$32,294	\$2,114	\$41,056	\$38,846	\$44,190	(\$11,800)	(\$26,344)	
6	\$0	204,254	\$33,263	\$2,104	\$40,851	\$36,120	\$46,915	(\$11,025)	(\$37,370)	
7	\$0	203,233	\$34,261	\$2,093	\$30,485	\$33,227	\$49,809	(\$20,383)	(\$57,753)	
8	\$0	202,217	\$35,289	\$2,083	\$30,332	\$30,155	\$52,881	(\$19,497)	(\$77,250)	
9	\$0	201,206	\$36,347	\$2,072	\$30,181	\$26,893	\$56,143	(\$18,580)	(\$95,829)	
10	\$0	200,199	\$37,438	\$2,062	\$20,020	\$23,430	\$59,605	(\$27,640)	(\$123,469)	
11	\$0	199,198	\$38,561	\$2,052	\$19,920	\$19,754	\$63,282	(\$26,606)	(\$150,076)	
12	\$0	198,202	\$39,718	\$2,041	\$19,820	\$15,851	\$67,185	(\$25,539)	(\$175,615)	
13	\$0	197,211	\$40,909	\$2,031	\$9,861	\$11,707	\$71,329	(\$34,297)	(\$209,911)	
14	\$0	196,225	\$42,137	\$2,021	\$9,811	\$7,308	\$75,728	(\$33,109)	(\$243,020)	
15	\$0	195,244	\$43,401	\$2,011	\$9,762	\$2,637	\$80,399	(\$31,884)	(\$274,904)	
Totals:		3,033,960	\$533,658	\$22,685	\$459,656	\$425,533	\$820,000	(\$274,904)	(\$1,495,560)	
Net Present Value (NPV)							(\$190,584)			

PVWatts: Monthly PV Performance Data		Rooftop Array
Requested Location:	38 Bartholdi Ave, Butler, NJ 07405	
Location:	NEWARK, NJ	
Lat (deg N):	40.7	
Long (deg W):	74.17	
Elev (m):	9	
DC System Size (kW):	116.64	
Module Type:	Standard	
Array Type:	Fixed (roof mount)	
Array Tilt (deg):	10	
Array Azimuth (deg):	205	
System Losses:	14	
Invert Efficiency:	96	
DC to AC Size Ratio:	1.1	
Average Cost of Electricity	0.14	
Initial Cost	No initial cost defined	
Cost of Electricity Generated	not determined	

Month	AC System Output(kWh)	Solar Radiation	Plane of Array	DC array Output (kWh)	Value (\$)
		(kWh/m ² /day)	Irradiance (W/m ²)		
1	7,330	2.36	73.19	7,717	1004.21
2	8,688	3.12	87.36	9,117	1190.2
3	12,163	4.03	124.97	12,739	1,666.28
4	13,565	4.81	144.18	14,209	1,858.36
5	16,070	5.68	176.12	16,809	2,201.54
6	15,771	5.92	177.54	16,513	2,160.58
7	15,697	5.76	178.64	16,432	2,150.49
8	14,469	5.36	166.02	15,140	1,982.20
9	12,407	4.61	138.41	12,989	1,699.69
10	10,204	3.56	110.51	10,701	1397.95
11	6,618	2.30	68.92	6,983	906.69
12	6,011	1.97	61.21	6,356	823.46
Total	138,990	49.49	1507.06	145,704	19041.65

PVWatts: Monthly PV Performance Data		Parking Lot Array	
Requested Location:	38 Bartholdi Ave, Butler, NJ 07405		
Location:	NEWARK, NJ		
Lat (deg N):	40.7		
Long (deg W):	74.17		
Elev (m):	9		
DC System Size (kW):	60		
Module Type:	Standard		
Array Type:	Fixed (roof mount)		
Array Tilt (deg):	7.5		
Array Azimuth (deg):	205		
System Losses:	14		
Invert Efficiency:	96		
DC to AC Size Ratio:	1.1		
Average Cost of Electricity	0.14		
Initial Cost	No initial cost defined		
Cost of Electricity Generated	not determined		

Month	AC System Output(kWh)	Solar	Plane of Array	DC array Output (kWh)	Value (\$)
		Radiation (kWh/m ² /day)	Irradiance (W/m ²)		
1	3,600	2.26	70.18	3,793	493.14
2	4,332	3.03	84.83	4,548	593.50
3	6,143	3.96	122.70	6,435	841.54
4	6,924	4.77	142.97	7,253	948.54
5	8,249	5.67	175.66	8,628	1,130.12
6	8,121	5.92	177.63	8,503	1,112.57
7	8,064	5.75	178.31	8,442	1,104.82
8	7,400	5.32	164.92	7,744	1,013.77
9	6,286	4.54	136.27	6,582	861.14
10	5,103	3.47	107.53	5,354	699.12
11	3,279	2.22	66.61	3,463	449.24
12	2,948	1.89	58.67	3,121	403.84
Total	70,448	48.80	1486.28	73,865	9651.34