Asbury Park Board of Education

Energy Savings Plan

Project Number: ESG-Project # DPBWI00587

Asbury Park, New Jersey | May 3, 2021

Revision #1

energy systems group

TABLE OF CONTENTS

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SECTION 1. EXECUTIVE SUMMARY

Various energy conservation measures were evaluated in the development of this Energy Savings Plan (ESP). Energy Systems Group has performed field verifications, collected data and taken field measurements to ensure the development of the most cost-effective solutions as well as accurate savings calculations. Various solutions were reviewed with the school district's administration to develop a set of Energy Conservation Measures (ECMs) that allow the school district to address the facility's priority items while reducing the total annual energy spend for the District. This study expands upon the original energy audit conducted by TRC Energy Services. The original audit information was used for building descriptions as well as an overall indication of the District needs.

Priority items include:

- District-wide controls upgrade / replacement
- District-wide lighting replacement with LED and lighting controls
- Dr. Martin Luther King MS; boiler replacements
- Bradley ES classroom unit ventilator replacements

Energy Savings

Energy saving calculations performed in the development of this ESP was completed using Microsoft Excel worksheets with Bin weather data to accurately model the building systems. Additional spreadsheets were used for measures that are not affected by the weather, such as lighting savings. Energy savings have been provided electronically for ease of review. All of the energy savings calculations that have been performed are in accordance with the New Jersey Clean Energy Program Protocols to Measure Resource Savings.

Benefits

The measures investigated in this Energy Savings Plan could result in an annual utility reduction of 1,397,622 kWhs of electricity (102,900 kWh from distributed generation and 1,294,722 kWh from Energy Conservation Measures) and save 21,054 therms of natural gas. The total utility cost savings is $4,297,556 over the life of the project (18 years). Additionally, these energy savings will result in a net reduction of greenhouse gases and will reduce the school district's carbon footprint by 2,166,669 lbs of CO_2 annually. All these savings are achieved while improving the classroom environment and renewing many items that have been in service beyond useful life expectancy.

SECTION 2. PROJECT DESCRIPTION

This Energy Savings Plan (ESP) addresses the following facilities. Any description in this report-stating district wide or similar refers only to the buildings listed below:

Asbury Park Board of Education	
Asbury Park High School	1003 Sunset Avenue, Asbury Park, NJ
Dr. Martin Luther King Jr. MS	1200 Bangs Avenue, Asbury Park, NJ
Bradley ES	1000 Third Avenue, Asbury Park, NJ
Barack Obama ES	1300 Bangs Avenue, Asbury Park, NJ
Thurgood Marshall ES	600 Monroe Avenue, Asbury Park, NJ
Dorothy McNish Parent Center	304 Prospect Avenue, Asbury Park, NJ
Buildings and Grounds	914 Second Avenue, Asbury Park, NJ
Information Technology Center	1506 Park Avenue, Asbury Park, NJ

Figure 1 Building List and Addresses

Facility Descriptions

Asbury Park High School

Figure 2 Asbury Park High School Building Exterior

Background Information

Asbury Park High School is a 171,260 square foot building. This building consists of four floors with classrooms, office space, gymnasiums, an auditorium and cafeteria. There is field house in the rear of the school.

Building Occupancy

Approximately 440 students and faculty members occupy the building.

Hours of Operation

- Monday through Friday 7:15 am to 4:15 pm
- Weekends – Closed
- The building operates year round

Envelope

Asbury Park High School is constructed of concrete block and brick with stone façade. The building has a flat roof covered with white bitumen roof membrane. The windows are mostly single pane with interior storm windows in some locations. The exterior doors are constructed of aluminum and glass.

Lighting

Lighting at Asbury Park High School consists primarily of fixtures with 32-watt linear fluorescent T-8 bulbs with electronic ballasts. The building also has many fixtures containing compact florescent lamps (CFL) and some fixtures containing incandescent bulbs.

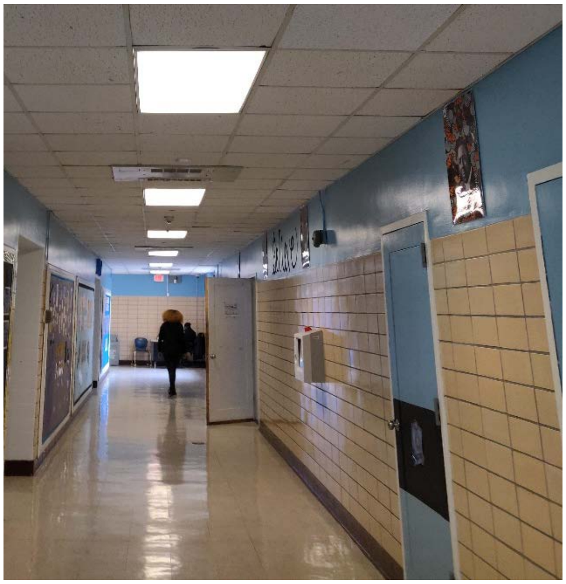

Figure 3 Asbury Park High School Interior Lighting

Exterior lighting is provided by high intensity discharge (HID) lamps. Some fixtures have been retrofitted to LEDs.

Interior lighting is controlled by manual wall switches. Exterior lighting is controlled by photocells, spot lighting is controlled by photocells.

Mechanical Systems

HVAC Systems and Equipment:

Asbury Park High School is conditioned by 11 air handling units (AHU) that are located on the building's roof or in the mechanical spaces. Most of the AHUs are constant volume, though four (AHU 1, -2, -5 and the ERU) are variable volume. The AHUs also provide ventilation for the building. The only areas of the High School without cooling are the school's two gyms.

Figure 4 Asbury Park High School Air Handling Unit (Rooftop)

Chilled water is provided to the AHUs from one 275-ton Trane air-cooled variable speed screw compressor chiller plant located on the roof.

Figure 5 Asbury Park High School Air Cooled Chiller

Heated hot water is provided to the AHUs from four PK Mach C-2500 condensing boilers located in the basement mechanical room, and installed in 2016. The boilers are configured in a variable flow primary distribution loop with 50-hp hot water pumps controlled with variable frequency drives. The boilers operate in lead/leg configuration and provide hot water to the air-handlers and fan coil units throughout the building

Figure 6 Asbury Park High School Boilers

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For the college wing, the only rooms that are cooled are the music room and the police room. The police room is cooled by a McQuay condensing unit outside while the music room appears to have a converted unit ventilator tied into the chilled water loop.

Four 20-ton and one 7.5-ton split systems are used to condition areas such as the media center. Classroom and office spaces are conditioned by window air conditioning units which are controlled by adjustable thermostat.

There are approximately 82-unit ventilators and fan coil units located throughout the building which provide heating and cooling to classrooms and office spaces.

Figure 7 Asbury Park High School Classroom Unit Ventilator

The building is controlled by DDC controllers and independent manual thermostats. The boiler and chiller plants are controlled by on-board systems.

Refer to Appendix 8 for a detailed list of HVAC equipment at the site.

Domestic Hot Water Systems

One (1) gas-fired domestic hot water heater provides the building heated hot water. The water heater is connected to an uninsulated 350-gallon uninsulated storage tank. Heated hot water is distributed through the building from a recirculation pump that operates continuously.

Figure 8 Asbury Park High School Domestic Hot Water Heater

Two (2) high efficiency gas-fired condensing hot water heaters supply showers and sinks for the field house which is located behind the school. The water heaters are connected to a 250-gallon storage tank. Heated hot water is distributed through the building from a recirculation pump that operates continuously.

Kitchen Equipment

Asbury Park High School has one commercial kitchen that has various gas-fired appliances including ovens, range tops, and griddle. The gas-fired appliances are generally used only for preparation and serving of the lunch service.

Plug Load

The facility's plug load consists of general classroom or office equipment, kitchenette equipment (microwaves and stand-up refrigerators) and server room equipment. Many TVs used in the classrooms are older CRT televisions.

There are approximately 283 computers in the building. There is no centralized PC power management software installed.

Plumbing/Water System

There are approximately 18 restrooms in the school. Most faucets are low-flow rated, while only few appear to be rated for 2.2 gallons per minute (gpm) or higher. The toilets are rated at less than 2.5 gallons per flush (gpf) and the urinals are rated at less than 2 gallons per flush (gpf).

The faucets in the kitchen area are higher flow devices.

Dr. Martin Luther King Jr. Middle School

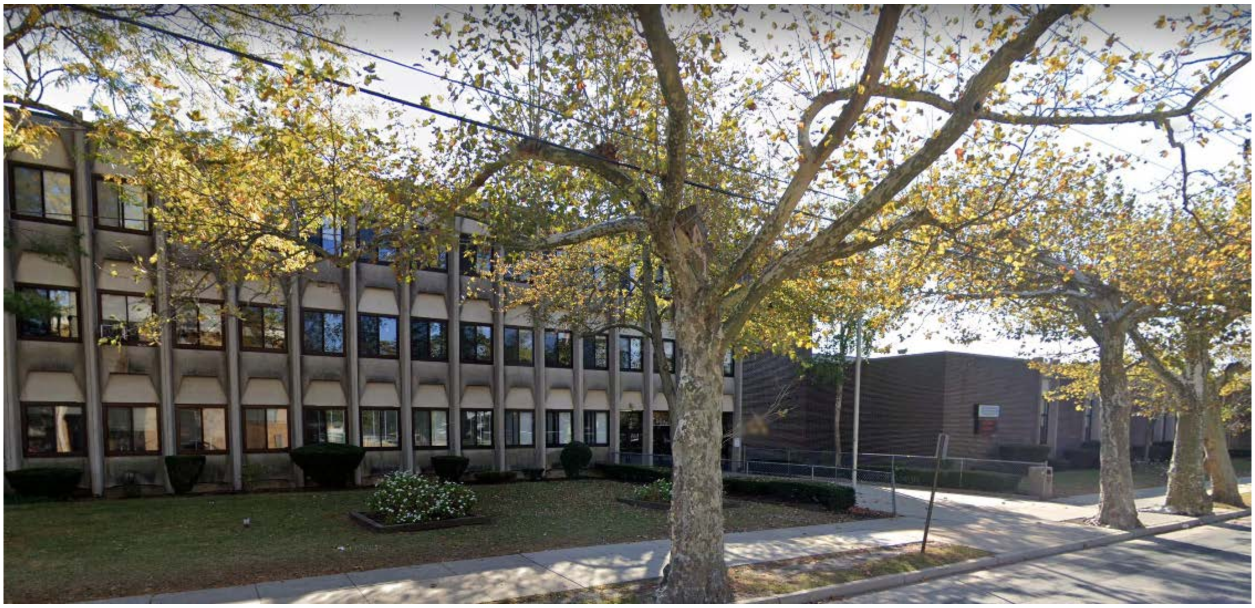


Figure 9 Martin Luther King Jr. Middle School Building Exterior

Background Information

Dr. Martin Luther King Jr. Middle School is a three-story building consisting of 87,250 square feet. This building consists of classrooms, offices, gymnasium and mechanical spaces. There is a trailer located behind the main building that includes additional classroom space.

Building Occupancy

Approximately 490 students and faculty members occupy the building.

Hours of Operation

- Monday through Friday 7:30 am to 4:00 pm
- Weekends - Closed
- The building operates year-round

Envelope

The building is constructed of concrete block with a concrete and brick façade. The building roof is flat with a white bitumen or black roof membrane. The roofs appear to be in fair condition. Building windows are double-paned and the exterior doors are constructed of aluminum and glass.

Lighting

Interior lighting is primarily provided by 32-watt linear fluorescent T-8 lamps with electronic ballasts. Many of the fixtures are 2-lamp 4-foot troffers with diffusers, while others are 1, 3 and 4-lamp T-8 fixtures. The gym also has metal halide lamps and there are a few incandescent bulbs throughout.

Figure 10 MLK Jr. MS Gym Lighting

Exterior lighting is predominantly provided by fixtures with metal halide lamps. Some parking lots have been converted to LED fixtures.

Interior lighting is controlled with manual stand-alone switches. Exterior lighting is controlled by time clocks or photocells.

Mechanical Systems

HVAC Systems and Equipment:

The building is heated by two (2) Cleaver-Brooks forced draft hot water boilers. The total boiler output is 5,230 MBh at an estimated 84.6% efficiency. Each boiler has a 2-hp forced draft fan with discharge dampers to control the combustion air volume. The boilers are configured in a constant flow primary distribution loop with two 7.5HP hot water pumps. The boilers operate in a lead/lag configuration and provide hot water to the unit ventilators and radiators. The unit ventilators have pneumatic controls. The boilers have surpassed their life expectancy.

Figure 11 MLK Jr. MS Boiler

Cooling is provided to certain areas of the building by two (2) 10-ton direct expansion (DX) packaged units. Two of these units provide cooling to the main office and media room.. The units provide constant air volume with a single supply fan, they utilize scroll condensers and DX coils.

Window air conditioning units provide spot cooling throughout the building. The STEM trailer behind the building is conditioned by wall-mounted heat pumps.

Refer to Appendix 8 for a detailed list of HVAC equipment at the site.

Domestic Hot Water Systems

One standard efficiency (80%) domestic hot water heater with a 100-gallon storage tank provides domestic hot water for the school. A recirculation pump continuously provides domestic hot water to the entire site.

Figure 12 MLK Jr. MS Domestic How Water Heater

Kitchen Equipment

The school has a commercial kitchen that is equipped with ovens, range tops and a griddle all which are electric. The kitchen also has a walk in cooler and walk-in freezer.

Plug Load

The facility's plug load consists of general classroom or office equipment, kitchenette equipment (microwaves and refrigerators) and server room equipment (three servers located near the fitness room). There are several refrigerated and non-refrigerated vending machines that serve the middle school.

There are approximately 636 computer work stations throughout the facility. There is no centralized PC power management software installed.

Plumbing/Water System

There are 15 restrooms in the school. Most faucets are low-flow water conserving devices. A few are rated greater than 2.2 gallons per minute. Toilets and urinals appear to be low-flow devices that have flow rates of 2 gallons per flush or less.

Bradley Elementary School

Figure 13 Bradley Elementary School Building Exterior

Background Information

Bradley Elementary School is located at 110 Third Avenue in Asbury Park, New Jersey. This building is approximately 82,305 square feet and consist of two stories that consist of office space, classrooms, a library, gymnasium and mechanical spaces.

Building Occupancy

Approximately 477 students and faculty members occupy the building.

Hours of Operation

- Monday through Friday 7:30 am to 4:00 pm.
- Weekends - Closed
- The building is at full occupancy September through June (44 total weeks of usage)

Envelope

The building is constructed of concrete block with a brick and tile façade. The roof is flat with a tan bitumen membrane. The building windows are double-paned, and the exterior doors are double-paned with glass and aluminum frames.

Lighting

Interior lighting is predominately provided by 32-watt linear fluorescent T8 lamps with electronic ballasts. The majority of the fixtures are 2-lamp, 4-foot long troffers with diffusers. There are also 3-lamp and 4-lamp T8 fixtures. A few years ago the lighting in the multipurpose room was converted to 3-lamp T5 fluorescent fixtures with incandescent or fluorescent bulbs. Additionally, there are some fixtures with metal halide lamps, incandescent bulbs, and/or compact fluorescent (CFL) bulbs.

Exterior lighting is provided by fixtures with metal halide lamps.

Interior lighting is controlled by manually operated wall switches. Exterior lighting is provided by time clocks or photocells.

Mechanical Systems

HVAC Systems and Equipment:

The building is provided heat by two (2) gas-fired forced draft hot water boilers, each with an output heating capacity of 3,569 MBH at an 85% combustion efficiency. Each boiler has a 2-hp forced draft fan with discharge dampers to control volume of combustion air. The boilers are configured in a constant loop primary flow distribution loop with two (2) 15-hp hot water pumps. The boilers provide hot water to the hot water coils throughout the school. They operate in a lead/lag configuration, and, based on historical natural gas usage, only a single boiler is required to serve the building load in most conditions. The existing boilers are high efficiency and in good condition.

Figure 14 Bradley ES Rooftop Unit

Six (6) cooling only direct expansion (DX) packaged air conditioning units are used to condition portions of the building. These units range in cooling capacity from 7 to 30 tons each, combining for a total cooling capacity of 110 tons. Seven split systems serve spaces throughout the building with evaporator coils located above classroom and office ceilings or integrated within the unit ventilators. The unit ventilators are Airedale with DX cooling coils, however cooling is not working for the existing Airedale units.

Figure 15 Bradley ES Classroom Unit Ventilator

Domestic Hot Water

The building is provided domestic hot water by one (1) high-efficiency (96%), gas-fired water heater that has a storage tank with a capacity of 100-gallons. Hot water pumps operate continuously to distribute domestic hot water throughout the entire building.

Refer to Appendix 8 for a detailed list of HVAC equipment at the site.

Kitchen Equipment

A small kitchen utilizes an electric steamer, several refrigerators, and an ice maker. The meal service is the re-heating of pre-prepared lunches for students and staff.

Plug Load

The facility's plug load consists of general classroom or office equipment, kitchenette equipment and server room equipment. There are microwaves and refrigerators that are used by facility members.

There is approximately 316 computer stations within the facility, with one large server rack. There is no centralized PC Power Management software installed.

Plumbing/Water System

There are approximately 32 restrooms in the building. Water-using fixtures such as faucets and toilets/ urinals all appear to be low-flow.

Barack Obama Elementary School

Figure 16 Barack Obama Elementary School Building Exterior

Background Information

Barack Obama Elementary School is located at 1300 Bangs Avenue in Asbury Park, New Jersey. This building is approximately 68,400 square feet. This building has three floors that consist of office space, classrooms, a kitchen, library, gymnasium, storage and mechanical spaces.

Building Occupancy

Approximately 436 students and faculty members occupy the building.

Hours of Operation

- Monday through Friday 7:30 am to 4:00 pm.
- Weekends – Closed
- The building is at full occupancy September through June (44 total weeks of usage)

Envelope

Both buildings are constructed of brick with a stucco façade. The buildings have flat roofs covered in white bitumen membrane. The windows are single pane and double paned. Exterior doors are aluminum and glass.

Lighting

Interior lighting at the facility consists exclusively of 32-watt T8 linear fluorescent fixtures with corresponding electronic ballasts. Most fixtures are 2-lamp 4-foot troffers with diffusers. There are some 1-lamp, 3-lamp and 4-lamp fixtures with compact fluorescent lights.

Exterior lighting is provided by high pressure sodium (HPS) fixtures.

Interior lighting is controlled by manually operated wall switches. Exterior lighting is controlled by time clocks or photocells.

Mechanical Systems

HVAC Systems and Equipment:

The school is heated by two (2) forced draft boilers that are from the 1950's. The boilers are insulated with asbestos-containing insulation. Each boiler has a forced draft fan that is 1.5hp. The boilers are configured in a constant flow primary distribution with two 1.5hp hot water pumps. The boilers operate In a lead-lag configuration. They provide hot water to heating coils in air handlers and classroom unit ventilators.

Figure 17 Barack Obama ES Boilers

Three (3) direct expansion (DX) split systems provide cooling to select spaces in the school. Chilled air is distributed by three (3) air handling units with direct expansion and hot water coils. The AHUs condition the main office, cafeteria, and media center. The AHUs are constant volume and provide a total of 32.5 (7.5, 10, and 15 tons) tons of cooling capacity.

Spot cooling is provided by window mounted air conditioning units. The window units are not properly sealed, and may contribute to excess air infiltration. All cooling is manually controlled by thermostats.

A 45kW gas-fired emergency generator is used in case of emergency power outages plus a few hours each year for testing / maintenance.

Refer to Appendix 8 for a detailed list of HVAC equipment at the site.

Domestic Hot Water

The building is provided domestic hot water by one (1) gas-fired water heater (85% efficient) with a standalone storage tank rated for 119 gallons. A recirculation pump runs continuously to distribute domestic hot water throughout the entire building.

Figure 18 Barack Obama ES Domestic Hot Water Heater

Kitchen Equipment

The school has a small warming kitchen that has two large commercial refrigerators and electric convection ovens.

Plug Load

The facility's plug load consists of general classroom or office equipment, kitchenette equipment and server room equipment. There are several microwaves, as well as refrigerated and non-refrigerated vending machines.

There are approximately 323 computer stations and two servers. There is no centralized PC Power Management software.

Plumbing/Water System

There are approximately 25 restrooms within the building. Most faucets are rated as low-flow, while a handful have a high flow rate of 2.5 gallons per minute or higher. The kitchen faucets are also rated to be high flow.

Thurgood Marshall Elementary School

Figure 19 Thurgood Marshall Elementary School Building Exterior

Background Information

Thurgood Marshall Elementary School is located at 600 Monroe Avenue in Asbury Park, New Jersey. This 94,025 square foot building has three floors consisting of office space, classrooms, gymnasiums, a library and mechanical spaces.

Building Occupancy

Approximately 575 students and faculty members occupy the building.

Hours of Operation

- Monday through Friday 7:30 am to 4:00 pm.
- Weekends - Closed
- The building is at full occupancy September through June (44 weeks per year)

Envelope

The building is constructed of concrete block with concrete and brick façade. The old roof section is covered in black membrane while the newer section roof is covered with white bitumen. A majority of the windows are double-paned, and the exterior doors are double-paned glass with aluminum frames.

Lighting

Interior lighting consists mostly of 32-watt linear fluorescent T8 lamps with electronic ballasts. Most fixtures are 2-lamp or 3-lamp 4-foot long troffers with diffusers. There are some 2-foot U bend tubes, 1-lamp and 4-lamp fixtures. The gym is lighted with 6-lamp T5 fluorescent fixtures. Additionally, the building has fixtures that use compact fluorescent (CFL) lamps and incandescent bulbs.

Exterior lighting is provided by fixtures outfitted with high-pressure sodium (HPS) lamps.

Exit signs are lit by LEDs, but some older signs are lit by compact fluorescent lightbulbs.

Lighting control for interior lighting is provided by manually operated wall switches. Exterior lighting is controlled by time clocks or photocells.

Mechanical Systems

HVAC Systems and Equipment:

The building is heated by two sets of eight (8) 300-KBH natural draft hot water boilers (16 total) which are configured in a constant flow primary loop with three (3) hot water pumps that serve different hot water loops. The pumps range are 10-hp, 7.5-hp, and 1.5-hp. The boilers provide hot water to the hot water coils throughout the school. They provide heat to the water-source heat pump and provide domestic hot water through a dedicated heat exchanger connected to a blending valve integrated in the domestic hot water loop.

Figure 20 Thurgood Marshall ES Boilers

There are approximately forty-two (42) water-source heat pump units that supply heating, cooling and ventilation for the building. These heat pumps are constant air volume units with a single 1/2 hp supply fan and no return fan. The heat pumps utilize scroll or reciprocating compressors depending on the unit.

Seven (7) direct-expansion (DX) package units, sized between five and twenty tons, with a total cooling capacity of 80 tons, condition areas that are not served by the water-source heat pumps. Six (6) heat recovery ventilation units exhaust air from the building while providing make-up outside air.

One (1) cooling tower rejects heat from the closed water-source heat pump loop during the summer. The cooling tower has a rusted basin and appears to be in poor condition.

All HVAC units are controlled by individual thermostats.

Refer to Appendix 8 for a detailed list of HVAC equipment at the site.

Domestic Hot Water

The building is provided domestic hot water through a heat exchanger integrated with the main modular boilers.

Kitchen Equipment

A small kitchen for the school contains four (4) half-size convection ovens, electric steamer, gas griddle, kettles, various refrigeration units and an ice maker.

Plug Load

The facility's plug load consists of general classroom or office equipment, kitchenette equipment and server room equipment. There are several refrigerated and non-refrigerated vending machines that serve the middle school.

There are approximately 506 computers and two server racks. There is no centralized PC Power Management software installed.

Plumbing/Water System

There is approximately 31 restrooms in the building. A majority of the faucets are high-flow rated for 2.2 gallons per minute or higher. The kitchen sinks have higher flow faucets. Toilets and urinals throughout the building are low-flow.

Dorothy McNish Parent Center

Figure 21 Doroth McNish Parent Center Building Exterior

Background Information

Dorothy McNish Parent Center is located at 304 Prospect Ave in Asbury Park, New Jersey. This 5,000 square foot facility is two stories that are mainly compromised by office and classroom spaces. The building was renovated in 2016.

Building Occupancy

Approximately 40 students and 6 faculty members occupy the building.

Hours of Operation

- Monday through Friday 8:00 am to 4:00 pm.
- Weekends – Closed

Envelope

The building is wood framed with a stucco façade. The roof is flat with black membrane. The first floor has no windows, the second floor contains single pane windows that are occupied with window air conditioning units. The building's exterior doors are constructed of aluminum.

Lighting

Lighting for the building consists of 4-foot T-8 linear fluorescent fixtures, both 2-lamp and 4-lamp fixtures. There are a few compact fluorescent bulbs and U-bend fluorescent fixtures.

Exterior lighting is provided by high intensity discharge (HID) lamps.

Interior lighting control is provided by manual wall switches. Exterior lighting control is provided by photocells or a time clock.

Mechanical Systems

HVAC Systems and Equipment:

The building is heated by two (2) standard-efficiency gas-fired furnaces. One furnace is dedicated to each floor. Heating is controlled by programmable thermostats, set by the occupants on each floor.

The building is cooled by seven (7) window air conditioning units, sized from 9,000 to 24,000 Btus/hr, that are manually controlled.

Refer to Appendix 8 for a detailed list of HVAC equipment at the site.

Domestic Hot Water

The building is provided domestic hot water by one (1) electric water heater with an input rating of 4.5kW. This water heater has a 30-gallon storage tank.

Kitchen Equipment

There is no standard kitchen. The building has microwaves and refrigeration equipment.

Plug Load

There are also several microwaves, refrigerators televisions and one refrigerated vending machine.

The facility's plug load consists of approximately 35 computer stations and a server rack. There is no centralized PC Power Management Software Installed.

Plumbing/Water System

The two restrooms in the facility have low-flow faucets, with flow rates less than 2.2 gallons per minute. The toilets are also low flow models.

Buildings and Grounds

Figure 22 Buildings and Grounds Building Exterior

Background Information

The Buildings and Grounds facility is located at 914 Second Ave, in Asbury Park New Jersey. This building is approximately 13,740 square foot. Three buildings are interconnected to function as one facility. This building has office space, warehouse storage areas, workshops and garage bays.

Building Occupancy

Approximately 8 faculty members occupy the building.

Hours of Operation

- Monday through Friday 7:15 am to 5:15 pm.
- Weekends – Closed
- The building operates year-round

Envelope

The interconnected buildings are constructed with concrete block with a stucco façade. The roof is low pitched with a white bitumen roof membrane, while the garage buildings have metal pan concrete roofs. The windows are single-paned and operable. The building's exterior doors are constructed of aluminum and four aluminum roll up doors. There are visible air gaps under the roll up doors.

Lighting

Lighting for the building is provided by linear fluorescent lamps with corresponding electronic ballasts. The majority of these being T8 lamps, while some parts of the main shop and garage are lit buy T5 lamps or T12 lamps. A majority of the fixtures are 4-lamp, 4-foot long troffers, though some may be 2, and 3-lamp fixtures. Other fixtures include metal halide lamps and fixtures containing compact fluorescent bulbs.

Exterior lighting is provided by metal halide fixtures.

Lighting is controlled by manually operated wall switches.

Mechanical Systems

HVAC Systems and Equipment:

The facility is heated by three (3) gas-fired ceiling-mounted unit heaters and one (1) electric unit heater.

Figure 23 Buildings and Ground Ceiling Mounted Heater

Spot cooling is provided by though-the-wall air conditioning units in the two offices. The air conditioning units are manually controlled.

Domestic Hot Water

The facility is provided domestic hot water from two (2) electric domestic water heaters. The main office restroom is served by a Rheem 13-kW electric tankless water heater. The garage restroom is served by a Vanguard 2-kW water heater with a 10-gallon storage tank.

Refer to Appendix 8 for a detailed list of HVAC equipment at the site.

Plug Load

There are three microwaves, two standard refrigerators and one television.

The facility's plug load consists of 10 computer work stations. There is no centralized PC Power Management software installed.

Plumbing/Water System

There are two restrooms at the facility. The main office restroom has a low-low faucet. The garage restroom has a high-flow faucet with a flow of 2.5 gallons per minute or greater. The toilets appear to be low-flow, less than 2.5 gallons per flush.

Information Technology Center

Background Information

Figure 24 IT Center Building Exterior

Asbury Park Information Technology Center is located at 1056 Park Ave in Asbury Park New Jersey. This 5,400 square foot building is comprised of office spaces, conference rooms, repair, and server rooms. The Information Technology Center houses the school districts central servers and IT Department.

Building Occupancy

Approximately 10 faculty members occupy the building.

Hours of Operation

- Monday through Friday 7:30 am to 5:30 pm.
- Weekends – Closed
- The building operates year-round

Envelope

The building is built with wood frame and lap-board façade. The roof system is pitched with composite shingles. Windows on the building are single-panned. The exterior doors of the building are constructed of aluminum.

Lighting

A majority of the light fixtures include linear 4-foot 32-watt T8 lamps with corresponding electronic ballasts. There are mostly two-lamp troffers with diffusers, but there is 1, 3, and 4 lamp fixtures as well. Some other fixtures include U-bend T8 tubes and compact fluorescent bulbs.

No exterior lighting has been observed.

Controls for light fixtures are provided by standalone switches.

Mechanical Systems

HVAC Systems and Equipment:

The building is heated by one (1) natural gas-fired boiler which is configured in a constant flow primary loop distribution loop. Three hot water pumps are in use which service different parts of the building. Hot water is supplied to baseboard radiators which are controlled by programmable thermostats.

Figure 25 IT Center Boiler

The building is cooled by two (2) cooling-only split systems, while three (3) window-mounted air conditioners cool office spaces. These units are all controlled by manual thermostats.

The server has a Sanyo mini-split system with a capacity of 3 tons. There is also a split system AC unit with a capacity of 5 tons. The evaporators are wall-mounted. The data center has two (2) through the wall AC units as a back-up to the split systems.

Figure 26 IT Center Split System AC

Figure 27 IT Center Through-Wall AC

Refer to Appendix 8 for a detailed list of HVAC equipment at the site.

Domestic Hot Water

Domestic hot water is provided by one (1) tankless condensing hot water heater with an input rating of 120,000 BTU/hr.

Figure 28 IT Center Domestic Hot Water Heater

Kitchen Equipment

The Facility has a few refrigerators and microwaves.

Plug Load

There are also several printers, copiers, microwaves and refrigerators.

There are approximately 31 computer stations and other computer equipment being repaired or serviced. The data center has five server racks served by three interruptible power supplies. There is no centralized PC power management software installed.

Plumbing/Water System

This facility has four (4) restrooms with high-flow fixtures that have a 2.2 gallon per minute flow rate. Toilets in the facility are rated for 3.5 gallons per flush.

Utility Baseline Analysis

NOTE: The billing information was provided by the school district.

Electric

Electrical energy is delivered and supplied by Jersey Central Power & Lighting (JCPL).The electric utility measures consumption in kilowatt-hours (kWh). One kWh usage is equivalent to 1000 watts running for one hour.

Natural Gas

Asbury Park Board of Education's natural gas commodity supplier and delivered by New Jersey Natural Gas. The gas utility New Jersey Natural Gas (NJNG) measures consumption in cubic feet x 100 (CCF) and converts the quantity into therms of energy. The district buildings fall under the General Service Large (GSL) Rate structure for natural gas.

Energy Usage Summary

Asbury Park Board of Education Energy Summary Analysis Table

Asbury Park Board of Education Energy Use Index (EUI) Analysis

The pie chart below shows the distribtuion of these two energy source costs relative to the entire District energy consumption. At 77% of the total consumption, electricity comprises a larger share of the energy costs.

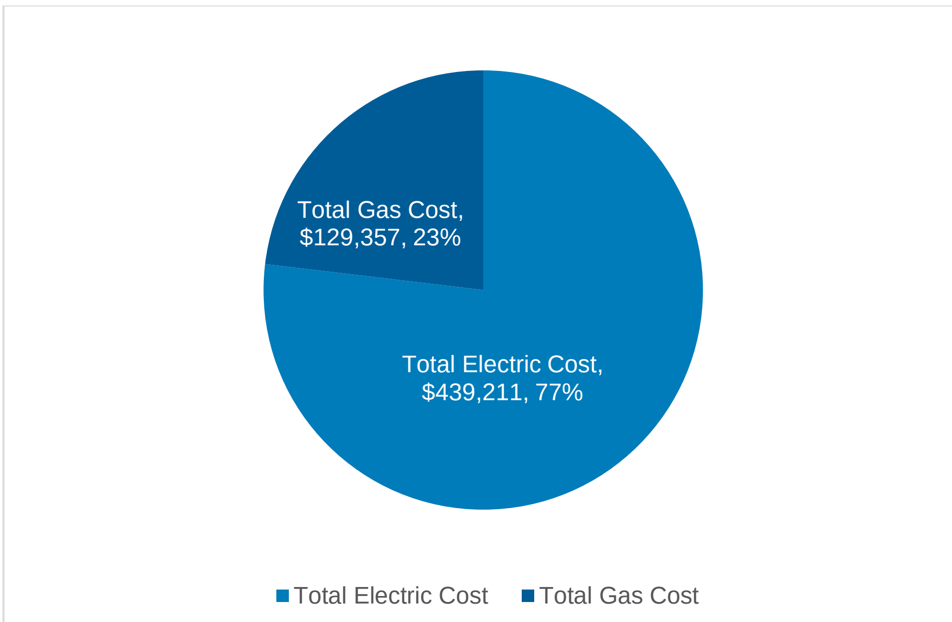


Figure 29 APSD Total Annual Utility Cost Breakdown

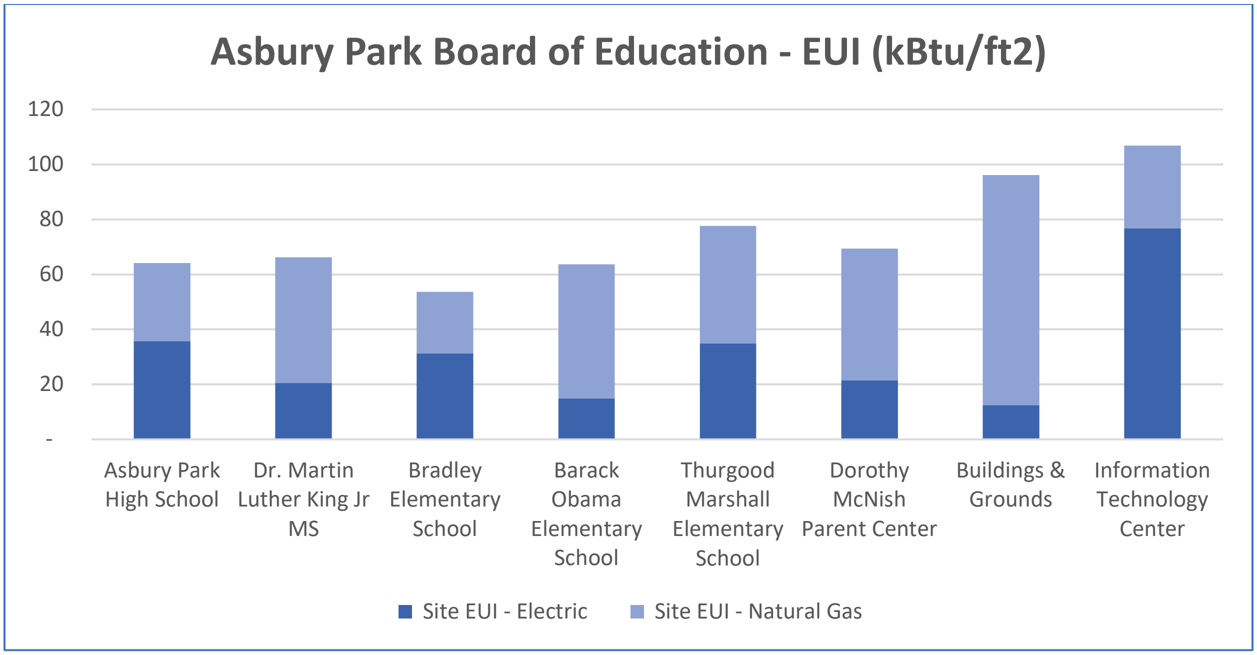


Figure 30 Asbury Park Board of Education Energy Use Index (EUI) Analysis

Asbury Park Board of Education Utility Cost Breakdown

The chart below shows the distribution of these two energy source costs relative to the entire District energy consumption. At 70% of the total consumption, electricity comprises a larger share of the energy costs.

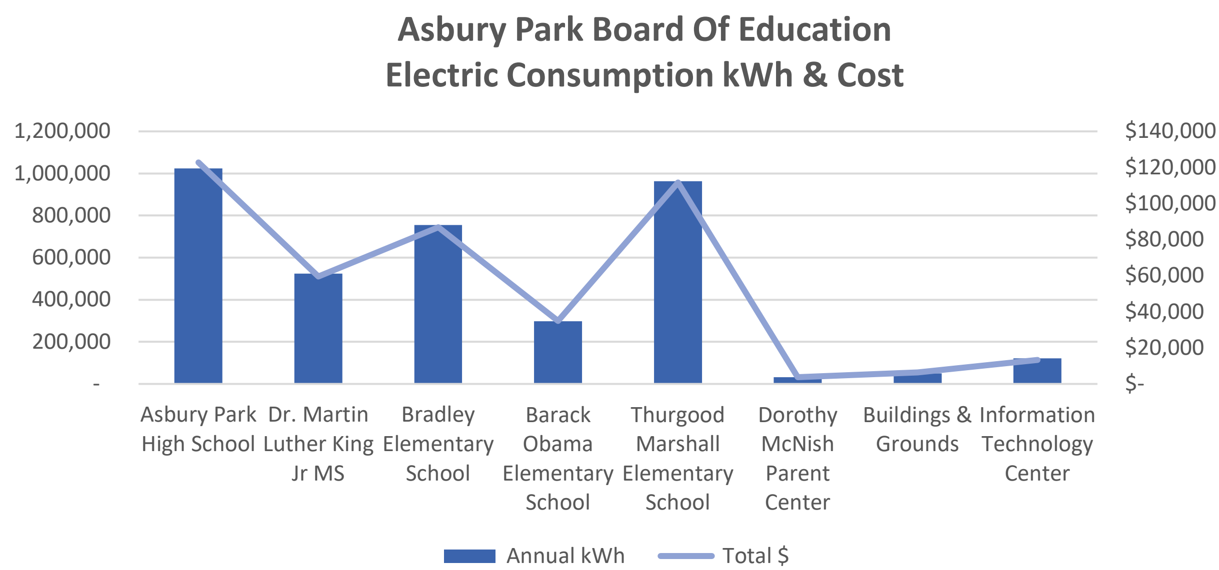


Figure 31 Asbury Park Board of Education Utility Cost Breakdown - Electric

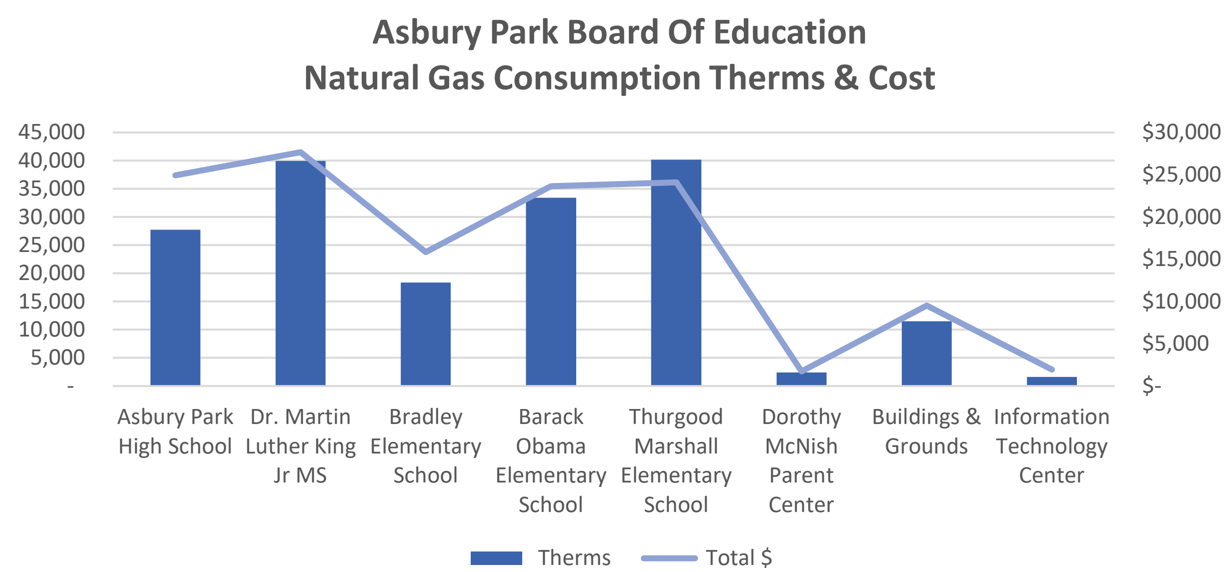


Figure 32 Asbury Park Board of Education Utility Cost Breakdown – Natural Gas

Marginal Rates

For the purposes of determining how energy conservation measures will affect the utility bill, it is important to understand what portions of the cost can be saved. In general, there are costs associated with utility bills that are fixed and independent of usage, such as the monthly meter charge. For example, in the case of a monthly meter charge, this charge often exists even if the energy usage were zero. An energy conservation measure often cannot produce a cost savings on this portion of the bill. The utility rate structure must, therefore, be analyzed to determine what portion of the bill a cost savings can be produced using a specific energy conservation measure. For the purposes of this report, the blended average utility rate is the total cost divided by the total energy units. The effective rate is the portion of the bill effected by energy saving or the applied energy conservation measure.

The utility rates identified below were used for purposes of calculating the dollar effect of the energy savings for the district.

Electric

The effective supply kWh rate is the most recent in the baseline period. The total effective $/kWh rate is the summation of the supply and transport effective rates. For simplification, an Average Effective $/kWh rate was determined by averaging annual effective $/kWh rates and is used for calculations. Rates shown include New Jersey Sales and Use Tax (SUT). A simplified average $/kW demand is used as the effective rate for savings calculations.

Baseline Data	Electric							
Facility Name	Peak Monthly kW	Annual kW	Total kW $	$/kW	Annual kWh	Total kWh $	Total $	$/kWh
Asbury Park High School	**442**	**4,248**	**$22,834**	**$5.38**	**1,023,680**	**$99,944**	**$122,778**	**$0.098**
Dr. Martin Luther King Middle School	**127**	**1,386**	**$8,003**	**$5.77**	**523,876**	**$51,536**	**$59,539**	**$0.098**
Bradley Elementary School	**233**	**2,379**	**$14,380**	**$6.04**	**755,400**	**$72,453**	**$86,833**	**$0.096**
Barack Obama Elementary School	**101**	**1,052**	**$5,849**	**$5.56**	**297,800**	**$29,124**	**$34,793**	**$0.098**
Thurgood Marshall Elementary School	**323**	**3,228**	**$19,617**	**$6.08**	**963,200**	**$92,118**	**$111,735**	**$0.096**
Dorothy McNish Parent Center	**13**	**145**	**$93**	**$0.64**	**31,434**	**$3,652**	**$3,745**	**$0.116**
Buildings and Grounds	**24**	**277**	**$168**	**$0.61**	**50,238**	**$6,145**	**$6,313**	**$0.122**
IT Center	**30**	**287**	**$1,065**	**$3.71**	**121,360**	**$12,230**	**$13,295**	**$0.101**
Total		**13,002**	**$72,009**	**$5.54**	**3,766,988**	**$367,202**	**$439,211**	**$0.097**

Figure 33 Electric Utility by Building

Asbury Park High School has two electric meters: (No. G28564740) [Account Number 100 017 082 932] and (No. S322340221) [Account Number 100 107 573 188].

Dr. Martin Luther King Middle School has three electric meters (No. D10682767) [Account Number 100 107 573 402], (No. S07046037) [Account Number 100 107 573 238], and (No. S309628126) [Account Number 100 107 573 204].

Bradley Elementary School has one electric meter (No. S309628126) [Account Number 100 107 573 204].

Barack Obama Elementary School has one electric meter (No. S309628124) [Account Number 100 107 573 428].

Thurgood Marshall Elementary School has one electric meter (No. G28740272) [Account Number 100 107 573 568].

Dorothy McNish Parent Center has one electric meter (No. S319712279) [Account Number 100 128 262 142].

Buildings and Grounds has two electric meters: (No. S312183133) [Account Number 100 043 318 136] and (No. G95964593) [Account Number 100 107 573 139].

IT Center has one electric meter (No. S310588608) [Account Number 100 107 573 543].

Natural Gas

Due to the complex nature and variability of the gas rates which includes demand and balancing charges in the tariff rates the blended average unit cost is considered the effective rate for savings calculations. In cases where more than one account/meter serves a school the total average of all combined accounts is used unless the account is not significant, for instance where the account exists but delivers no natural gas on a regular basis or uses a very small amount relative to the other accounts.

Baseline Data	Natural Gas			
Facility Name	**Therms**	**Btu/ft2**	**Total $**	**$/Unit**
Asbury Park High School	27,748	28,406	$24,934	$0.90
Dr. Martin Luther King Middle School	39,951	45,789	$27,668	$0.69
Bradley Elementary School	18,400	22,356	$15,831	$0.86
Barack Obama Elementary School	33,420	48,860	$23,635	$0.71
Thurgood Marshall Elementary School	40,157	42,709	24,103	$0.60
Dorothy McNish Parent Center	2,397	47,940	$1,737	$0.72
Buildings and Grounds	11,500	83,697	$9,509	$0.83
IT Center	1,629	30,167	$1,940	$1.19
Total	**175,202**		**$129,357**	**$0.74**

Figure 34 Natural Gas Utility by Building

Asbury Park High School has one gas meter (No. 00745013) [Account Number 11-3152-5930-21]

Dr. Martin Luther King Middle School has one gas meter (No. 00513064) [Account Number 14-3166-5505-24]

Bradley Elementary School has one gas meter (No. 00719928) [Account Number 10-3148-5000-21]

Barack Obama Elementary School has one gas meter (No. 01051663) [Account Number 13-3162-4050-2Y]

Thurgood Marshall Elementary School has one gas meter (No. 00956539) [Account Number 09-3142-5181-24]

Dorothy McNish Parent Center has one gas meter (No. 00852600) [Account Number 14-3168-5710-46]]

Buildings and Grounds has two gas meters: (No. 00697882) [Account Number 22-0007-5232-26] and (No. 00759908) [Number 10-3148-1885-33].

IT Center has one gas meter (No. 01062008) [Account Number 22-0017-7547-73]

Utility Breakdown by Building

Electric Usage and Demand

A detailed look at the monthly usage (kWh) in a typical year is shown in the Appendix.

Natural Gas Usage

A detailed look at the monthly usage (therms) in a typical year is shown in the Appendix.

Utility Escalation Rates

For purposes of calculating the extended value of the energy savings of this project, the following utility escalation rates have been used.

Name of School	Energy					
	Electric Consumption		Annual Electric Demand		Natural Gas	
	Escalation Rate	Start Year of Escalation	Escalation Rate	Start Year of Escalation	Escalation Rate	Start Year of Escalation
Asbury Park High School	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
Dr. Martin Luther King Middle School	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
Bradley Elementary School	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
Barack Obama Elementary School	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
Thurgood Marshall Elementary School	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
Dorothy McNish Parent Center	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
Buildings and Grounds	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
IT Center	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1

Figure 35 Utility Escalation Rates

SECTION 3. FINANCIAL IMPACT

Energy Savings and Cost Summary

The table below provides a summary of the costs and savings associated with the measures recommended in the Energy Savings Plan. The savings have been calculated based on the savings methodology detailed throughout this report and included in the appendix of this report. Costs for each measure have been estimated based on project implementation experience and industry standards.

ECM #	Building	Energy Conservation Measure "ECM"	ECM Hard Cost	Total Savings, $/yr	Simple Payback, yrs
01-1	Asbury Park High School	Comprehensive LED Lighting Upgrades + Controls	$231,315.60	$21,451.17	10.8
01-1	Bradley Elementary School	Comprehensive LED Lighting Upgrades	$172,227.00	$18,869.53	9.1
01-1	Thurgood Marshall Elementary School	Comprehensive LED Lighting Upgrades	$233,087.34	$23,751.22	9.8
01-2	Dr. Martin Luther King Jr MS	Comprehensive LED Lighting Upgrades - DI	$121,615.46	$12,811.93	9.5
01-2	Dr. Martin Luther King Jr MS	Install Occupancy Sensor Lighting Controls - DI	$6,330.17	$794.77	8.0
01-2	Barack Obama Elementary School	Comprehensive LED Lighting Upgrades - DI	$54,623.14	$7,814.84	7.0
01-2	Barack Obama Elementary School	Install Occupancy Sensor Lighting Controls - DI	$6,706.93	$1,034.01	6.5
01-2	Dorothy McNish Parent Center	Comprehensive LED Lighting Upgrades - DI	$6,055.59	$1,421.94	4.3
01-2	Buildings & Grounds	Comprehensive LED Lighting Upgrades - DI	$11,671.85	$2,128.66	5.5
01-2	Buildings & Grounds	Install Occupancy Sensor Lighting Controls - DI	$690.24	$151.43	4.6
01-2	Information Technology Center	Comprehensive LED Lighting Upgrades - DI	$6,765.50	$709.26	9.5
01-2	Information Technology Center	Install Occupancy Sensor Lighting Controls - DI	$1,531.51	$171.92	8.9
02-1	Asbury Park High School	High Efficiency Transformer Upgrade	$44,360.82	$4,062.19	10.9
02-1	Dr. Martin Luther King Jr MS	High Efficiency Transformer Upgrade	$52,357.62	$4,241.42	12.3
02-1	Bradley Elementary School	High Efficiency Transformer Upgrade	$26,094.66	$2,648.50	9.9
02-1	Thurgood Marshall Elementary School	High Efficiency Transformer Upgrade	$39,892.20	$3,835.37	10.4
04-1	Dr. Martin Luther King Jr MS	Condensing Hot Water Boiler Replacement - DI	$506,866.54	$117.22	4,324.0

ECM #	Building	Energy Conservation Measure "ECM"	ECM Hard Cost	Total Savings, $/yr	Simple Payback, yrs
07-1	Asbury Park High School	Building Envelope Weatherization	$38,376.48	$3,379.55	11.4
07-1	Dr. Martin Luther King Jr MS	Building Envelope Weatherization	$62,915.64	$4,807.56	13.1
07-1	Bradley Elementary School	Building Envelope Weatherization	$21,723.96	$2,172.71	10.0
07-1	Barack Obama Elementary School	Building Envelope Weatherization	$28,245.84	$1,995.61	14.2
07-1	Thurgood Marshall Elementary School	Building Envelope Weatherization	$23,625.24	$1,868.91	12.6
07-1	Dorothy McNish Parent Center	Building Envelope Weatherization	$5,636.52	$545.06	10.3
07-1	Buildings & Grounds	Building Envelope Weatherization	$3,120.18	$209.97	14.9
07-1	Information Technology Center	Building Envelope Weatherization	$1,352.52	$140.71	9.6
08-1	Asbury Park High School	Mechanical Insulation	$12,778.56	$1,513.43	8.4
08-1	Bradley Elementary School	Mechanical Insulation	$7,775.46	$838.32	9.3
08-1	Thurgood Marshall Elementary School	Mechanical Insulation	$6,035.34	$422.45	14.3
08-2	Dr. Martin Luther King Jr MS	Mechanical Insulation - DI	$19,438.65	$0.00	N/A
08-2	Barack Obama Elementary School	Mechanical Insulation - DI	$10,398.90	$0.00	N/A
08-2	Information Technology Center	Mechanical Insulation - DI	$6,349.50	$0.00	N/A
08-2	Buildings & Grounds	Mechanical Insulation - DI	$1,772.25	$0.00	N/A
11-1	Buildings & Grounds	Plug Load Controls	$132.41	$39.81	3.3
11-1	Dorothy McNish Parent Center	Plug Load Controls	$794.46	$82.33	9.6
11-1	Information Technology Center	Plug Load Controls	$1,191.68	$173.20	6.9
11-1	Asbury Park High School	Plug Load Controls	$6,620.46	$521.27	12.7
11-1	Dr. Martin Luther King Jr MS	Plug Load Controls	$7,150.10	$526.51	13.6
11-1	Bradley Elementary School	Plug Load Controls	$4,899.14	$359.65	13.6
11-1	Barack Obama Elementary School	Plug Load Controls	$4,766.73	$425.74	11.2
11-1	Thurgood Marshall Elementary School	Plug Load Controls	$7,150.10	$555.80	12.9
13-1	Asbury Park High School	Cogeneration 35 kW	$420,328.74	$7,095.93	59.2
14-1	Asbury Park High School	Refrigeration Controls	$4,092.24	$1,291.18	3.2

ECM #	Building	Energy Conservation Measure "ECM"	ECM Hard Cost	Total Savings, $/yr	Simple Payback, yrs
14-2	Dr. Martin Luther King Jr MS	Refrigeration Controls	$2,455.14	$509.09	4.8
14-3	Bradley Elementary School	Refrigeration Controls	$1,637.10	$330.90	4.9
14-4	Barack Obama Elementary School	Refrigeration Controls	$2,455.14	$506.10	4.9
14-5	Thurgood Marshall Elementary School	Refrigeration Controls	$2,455.14	$1,176.82	2.1
16-1	Asbury Park High School	Building Automation System -Core	$101,769.48	$152.68	666.5
16-1	Asbury Park High School	Building Automation System -Intermediate	$12,461.34	$18.70	666.5
16-1	Asbury Park High School	Building Automation System -Terminal	$28,612.02	$42.93	666.5
16-1	Dr. Martin Luther King Jr MS	Building Automation System -Core	$29,475.96	$44.56	661.5
16-1	Dr. Martin Luther King Jr MS	Building Automation System -Intermediate	$57,360.72	$86.71	661.5
16-1	Bradley Elementary School	Building Automation System -Core	$35,199.18	$51.88	678.5
16-1	Bradley Elementary School	Building Automation System -Intermediate	$116,700.24	$172.00	678.5
16-1	Bradley Elementary School	Building Automation System -Terminal	$120,114.18	$177.03	678.5
16-1	Thurgood Marshall Elementary School	Building Automation System -Core	$41,370.18	$60.80	680.4
16-1	Thurgood Marshall Elementary School	Building Automation System -Intermediate	$150,065.46	$220.54	680.4
16-1	Thurgood Marshall Elementary School	Building Automation System -Terminal	$259,940.88	$382.02	680.4
16-1	Dorothy McNish Parent Center	Complete Building Automation System	$19,901.22	$35.53	560.1
16-1	Information Technology Center	Complete Building Automation System	$12,595.98	$19.51	645.8
16-1	Buildings & Grounds	Complete Building Automation System	$18,559.92	$34.89	532.0
19-1	Bradley Elementary School	Replacement of Classroom UVs (HPs)	$1,037,952.00	$4,800.66	216.2
22-1	Asbury Park High School	Retrocommissioning	$30,738.05	$4,393.92	7.0
22-1	Dr. Martin Luther King Jr MS	Retrocommissioning	$27,455.37	$2,395.93	11.5
22-1	Bradley Elementary School	Retrocommissioning	$25,899.30	$2,973.16	8.7
22-1	Barack Obama Elementary School	Retrocommissioning	$21,523.75	$1,613.64	13.3
22-1	Thurgood Marshall Elementary School	Retrocommissioning	$29,587.29	$3,511.71	8.4

ECM #	Building	Energy Conservation Measure "ECM"	ECM Hard Cost	Total Savings, $/yr	Simple Payback, yrs
22-1	Dorothy McNish Parent Center	Retrocommissioning	$1,573.37	$171.87	9.2
22-1	Buildings & Grounds	Retrocommissioning	$4,323.63	$534.14	8.1
22-1	Information Technology Center	Retrocommissioning	$1,699.24	$514.88	3.3
23-1	Asbury Park High School	PC Power Management	$74,460.00	$5,400.81	13.8
24-1	District-Wide	Contingency	$425,000.00	$0.00	N/A
		TOTALS	**$4,922,204.54**	**$165,314.49**	**29.8**

Figure 36 Recommended Project ECMs

Operational Savings Estimates

The lighting retrofits recommended for this project will reduce the number of lamps that need to be replaced each year due to the longer lasting lamps and new technology fixtures. The LED lighting recommended for the exterior fixtures will last much longer than the current high intensity discharge (HID) lighting and will generate material cost savings.

A brief description of the operational savings estimated for this project is included below. Energy Systems Group has worked with the District to quantify the exact sources of savings by going through past invoices and expenses. The operational savings will not be escalated.

Operational Savings for Financial Model

ECM Description	Annual Savings
LED Lighting Upgrades & Occupancy Sensors – District Wide	$29,821
Reduction in replacement parts and maintenance expenses – District Wide	$33,161
Totals	$62,982

Potential Revenue Generation Estimates

As part of the Energy Savings Plan for Asbury Park Board of Education, several avenues for obtaining rebates and incentives have been investigated which include:

- NJ Smart Start Equipment Incentives
- Pay for Performance
- Combined Heat and Power Incentive
- Demand Response Energy Efficiency Credit

The estimated incentive amount for each program is listed below. Upon final selection of project scope and award of subcontractor bids, the incentive applications will be filed.

NJ Smart Start Equipment Incentives

The NJ Smart Start Equipment Incentives provide prescriptive rebates for defined retrofits. Incentives are applied on a unit-by-unit basis for making energy efficiency upgrades. The table below summarizes the equipment incentives, which will be applied for at Asbury Park Board of Education:

Energy Conservation Measure	Facility	Estimated Incentive
LED Lighting Upgrades & Controls	Asbury Park High School	$32,000
LED Lighting Upgrades & Controls	Dr. Martin Luther King Jr Middle School	$57,964
LED Lighting Upgrades	Bradley Elementary School	$32,000
LED Lighting Upgrades & Controls	Barack Obama Elementary School	$22,461
LED Lighting Upgrades	Thurgood Marshall Elementary School	$36,000
LED Lighting Upgrades	Dorothy McNish Parent Center	$2,536
LED Lighting Upgrades & Controls	Buildings and Grounds	$7,030
LED Lighting Upgrades	Information Technology Center	$5,542
Boiler Replacement	Dr. Martin Luther King Jr Middle School	$146,656
Totals		**$342,189**

Pay for Performance Incentives

Pay for Performance incentives are awarded upon the satisfactory completion of three milestones:

Incentive Structure

Incentive #1: Energy Reduction Plan		
Incentive Amount:	$0.15	per sq ft
Minimum Incentive:	$7,500	
Maximum Incentive:	$50,000	or 50% of facility annual energy cost

This incentive is designed to offset some or all of the cost of services associated with the development of the Energy Reduction Plan (ERP) and is paid upon ERP approval. Incentive is contingent on implementation of recommended measures outlined in the ERP. If installation does not commence within the required timeframe, Incentive #1 may be required to be returned to the program. In the event the project is cancelled and Incentive #1 is not returned, the project may reapply to the program in the future but another Incentive #1 will not be paid.

Incentive #2: Installation of Recommended Measures			
	Minimum Performance Target:	**15%**	
Electric Incentives	Base Incentive based on 15% savings:	$0.09	per projected kWh saved
	For each % over 15% add:	$0.005	
	Maximum Incentive:	$0.11	
Gas Incentives	Base Incentive based on 15 % savings:	$0.90	per projected Therm saved
	For each % over 15% add:	$0.05	
	Maximum Incentive:	$1.25	
	Incentive Cap:	**25%**	**of total project cost**

This incentive is based on projected energy savings outlined in the ERP. Incentive is paid upon successful installation of recommended measures.

Incentive #3: Post-Construction Benchmarking Report			
	Minimum Performance Target:	**15%**	
Electric Incentives	Base Incentive based on 15% savings:	$0.09	per projected kWh saved
	For each % over 15% add:	$0.005	
	Maximum Incentive:	$0.11	
Gas Incentives	Base Incentive based on 15% savings:	$0.90	per projected Therm saved
	For each % over 15% add:	$0.05	
	Maximum Incentive:	$1.25	
	Incentive Cap:	**25%**	**of total project cost**

This incentive will be released upon submittal of a Post-Construction Benchmarking Report that verifies that the level of savings actually achieved by the installed measures meets or exceeds the minimum performance threshold. Total value of Incentive #2 and Incentive #3 may not exceed 50% of the total project cost. Incentive Caps apply.

Pay for Performance was analyzed for this project and determined not to be appropriate given the value of the prescriptive incentives available.

Cogeneration Incentives

Incentives are available for Combined Heat and Power (CHP) / Cogeneration systems with heat recovery and productive use of waste heat that are located on-site. Cogeneration units that are powered by natural gas and under 500kW, as in the case of the system recommended Asbury Park High School is eligible for an incentive of $2.00/ watt. There is a minimum of 5,000 EFL Run hours that the school will need to meet to qualify for this incentive.

The CHP incentive is paid in three increments as outlined below:

- Thirty percent (30%) of the incentive upon proof of equipment purchase
- Fifty (50%) percent upon project completion and verification of installation
- Remainder twenty percent (20%) upon acceptance and confirmation the project is achieving the required performance thresholds based on twelve (12) months of operating data. proposed and/or minimum efficiency threshold

The minimum payback to be eligible for the CHP incentive was not met and the project is therefore ineligible.

Demand Response Energy Efficiency Credit

The LED Lighting Upgrades recommended for the District will be eligible for the Energy Efficiency Credit available through PJM. The Energy Efficiency Credit pays consumers based on the permanent load reduction through the installation of energy efficiency measures. The following table summarizes the available Demand Response Incentives available due to the lighting upgrades at all buildings at Asbury Park Board of Education

Demand Response Energy – Emergency Capacity Credit		
PJM Payment Year	**Approved Load (kW)**	**Annual Customer Capacity Benefit**
2021/2022	197	$4,327
2022/2023	197	$4,327
2023/2024	197	$4,327
2024/2025	197	$4,327
Totals		**$17,308**

Business Case for Recommended Project

FORM VI - ENERGY SAVINGS PLAN

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCO's PRELIMINARY ANNUAL CASH FLOW ANALYSIS FORM
Asbury Park School District
ENERGY SAVINGS IMPROVEMENT PROGRAM

ESCO Name: ENERGY SYSTEMS GROUP **Project Scenario** 3

Note: Respondents must use the following assumptions in all financial calculations:

(a) The cost of all types of energy should be assumed to inflate at 2.2% gas, 2.4% electric per year; and

1. Term of Agreement: 22 years
2. Construction period² (months): 15
3. Cash Flow Analysis Format:

Total Financed Amount[4]	$ 6,560,111
Design/Consultant Fee	$ 409,165
BC/FA	$ 200,000
Total ESG Project Cost [1]	$ 5,950,945

Interest Rate to be used for Proposal Purposes: **2.25%**

	Annual Energy Savings	Annual Operational Savings	Energy Rebates/ Incentives	Solar PPA	Total Annual Savings	Annual Project Costs	Board Costs	Annual Service Costs	Net Cash-Flow to client	Cumulative Cash Flow
Installation[3]	$ 100,966	$ -	$ -	$ -	$ 100,966	$ -	$ -	$ -	$ 100,966	$ 100,966
1	$ 269,948	$ 62,983	$ 330,141	$ 161,878	$ 824,950	$ 790,455	$ 822,450	$ 31,994	$ 2,500	$ 103,466
2	$ 172,732	$ 62,983	$ 4,111	$ 165,440	$ 405,265	$ 402,765	$ 402,765	$ -	$ 2,500	$ 105,966
3	$ 176,565	$ 33,161	$ 4,327	$ 169,079	$ 383,132	$ 380,632	$ 380,632	$ -	$ 2,500	$ 108,466
4	$ 180,482	$ 33,161	$ 4,327	$ 172,799	$ 390,770	$ 388,270	$ 388,270	$ -	$ 2,500	$ 110,966
5	$ 184,487	$ 33,161	$ -	$ 176,600	$ 394,249	$ 391,749	$ 391,749	$ -	$ 2,500	$ 113,466
6	$ 188,581	$ -	$ -	$ 180,486	$ 369,067	$ 366,567	$ 366,567	$ -	$ 2,500	$ 115,966
7	$ 192,766	$ -	$ -	$ 184,456	$ 377,222	$ 374,722	$ 374,722	$ -	$ 2,500	$ 118,466
8	$ 197,043	$ -	$ -	$ 188,514	$ 385,558	$ 383,058	$ 383,058	$ -	$ 2,500	$ 120,966
9	$ 201,416	$ -	$ -	$ 192,662	$ 394,077	$ 391,577	$ 391,577	$ -	$ 2,500	$ 123,466
10	$ 205,885	$ -	$ -	$ 196,900	$ 402,786	$ 400,286	$ 400,286	$ -	$ 2,500	$ 125,966
11	$ 210,454	$ -	$ -	$ 201,232	$ 411,686	$ 409,186	$ 409,186	$ -	$ 2,500	$ 128,466
12	$ 215,125	$ -	$ -	$ 205,659	$ 420,784	$ 418,284	$ 418,284	$ -	$ 2,500	$ 130,966
13	$ 219,899	$ -	$ -	$ 210,184	$ 430,082	$ 427,582	$ 427,582	$ -	$ 2,500	$ 133,466
14	$ 224,779	$ -	$ -	$ 214,808	$ 439,586	$ 437,086	$ 437,086	$ -	$ 2,500	$ 135,966
15	$ 229,767	$ -	$ -	$ 219,534	$ 449,301	$ 446,801	$ 446,801	$ -	$ 2,500	$ 138,466
16	$ 234,866	$ -	$ -	$ -	$ 234,866	$ 232,366	$ 232,366	$ -	$ 2,500	$ 140,966
17	$ 240,079	$ -	$ -	$ -	$ 240,079	$ 237,579	$ 237,579	$ -	$ 2,500	$ 143,466
18	$ 245,407	$ -	$ -	$ -	$ 245,407	$ 242,907	$ 242,907	$ -	$ 2,500	$ 145,966
19	$ 250,854	$ -	$ -	$ -	$ 250,854	$ 248,354	$ 248,354	$ -	$ 2,500	$ 148,466
20	$ 256,421	$ -	$ -	$ -	$ 256,421	$ 245,672	$ 245,672	$ -	$ 10,749	$ 159,215
Totals	**$ 4,297,556**	**$ 225,448**	**$ 342,906**	**$ 2,840,231**	**$ 7,706,142**	**$ 7,615,898**	**$ 7,647,893**	**$ 31,994**	**$ 58,249**	**$ -**

NOTES:

1 **Includes: Hard costs and project service fees defined in ESCO's PROPOSED 'FORM V"**
2 **No payments are made by the Board during the construction period.**
3 **Installation period savings for Energy Savings and Operational Savings are guarenteed. These savings will be used in addition to the first loan payment.**
4 **Total Financed Cost includes all Fees and project costs.**

Greenhouse Gas Reductions

Avoided Emissions	Total Electric Savings	Total Natural Gas Savings	Total Annual Avoided Emissions
Annual Unit Savings	**kWh**	**Therms**	**Total**
NO_X (lbs)	1,551	194	1,745
SO_2 (lbs)	1,370	0	1,370
CO_2 (lbs)	1,920,333	246,336	2,166,669

Factors Used in Calculations:

CO_2 Electric Emissions:	*1,374*	*lbs.*	*per*	*MWh*	*saved*
CO_2 Gas Emissions:	*11.7*	*lbs.*	*per*	*therm*	*saved*
NO_X Electric Emissions:	*1.11*	*lbs.*	*per*	*MWh*	*saved*
NO_X Gas Emissions:	*0.0092*	*lbs.*	*per*	*therm*	*saved*
SO_2 Electric Emissions:	*0.98*	*lbs.*	*per*	*MWh*	*saved*

SECTION 4. ENERGY CONSERVATION MEASURES

1-1 Comprehensive LED Lighting Upgrades

ECM Summary

Lighting Retrofit and Replacement: Most of the lighting fixtures throughout the district utilize older technologies that can be upgraded. Improvements to lighting will reduce electrical consumption and improve lighting levels. The costs of material to maintain the current systems will also be reduced since these renovations replace items (i.e., lamps and ballasts) that are near the end of their life cycle and/or considered environmentally hazardous.

Where appropriate, lighting levels will be adjusted to meet Illumination Engineering Society (IES) standards.

Lighting Levels: Our proposed lighting system improvements will maximize savings while maintaining or improving existing light levels in each area. All installations will comply with IES standards. Post-retrofit light levels are typically increased because of the improved design and installation of newer equipment, but areas that are currently over lit will be adjusted to maintain IES recommended light level. Before and after sample light level reading will be performed to confirm expected results.

Exterior Lighting: In an effort to reduce electricity consumption and provide better security for the Asbury Park Board of Education buildings, ESG is proposing to retrofit the existing outside lighting (excludes parking lots) on the buildings with newer, LED technology with photo cells for automatic control. In addition, every effort will be made to standardize the installed components for equipment uniformity and maintenance simplicity. Typical LED lighting system exhibit the following characteristics:

- Extremely Long Life – up to 50,000+ hours
- Highly efficient with very low wattage consumption
- Solid state lighting technology ensures that the fixtures are highly durable

Lighting Controls: Lighting controls are effective in areas where lighting is left on unnecessarily, mainly because it is a common area or due to 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. 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. Lighting controls will be installed in various offices, break rooms, restrooms, and other locations where appropriate. In the next phase, ESG will perform detailed sample measurements to determine coincident lighting room occupancy and overall lighting level information to accurately determine and identify spaces suitable for lighting controls throughout each facility.

Facilities Recommended for this Measure

- Asbury Park High School (Lighting and Controls)
- Bradley Elementary School (Lighting Only)
- Thurgood Marshall Elementary School (Lighting Only)

Scope of Work

Asbury Park High School

- All fixtures with *4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST, as listed, will be retrofitted with TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
- All fixtures with *4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST, as listed, will be retrofitted with TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
- All fixtures with *2' FIXTURE, 2-F17/T8/STD LAMPS, (.88) ELECTRONIC BALLAST, as listed, will be retrofitted with TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
- All fixtures with *2' FIXTURE, 1-F17/T8/STD LAMPS, (.88) ELECTRONIC BALLAST, as listed, will be retrofitted with TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
- All fixtures with *4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST, as listed, will be retrofitted with TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
- All fixtures with *4' FIXTURE, 1-F32/T8 LAMP, (.88) ELECTRONIC BALLAST, as listed, will be retrofitted with TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
- All fixtures with 1L - A LAMP 60 WATT INCANDESCENT, as listed, will be retrofitted with ENCLOSED RATED 9W DIMMABLE LED OMNI A19 4000K GEN 8
- All fixtures with 2 - 7 WATT BI PIN FLUORESCENT FIXTURE WITH ELECTRONIC BALLAST, as listed, will be retrofitted with new COOPER SURELITE LED EXIT/EMERGENCY COMBO (RED LETTERS)
- All fixtures with *2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST, as listed, will be retrofitted with TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
- All fixtures with 1 - 13 WATT CFL QUAD PIN (WITH BALLAST), as listed, will be retrofitted with ENCLOSED RATED 9W DIMMABLE LED OMNI A19 4000K GEN 8
- All fixtures with 1L - A LAMP 100 WATT INCANDESCENT, as listed, will be retrofitted with ENCLOSED RATED 9W DIMMABLE LED OMNI A19 4000K GEN 8
- All fixtures with 4' FIXTURE, 6-F54/T5/HO/LAMPS, 2-ELECTRONIC BALLASTS, as listed, will be replaced with CB4 LED HIGHBAY, 82.4W, 4000K, 120-277V WHITE - DLC LISTED
- All fixtures with 6' FIXTURE, 2-F72/HO LAMPS, ELECTRONIC BALLAST, as listed, will be retrofitted with TUBE LIGHT, G5 SEP, T8, 12W, 3FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
- All fixtures with METAL HALIDE, 1-250 WATT LAMP, as listed, will be replaced with CB4 LED HIGHBAY, 82.4W, 4000K, 120-277V WHITE - DLC LISTED
- All fixtures with 1 - 13 WATT CFL QUAD PIN (WITH BALLAST), as listed, will be retrofitted with PL STAB-IN BALLAST BYPASS, VERTICAL, G24Q/G24D 6.5W, 4000K, 120-277V

Thurgood Marshall Elementary School

- All fixtures with *4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST, as listed, will be retrofitted with TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
- All fixtures with *4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST, as listed, will be retrofitted with TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
- All fixtures with *2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST, as listed, will be retrofitted with TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
- All fixtures with 18 WATT BI PIN FLUORESCENT FIXTURE WITH ELECTRONIC BALLAST, as listed, will be replaced with COOPER SURELITE LED EXIT/EMERGENCY COMBO (RED LETTERS)
- All fixtures with METAL HALIDE, 1-150 WATT LAMP, as listed, will be retrofitted with MAXLITE: UNIVERSAL DOWNLIGHT 8" 18W 4000K-120-277V
- All fixtures with *4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST, as listed, will be retrofitted with TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
- All fixtures with 1L - A LAMP 100 WATT INCANDESCENT, as listed, will be retrofitted with MAXLITE: UNIVERSAL DOWNLIGHT 8" 18W 4000K-120-277V
- All fixtures with 1 - 26 WATT CFL SCREW-IN, as listed, will be retrofitted with ENCLOSED RATED 9W DIMMABLE LED OMNI A19 4000K GEN 8
- All fixtures with HIGH BAY FIXTURE WITH 6-42 WATT CFL, 2 BALLASTS, as listed, will be replaced with CB4 LED HIGHBAY, 82.4W, 4000K, 120-277V WHITE - DLC LISTED
- All fixtures with 4' FIXTURE, 6-F54/T5/HO/LAMPS, 2-ELECTRONIC BALLASTS, as listed, will be retrofitted with 4-FT 25W SEP PLASTIC T5 H.O. LED TUBE LAMP, 4000K, 120-277V - DLC LISTED
- All fixtures with 2' 2-F40T8, BIAX ELECTRONIC BALLAST, as listed, will be replaced with INTERIOR LUMINAIRES, G2 THIN PANEL, 2X2, 20W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
- All fixtures with *4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST, as listed, will be replaced with ESPEN CONSTANT WATTAGE LED EMERGENCY BACKUP KIT 120-277V, 5W@90MIN
- All fixtures with 2 - 26 WATT CFL FIXTURE, as listed, will be retrofitted with PL STAB-IN BALLAST BYPASS, HORIZONTAL, G24Q/G24D 10.5W, 3000K, 120-277V

- All fixtures with 2 - 26 WATT CFL FIXTURE, as listed, will be retrofitted with MAXLITE: UNIVERSAL DOWNLIGHT 8" 18W 4000K-120-277V
- All fixtures with METAL HALIDE, 1-150 WATT LAMP, as listed, will be retrofitted with MAXLITE - PAR38 23W, WET LISTED, DIMMABLE, 3000K, 120-277V, FLOOD 40° - ENERGY STAR
- All fixtures with METAL HALIDE, 1-250 WATT LAMP, as listed, will be retrofitted with IVELOT AREA LIGHT, TYPE 3, 67W, 7500 LUMENS, POLE MOUNT, 70CRI, 4000K BRONZE, 120-277V 0-10 DIM
- All fixtures with METAL HALIDE, 1-250 WATT LAMP, as listed, will be retrofitted with X34 FLOOD 52W 5500LM LED 277V 3000K 80 CRI BRONZE - DLC LISTED
- All fixtures with METAL HALIDE, 1-250 WATT LAMP, as listed, will be retrofitted with LPACK WALLPACK 52W WARM LED BRONZE - DLC LISTED
- All fixtures with METAL HALIDE, 1-150 WATT LAMP, as listed, will be retrofitted with LED FLOOD 15W, 4000K, 0-10V DIM, 120-277V, 2143LM - DLC LISTED

Bradley Elementary School

- All fixtures with *2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST, as listed, will be retrofitted with TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
- All fixtures with *4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST, as listed, will be retrofitted with TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
- All fixtures with *4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST, as listed, will be retrofitted with TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
- All fixtures with *4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST, as listed, will be retrofitted with TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
- All fixtures with 2 - 26 WATT CFL QUAD - PIN FIXTURE, as listed, will be retrofitted with ETI-14″ I-SERIES SQUARE FLUSHMOUNT-22W-4000K-1550L
- All fixtures with HIGH BAY FIXTURE WITH 8-42 WATT CFL, as listed, will be replaced with HIGH BAY, G2 ECO LINEAR, 2X2, 141W, 4000K, 120-277VAC, DIMMABLE, GENERAL FROSTED OPTIC
- All fixtures with 4' FIXTURE, 8-F54/T5/HO/LAMPS, ELECTRONIC BALLAST, as listed, will be retrofitted with 4-FT 25W SEP PLASTIC T5 H.O. LED TUBE LAMP, 4000K, 120-277V - DLC LISTED
- All fixtures with 1- 250 WATT QUARTZ LAMP, as listed, will be retrofitted with SYLVANIA-LED PAR 38 HIGH OUTPUT DIMMABLE 3000K 40° BEAM ANGLE - ENERGY STAR
- All fixtures with 2 - 26 WATT CFL QUAD - PIN FIXTURE, as listed, will be retrofitted with MAXLITE: UNIVERSAL DOWNLIGHT 8" 13W 4000K-120-277V
- All fixtures with METAL HALIDE, 1-250 WATT LAMP, as listed, will be retrofitted with WALLMAX OPEN FACE WALL PACK - 40W, 120-277V, 5000K, BRONZE

Savings Methodology

In general, savings calculations for lighting retrofits are calculated using the following methodology:

Savings Calculation Method		
Baseline Energy Usage (kWh / yr)	=	Existing Fixture Watts x Operating Hours / yr x 1 kW / 1000 Watts
Estimated Energy Usage (kWh / yr)	=	Proposed Fixture Watts x Op. Hours/yr x 1 kW / 1000 Watts
Energy Savings (kWh / yr)	=	Baseline Energy Usage – Estimated Energy Usage
Baseline Demand (kW)	=	Existing Fixture Watts / 1000 Watts
Retrofit Demand (kW)	=	Proposed Fixture Watts / 1000 Watts
Energy Savings (kW)	=	(Existing Fixture Watts – Proposed Fixture Watts) x 1 kW / 1000 Watts

Maintenance

Lighting will need to be replaced in order to provide consistent light quality throughout the exterior space. It is recommended to conduct group re-lamping on regularly scheduled intervals in order to minimize maintenance requirements.

Benefits

- Electrical energy savings
- Improved exterior light quality
- Reduction in maintenance of exterior lighting system
- Improved safety around school perimeter
- Reduced lamp replacement for 5 to 10 years for LEDs

1-2 Direct Install Program (Lighting)

ECM Summary

Existing small to mid-sized commercial and industrial facilities with a peak electric demand that did not exceed 200 kW in any of the preceding 12 months are eligible to participate in Direct Install. Applicants will submit the last 12 months of electric utility bills indicating that they are below the demand threshold and have occupied the building during that time. Buildings must be located in New Jersey and served by one of the state's public, regulated electric or natural gas utility companies. Created specifically for existing small to medium-sized facilities, Direct Install is a turnkey solution that makes it easy and affordable to upgrade to high efficiency equipment. The program pays up to 70% of retrofit costs, dramatically improving your payback on the project.

Facilities Available for Direct Install

- Dr. Martin Luther King Jr Middle School
- Dorothy McNish Parent Center
- Information Technology Center
- Barack Obama Elementary School
- Buildings & Grounds

Scope of Work

- ESG will work closely with one of the program partners to evaluate the Direct Install Program
- The systems and equipment addressed by the program are:
    - Lighting

There is no allowance for or dimming system retrofits in the auditoriums. Detailed Line by Line by school is showed in the Appendix.

Savings Methodology

In general, savings calculations for lighting retrofits are calculated using the following methodology:

Savings Calculation Method		
Baseline Energy Usage (kWh / yr)	=	Existing Fixture Watts x Operating Hours / yr x 1 kW / 1000 Watts
Estimated Energy Usage (kWh / yr)	=	Proposed Fixture Watts x Op. Hours/yr x 1 kW / 1000 Watts
Energy Savings (kWh / yr)	=	Baseline Energy Usage – Estimated Energy Usage
Baseline Demand (kW)	=	Existing Fixture Watts / 1000 Watts
Retrofit Demand (kW)	=	Proposed Fixture Watts / 1000 Watts
Energy Savings (kW)	=	(Existing Fixture Watts – Proposed Fixture Watts) x 1 kW / 1000 Watts

Maintenance

Lighting will need to be replaced in order to provide consistent light quality throughout the exterior space. It is recommended to conduct group re-lamping on regularly scheduled intervals in order to minimize maintenance requirements.

Benefits

- Reduced installation cost utilizing Direct Install Incentive Program.
- Electrical energy savings

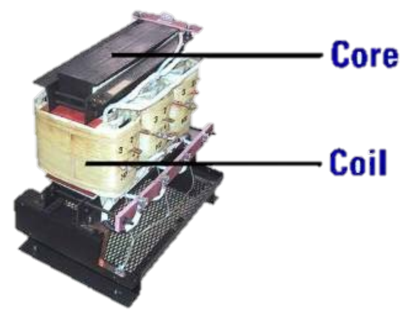
2-1 Transformer Replacement

ECM Summary

The primary goal of this ECM is increased energy savings through replacement of old, inefficient transformers with new, ultra-high efficient transformers. While facilities can be unique, electrical infrastructure is almost always based on U.S. industry standard transformers. Transformers are typically purchased as part of a total electrical distribution package, installed, and forgotten for 40-50 years. The majority of these transformers are operating at a small fraction of their nameplate capacity, resulting in very low efficiency, and are producing large amounts of excess heat, resulting in energy losses and higher utility costs. In addition, half of all existing transformers, according to the Dept. of Energy, are approaching a mean time to failure of 32 years. Replacing these units prior to a sudden end of life, results in lower risk of facility down time.

PowerSmiths ESaver Transformer

For a transformer retrofit to deliver real energy savings, the losses of the new transformer must be measurably lower than those of the existing transformer. This may sound obvious, but losses of existing transformers are not widely understood in relation to actual load conditions and load profiles. Given a real-world setting, estimating or "stipulating" savings using factory or industry test data/standards for either the existing or typical replacement unit would be significantly flawed.



Transformer Components

Transformers are comprised of two major components: a steel core, and windings made of aluminum or copper.

Because transformers are in operation 24-hours/day, 365-days/year, they produce energy losses around the clock. Core losses, also known as no-load-losses, are constant. The core remains energized at all times, regardless of the % load (so losses are always the same). Coil losses, also known as load losses, vary with the load placed upon them, i.e. as load increases, as do the losses.

Code and all published data are based on performance at a 35% linear load. Therefore, almost all transformers are designed for highest efficiency under that load profile. However, this profile does not typically exist in the real world. Linear loads essentially ceased to exist with the advent of computers and VFD's, and the average load on a transformer in 2016, across almost all verticals, is only about 13%. To reach this extreme percentile, the vast majority must be loaded at lower than 10%! Under this lower load profile, virtually all the losses are found in the core. Through the use of design and manufacturing advances, but more importantly, better materials (i.e. higher grade insulation, copper, aluminum and, most critically, steal in the core), energy efficient transformers lower resistance, producing extremely low no-load-losses and minimized load-losses.

Facilities Recommended for this Measure

- Asbury Park High School
- Bradley Elementary School
- Martin Luther King Middle School
- Thurgood Marshall Elementary School

Scope of Work by School

Asbury Park High School		
kVA	**Total Quantity**	**Replacement Quantity**
30	**8**	**8**

Bradley Elementary School		
kVA	**Total Quantity**	**Replacement Quantity**
30	**1**	**1**
75	**1**	**1**
112.5	**1**	**1**

Martin Luther King Middle School		
kVA	**Total Quantity**	**Replacement Quantity**
10	**1**	**1**
25	**1**	**1**
30	**2**	**2**
37.5	**2**	**2**
75	**1**	**1**
112.5	**1**	**1**

Marshall Elementary School		
kVA	**Total Quantity**	**Replacement Quantity**
45	**2**	**2**
112.5	**1**	**1**
150	**1**	**1**

Savings Methodology

Savings are calculated using the following methodology for all the transformers:

Savings Calculation Methodology		
Baseline Annual losses from Transformers (kWh/yr)	=	(Baseline Transformer kW Losses (Normal Operation) x Equipment Operating hrs/ day x Equipment Operating days/yr) + Baseline Transformer kW Losses (Outside Op. hrs) x (24 x 365 - Equipment Operating hrs/ day x Equipment Operating days/yr)
Powersmith Annual losses from Transformers (kWh/yr)	=	(Powersmiths Transformer kW Losses (Normal Operation) x Equipment Operating hrs/ day x Equipment Operating days/yr) + Powersmiths Transformer kW Losses (Outside Op. hrs) x (24 x 365 - Equipment Operating hrs/ day x Equipment Operating days/yr)
Electrical Savings (kWh/yr)	=	Baseline Annual losses from Transformers – Powersmith Annual losses from Transformers

Maintenance

- Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electrical Energy Savings

4-1 Condensing Hot Water Boiler Plant (Direct Install)

ECM Summary

Steam boilers are used to provide heating, through the use of a hot water heat exchanger, to various areas throughout the building. In schools where the boilers are old and in a poor condition, the replacement of existing boilers with a similar output of new greater efficiency units will provide efficiency gains that will generate operating and fuel cost savings. The radiant and convective heat losses will also be reduced with the installation of new boilers which makes the entire hot water system more efficient. Where applicable, the steam boilers that are recommended for replacement will be replaced by condensing boilers with increased efficiencies (including thermal and combustion losses).

The replacement of the single boiler in these boiler plants with multiple new high-efficiency units will generate significant energy savings as well as provide redundancy to the heating system. Each new boiler will be slightly smaller than the existing single boiler but as a whole central plant will meet or exceed the heating capacity of the current boiler. The installation of the smaller boilers will increase the efficiency of the entire plant by operating more efficiently at low loads than the single boiler.

Facilities Recommended for this Measure

- Dr. Martin Luther King Jr. Middle School

Scope of Work

Dr. Martin Luther King Middle School

Demolition and Removal Work

- Replace (2) each Cleaver Brooks fire tube boilers with (2) new high efficiency AERCO Benchmark Standard 3000, or approved equivalent, condensing boilers
- Demolition of (2) existing Cleaver Brooks fire tube boilers.
- Demolition of existing feed water tank and pumps – cut up for removal, if necessary
- Disconnect, remove and properly dispose of hot water supply and return piping for boilers to nearest isolation valves or as required for new installation.
- Disconnect, remove and properly dispose of gas flue for boilers as required.
- Disconnect all electric, controls, gas piping, water lines, pressure reliefs and drains.
- Remove all demolished materials from premises and dispose of in accordance with local regulations.

New Installation Work:

Proposed are the following:

- Furnish & install (F&I) (2) each high-efficiency AERCO Benchmark Standard 3000 condensing boilers set on new housekeeping concrete pad.

Details of installation to include the following:

- F&I Qty. (2) new AERCO Benchmark Standard 3000 condensing hot water boilers
- F&I new pumps, piping, and insulation.
- F&I new hot water, supply and return piping from new boilers to existing main steam condensate lines.
- F&I new boiler drains, pressure reliefs piped to floor drains, water supply, blow down drains piped over to existing floor drains.

- F&I new 2" fiberglass insulation on all new and existing hot water supply and return piping "that has no insulation".
- F&I new gas line piping from existing gas line to new boilers with new shut off valves.
- F&I new CPVC combustion air intake and flue exhaust piping for each boiler.
- F&I proper pipe suspensions for all piping.
- F&I pipe identification and tags for all pipe, valves, etc.
- Re-connect existing line voltage electrical circuits to new boilers.
- Provide factory startup; assist during startup and testing of both new boilers.

Savings Methodology

In general, savings calculations for boiler replacement are calculated using the following methodology:

Boiler Replacement

$E_E = \sum_{i=1}^{8760}(Q_i \div \eta_E)$

$E_P = \sum_{i=1}^{8760}(Q_i \div \eta_P)$

$E_S = E_E - E_P$

$C_S = E_S \times FUR$

Where,

E_E = Annual energy (fuel) use of existing system
E_P = Annual energy use of proposed system
E_S = Annual energy savings
C_S = Annual cost savings
Q_i = Hourly heating demand, modeled as a linear fit of OA DBT (dry-bulb temperature), with a cut-off temperature above which there is no heating
η = Combustion efficiency of heating system based on field data, manufacturer's rating or snap-shot measurements
FUR = Fuel unit utility rate, determined from baseline utility rate analysis

Subscript "i" denotes the number of hours in a year. Subscripts "E" and "P" stand for Existing and Proposed system, respectively.

Maintenance

Follow manufacturers' recommendations for preventative maintenance.

Benefits

- Natural Gas savings
- Operational savings through new equipment and preventative maintenance plan

7-1 Building Envelope Weatherization

ECM Summary

Infiltration drives energy costs higher by allowing unconditioned outside air to enter the building, thus adding to the building load and causing additional unnecessary heating and cooling loads. The Asbury Park Board of Education was surveyed in order to identify potential improvements for outside air infiltration reduction. The main observations are listed below:

- Most entrance doors need weather stripping, sweeps or the closure or strike plate adjusted;
- Sealant is recommended around the perimeter of several windows;
- Numerous penetrations were observed that need to be sealed.

These deficiencies mostly reflect the skin of the buildings, which either have existed since original construction of the building, were added during some retrofit periods, or were caused by deterioration.

Facilities Recommended for this Measure

- District Wide

Scope of Work

A building envelope audit was performed for the entire district. The results of the audit were the identification of several areas of envelope deficiency. The deficient areas were tabulated and their savings potential calculated. Building Envelope Scope drawings are listed in the Appendix.

Building Envelope Scope drawings and recommendations are listed in the Appendix.

Savings Methodology

The physics of air leakage guide the requirements for the design of an effective air leakage control retrofit project.

- Big Holes = Area
  Sealing big holes and/or a lot of small holes generates savings.
- Big Pressure Differentials = ΔP
  Sealing surfaces that have the highest pressures acting on them generates savings: at the top and bottom of the building (stack pressure), spaces that are pressurized or depressurized (mechanical pressure) and surfaces that are most exposed to the elements (wind pressure).
- Big Temperature Differentials = ΔT or HDD
  Sealing interior-to-exterior air leakage pathways generates savings. Isolating interior spaces (or compartmentalizing) is effective only across interior spaces with very different interior environment needs.

Thermal Upgrade

ESG uses standard heat loss calculations (U, A, ΔT) to estimate savings from thermal barrier improvements.

As with air leakage, the physics of thermal heat loss guide the requirements for the design of an effective energy saving insulation upgrade project.

- Weak Existing Insulation Values: U-Value
  Insulating surfaces with the weakest existing insulation values generates savings.
- Big Surface Areas: Area
  Insulating large surface areas generates savings.
- Big Temperature Differentials: ΔT or Degree Days
  Insulating interior-to-exterior surfaces (attic surfaces are included in this category) generates savings. Isolating interior surfaces (or compartmentalizing) is effective only across interior spaces with very different interior environment needs.

INFILTRATION/ EXFILTRATION SAVINGS CALCULATION METHODOLOGY

Cooling Savings

			Flow Factor		$(\Delta P)^{\wedge n}$		A		CFM Reduction
1)	Q	=	Flow Factor	x	Wind Pressure	x	Aggregate Air Leakage Pathway Hole	=	Cubic Feet / Minute (CFM)
			Total Heat Constant		CFM Reduction		Enthalpy		Tons
2)	Tons	=	4.5	x	CFM Reduction	x	Enthalpy Value	=	Tons
					12,000				
					BTU Hour per Ton				
3)	kWh Savings	=	Tons		kW per Ton		Cooling Hours		kWh
			Tons	x	1.2	x	Cooling Hours for Location	=	kWh
4)	Savings	=	kWh		Fuel Cost/kWh				
			kWh Savings	x	Fuel Cost in $	=	Savings in Dollars		
5)	Savings from Air Leakage Control				....			=	Savings in Dollars
6)	Project Investment				....			=	Investment in Dollars
7)	Simple Payback				....			=	Investment / Savings

INFILTRATION/ EXFILTRATION SAVINGS CALCULATION METHODOLOGY

Cooling Savings

			Flow Factor		$(\Delta P)^{\wedge n}$		A		CFM Reduction
1)	Q	=	Flow Factor	x	Wind Pressure	x	Aggregate Air Leakage Pathway Hole	=	Cubic Feet / Minute (CFM)
			Total Heat Constant		CFM Reduction		Enthalpy		Tons
2)	Tons	=	4.5	x	CFM Reduction	x	Enthalpy Value	=	Tons
					12,000				
					BTU Hour per Ton				
3)	kWh Savings	=	Tons		kW per Ton		Cooling Hours		kWh
			Tons	x	1.2	x	Cooling Hours for Location	=	kWh
4)	Savings	=	kWh		Fuel Cost/kWh				
			kWh Savings	x	Fuel Cost in $	=	Savings in Dollars		
5)	Savings from Air Leakage Control				....			=	Savings in Dollars
6)	Project Investment				....			=	Investment in Dollars
7)	Simple Payback				....			=	Investment / Savings

Maintenance

After the building envelopes have been improved, operations and maintenance should be reduced, due to improved space conditions and lower humidity during the cooling season. The maintenance staff should maintain the newly installed equipment per manufacturers' recommendations. The manufacturer specification sheets will be provided for exact maintenance requirements.

Benefits

- Electrical energy savings
- Fuel energy savings
- Increased thermal comfort

8-1 Mechanical Insulation

ECM Summary

Non-insulated pipelines and associated valves and fittings carrying thermal fluids because heat loss where not intended and result in excess fuel consumption, as well as discomfort in occupied areas. Valves and fittings without insulation were observed throughout the buildings and installation of new insulation is recommended. Installation of the proper amount of insulation will not only conserve energy but will also improve safety by reducing the chance for burns on hot piping or slipping due to condensate on a pipe. This ECM would insulate bare and poorly insulated heating hot water piping and failed heating hot water piping insulation in the boiler room.

Uninsulated Pipes (High School)

Facilities Recommended for this Measure

- Asbury Park High School
- Bradley Elementary School
- Thurgood Marshall Elementary School

Scope of Work

Findings

- Pipe Insulation
    - Un-insulated pipes in the heating and domestic hot water systems are leading to unnecessary distribution losses and wasted energy.
- Valve & Fitting
    - Insulation valves and fittings are difficult components of a mechanical system to insulate and as a result are frequently left un-insulated. These un-insulated or poorly insulated components have the same temperature fluids passing through them as the pipes that are more likely to be insulated; un-insulated components of the distribution system lead to avoidable thermal energy and losses.
- Tank Insulation
    - tanks are difficult components of a mechanical system to insulate and as a result are frequently left un-insulated. Un-insulated or poorly insulated tanks or equipment have the same temperature fluids passing through them as the pipes that are more likely to be insulated; un-insulated components of the distribution system lead to unnecessary distribution losses and wasted energy

Refer to the appendix for a detailed scope of work

Note*: All insulation thickness shall be confirmed to be in accordance with the New Jersey Energy Conservation Code, ASHRAE 90.1 2013. Contract shall be responsible for verification of these thicknesses.*

Mechanical Insulation Savings Calculations

This section describes our methodology for calculating energy savings. We use standard heat transfer methods to compute heat loss from bare and insulated mechanical systems (piping, valves, fittings, tanks and ductwork). The difference in heat loss is the energy savings, as follows:

Energy Savings = [Existing Heat Loss] – [Insulated Heat Loss]

Methodology

We use standard heat transfer methods to compute radiation, convection, and conduction heat loss from

(Alternatively, gain to, for cold systems) bare and insulated systems. Key parameters that affect the heat transfer rate include: temperature of fluid (e.g. steam, hot water, chilled water, etc.); surface temperature of the component (e.g. pipe, fitting, tank, ductwork); temperature of environment; emissivity of surface; average wind speed where applicable; percentage of existing component covered with insulation; and condition of existing insulation, where applicable.

Energy Use

Existing and proposed energy use are computed as follows:

Pipes & Fittings

Heat Loss (Btu/h) = (Heat Loss / lin.ft. bare pipe) * (lin.ft. of pipe) * [1 – (%insulated)] +
(Heat Loss / lin.ft. insulated pipe) * (lin.ft. of pipe) * (%insulated)

Fuel Loss (MMBTU/yr) = (Heat Loss Btu/h) * (heating hrs/year) ÷ (efficiency)
Electric Loss (kWh/yr) = (Heat Loss Btu/h) * (cooling hrs/year) ÷ (12,000 Btu/ton-hr) x (cooling kW/ton)

Tanks Plates, & Ductwork

Existing and proposed heat loss for tanks, plates, and ductwork are calculated as follows:

Heat Loss (Btu/h) = (Heat Loss / sq.ft.) * (sq.ft. of component) * (qty) * [1 – (%insulated)] +
(Heat Loss / sq.ft. insulated) * (qty) * (sq.ft. of component) * (%insulated)
Fuel Loss (MMBTU/yr) = (Heat Loss Btu/h) * (heating hrs/year) ÷ (efficiency)
Electric Loss (kWh/yr) = (Heat Loss Btu/h) * (cooling hrs/year) ÷ (12,000 Btu/ton-hr) x (cooling kW/ton)

Energy Savings

Energy savings are the difference between existing and proposed heat loss:

Fuel Savings (MMBTU/yr) = (Existing Fuel Loss) – (Proposed Fuel Loss)
Electric Savings (MMBTU/yr) = (Existing Electric Loss) – (Proposed Electric Loss)
Cost Savings ($/yr) = (Fuel Savings MMBTU/yr) * (Fuel Rate $/MMBTU) +
(Electric Savings kWh/yr) * (Electric Rate $/kWh)

Heat Transfer: Bare Systems

Bare systems are subject to convection and radiation heat transfer. We ignore conductive heat transfer through the pipe/fitting material (e.g. steel, copper, PVC etc.) as this is negligible as compared to heat transfer through insulation and air convection.

Pipes & Fittings

This section describes the heat transfer calculations for pipes and fittings for indoor systems subject to natural convection (no wind). The calculations for outdoor systems subject to forced convection (wind) are similar except that the formulas are more complicated. These methods are presented following this section.

For fittings (valves, elbows, strainers, etc.), we estimate heat loss based on equivalent length of straight pipe, which is the ratio of the area of the fitting to the area of 1 linear foot of pipe of the same size (fitting equivalent length = Area of fitting, ft^2 / Area of pipe of equivalent diameter, ft^2).

$$q_{pipe} = \frac{2 * \pi * \Delta T}{\frac{1}{h * \left(D_{outer}/_{2} \right)}}$$

Where:
q_{pipe} = *heat loss per linear foot = Btu/h/lin.ft.*

$h = total\ convective\ heat\ transfer\ factor = h_{convection} + h_{radiation}$

$h_{convection} = 0.213 * \left(\frac{\Delta T}{D}\right)^{\left(\frac{1}{4}\right)}$ [ASHRAE 2005, Ch. 3, Eq. T10.16]

$\square T = T_{surface} – T_{air}$
$\Delta T = T_{surface} - T_{air}$
D = Outer diameter
$$h_{radiation} = \varepsilon * \sigma * \left(T_{surface}^4 - T_{air}^4\right) / \left(T_{surface} - T_{air}\right)$$

e = emissivity of surface
s = Stefan-Boltzmann constant = 0.1714 x 10-8 Btu / (hr-ft^2-°R^4)
$T_{surface} = Temperature\ of\ surface$
$T_{air} = Average\ ambient\ air\ temperature$

Heat Transfer: Insulated Systems

Insulated systems are subject to convection, radiation, and conductive heat transfer. We ignore conductive heat transfer through the pipe/fitting material (e.g. steel, copper, PVC etc.) as this is negligible when compared to heat transfer through insulation and air convection.

$$q_{pipe} = \frac{2 * \pi * \Delta T}{\frac{ln\left(D_{outer}/D_{inner}\right)}{k} + \frac{1}{h * \left(D_{outer}/2\right)}}$$

Where:

q_{pipe} = *heat loss per linear foot = Btu/h/lin.ft.*

$$h_{convection} = 0.213 * \left(\frac{\Delta T}{D}\right)^{\left(\frac{1}{4}\right)}$$ [ASHRAE 2005, Ch. 3, Eq. T10.16]

□T = $T_{surface} - T_{air}$

$\Delta T = T_{surface} - T_{air}$

D = Outer diameter

$$h_{radiation} = \varepsilon * \sigma * \left(T_{surface}^4 - T_{air}^4\right) / \left(T_{surface} - T_{air}\right)$$

e = emissivity of surface

s = Stefan-Boltzmann constant = 0.1714 x 10-8 Btu / (hr-ft^2-°R^4)

$T_{surface}$ = *Temperature of surface*

T_{air} = *Average ambient air temperature*

L = Pipe length or fitting equivalent length

Heat Transfer for Outdoor Systems

The methods for computing heat loss for outdoor systems subject to forced convection (wind) are identical to the methods for indoors systems described above except that the formulas to compute the convective heat transfer coefficient h is more complicated. These methods are described below:

Pipes & Fittings: Outdoor Systems

The convection heat transfer coefficient is:

$$h_{convection} = Nu * k / D_{outer}$$

$$Nu = Nussault\ number = 0.3 + \frac{0.62 * Re^{\left(\frac{1}{2}\right)} * Pr^{\left(\frac{1}{3}\right)}}{\left[1 + \left(\frac{0.4}{Pr}\right)^{\left(\frac{2}{3}\right)}\right]^{\left(\frac{1}{4}\right)}} * \left[1 + \left(\frac{Re}{282{,}000}\right)^{\left(\frac{5}{8}\right)}\right]^{\left(\frac{4}{5}\right)}$$

$$Re = Reynolds\ number = \frac{V * D_{outer}}{v}$$

$\mathrm{Pr} = Prandtl\ number = 0.7\ (for\ air)$
$v = kinematic\ viscosity\ of\ air$
$V = wind\ speed$
$D_{outer} = outer\ pipe\ diameter$

Plates, Tanks, Ductwork: Outdoor Systems

The convection heat transfer coefficient for flat surfaces is estimated as follows

$$h_{convection} = Nu * k / D_{outer}$$

$$Nu = Nussault\ number = 0.415 * Re^{\left(\frac{1}{2}\right)} * Pr^{\left(\frac{1}{3}\right)}$$

$$Re = Reynolds\ number = \frac{V * L}{v}$$

$\mathrm{Pr} = Prandtl\ number = 0.7\ (for\ air)$
$v = kinematic\ viscosity\ of\ air$
$V = wind\ speed$
$L = width\ or\ diameter\ of\ component$

Maintenance

The maintenance staff should maintain the newly installed equipment per manufacturers' recommendations. The manufacturer specification sheets will be provided for exact maintenance requirements.

Benefits

- Fuel energy savings

8-2 Mechanical Insulation (Direct Install)

ECM Summary

Non-insulated pipelines and associated valves and fittings carrying thermal fluids because heat loss where not intended and result in excess fuel consumption, as well as discomfort in occupied areas. Valves and fittings without insulation were observed throughout the buildings and installation of new insulation is recommended. Installation of the proper amount of insulation will not only conserve energy but will also improve safety by reducing the chance for burns on hot piping or slipping due to condensate on a pipe. This ECM would insulate bare and poorly insulated heating hot water piping and failed heating hot water piping insulation in the boiler room.

Uninsulated Pipes (Middle School)

Facilities Recommended for this Measure

- Dr. Martin Luther King Jr. Middle School
- Barack Obama Elementary School
- Information Technology Center
- Buildings & Grounds

Scope of Work

Findings

- Pipe Insulation
  - Un-insulated pipes in the heating and domestic hot water systems are leading to unnecessary distribution losses and wasted energy.
- Valve & Fitting
  - Insulation valves and fittings are difficult components of a mechanical system to insulate and as a result are frequently left un-insulated. These un-insulated or poorly insulated components have the same temperature fluids passing through them as the pipes that are more likely to be insulated; un-insulated components of the distribution system lead to avoidable thermal energy and losses.
- Tank Insulation
  - Tanks are difficult components of a mechanical system to insulate and as a result are frequently left un-insulated. Un-insulated or poorly insulated tanks or equipment have the same temperature fluids passing through them as the pipes that are more likely to be insulated; un-insulated components of the distribution system lead to unnecessary distribution losses and wasted energy

Refer to the appendix for a detailed scope of work

Note*: All insulation thickness shall be confirmed to be in accordance with the New Jersey Energy Conservation Code, ASHRAE 90.1 2013. Contract shall be responsible for verification of these thicknesses.*

Savings Methodology

Mechanical Insulation Savings Calculations

This section describes our methodology for calculating energy savings. We use standard heat transfer methods to compute heat loss from bare and insulated mechanical systems (piping, valves, fittings, tanks and ductwork). The difference in heat loss is the energy savings, as follows:

Energy Savings = [Existing Heat Loss] – [Insulated Heat Loss]

Methodology

We use standard heat transfer methods to compute radiation, convection, and conduction heat loss from

(Alternatively, gain to, for cold systems) bare and insulated systems. Key parameters that affect the heat transfer rate include: temperature of fluid (e.g. steam, hot water, chilled water, etc.); surface temperature of the component (e.g. pipe, fitting, tank, ductwork); temperature of environment; emissivity of surface; average wind speed where applicable; percentage of existing component covered with insulation; and condition of existing insulation, where applicable.

Energy Use

Existing and proposed energy use are computed as follows:

Pipes & Fittings

Heat Loss (Btu/h) = (Heat Loss / lin.ft. bare pipe) * (lin.ft. of pipe) * [1 – (%insulated)] +
(Heat Loss / lin.ft. insulated pipe) * (lin.ft. of pipe) * (%insulated)

Fuel Loss (MMBTU/yr) = (Heat Loss Btu/h) * (heating hrs/year) ÷ (efficiency)
Electric Loss (kWh/yr) = (Heat Loss Btu/h) * (cooling hrs/year) ÷ (12,000 Btu/ton-hr) x (cooling kW/ton)

Tanks Plates, & Ductwork

Existing and proposed heat loss for tanks, plates, and ductwork are calculated as follows:

Heat Loss (Btu/h) = (Heat Loss / sq.ft.) * (sq.ft. of component) * (qty) * [1 – (%insulated)] +
(Heat Loss / sq.ft. insulated) * (qty) * (sq.ft. of component) * (%insulated)
Fuel Loss (MMBTU/yr) = (Heat Loss Btu/h) * (heating hrs/year) ÷ (efficiency)
Electric Loss (kWh/yr) = (Heat Loss Btu/h) * (cooling hrs/year) ÷ (12,000 Btu/ton-hr) x (cooling kW/ton)

Energy Savings

Energy savings are the difference between existing and proposed heat loss:

Fuel Savings (MMBTU/yr) = (Existing Fuel Loss) – (Proposed Fuel Loss)
Electric Savings (MMBTU/yr) = (Existing Electric Loss) – (Proposed Electric Loss)
Cost Savings ($/yr) = (Fuel Savings MMBTU/yr) * (Fuel Rate $/MMBTU) +
(Electric Savings kWh/yr) * (Electric Rate $/kWh)

Heat Transfer: Bare Systems

Bare systems are subject to convection and radiation heat transfer. We ignore conductive heat transfer through the pipe/fitting material (e.g. steel, copper, PVC etc.) as this is negligible as compared to heat transfer through insulation and air convection.

Pipes & Fittings

This section describes the heat transfer calculations for pipes and fittings for indoor systems subject to natural convection (no wind). The calculations for outdoor systems subject to forced convection (wind) are similar except that the formulas are more complicated. These methods are presented following this section.

For fittings (valves, elbows, strainers, etc.), we estimate heat loss based on equivalent length of straight pipe, which is the ratio of the area of the fitting to the area of 1 linear foot of pipe of the same size (fitting equivalent length = Area of fitting, ft^2 / Area of pipe of equivalent diameter, ft^2).

$$q_{pipe} = \frac{2 * \pi * \Delta T}{\frac{1}{h * \left({D_{outer}}/{2}\right)}}$$

Where:

q_{pipe} = *heat loss per linear foot = Btu/h/lin.ft.*

$h = total\ convective\ heat\ transfer\ factor = h_{convection} + h_{radiation}$

$h_{convection} = 0.213 * \left(\frac{\Delta T}{D}\right)^{\left(\frac{1}{4}\right)}$ [ASHRAE 2005, Ch. 3, Eq. T10.16]

□T = $T_{surface} - T_{air}$

$\Delta T = T_{surface} - T_{air}$

D = Outer diameter

$h_{radiation} = \varepsilon * \sigma * {\left(T_{surface}^4 - T_{air}^4\right)}/{\left(T_{surface} - T_{air}\right)}$

e = emissivity of surface

s = Stefan-Boltzmann constant = 0.1714 x 10-8 Btu / (hr-ft^2-°R^4)

$T_{surface} = Temperature\ of\ surface$

$T_{air} = Average\ ambient\ air\ temperature$

Heat Transfer: Insulated Systems

Insulated systems are subject to convection, radiation, and conductive heat transfer. We ignore conductive heat transfer through the pipe/fitting material (e.g. steel, copper, PVC etc.) as this is negligible when compared to heat transfer through insulation and air convection.

$$q_{pipe} = \frac{2 * \pi * \Delta T}{\frac{ln\left(D_{outer}/D_{inner}\right)}{k} + \frac{1}{h * \left(D_{outer}/2\right)}}$$

Where:
q_{pipe} = *heat loss per linear foot = Btu/h/lin.ft.*

$$h_{convection} = 0.213 * \left(\frac{\Delta T}{D}\right)^{\left(\frac{1}{4}\right)}$$ [ASHRAE 2005, Ch. 3, Eq. T10.16]

□T = $T_{surface} - T_{air}$
$\Delta T = T_{surface} - T_{air}$
D = Outer diameter

$$h_{radiation} = \varepsilon * \sigma * \left(T_{surface}^4 - T_{air}^4\right) / \left(T_{surface} - T_{air}\right)$$

e = emissivity of surface
s = Stefan-Boltzmann constant = 0.1714 x 10-8 Btu / (hr-ft^2-°R^4)
$T_{surface}$ = *Temperature of surface*
T_{air} = *Average ambient air temperature*
L = Pipe length or fitting equivalent length

Heat Transfer for Outdoor Systems

The methods for computing heat loss for outdoor systems subject to forced convection (wind) are identical to the methods for indoors systems described above except that the formulas to compute the convective heat transfer coefficient h is more complicated. These methods are described below:

Pipes & Fittings: Outdoor Systems

The convection heat transfer coefficient is:

$$h_{convection} = Nu * k / D_{outer}$$

$$Nu = Nussault\ number = 0.3 + \frac{0.62 * Re^{\left(\frac{1}{2}\right)} * Pr^{\left(\frac{1}{3}\right)}}{\left[1 + \left(\frac{0.4}{Pr}\right)^{\left(\frac{2}{3}\right)}\right]^{\left(\frac{1}{4}\right)}} * \left[1 + \left(\frac{Re}{282{,}000}\right)^{\left(\frac{5}{8}\right)}\right]^{\left(\frac{4}{5}\right)}$$

$$Re = Reynolds\ number = \frac{V * D_{outer}}{v}$$
$\mathrm{Pr} = Prandtl\ number = 0.7\ (for\ air)$
$v = kinematic\ viscosity\ of\ air$
$V = wind\ speed$
$D_{outer} = outer\ pipe\ diameter$

Plates, Tanks, Ductwork: Outdoor Systems

The convection heat transfer coefficient for flat surfaces is estimated as follows

$$h_{convection} = Nu * k / D_{outer}$$

$$Nu = Nussault\ number = 0.415 * Re^{\left(\frac{1}{2}\right)} * Pr^{\left(\frac{1}{3}\right)}$$

$$Re = Reynolds\ number = \frac{V * L}{v}$$

$\mathrm{Pr} = Prandtl\ number = 0.7\ (for\ air)$
$v = kinematic\ viscosity\ of\ air$
$V = wind\ speed$
$L = width\ or\ diameter\ of\ component$

Maintenance

The maintenance staff should maintain the newly installed equipment per manufacturers' recommendations. The manufacturer specification sheets will be provided for exact maintenance requirements.

Benefits

- Fuel energy savings

11-1 Plug Load Controls

BERT Plug Load Management Software

BERT Plug Load Management Devises

ECM Summary

Energy Systems Group recommends utilizing specialty wall sockets from BERT that have software to track real-time electrical usage of your appliances. The software also allows you to use your web browser to view this usage and automatically turn on/off any and all appliances plugged into these outlets.

Facilities Recommended for this Measure

- District Wide

Scope of Work

Energy Systems Group proposes to install (247) BERT plug load management devices.

Savings Methodology

Savings are calculated using the following methodology for all devices plugged in:

Savings Calculation Methodology		
Baseline Energy Usage (kWh / yr)	=	Average kW x Baseline Weekly Hours x 4.348 wks/mo. x Months/yr
Proposed Energy Usage (kWh/ yr)	=	Average kW x Proposed Weekly Hours x 4.348 wks/mo. x Months/yr
Electrical Savings (kWh/ yr)	=	Baseline Energy Usage – Proposed Energy Usage

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electrical energy savings

13-1 Cogeneration (CHP) 35 kW

ECM Summary

Energy Systems Group proposes to install one (1) 35 kW cogeneration machine at Asbury Park High School to supply electricity and heat to the buildings, which will offset a portion of the boiler load. The recovered heat will be rejected into the boiler hot water heating system.

Facilities Recommended for this Measure

- Asbury Park High School

Scope of Work

Install a 35kW hot-water Yanmar system to be located in the existing mechanical room. The system shall be provided with distribution piping and pumps to integrate into the existing heating hot water loop. No heat rejection fan is required.

New Installation Work:

Proposed are the following:

- Furnish & install (F&I) (1) each Yanmar Model CP35D1-TNUG (35kW) natural gas fired CHP unit with heat rejection system located outdoors adjacent to unit.
- F&I new gas piping to CHP unit from main gas meter bank.
- F&I new exterior hot water piping from unit directly into boiler room to hot water system piping and heat rejection system. Piping shall have exterior rated insulation and be electrically heat trace from building exterior wall to unit.
- F&I one (1) new double wall plate and frame heat exchanger to be tied to return side of the existing domestic hot water boiler with 900-gallon storage tank. Heat exchanger shall be sized for 200 MBH of heat transfer.
- F&I all required CHP supply and return piping from unit to tie ins for heating hot water and
- F&I new electrical power from Yanmar CHP unit to building main switchgear.
- F&I all required control valves, circulation pumps, power, and wiring.
- Drain existing 900-gallon domestic hot water storage tank, clean and flush out any existing sediment.
- Exhaust vent piping shall extend from unit.
- Provide factory commissioning of system (start up and testing).

Savings Methodology

In general, savings calculations for lighting retrofits are calculated using the following methodology:

Savings Calculation Method	
Energy:	35 kW/module x 1 module(s) x 0.977 net after "parasitic losses"
	= 34.2 net kW output x $/kWh avg. displaced energy x run hours
Demand :	35 kW/module x 1 module(s) available x 0.977 net after "parasitic losses"
When Heat Used to Displace Boiler Gas Use:	$\frac{\left(\frac{Th}{hr\ module}\right)\ x}{boiler\ efficiency}\ x\ 1\ modules\ x\ \$/\text{Th boiler gas rate}$

Maintenance

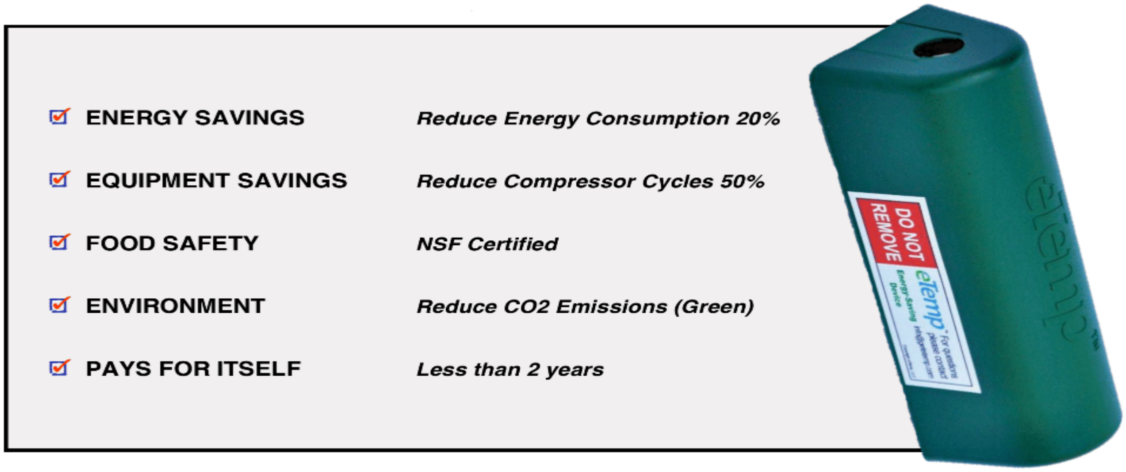
Follow manufacturers' recommendations for preventative maintenance. In order to be eligible for New Jersey Clean Energy incentives, Asbury Park Board of Education must demonstrate that they have contracted for an extended maintenance agreement to service the cogeneration units. This maintenance agreement will be conducted outside of the Energy Savings Improvement Program, as required by law.

Benefits

The installation of a cogeneration unit will result in significant economic benefits to the overall ESIP program. These benefits include:

- Up to 20-year financing term.
- Substantial NJ Clean Energy incentives, where eligible
- Potential demand response revenue generation.
- Potential additional funding from FEMA grants and other local, state, and national incentives.

14-1 Improved Temperature Sensor for Walk-In Coolers



ECM Summary

The kitchens throughout Asbury Park Board of Education contain walk-in freezers, walk-in coolers, reach-in freezers and reach-in coolers. These units are controlled by a dry bulb temperature and as a result run continuously throughout the year. Installing an eTemp control retrofit was assessed. The refrigeration systems usually monitor circulating air temperature in order to decide when to switch on and off. The circulating air temperature tends to rise far more quickly than the food temperature, and as result, the refrigeration unit works harder than necessary to maintain stored products at the right temperature. This, in turn, leads to excessive electricity consumption and undue wear and tear on the equipment. With eTemp, the thermostat regulates the refrigeration temperature based upon product temperature rather than air temperature, thereby maintaining product at the proper temperature. Savings is a result of reduced frequency of the compressor cycles, which are now based on food temperature rather than volatile air temperature. The equipment present in the schools are shown in the table below.

Facilities Recommended for this Measure

- Barack Obama Elementary School
- Asbury Park High School
- Thurgood Marshall Elementary School
- Bradley Elementary School
- Dr. Martin Luther King Jr Middle School

Scope of Work

- Furnish and install one (1) eTemp on the following locations.
- Fit eTemp to the thermostat sensor that controls the compressor.
- Provide start up and warranty.
- Provide training for maintenance personnel

Building	Type	Quantity
Barack Obama Elementary School	Reach-in Cooler	3
Bradley Elementary School	Reach-in Cooler	2
Asbury Park High School	Walk-in Freezer	1
Asbury Park High School	Reach-in Cooler	3

Asbury Park High School	Reach-in Freezer	1
Martin Luther King	Reach-in Cooler	3
Thurgood Marshall	Walk-in Cooler	1
Thurgood Marshall	Walk-in Freezer	1
Thurgood Marshall	Reach-in Cooler	1

Savings Methodology

Savings are calculated using the following methodology:

Energy savings will result from reducing the compressor cycling. In general, ESG uses the following approach to determine savings for this specific measure:

Savings Calculation Method		
Pre - kW	=	Compressor (HP) x 0.746 x Pre Cycles/hr
Post - kW	=	Compressor (HP) x 0.746 x Post Cycles/hr
Summer Season Hrs (Hs)	=	Total Hrs/yr x 55%
Winter Season Hrs (Hw)	=	Total Hrs/yr x 45%
Compressor Summer Cycling (% On) (Cs)	=	55%
Compressor Winter Cycling (% On) (Cw)	=	45%
Compressor Summer Operating (Hrs)	=	Hs x Cs
Compressor Winter Operating (Hrs)	=	Hw x Cw
Savings (kW)	=	Pre – Post (KW)
Savings (kWh)	=	(Compressor Summer Operating (Hrs)+ Compressor Winter Operating (Hrs)) x (Pre – Post (KW))

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electrical energy savings
- Reduce compressor run-time

16-1 Upgrade Building Management System

ECM Summary

The existing Building Automation System (BAS) is Trane Summit system. It works well but suffers from being an older installation with outdated graphics and a disorganized layout form years' of modifications. In addition, not all of the equipment is properly integrated in the BAS which results in simultaneous heating and cooling and other problems that result from the equipment running independently from each other.

This ECM will upgrade the BAS to a Trane Tracer Ensemble Enterprise system. The upgrade will include the programming, migration of HVAC equipment, and graphical improvements. The Daiken Variable Refrigerant Flow (VRF) units used in the classrooms not currently connected will be integrated into the Building Automation System for better monitoring and control as well as improved overall efficiency when heating/cooling the classrooms.

Facilities Recommended for this Measure

- Asbury Park High School
- Bradley Elementary School
- Thurgood Marshall Elementary School
- Information Tech Center
- Dr. Martin Luther King Jr. Middle School
- Dorothy McNish
- Buildings and Grounds

Automated Logic web based WebCTRL® Building Automation Controls System Platform including the following:

1. A fully operational BAC system
    a. Graphics and programming as required for new installation.
    b. Controls and/or monitoring for new equipment as listed below.
    c. BMS Integration and Communication Bus consisting of the following:
        i. WebCTRL® Server
        ii. Operator Workstation
        iii. Optiflex Network Controllers
        iv. Ethernet Switches as required.
        v. WEB connectivity through owner's LAN, switch and IP address at each Network Controller and OWS.
        vi. Integration into HVAC Equipment manufacturer's BMS ready BACnet controllers.
        vii. Provide all horizontal wire and conduit for BuildingManagement System Communication Bus as required.

Controls and/or monitoring for equipment as listed below:

<u>High School</u>
1. Andover Integration
    a. We will furnish and install and wire the following devices:
        i. (2) G5CE Controller to replace existing JACE and Integrate
        ii. (4) AMR Controllers to pick up 163 nodes
        iii. (4) AMR Controllers to pick up Industrial Arts Wing
        iv. (3) DDC Control Panels

2. Classroom Ceiling Mounted UVs (3) New and (1) Existing
    a. We will furnish and install and wire the following devices:
        i. (4) ZN253 Controllers one for each unit
        ii. (4) ZS2PL Room Sensors one for each unit
        iii. (4) Current Sensors one for each unit
        iv. (4) Averaging Sensors one for each unit
        v. (4) Freeze Stats one for each unit
    b. We will furnish and wire the following devices installed by others:
        i. (6) 3⁄4" 2-way valves to be installed by others

3. Air-Cooled Chiller
    a. The Air-Cooled Chiller is on the existing Andover System and will be pulled into ALC WebCTRL® with the overall Andover integration in 1. Above.

4. Small Gym AHU
    a. The Small Gym AHU is on the existing Andover System and will be pulled into ALC WebCTRL® with the overall Andover integration in 1. Above.

5. UVs/AHUs

a. The UVs/AHUs (AHUs are small, serving individual classrooms) that are currently on the Andover System will be pulled into ALC WebCTRL® with the overall Andover Integration. The customer did not report any units that were not on the Andover System.

6. Combined Heat & Power
    i. Direct Integration to new equipment via BACnet, ARCnet or MSTP
    ii. (1) G5CE Controller
    iii. (1) DDC Control Panel
7. Intellidyne Boiler Control Integration
    a. We will furnish and install and wire the following devices:
        i. Direct Integration to new equipment via BACnet, ARCnet or MSTP
        ii. (4) AMR Controllers
        iii. (1) DDC Control Panel

<u>Middle School</u>

Furnish and install and wire (1) G5CE Controller and Control Panel location TBD
Furnish and install and wire (1) outdoor air sensor, weather station

8. Existing Gym Ceiling AHUs (2)
    a. We will furnish and install and wire the following devices:
        i. (2) SE6166sp Controllers one for each unit
        ii. (2) Differential pressure sensors one for each unit
        iii. (2) Averaging sensors one for each unit
        iv. (2) Temperature sensors one for each unit
        v. (2) Current Sensors one for each unit
        vi. (2) Room sensors one for each unit
        vii. (2) Relays one for each unit
        viii. (2) DDC Control Panels one for each unit
        ix. (2) Thermostat guards one for each unit
    b. We will furnish and wire the following devices installed by others:
        i. (6) Damper actuators
        ii. (2) 3⁄4 “ 2-way valves

9. Existing Exhaust Fans (19)
    a. We will furnish and wire and install the following devices:
        i. (19) ZN220 Controllers
        ii. (19) Relays
        iii. (19) Current sensors
        iv. (19) Small DDC Control Panel

10. New Condensing Hot Water Boilers (2) and (1) Domestic hot water heater
    a. We will furnish and install and wire the following devices:
        i. (1) AMR Controller
        ii. DDC Control Panel
11. New VFDs (2) on HHW pumps
    a. We will furnish and install and wire the following devices:
        i. (2) Current sensors one per VFD
        ii. (2) Relays one per VFD

iii. (1) Differential pressure sensors
iv. (1) SE6104a Controller
v. (1) DDC Control Panel

Bradley Elementary

12. Existing Roof Top Units (6) RTUs add controls
    a. We will furnish and install and wire the following devices:
        i. (6) SE6104a Controller one per RTU
        ii. (6) DDC Control Panel one per RTU
        iii. (6) Transformer one per RTU
        iv. (6) Room sensor one per RTU
        v. (6) Current sensors one per RTU
        vi. (6) Freeze Stat one per RTU
        vii. (6) Relays one per RTU
        viii. (6) Averaging sensor one per RTU
        ix. (6) Temperature sensor one per RTU
    b. We will furnish and wire the following device to be installed by others:
        i. (6) 3⁄4" 2-way valve one per RTU
        ii. (6) Damper Actuator one per RTU
13. Existing ERU-1 – an ALC technician will replace the board in the SE6104 with a new one.
14. Existing Boiler Room Control Panel – an ALC technician will replace the existing obsolete M-Controller with an OF1628
15. Existing Exhaust Fans (11)
    a. We will furnish and install and wire the following devices:
        i. (1) OF1628 Controller
        ii. (1) FIO88U Expansion module
        iii. (11) Relays
16. Existing Fan Coil Units (3)
    a. We will furnish and install and wire the following devices:
        i. (3) SE6104a Controller per FCU (3 total)
        ii. (3) Relays one per FCU
        iii. (3) Freeze Stats one per FCU
        iv. (3) Current sensors one per FCU
        v. (3) Temperature sensors one per FCU
    b. We will furnish and wire the following devices installed by others:
        i. (3) damper actuators one per FCU

17. Existing Split Units (7) install controls
    a. We will furnish and install and wire the following devices:
        i. Direct Integration to new equipment (7) Split via BACnet, ARCnet or MSTP
        ii. (7) AMR controllers one for each Split
        iii. (1) G5CE controller
        iv. (7) Small DDC Control Panel per Split
        v. () Space sensor provided by others

18. New Unit Ventilators (27)
    a. We will furnish and install and wire the following devices:

i. Direct Integration to new equipment (27) UVs via BACnet, ARCnet or MSTP
ii. (1) G5CE Controller
iii. (1) DDC Control Panel

19. New Intellidyne Boiler Control Integration (may be add/alt)
    a. We will furnish and install and wire the following devices:
        i. Direct Integration to new equipment via BACnet, ARCnet or MSTP
        ii. (1) AMR Controller
        iii. (1) DDC Control Panel

Thurgood Marshall Elementary

20. Existing Hydrotherm Condensing Hot Water Boilers
    a. We will furnish and install and wire the following devices:
        i. (1) OF1628 Controller
        ii. (1) FIO812U Expansion Controller
        iii. (1) DDC Control Panel
        iv. (1) Outdoor sensor weather station
        v. (12) Current sensors
        vi. (4) Current sensors for DHW and HHW
        vii. (4) Temperature sensors
        viii. (12) Relays for boilers
        ix. (4) Relays for DHW and HHW
        x. (18) Strap on temperature sensors

21. VFDs (4) - (2) on cooling towers and (2) on HHW pumps (may be add/alt)
    a. We will furnish and install and wire the following devices:
        i. (2) AMR Controllers (1 per set of pumps)

22. Existing (7) Rooftop Units add controls
    a. We will furnish and install and wire the following devices:
        i. (7) SE6104a Controller one per RTU
        ii. (7) DDC Control Panel one per RTU
        iii. (7) Room sensor one per RTU
        iv. (7) Current sensors one per RTU
        v. (7) Freeze Stat one per RTU
        vi. (7) Relays per RTU one per RTU
        vii. (7) Averaging sensor one per RTU
        viii. (14) Temperature duct sensor two per RTU
        ix. (7) Differential Pressure one per RTU
    b. We will furnish and wire the following devices installed by others:
        i. (21) Damper actuators three per RTU
23. Existing Water Source Heat Pumps (42) add controls
    a. We will furnish and install and wire the following devices:
        i. (42) SE6104a Controller one per Heat Pump
        ii. (42) Small DDC Control Panel one per Heat Pump
        iii. (42) Transformer one per Heat Pump
        iv. (42) Room sensor one per Heat Pump

v. (42) Current sensors one per Heat Pump
vi. (42) Freeze Stat one per Heat Pump
vii. (42) Relays one per Heat Pump
viii. (42) Temperature sensor one per Heat Pump
ix. (42) Temperature duct sensor one per Heat Pump

24. Existing (6) ERUs add controls
    a. We will furnish and install and wire the following devices:
        i. (6) SE6104a Controller one per ERU
        ii. (18) Pressure switches three per ERU
        iii. (12) Current sensor two per ERU
        iv. (12) Temperature sensor two per ERU
        v. (6) Freeze Stat one per ERU
        vi. (6) Room sensor one per ERU
        vii. (6) Transformer one per ERU
        viii. (6) DDC Control Panel one per ERU
        ix. (6) Relay one per ERU

<u>Dorothy McNish</u>

25. Existing Furnace integration (2) (two furnaces in building, one on each floor)
    a. We will furnish and install and wire the following devices:
        i. (1) DDC Control Panel
        ii. (1) G5CE Controller
        iii. (1) Outdoor Air Sensor – Weather Station
        iv. (2) ZN551 Controllers
        v. (2) Room Sensors
        vi. (2) Temperature Duct Sensors
        vii. (2) Relays
        viii. (2) Current Sensors

<u>Information Technology Center</u>

26. Furnace integration (1) Furnace add controls
    a. We will furnish and install and wire the following devices:
        i. (1) G5CE Controller
        ii. (1) ZN551 Controller
        iii. (1) Room Temperature Sensor
        iv. (1) DDC Control Panel
        v. (1) Duct Temperature Sensor
        vi. (1) Relay
        vii. (1) Current Sensor
        viii. (1) Outside Air Temperature Sensor Weather Station

27. Existing Split System (3) Integration
    a. We will furnish and install and wire the following devices:
        i. (3) ZN220 Controller one per Split
        ii. (3) Small DDC Control Panel one per Split

iii. (3) Room Temperature Sensor one per Split

Building and Grounds

28. Existing Furnace (1) add controls
    a. We will furnish and install and wire the following devices:
        i. (1) G5CE Controller
        ii. (1) ZN551 Controller
        iii. (1) Room Temperature Sensor
        iv. (1) DDC Control Panel
        v. (1) Outside Air Temperature Sensor Weather Station
        vi. (1) Relay
29. Existing Unit Heaters (3) add controls
    a. We will furnish and install and wire the following devices
        i. (3) ZN551 Controller one per unit
        ii. (3) Room Temperature Sensor one per unit
        iii. (3) DDC Control Panel one per unit
        iv. (3) Relay one per unit
        v.

District Elevator (location to be determined)

30. 39. New Split Units (1) install controls for elevator MER
    a. We will furnish and install and wire the following devices:
        i. Direct Integration to new equipment (7) Split via BACnet, ARCnet or MSTP
        ii. (1) AMR controllers one for each Split
        iii. (1) Small DDC Control Panel
        iv. (1) Room Temperature sensor

I. We exclude the following:

1. For Intellidyne boiler controls, ALC is not responsible for miscellaneous wiring on boilers such as outside air temperature, hot water system, communication between boilers or safeties, pumps, boilers, pressure sensors, VFDs. ALC understands that the Intellidyne controls will control boiler system including boilers, pumps and VFDs in order to control temperature and pressure. The ALC BMS will monitor these systems only.
2. Controls added to existing RTUs will not include damper actuation, therefore will not be configured for demand control ventilation.
3. Power wiring is not included.
4. Variable speed drives and motor starters and the installation thereof.
5. Lead/Lag panels.
6. All work Associated with the Fire Alarm system work (smoke detectors, relays, wiring, etc.).
7. All work Associated with the Smoke Purge System.
8. All work Associated with the Fire/Smoke Dampers.
9. Furnish and Install of all types of Dampers, Actuators, Valves.
10. Air and water balancing.
11. Access doors.
12. Demolition work.
13. Patching, painting and debris removal.
14. Roofing work and roof penetration.
15. Factory mounting and wiring costs for VAV, CAV, box controls.

16. Installation of pipe and duct mounted devices claimed by respective trades.
17. Supply of communication cards in the new equipment – BACnet gateways
18. Service Contract : existing service agreement to be modified to include new equipment as part of a separate proposal.

I. Clarifications:

1. All work is performed on straight time.
2. ALC understands this project is qualified as a tax exempt project. If for any reason this is a taxable job, ALC will add sales tax on top of sell price.
3. For work in other buildings, it is assumed that existing DDC panels are within 50' of the equipment/devices being installed
4. We are not liable for any special, indirect, consequential, incidental, or liquidated damages.
5. Automated Logic Contracting Services, Inc., doing business as Automated Logic NY/NJ, is a wholly owned subsidiary of Automated Logic Contracting Services, Inc.
6. This proposal is based on receipt of a proper capital Improvement or Tax Exempt Certificate. If a proper Certificate is not received within 30 days, sales tax will be added to all invoices and be the responsibility of the customer to pay.
7. Fire-stop will be provided for new penetrations only.

Savings Methodology

See savings calculations provided in Appendix.

Maintenance

Periodically the equipment should be checked to ensure proper operation. Update software as needed.

Benefits

- Energy Savings
- Improved occupant comfort
- Decreased equipment downtime
- Increase equipment longevity

19-1 Replacement of Bradley Classroom UVs

ECM Summary

The classrooms in Bradley Elementary School employ the use of classroom UVs for ventilation, heating, and cooling. The existing units have reached end-of-life and are no longer functioning properly. Over half of the units no longer have functional cooling. This ECM will remove all twenty-seven (27) classroom units and replace them with new units. This will restore full functionality including cooling. Additionally, as the units will be using newer, more efficiency technologies and lack the deficiencies seen in the existing ones, overall operating cost will be lowered compared to a baseline adjusted energy consumption.

Facilities Recommended for this Measure

- Bradley Elementary School

Scope of Work

Model	Description	Qty
4 Ton Units	CMD48FAMBASNNA92N	10
#76966	WIRING DIA 8H007186____	10
#76967	PIPE DIA 8H007196____	10
#71610	Disconnect Switch Assembly	10
#49161	Hot Water Modulating Valve - 3/4" - Three-Way	10
#49137	Hot Water Shut-Off Valve 3/4" (Qty 2)	10
#49141	Hot Water Strainer 3/4"	10
#48885	Hot Water Circuit Setter 3/4"	10
#48882	Hot Water Balancing Valve 3/4"	10
#57815	Hot Water PT Port 3/4" (Qty 2)	10
#50614	BACnet Compatible Card	10
#71576	Head Pressure Control Transducer	10
#56691	Phase Failure Relay	10
#50918	Supply Fan Status (Current Sensor)	10
#59512	Outdoor Fan Status (Pressure Switch)	10
#67806	Outdoor Coil Filter	10
#49149	Condensate Pan Float Switch	10
#67804	Coil Freeze Protection (Water or Steam)	10
#67840	Compressor Acoustic Wrap	10
#22222	Beige (Hammertone Finish)	10
59229	Digital Wallstat (pGDX), Temp & Humidity - Remote Mount	10
67876	Side Trim - Flat + hanger - 120"	20
77740	Duct Shroud - 38" High	10
67874	Vibration Mat	10
58632	6" Rear Extension - 35-38" Sill Height	10
67854	38" x 6" Rear Filler Panels	10
67808	Merv 8 Supply Air Replacement Filters - (2 Per Set)	10
67816	Outdoor Coil Replacement Filter	10
50359	5 Year Extended Compressor Warranty	10
5 Ton Units	CMD60FBMBASNNA92N	17
#76966	WIRING DIA 8H007186____	17
#76967	PIPE DIA 8H007196____	17
#71610	Disconnect Switch Assembly	17
#49161	Hot Water Modulating Valve - 3/4" - Three-Way	17
#49137	Hot Water Shut-Off Valve 3/4" (Qty 2)	17
#49141	Hot Water Strainer 3/4"	17
#48885	Hot Water Circuit Setter 3/4"	17
#48882	Hot Water Balancing Valve 3/4"	17
#57815	Hot Water PT Port 3/4" (Qty 2)	17
#50614	BACnet Compatible Card	17
#71576	Head Pressure Control Transducer	17
#56691	Phase Failure Relay	17
#50918	Supply Fan Status (Current Sensor)	17
#59512	Outdoor Fan Status (Pressure Switch)	17
#67871	Outdoor Coil Filter	17
#49149	Condensate Pan Float Switch	17

Model	Description	Qty
#67804	Coil Freeze Protection (Water or Steam)	17
#67840	Compressor Acoustic Wrap	17
#22222	Beige (Hammertone Finish)	17
59229	Digital Wallstat (pGDX), Temp & Humidity - Remote Mount	17
67876	Side Trim - Flat + hanger - 120"	34
77740	Duct Shroud - 38" High	17
59592	Vibration Mat	17
58645	6" Rear Extension - 35-38" Sill Height	17
67854	38" x 6" Rear Filler Panels	17
67808	Merv 8 Supply Air Replacement Filters - (2 Per Set)	17
67872	Outdoor Coil Replacement Filter	17
50359	5 Year Extended Compressor Warranty	17
		27

Savings Methodology

Savings Calculation Method		
Cooling Savings (kWh)	=	UV-Size (Tons) x Peak Heat Pump Coefficient (%) x (Existing UV kW/Ton – New UV kW/Ton) x Bin Hours

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electric savings
- Improve equipment reliability
- Restored occupant comfort

22-1 Retro-commissioning

ECM Summary

Due to the complexity of today's HVAC systems and controls, it is likely for systems to be operating incorrectly or not as efficiently as they could be. Retro-commissioning studies reveal hidden deficiencies and highlights operational & maintenance (O&M) issues that could have been avoided as well as exposes hidden control system problems. There are valuable benefits to retro-commissioning in existing buildings. It is a detailed and specialized process that reviews how an HVAC system is controlled and designed to operate. Applying retro-commissioning to existing facilities includes planning, discovering root causes of inefficiencies, development of a cost-effective project delivery and a focus on optimizing value to the building owner. The study includes functional system testing under various modes, such as heating or cooling loads, occupied and unoccupied modes, varying outside air temperature and space temperatures.

Energy Systems Group is currently in the process of executing an Energy Savings Improvement Project (ESIP) for the Asbury Park Board of Education. Currently several schools are having issues with the Geo-Thermal System and ESG is recommending retro-commissioning as an ECM to reduce energy consumption and improve overall HVAC operations.
This is a systematic process to ensure that the building energy systems perform interactively according to the original design intent and the current operational needs of the facility. Retro-commissioning is a common practice recommended by the American Society of Heating Refrigeration and Energy (ASHRAE) to be revisited every couple of years. We recommend that an engineering firm who specializes in energy control systems and retro-commissioning be contacted for a detailed evaluation and implementation costs. Facility operations personnel would work with the engineers to develop goals and objectives. During on-site testing, the qualified personnel conducting the study would immediately make any no/low cost improvements as identified. Furthermore, any suggested corrective actions which require the purchase of material, a contractor who specializes in that scope of work would be contacted to implement the remaining improvements.

Facilities Recommended for this Measure

- District Wide

Scope of Work

<u>Task 1: Site Visit to define RCx plan</u>

This Task will include a kick-off meeting on site with all parties to review project scope, deliverables, schedule, required information and safety/ security procedures.
Following the Kick-off meeting each school bill be visited (based on a mutually agreed upon schedule) and become familiar with the operations and maintenance of the existing HVAC equipment and controls. This will be accomplished by observing controls operation, staff interviews and review of any original design documentation available. HVAC equipment includes RTUs, ventilators, and boilers.

Upon completion of the site investigations, a Retro-Commissioning plan will be written outlining the recommended changes needed to correct noted deficiencies and to bring existing equipment and controls to the original design operating sequences. This task would include providing a budget estimate for the recommended repairs and estimated energy savings.

Deliverables

• Kick-Off Meeting Minutes.
• Retro-Commissioning Plan- Existing Equipment – PDF Format.

Task 2: Retro-Commissioning of Existing Equipment

This will include the actual retro-commissioning activities of the deficiencies identified in Task 1. General activities will include point-to-point controls verification and calibration adjustments, adjustments to current sequences and schedules to optimize equipment performance, and identification of broken valves, belts, damper actuators, damper linkages, clogged coils and filters. This task may require Testing and Balancing of air and water flows, which would be additional services.

Deliverables

• Retro-Commissioning Deficiencies Log (Interactive- Excel based).
• Cost Estimate.

Task 3: Prepare Commissioning Plan for New Equipment

This task would include developing a Commissioning Plan for the proposed equipment and controls. Specifically, the plan would include the Owner's Project Requirements (OPR), identify all responsible parties and their roles in the commissioning process, pre-functional checklists and functional checklists. This plan would also identify maintenance and operations procedures and required staff training. The Commissioning plan is based upon the Engineered Design documents, OPR and approved submittals, including the Temperature Controls Sequence of Operations. The plan is to be part of the contact documents that are to be used for bidding/ procuring.

Deliverables

• Commissioning Plan – New Equipment- PDF Format.

Task 4: Commissioning of New Equipment

This task will include the actual Commissioning of the new equipment. General activities include review of approved submittals, documenting start-up procedures, witnessing the demonstration of the new equipment and controls and verifying that the equipment and controls function in accordance with the approved Engineered Designs. The installing contractor(s) shall be responsible for completing and submitting the pre-functional checklists and any manufacture's start-up checklists. All operational deficiencies will be compiled and distributed to the responsible parties using a living document (Excel based) until all deficiencies are either verified as corrected or resolved.

Deliverables

• Commissioning Deficiencies Log (Interactive- Excel based).

Task 5: Prepare Final Reports

This Task includes the preparation of final RCx and Cx reports. The reports table of contents typically includes:

• Executive Summary
• Project Summary
• RCx and Cx Plans
• Deficiency logs
• Operations and Maintenance requirements
• Training Requirements
• Recommendation for Improvements
• Appendices (Site Photos, correspondence, Cost Estimates and Energy Savings Calculations Completed Pre-Functional checklists, Competed Start-up Reports Completed Functional Checklists)

Deliverables

- Final Commissioning and Retro-Commissioning Report, PDF format.

Assumptions

1) RCx and Cx Tasks will not include:
   - Lighting and lighting controls.
   - Building Envelop.
   - Kitchen Equipment.
   - Water Consuming Equipment.
   - Computer / plug load management.

2) RCx Task 2 scope of work and fee will be re-evaluated after Task 1 is complete.
3) Provide functional testing for 30% of each type of HVAC equipment for RCx tasks.
4) Provide functional testing for 100% of each type of HVAC equipment and controls for Cx tasks.
5) Building equipment access will be granted during scheduled RCx/Cx tasks and CHA employees will have escorts as needed.
6) Retro commissioning will use original design criteria as a benchmark for final operation.
7) Building Energy Management Controls vendors and/or School Personnel knowledgeable in the operation and manipulation of the controls systems will be present during scheduled RCx/ Cx Tasks.
8) New HVAC equipment and controls will be fully operational and fully tested by the installing contractors prior to Cx (point to point verification by others).
9) Existing HVAC equipment to receive RCx testing will be operational to the fullest extent possible.

Savings Methodology

Stipulated Savings = (% of total energy usage)

Total Annual Natural Gas Savings (Th) = Total Annual Natural Gas Usage * Stipulated Savings
Total Annual Electric Savings (kWh) = Total Annual Energy Usage * Stipulated Savings

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electric and natural gas savings

23-1 Install Computer Power Management System

ECM Summary

Energy Systems Group will furnish and install a software utility that measures, manages, and minimizes the energy consumed by the network's PC clients through one centralized interface. It provides IT departments with a powerful approach to automate energy-efficient "best practices" throughout their networks, while it adds new control and flexibility to traditional PC power management.

With the help and cooperation of the District, ESG will install and rapidly deploy PC Power Management software on the District's PC network. A one-day deployment plan will address server and client installation, basic administrative configurations, logical power management profile groupings, and energy consumption reporting. Ongoing technical support and product revisions, with an annual energy audit to ensure maximized energy savings are also included for a period of three years.

Facilities Recommended for this Measure

- District Wide

Scope of Work

Power Management software/hardware and installation will include approximately 2,033 existing computer machines. Details concerning computer quantities are listen in the appendix concerning the energy savings calculations.

Savings Methodology

In general, savings calculations for lighting retrofits are calculated using the following methodology:

Savings Calculation Method	
Existing kW	= Listed Equipment Amperage x Voltage of Equipment
Cost per kWh	= Average Site Data Package $/kWh
Cost of Existing Equipment	= Existing kW x Cost per kWh x Effective Full Load Hours
Cost of Proposed Equipment	= Existing kW x Cost per kWh x Full Load Hours Using Control
Energy Savings	= Existing Equipment Costs – Proposed Equipment Costs

Maintenance

Update software as needed.

Benefits

- Energy Savings

24-1 Construction Contingency

ECM Summary

Energy Systems Group proposes to maintain contingency for unforeseen construction-related issues. Due to the age of the buildings in the Asbury Park School District, and the already known amount of asbestos, the contingency will mitigate any construction related issues with abating additional asbestos.

Facilities Recommended for this Measure

- District Wide

Scope of Work

To be determined.

Savings Methodology

No savings associated

Maintenance

N/A

Benefits

N/A

Solar Power Purchase Agreement (Rooftop)

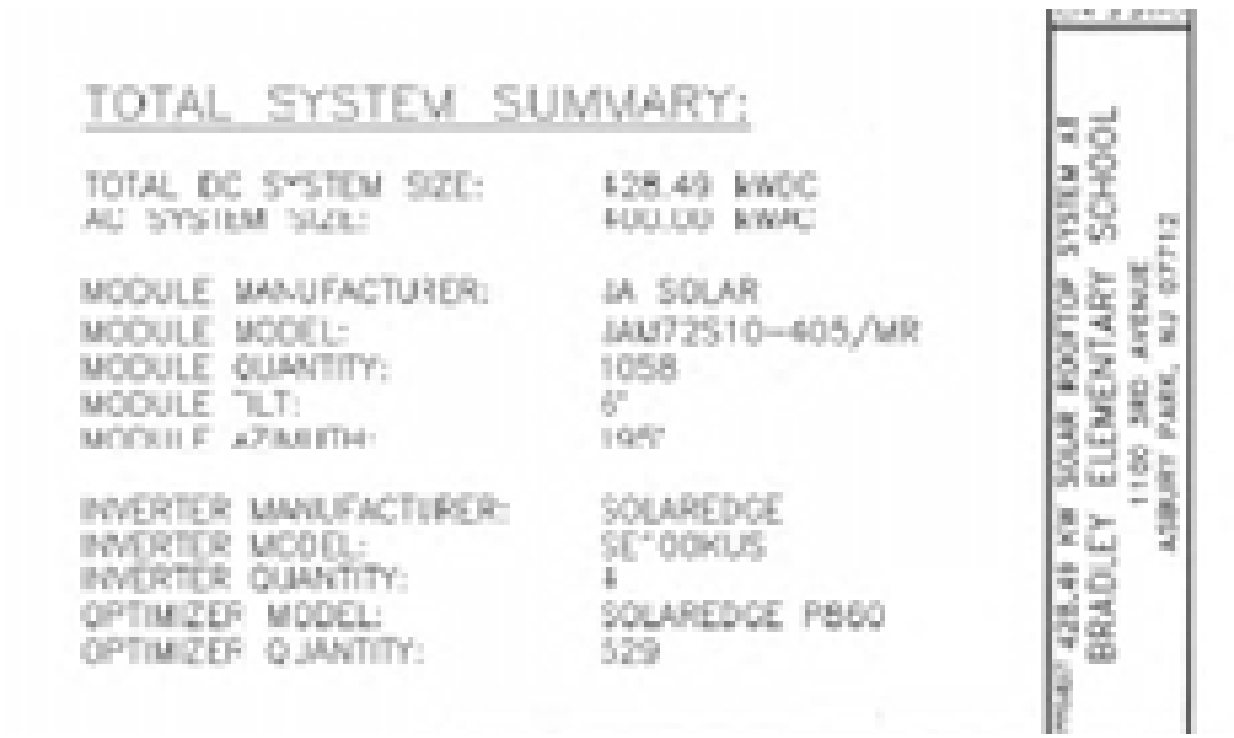
ECM Summary

Grid-tied solar electric systems convert sunlight into electricity. As long as your solar electric system is connected to the utility grid, its clean electricity can be used in your school, or “banked” into the utility grid for later use. Through a process known as net metering, your utility will accept your excess solar power when you are producing more than you are using and will supply you with reliable grid power when the sun is not shining. Your utility company will calculate your bill on the difference between your solar production and electric use.

Facilities Recommended for this Measure

- Asbury Park High School
- Bradley Elementary School
- Thurgood Marshall Elementary School
- Dr. Martin Luther King Jr. Middle School

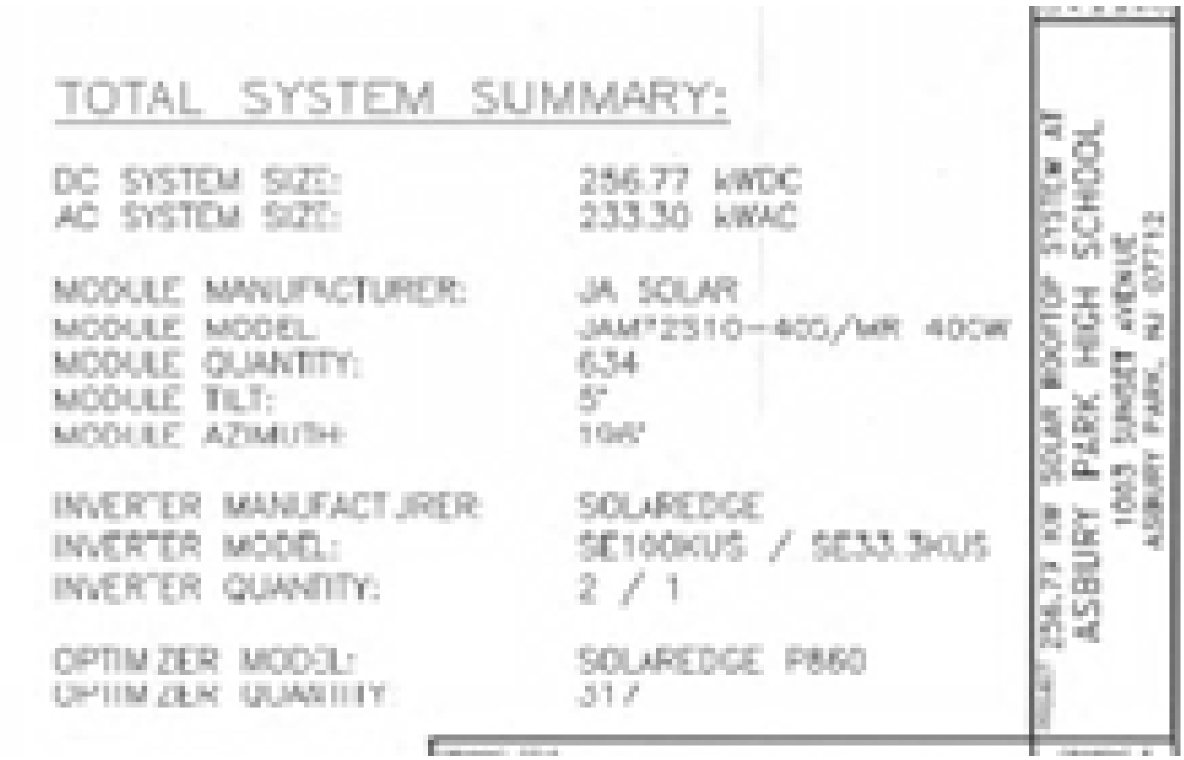
Scope of Work

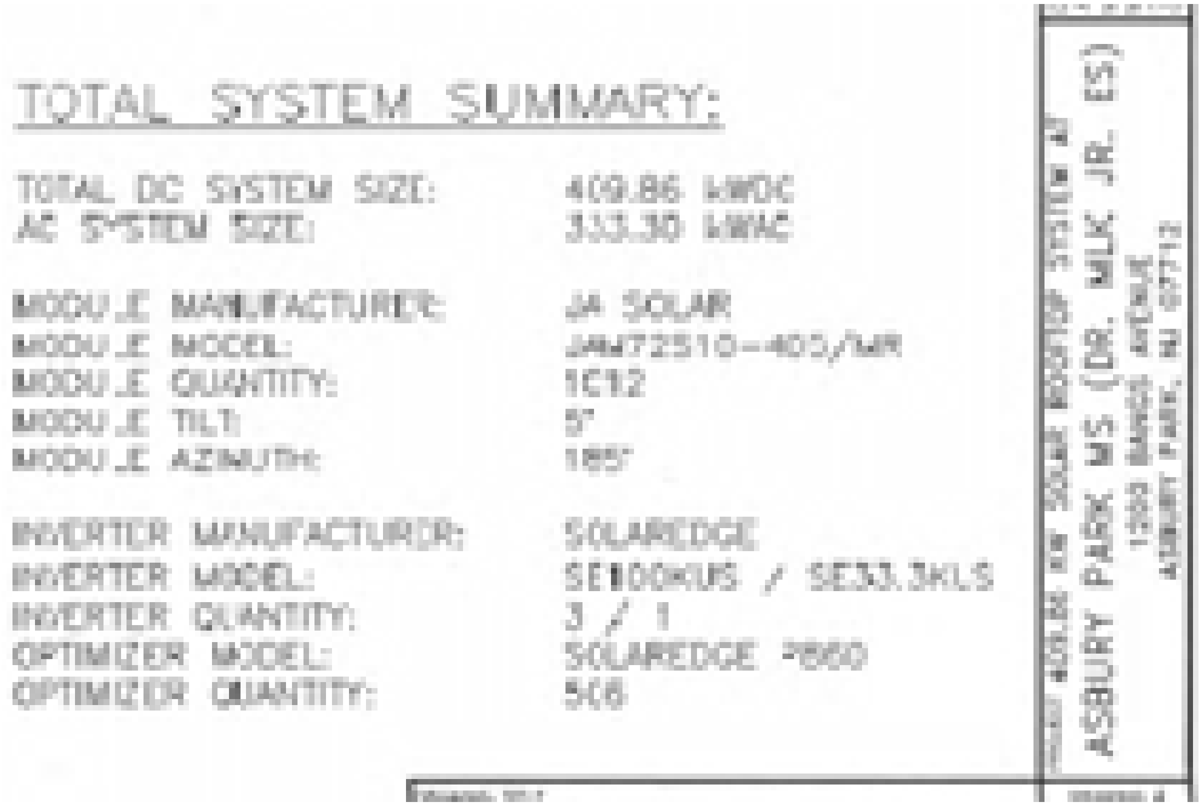


TOTAL SYSTEM SUMMARY:

TOTAL DC SYSTEM SIZE:	311.04 KWDC
AC SYSTEM SIZE:	266.60 KWAC
MODULE MANUFACTURER:	JA SOLAR
MODULE MODEL:	JAM72S10-405/MR
MODULE QUANTITY:	768
MODULE TILT:	5°
MODULE AZIMUTH:	195°
INVERTER MANUFACTURER:	SOLAREDGE
INVERTER MODEL:	SE100KUS / SE66.6KUS
INVERTER QUANTITY:	2 / 1
OPTIMIZER MODEL:	SOLAREDGE P860
OPTIMIZER QUANTITY:	384

PROJECT: 311.04 KW SOLAR ROOFTOP SYSTEM AT
THURGOOD MARSHALL ES
600 MONROE AVENUE
ASBURY PARK, NJ 07712


TOTAL SYSTEM SUMMARY:
DC SYSTEM SIZE: 256.77 kWDC
AC SYSTEM SIZE: 233.30 kWAC
MODULE MANUFACTURER: JA SOLAR
MODULE MODEL: JAM72S10-400/MR 400W
MODULE QUANTITY: 634
MODULE TILT: 5°
MODULE AZIMUTH: 196°
INVERTER MANUFACTURER: SOLAREDGE
INVERTER MODEL: SE100KUS / SE33.3KUS
INVERTER QUANTITY: 2 / 1
OPTIMIZER MODEL: SOLAREDGE P860
OPTIMIZER QUANTITY: 317
256.77 kW SOLAR ROOFTOP SYSTEM AT
ASBURY PARK HIGH SCHOOL
1003 SUNSET AVENUE
ASBURY PARK, NJ 07712



TOTAL SYSTEM SUMMARY:

TOTAL DC SYSTEM SIZE:	409.86 kWDC
AC SYSTEM SIZE:	333.30 kWAC
MODULE MANUFACTURER:	JA SOLAR
MODULE MODEL:	JAM72S10-405/MR
MODULE QUANTITY:	1C12
MODULE TILT:	5°
MODULE AZIMUTH:	185°
INVERTER MANUFACTURER:	SOLAREDGE
INVERTER MODEL:	SE100KUS / SE33.3KUS
INVERTER QUANTITY:	3 / 1
OPTIMIZER MODEL:	SOLAREDGE P860
OPTIMIZER QUANTITY:	506

Savings Methodology

Standard analysis follows ASHRAE or other industry standard or accepted methodologies.

Maintenance

The system will require routine maintenance and testing. The costs of this maintenance has been accounted for in the financial analyses.

Benefits

Reduced electricity rates for 15 year term.

SECTION 5. MEASUREMENT AND VERIFICATION

Measurement & Verification (M&V) Methodologies

This section contains a description of the types of Measurement and Verification (M&V) methodologies that Energy Systems Group will use to guarantee the performance of this project.

They have been developed and defined by two independent authorities:

- International Performance Measurement and Verification Protocol (IPMVP)
- Federal Energy Management Program (FEMP)

There are four guarantee options that may be used to measure and verify the performance of a particular energy conservation measure. Each one is described below.

Option A – Retrofit Isolation: Key Parameter Measurement

Energy savings is determined by field measurement of the key parameters affecting the energy use of the system(s) to which an improvement measure was applied separate from the energy use of the rest of the facility. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the measured parameter, and the length of the reporting period.

Measurement of key parameters means that those parameters not selected for field measurement will be estimated. Estimates can be based on historical data, manufacturer's specifications, or engineering judgment. Documentation of the source or justification of the estimated parameter will be described in the M&V plan in the contract. Energy savings is determined through engineering calculations of the baseline and post-retrofit energy used based on the combination of measured and estimated parameters, along with any routine adjustments.

Option B – Retrofit Isolation: All Parameter Measurement

Like Option A, energy savings is determined by field measurement of the energy use of the systems to which an improvement measure was applied separate from the energy use of the rest of the facility. However, all of the key parameters affecting energy use are measured; there are no estimated parameters used for Option B. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the savings and the length of the reporting period. Energy savings is determined through engineering calculations of the baseline and post-retrofit energy used based on the measured parameters, along with any routine adjustments.

Option C – Whole Building Metering/Utility Bill Comparisons

Option C involves the use of utility meters or whole building sub-meters to assess the energy performance of a total building. Option C assesses the impact of any type of improvement measure, but not individually if more than one is applied to an energy meter. This option determines the collective savings of all improvement measures applied to the part of the facility monitored by the energy meter. In addition, since whole building meters are used, savings reported under Option C include the impact of any other change made in facility energy use (positive or negative).

Option C may be used in cases where there is a high degree of interaction between installed improvement measures or between improvement measures and the rest of the building or the isolation and measurement of individual improvement measures is difficult or too costly.

This Option is intended for projects where savings are expected to be large enough to be discernable from the random or unexplained energy variations that are normally found at the level of the whole facility meter. The larger the savings, or the smaller the unexplained variations in the baseline, the easier it will be to identify savings. In addition, the longer the period of savings analysis after installing the improvement measure, the less significant is the impact of short-term unexplained variations. Typically, savings should be more than 20% of the baseline energy use if they are to be separated from the noise in the baseline data.

Periodic inspections should be made of all equipment and operations in the facility after the improvement measure installation. These inspections will identify changes from baseline conditions or intended operations. Accounting for changes (other than those caused by the improvement measures) is the major challenge associated with Option C-particularly when savings are to be monitored for long periods.

Savings are calculated through analysis of whole facility utility meter or sub-meter data using techniques from simple comparison to regression analysis.

Option D – Calibrated Simulation

Option D involves the use of computer simulation software to predict energy use, most often in cases where baseline data does not exist. Such simulation models must be calibrated so that it predicts an energy use and demand pattern that reasonably matches actual utility consumption and demand data from either the base-year or a post-retrofit year.

Option D may be used to assess the performance of all improvement measures in a facility, akin to Option C. However, different from Option C, multiple runs of the simulation in Option D allow estimates of the savings attributable to each improvement measure within a multiple improvement measure project.

Option D may also be used to assess just the performance of individual systems within a facility, akin to Option A and B. In this case, the system's energy use must be isolated from that of the rest of the facility by appropriate meters.

Savings are calculated using energy use simulation models, calibrated with hourly or monthly utility billing data and/or end-use metering.

Selecting M&V Options for a Specific Project

The tailoring of your specific M&V option is based on the level of M&V precision required to obtain the desired accuracy level in the savings determination and is dependent on:

- The complexity of the Energy Conservation Measure
- The potential for changes in performance
- The measured savings value.

The challenge of the M&V plan is to balance three related elements:

- The cost of the M&V Plan
- Savings certainty
- The benefit of the particular conservation measure.

Savings can also be non-measured. If savings are non-measured, these savings are mutually agreed upon as achieved at substantial completion of the respective facility improvement measure and shall not be measured or monitored during the term of the performance contract. Non-measured energy savings are limited to no more than 10-15% of the overall project savings.

Recommended Performance Verification Steps

Energy Systems Group's performance verification methods are designed to provide the facility's administration with the level of M&V necessary to protect them from an under-performing ECM yet have a minimal impact on the project's financial success.

The selection of the M&V methods to be used is based on the criteria as detailed by IPMVP and Energy Systems Group's experience with hundreds of successful performance contracts in the K-12, state, and local government sectors. Following is a table illustrating how the savings of the major energy conservation measures proposed for this project will be verified.

ECM Description	Measurement and Verification Method – Summary	Detail of M&V Methodology
Comprehensive LED Lighting + Controls	Option A: One-time pre and post-retrofit kW measurement. Burn hours agreed upon with school district.	Pre M&V: Lighting power readings will be taken on a sample of lighting fixtures. Lighting burn hours had sample measurements taken. Post M&V: Lighting power readings will be taken on a sample of lighting fixtures. Measurements will occur once at the outset of the agreement. Energy Savings: Energy savings will be calculated using the actual measured wattage reduction and measured burn-hours. Controls savings will be calculated based on reduction from sample measured burn hours down to "typical" burn hours for given space usage cases as listed in Appendix.
Comprehensive LED Lighting	Option A: One-time pre and post-retrofit kW measurement. Burn hours agreed upon with school district.	Pre M&V: Lighting power readings will be taken on a sample of lighting fixtures. Lighting burn hours had sample measurements taken. Post M&V: Lighting power readings will be taken on a sample of lighting fixtures. Measurements will occur once at the outset of the agreement. Energy Savings: Energy savings will be calculated using the actual measured wattage reduction and measured burn-hours.
Comprehensive LED Lighting - DI	Option A: One-time pre and post-retrofit kW measurement. Burn hours agreed upon with school district.	Pre M&V: Lighting power readings will be taken on a sample of lighting fixtures. Lighting burn hours had sample measurements taken. Post M&V: Lighting power readings will be taken on a sample of lighting fixtures. Measurements will occur once at the outset of the agreement. Energy Savings: Energy savings will be calculated using the actual measured wattage reduction and measured burn-hours.
Install Occupancy Sensor Lighting Upgrades – DI	Non-Measured: Savings are from reduced burn hours of lights	Pre M&V: Assumed lighting burn hours provided by NJ Clean Energy Direct Install program. Post M&V: Assumed reduced lighting burn hours provided by NJ Clean Energy Direct Install program.

ECM Description	Measurement and Verification Method – Summary	Detail of M&V Methodology
Transformer Replacement	Non-Measured: Savings are from reduced losses achieved by replacing old transformers with new, higher efficiency models	Pre M&V: Sample measurements were taken of several existing transformers to determine existing losses. Post M&V: Once the installation is completed, the new transformers will be inspected to verify if they are working properly. The efficiency of the new transformers will be determined via factory based testing completed prior to shipping and installation. Energy Savings: Savings are from reduced losses from installing high efficiency transformers.
Condensing Hot Water Boiler Replacement - DI	Option A: One time pre and post-retrofit combustion efficiency measurement	Pre-M&V: Combustion analysis will be completed on existing boilers to determine existing combustion efficiency. Post-M&V: Combustion analysis will be competed on the newly installed boilers to verify the improvement in combustion efficiency Energy Savings: Savings are from reduced natural gas consumption while providing the same thermal output to the building.
Building Envelope Weatherization	Non-Measured: Existing envelope deficiencies will be documented based on collected field data to provide a baseline for evaluating the effectiveness of the air barrier system. Post-retrofit verifications of improvements will be documented.	Pre M&V: The magnitude of the air infiltration caused by cracks and joint deficiencies was determined by field surveys. Post M&V: The areas identified for weatherization improvements will be verified to be complete through visual inspections and as-built documentation. A one-time infrared survey of the buildings, when seasonally appropriate, will be conducted for the M&V agreement. Energy Savings: Energy savings will be based on the ASHRAE crack method calculations. If the commissioning process reveals any variation in the as-built conditions, then savings will be adjusted accordingly.
Mechanical Insulation	Non-Measured: Existing mechanical insulation deficiencies will be documented based on collected field data to provide a baseline for evaluating the effectiveness of the air barrier system. Post-retrofit verifications of improvements will be documented.	Pre M&V: The magnitude of the missing insulation was determined by field surveys. Post M&V: The areas identified for repair or replacement of mechanical insulation will be verified to be complete through visual inspections and as-built documentation. A one-time infrared survey of the buildings, when seasonally appropriate, will be conducted for the M&V agreement. Energy Savings: Energy savings will be based on measure surface areas and average temperature difference between pipe surface and ambient air.

ECM Description	Measurement and Verification Method – Summary	Detail of M&V Methodology
Mechanical Insulation - DI	Non-Measured: Existing mechanical insulation deficiencies will be documented based on collected field data to provide a baseline for evaluating the effectiveness of the air barrier system. Post-retrofit verifications of improvements will be documented.	Pre M&V: The magnitude of the missing insulation was determined by field surveys. Post M&V: The areas identified for repair or replacement of mechanical insulation will be verified to be complete through visual inspections and as-built documentation. A one-time infrared survey of the buildings, when seasonally appropriate, will be conducted for the M&V agreement. Energy Savings: Energy savings will be based on measure surface areas and average temperature difference between pipe surface and ambient air.
Plug Load Controls	Option A: Savings are from reduced electric consumption by controlling plugged equipment.	Pre M&V: After the installation of plug load controls are completed, no schedule modifications will be made for a duration of time long enough to gather sufficient data to establish a baseline trend. Both operating hours as well as power consumptions will be measured during this time. Post M&V: Once the new schedules are in places, actual device usage will be monitored. Energy Savings: Savings are from the reduced runtime and power consumption of plug load devices.
Combined Heat and Power	Option B: Savings are from the electric and heat provided by the cogeneration system.	Pre M&V: The baseline utility bills were analyzed to determine baseline heating and electric loads and the time that the cogeneration system is able to operate per year and the capacity of the cogeneration system. Post M&V: The electric generation output from the cogeneration system will be measured with an electric meter. The heat output from the cogeneration system will be determined by measuring the water inlet/outlet temperature and flow rate. The gas input to the cogeneration system will be measured with a gas meter. Combined, these data points will be used to verify the conversion efficiency of the cogeneration system. Energy Savings: Savings are from the electric and heat provided by the cogeneration system.
Refrigerant Control Upgrades	Non-Measured: Savings are from the reduced electric consumption of freezers and coolers.	Pre M&V: Manufacturer's data and operating parameters will be collected on the freezer and refrigerator. Post M&V: Once the installation is completed, the walk-in box control system will be inspected to ensure proper operation.

ECM Description	Measurement and Verification Method – Summary	Detail of M&V Methodology
		Energy Savings: Savings are from the reduced electric consumption of freezers and coolers.
PC Power Management	Non-Measured; Savings are from ensuring computers throughout the district properly power off and/or enter a low power mode when not in use and during typical non-occupied periods such as overnight or during academic breaks.	Pre M&V: Quantity of computers used throughout district will be verified with the district. Post M&V: Verification will be completed that the power management software is installed and running corrected. Schedules will be confirmed with the district to ensure that the power cycle of the computers matches the anticipated usage periods. Energy Savings: Computers either being completely off or in a low power state rather than being left fully on when not in use will reduce overall energy consumption.
Upgrade Building Automation System	Non-Measured: Savings are from proper scheduling of equipment and setpoints, accurate monitoring of building conditions, and improved operation of building system through real-time monitoring of HVAC equipment as opposed to relying solely on preventative maintenance or reactionary repairs.	Pre-M&V: The majority of the buildings throughout the district lack a centralized Building Automation System. Among those that have one, most are either antiquated or not functioning properly. Some equipment is controlled at the local level only and other are unable to be controlled at all, operating on preexisting schedules and setpoints that no longer match the building use. Post-M&V: All of the buildings and equipment including the BAS scope will have proper schedules and setpoints configured. Real-time monitoring of building conditions and running equipment as well as alarms will be accessible to district maintenance staff. Energy Savings: Better control of equipment with proper scheduling and temperature setbacks will reduce energy consumption throughout the district.
Bradley UV Replacements	Non-Measured: Savings come from reduced cooling energy consumption as a result of improved cooling efficiencies	Pre-M&V: Existing classroom UVs are in poor working condition. The majority of the units are non-longer functioning requiring a baseline adjustment to calculate energy savings from. Post-M&V: New UV will be verified to be working correctly. Energy Savings: Replacing old, poorly functioning compressor-ized UV equipment with new, high efficiency models will lead to reduce cooling energy consumption.
Retro-Commissioning	Non-Measured: Savings are retro-commissioning the HVAC equipment to	Pre M&V: During the IGA, opportunities to improve energy consumption of HVAC equipment through the district were noted. Some examples

ECM Description	Measurement and Verification Method – Summary	Detail of M&V Methodology
	ensure they are working as expected.	include schedules and setpoints incorrectly set or overridden, equipment running without control and instead turned on and off manually, short-cycling of equipment, RTUs with doors not properly shut, motors not operating when equipment is running, and others Post M&V: Upon completion of the Retrocommissioning study, the report will be used as a guide to make as many corrections in order of priority as possible within the allotted budget of the Retrocommissioning ECM. Energy Savings: Savings are retro-commissioning the HVAC equipment to ensure they are working as expected.

Measurement and Verification Services

Measurement and Verification Services will be provided in association with the guarantee provided by Energy Systems Group. The guarantee will be in effect for each year that the District elects to participate in the Measurement and Verification Services. The cost of the measurement and verification services is included in the business case in the "Annual Services" column as outlined in the table below:

Year	Annual Amount ($/Yr)
1	$31,944
Total	$31,944

ESG will provide the M&V Services set forth below in connection with the Assured Performance Guarantee.

- During the Installation Period, an ESG Performance Engineer will track Measured Project Benefits. ESG will report the Measured Project Benefits achieved during the Installation Period, as well as any Non-Measured Project Benefits applicable to the Installation Period, to Customer within 60 days of the commencement of the Guarantee Term.
- Within 60 days of each anniversary of the commencement of the Guarantee Term, ESG will provide Customer with an annual report containing:
  - An executive overview of the project's performance and Project Benefits achieved to date;
  - A summary analysis of the Measured Project Benefits accounting; and
  - Depending on the M&V Option, a detailed analysis of the Measured Project Benefits calculations.
- During the Guarantee Term, an ESG Performance Engineer will monitor the on-going performance of the Improvement Measures, as specified in this Agreement, to determine whether anticipated Measured Project Benefits are being achieved. The Performance Engineer will visit Customer regularly and assist Customer on-site or remotely, with respect to the following activities:
  - Review of information furnished by Customer from the facility management system to confirm that control strategies are in place and functioning;
  - Advise Customer's designated personnel of any performance deficiencies based on such information;
  - Coordinate with Customer's designated personnel to address any performance deficiencies that affect the realization of Measured Project Benefits; and
  - Inform Customer of opportunities to further enhance project performance and of opportunities for the implementation of additional Improvement Measures.
  - Track utility bills on a monthly basis to determine current utility rate costs and to identify any billing anomalies.
- For specified Improvement Measures, ESG will:
  - Conduct pre and post installation measurements required under this Agreement;
  - Confirm the building management system employs the control strategies and set points specified in this Agreement; and
  - Analyze actual as-built information and adjust the Baseline and/or Measured Project Benefits to conform to actual installation conditions (e.g., final lighting benefits calculations

will be determined from the as-built information to reflect the actual mix of retrofits encountered during installation).

- Confirm that the appropriate metering and data points required to track the variables associated with the applicable Improvement Measures' benefits calculation formulas are established; and
- Set up appropriate data capture systems (e.g., trend and totalization data on the facility management system) necessary to track and report Measured Project Benefits for the applicable Improvement Measure.

SECTION 6. CUSTOMER SUPPORT

Maintenance Impacts/ On-Going Service

New pieces of equipment that are installed as part of the ESIP project will be provided with the standard manufacturer warranty. Once installation of the equipment is complete, the remaining warranty period will be transferred to Asbury Park Board of Education; any warranty issues will be handled directly with the equipment manufacturer rather than with Energy Systems Group.

a) ESG subcontractors will warranty the installation for a period of 12 months, beginning at substantial completion.

b) In addition, ESG will facilitate warranty related issues for a period of 12 months, beginning at substantial completion. Extended manufacture warranties beyond the 12-month installation warranty period will be facilitated by the District.

The installation of the recommended measures will reduce the amount of emergency maintenance required by the district through the installation of new equipment; however, preventative maintenance is still required in order to ensure the correct operation of the equipment for the expected lifetime. A service agreement cannot be included as part of this project per the New Jersey Local Finance Notice 2009-11. Once the scope is finalized and bids are received, Energy Systems Group will assist the District in preparing bids for any preventative service agreement that is felt necessary for the new equipment. The service agreement will cover recommended maintenance per each equipment manufacturer. Training on the proper maintenance and operation of each piece of equipment has also been included as part of the ESIP project which will allow the District to complete the majority of maintenance and repair in-house in order to utilize District resources.

In order to ensure the District is fully capable of achieving the energy savings and fully utilizing the new HVAC and Building Automation Systems, Energy Systems Group has included training for district employees.

Energy Systems Group recommends the District go out to bid for the following 3rd party service contracts in order to achieve the continuous savings throughout the term of the Energy Savings Improvement Program:

- Cogeneration Service Agreement to allow for emergency service and preventative maintenance on the new cogeneration systems. In order to receive the incentives for the cogeneration system, a 10-year maintenance contract must be in place. Energy Systems Group has shown the savings paying for this maintenance agreement but has not included the agreement within the ESIP.

Services for Lighting, Combined Heat and Power, Plug Load Management, PC Power Management, and walk-in freezer controller upgrades, such as filter changes and on-going maintenance can be completed by District staff.

Design and Compliance Issues

Asbury Park Board of Education will work closely with Energy Systems Group and Engineering Drive Design to oversee and complete all design engineering for the purposes of public bidding of the work as well as completing construction drawings.

As part of the Energy Savings Plan development, Energy Systems Group completed a thorough analysis of the building electrical and mechanical systems including light level readings throughout the spaces. The existing light levels are typically within 10-20% of current Illumination Engineering Society (IES) recommendations, which is reasonable given the varying age of lamps throughout the District. The proposed lighting solution will continue to adhere to current IES and NJ Education Code guidelines for light levels, which in many cases may increase the current light levels to the spaces. At this time, Energy Systems Group did not observe any compliance issues in the development of this Energy Savings Plan.

Customer Risks

Asbestos reports were obtained and reviewed for all schools as part of Energy Systems Group's safety policy. Based on the reports, asbestos materials will have to be abated prior to any work being performed. If any additional asbestos is found during the installation of the measures, Energy Systems Group will stop work and notify the Board of Education. Any work associated with testing or remediation of asbestos containing material will be the responsibility of Asbury Park Board of Education. Based on the asbestos reports provided, we feel this is a low risk item. This does not include asbestos abatement work specifically called out to as part of this project's scope of work.

The NJ SmartStart, Pay for Performance, Demand Response Energy Efficiency Credit, and Combined Heat and Power Incentives outline the anticipated incentive amounts to Asbury Park Board of Education. Energy Systems Group does not guarantee the rebate or state incentive structure. If the programs change or the incentive amounts differ, Asbury Park Board of Education will be responsible to make up the difference in received incentives for the financing. The difference could result from over performance of energy conservation measures, other rebates/ incentives that may be available, restructuring the loan payment for years 1 and 2, or capital contributions by the District.

Public Engagement and Community Outreach

Student Engagement in ESIP Development: ESG has involved students at all levels in the energy related fields. At Asbury Park BOE, we plan to **expand on interests related to energy conservation throughout the district and would welcome and actively encourage student involvement in various phases of the proposed project. Furthermore, in line with our commitment, and with Asbury Park BOE's concurrence, we propose to offer presentations to Energy Clubs, including them in** the process.

STEM EXPO Sponsorship: ESG has a history of sponsoring STEM programs for many school districts and Universities across the country. If selected, ESG would like to sponsor the Asbury Park BOE's Annual STEM EXPO and further complement your Engineering/Technology Science curriculum.

Community Outreach Program: ESG is focused on creating a partnership with Asbury Park Board of Education that will extend beyond the scope of this project. Keeping the community informed and involved in the process is key to success. One way this can be achieved is thru a ***Community Scholarship Program.*** At Northern Illinois University (NIU), ESG established The **Energy Systems Group Scholarship Award in Engineering** to underscore our commitment. Established in 2001, ESG and NIU jointly select students for award of this scholarship. To date, we have awarded **$35,000** to NIU engineering students with superior academic excellence. ESG would like to establish a similar program for Asbury Park Board of Education.

ESG will seek to develop and build partnerships between The National Education Foundation (NEF) and the Asbury Park Board of Education. These partnerships were developed by ESG and the NEF, to bring engineering and engineering technology career opportunities to students through the educational programs offered by the University of Salt Lake City Utah. These programs help students who might not otherwise consider careers in these sciences or further expand the knowledge of the children who are participating in such class. In addition, this affords local colleges and Universities the opportunity to recruit future applicants from the local school boards. Some of these programs are listed below:

Student Engagement in ESIP Development: ESG has involved students at all levels in the energy related fields. At APSD, we plan to **expand on interests related to energy conservation throughout the APSD campus and would welcome and actively encourage student involvement in various phases of the proposed project. Furthermore, in line with our commitment, and with APSD's concurrence, we propose to offer presentations to Energy Clubs, including them in** the process.

Solar Photovoltaic Systems at Work Grades 9-12: This program includes learning activities for the secondary levels and a supply kit to investigate solar energy and its uses. Additional instructional materials include the Renewable Energy Sources poster, Energist, the Electrical Generation poster and Energist, the Energy Basics CD, and the Eye Chart poster. The program can stand alone or complement Energy Fun, Energy Fundamentals, Energy Action Technology, or Energy Action Patrol.

Career Exploration, grades 11-12: Provides students with career related work experience while obtaining up to 40 hours of academic credit. The program allows students a superb opportunity to integrate classroom theory into the world of work, as well as providing career option exploration, skill development, work environment exposure, and professional contacts.

SECTION 7: IMPLEMENTATION SCHEDULE

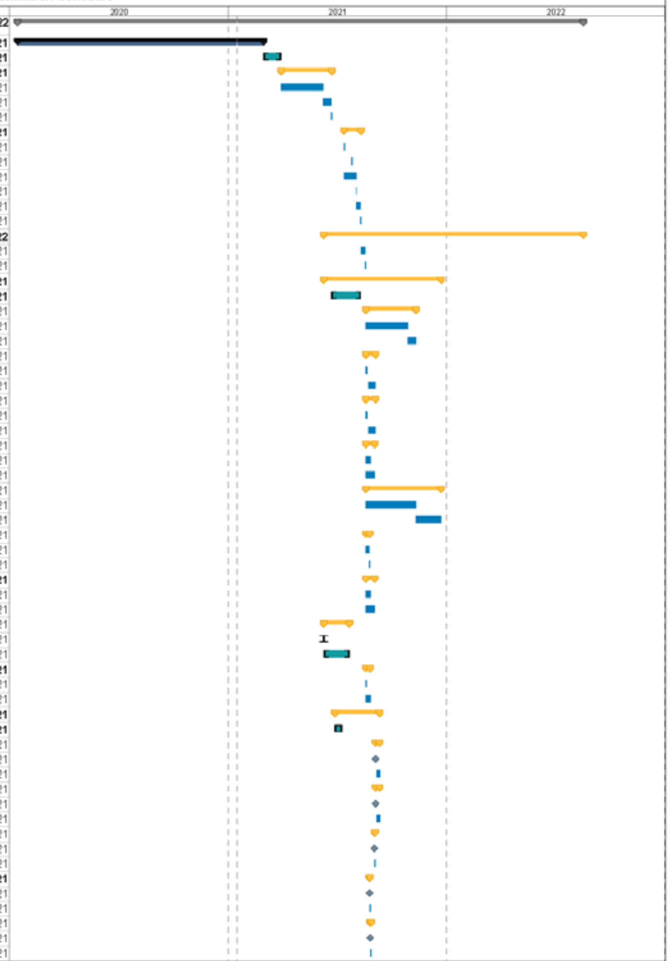
A preliminary installation schedule for the measures implemented as part of the ESP is included below to provide a reasonable expectation for the timeline of construction. Once final bids are received and financing of the project is complete, the installation will be finalized in much greater detail and reviewed with the team from the Asbury Park Board of Education to ensure agreement. A high-level review of the next steps in the process is shown below as well as the estimated time frame to complete each step:

- Complete Third Party Engineering Review of Energy Savings Plan – 2 weeks (Jan 18 – Feb 1)
- Complete Board of Public Utilities Review of Energy Savings Plan – 14 days (Feb 8 – Feb 22)
- Approval resolution to contract with Energy Systems Group: February 26th
- Financing of project: 21 days (March 1 – March 12)
- Complete 100% design drawings and bid specifications – June 7
- Public bidding for Sub-Contractors – July – August 2021
- Installation – August 2021- August 2022
- Maintenance: On-going

The project plan on the following page details the Installation Phase schedule.

Asbury Park School District
ESP Development & Installation Schedule

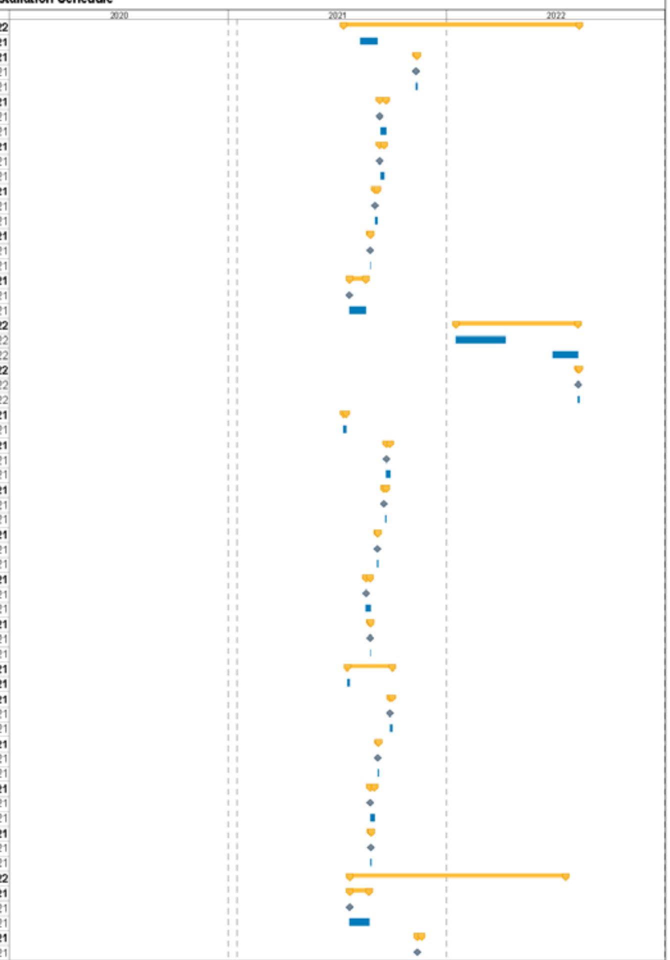
ID	Task Name	Duration	Start	Finish
0	**Project Schedule for Asbury Park School District ESIP**	**678 days**	**Tue 1/14/20**	**Wed 8/17/22**
1	**Phase 1: Investment Grade Audit/ Energy Savings Plan**	**295 days**	**Tue 1/14/20**	**Sun 2/28/21**
3	**Project Financing**	**21 days**	**Mon 3/1/21**	**Mon 3/29/21**
4	**Phase 2: Design**	**61 days**	**Tue 3/30/21**	**Tue 6/22/21**
5	Final Design Engineering	10 wks	Tue 3/30/21	Mon 6/7/21
6	Bid Specification Development	2 wks	Tue 6/8/21	Mon 6/21/21
7	Final Design Review Workshop	1 day	Tue 6/22/21	Tue 6/22/21
8	**Phase 3: Procurement**	**21 days**	**Tue 7/13/21**	**Tue 8/10/21**
9	Advertise Bids	1 day	Tue 7/13/21	Tue 7/13/21
10	Pre-Proposal Conference & Site Visits	1 day	Mon 7/26/21	Mon 7/26/21
11	Bid Duration for Subcontractors	15 days	Tue 7/13/21	Mon 8/2/21
12	Opening of Bids	1 hr	Mon 8/2/21	Mon 8/2/21
13	Evaluation of Bids and Confer on Selection of Sub-Contractors	1 wk	Tue 8/3/21	Mon 8/9/21
14	Subcontractor Selection	1 day	Tue 8/10/21	Tue 8/10/21
15	**Phase 4: Construction**	**311 days**	**Wed 6/9/21**	**Wed 8/17/22**
16	Issue Subcontracts	1 wk	Wed 8/11/21	Tue 8/17/21
17	Construction kick-off meeting	1 day	Wed 8/18/21	Wed 8/18/21
18	**Asbury Park High School**	**141 days**	**Wed 6/9/21**	**Wed 12/22/21**
19	**Comprehensive LED Lighting Upgrades + Controls**	**35 days**	**Tue 6/22/21**	**Mon 8/9/21**
20	**Electrical Transformers**	60 days	Thu 8/19/21	Wed 11/10/21
21	Lead Time	10 wks	Thu 8/19/21	Wed 10/27/21
22	Installation	2 wks	Thu 10/28/21	Wed 11/10/21
23	**Building Envelope Weatherization**	12 days	Thu 8/19/21	Fri 9/3/21
24	Lead Time	2 days	Thu 8/19/21	Fri 8/20/21
25	Installation	2 wks	Mon 8/23/21	Fri 9/3/21
26	**Mechanical Insulation**	12 days	Thu 8/19/21	Fri 9/3/21
27	Lead Time	2 days	Thu 8/19/21	Fri 8/20/21
28	Installation	2 wks	Mon 8/23/21	Fri 9/3/21
29	**Plug Load Controls**	10 days	Thu 8/19/21	Wed 9/1/21
30	Lead Time	1 wk	Thu 8/19/21	Wed 8/25/21
31	Installation	2 wks	Thu 8/19/21	Wed 9/1/21
32	**Cogeneration (CHP)**	90 days	Thu 8/19/21	Wed 12/22/21
33	Lead Time	12 wks	Thu 8/19/21	Wed 11/10/21
34	Installation	30 days	Thu 11/11/21	Wed 12/22/21
35	**Refrigeration Controls**	4 days	Thu 8/19/21	Tue 8/24/21
36	Lead Time	3 days	Thu 8/19/21	Mon 8/23/21
37	Installation	1 day	Tue 8/24/21	Tue 8/24/21
38	**PC Power Management**	**10 days**	**Thu 8/19/21**	**Wed 9/1/21**
39	Lead Time	1 wk	Thu 8/19/21	Wed 8/25/21
40	Installation	2 wks	Thu 8/19/21	Wed 9/1/21
41	**BAS Upgrade**	31 days	Wed 6/9/21	Wed 7/21/21
42	Lead Time	1 day	Wed 6/9/21	Wed 6/9/21
43	Installation	30 days	Thu 6/10/21	Wed 7/21/21
44	**Retro-Commissioning Study & HVAC Improvements**	**5 days**	**Thu 8/19/21**	**Wed 8/25/21**
45	Lead Time	1 day	Thu 8/19/21	Thu 8/19/21
46	Commissioning	1 wk	Thu 8/19/21	Wed 8/25/21
47	**Barack Obama Elementary School**	**55 days**	**Mon 6/28/21**	**Fri 9/10/21**
48	**Comprehensive LED Lighting Upgrades + Controls (DI)**	**10 days**	**Mon 6/28/21**	**Fri 7/9/21**
49	**Building Envelope Weatherization**	5 days	Fri 9/3/21	Fri 9/10/21
50	Lead Time	0 days	Fri 9/3/21	Fri 9/3/21
51	Installation	1 wk	Mon 9/6/21	Fri 9/10/21
52	**Mechanical Insulation**	5 days	Fri 9/3/21	Fri 9/10/21
53	Lead Time	0 days	Fri 9/3/21	Fri 9/3/21
54	Installation	1 wk	Mon 9/6/21	Fri 9/10/21
55	**Plug Load Controls**	1 day	Wed 9/1/21	Thu 9/2/21
56	Lead Time	0 days	Wed 9/1/21	Wed 9/1/21
57	Installation	1 day	Thu 9/2/21	Thu 9/2/21
58	**Refrigeration Controls**	**1 day**	**Tue 8/24/21**	**Wed 8/25/21**
59	Lead Time	0 days	Tue 8/24/21	Tue 8/24/21
60	Installation	1 day	Wed 8/25/21	Wed 8/25/21
61	**Retro-Commissioning Study & HVAC Improvements**	2 days	Wed 8/25/21	Fri 8/27/21
62	Lead Time	0 days	Wed 8/25/21	Wed 8/25/21
63	Commissioning	2 days	Thu 8/26/21	Fri 8/27/21



Page 1 Fri 1/15/21

Asbury Park School District
ESP Development & Installation Schedule

ID	Task Name	Duration	Start	Finish
64	**Bradley Elementary School**	**283 days**	**Mon 7/12/21**	**Wed 8/10/22**
65	**Comprehensive LED Lighting Upgrades**	**20 days**	**Tue 8/10/21**	**Mon 9/6/21**
66	**Electrical Transformers**	**2 days**	**Wed 11/10/21**	**Fri 11/12/21**
67	Lead Time	0 days	Wed 11/10/21	Wed 11/10/21
68	Installation	2 days	Thu 11/11/21	Fri 11/12/21
69	**Building Envelope Weatherization**	**7 days**	**Fri 9/10/21**	**Tue 9/21/21**
70	Lead Time	0 days	Fri 9/10/21	Fri 9/10/21
71	Installation	7 days	Mon 9/13/21	Tue 9/21/21
72	**Mechanical Insulation**	**5 days**	**Fri 9/10/21**	**Fri 9/17/21**
73	Lead Time	0 days	Fri 9/10/21	Fri 9/10/21
74	Installation	5 days	Mon 9/13/21	Fri 9/17/21
75	**Plug Load Controls**	**2 days**	**Thu 9/2/21**	**Mon 9/6/21**
76	Lead Time	0 days	Thu 9/2/21	Thu 9/2/21
77	Installation	2 days	Fri 9/3/21	Mon 9/6/21
78	**Refrigeration Controls**	**1 day**	**Wed 8/25/21**	**Thu 8/26/21**
79	Lead Time	0 days	Wed 8/25/21	Wed 8/25/21
80	Installation	1 day	Thu 8/26/21	Thu 8/26/21
81	**BAS Upgrade**	**20 days**	**Wed 7/21/21**	**Wed 8/18/21**
82	Lead Time	0 days	Wed 7/21/21	Wed 7/21/21
83	Installation	20 days	Thu 7/22/21	Wed 8/18/21
84	**Replacement of Classroom Airedale**	**146 days**	**Mon 1/17/22**	**Mon 8/8/22**
85	Lead Time	12 wks	Mon 1/17/22	Fri 4/8/22
86	Installation	30 days	Tue 6/28/22	Mon 8/8/22
87	**Retro-Commissioning Study & HVAC Improvements**	**2 days**	**Mon 8/8/22**	**Wed 8/10/22**
88	Lead Time	0 days	Mon 8/8/22	Mon 8/8/22
89	Installation	2 days	Tue 8/9/22	Wed 8/10/22
90	**Buildings and Grounds**	**5 days**	**Mon 7/12/21**	**Fri 7/16/21**
91	Comprehensive LED Lighting Upgrades + Controls (DI)	5 days	Mon 7/12/21	Fri 7/16/21
92	**Building Envelope Weatherization**	**4 days**	**Tue 9/21/21**	**Mon 9/27/21**
93	Lead Time	0 days	Tue 9/21/21	Tue 9/21/21
94	Installation	4 days	Wed 9/22/21	Mon 9/27/21
95	**Mechanical Insulation**	**2 days**	**Fri 9/17/21**	**Tue 9/21/21**
96	Lead Time	0 days	Fri 9/17/21	Fri 9/17/21
97	Installation	2 days	Mon 9/20/21	Tue 9/21/21
98	**Plug Load Controls**	**1 day**	**Mon 9/6/21**	**Tue 9/7/21**
99	Lead Time	0 days	Mon 9/6/21	Mon 9/6/21
100	Installation	1 day	Tue 9/7/21	Tue 9/7/21
101	**BAS Upgrade**	**5 days**	**Wed 8/18/21**	**Wed 8/25/21**
102	Lead Time	0 days	Wed 8/18/21	Wed 8/18/21
103	Installation	5 days	Thu 8/19/21	Wed 8/25/21
104	**Retro-Commissioning Study & HVAC Improvements**	**1 day**	**Wed 8/25/21**	**Thu 8/26/21**
105	Lead Time	0 days	Wed 8/25/21	Wed 8/25/21
106	Installation	1 day	Thu 8/26/21	Thu 8/26/21
107	**Dorothy McNish Parent Center**	**55 days**	**Mon 7/19/21**	**Fri 10/1/21**
108	**Comprehensive LED Lighting Upgrades + Controls (DI)**	**4 days**	**Mon 7/19/21**	**Thu 7/22/21**
109	**Building Envelope Weatherization**	**4 days**	**Mon 9/27/21**	**Fri 10/1/21**
110	Lead Time	0 days	Mon 9/27/21	Mon 9/27/21
111	Installation	4 days	Tue 9/28/21	Fri 10/1/21
112	**Plug Load Controls**	**1 day**	**Tue 9/7/21**	**Wed 9/8/21**
113	Lead Time	0 days	Tue 9/7/21	Tue 9/7/21
114	Installation	1 day	Wed 9/8/21	Wed 9/8/21
115	**BAS Upgrade**	**5 days**	**Wed 8/25/21**	**Wed 9/1/21**
116	Lead Time	0 days	Wed 8/25/21	Wed 8/25/21
117	Installation	5 days	Thu 8/26/21	Wed 9/1/21
118	**Retro-Commissioning Study & HVAC Improvements**	**1 day**	**Thu 8/26/21**	**Fri 8/27/21**
119	Lead Time	0 days	Thu 8/26/21	Thu 8/26/21
120	Installation	1 day	Fri 8/27/21	Fri 8/27/21
121	**Dr. Martin Luther King Jr. Middle School**	**257 days**	**Thu 7/22/21**	**Mon 7/18/22**
122	**Comprehensive LED Lighting Upgrades + Controls (DI)**	**22 days**	**Thu 7/22/21**	**Mon 8/23/21**
123	Lead Time	0 days	Thu 7/22/21	Thu 7/22/21
124	Installation	22 days	Fri 7/23/21	Mon 8/23/21
125	**Electrical Transformers**	**5 days**	**Fri 11/12/21**	**Fri 11/19/21**
126	Lead Time	0 days	Fri 11/12/21	Fri 11/12/21

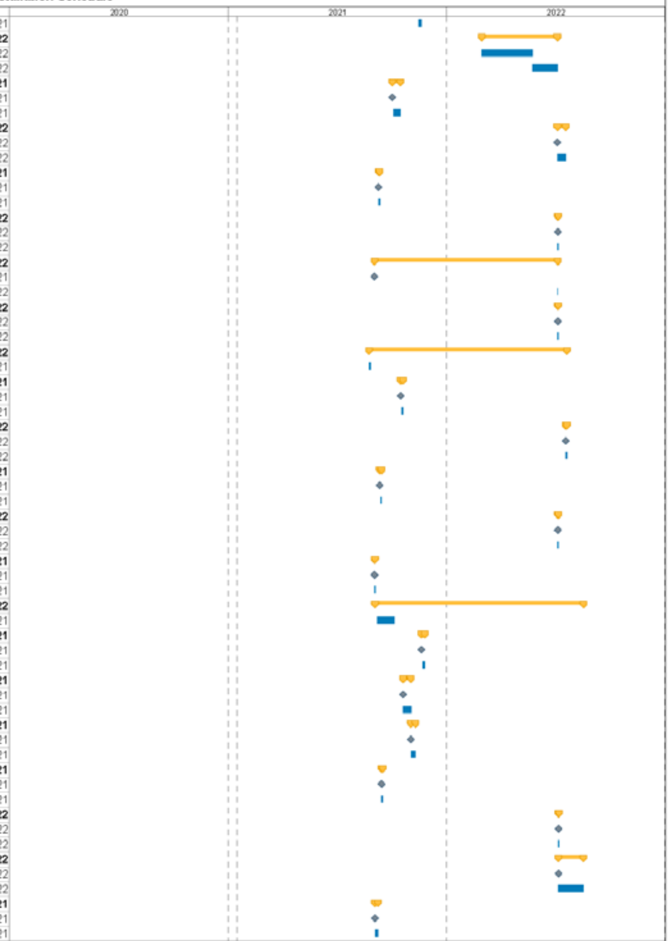


Page 2

Fri 1/15/21

Asbury Park School District
ESP Development & Installation Schedule

ID	Task Name	Duration	Start	Finish
127	Installation	5 days	Mon 11/15/21	Fri 11/19/21
128	**Boiler Replacement**	**90 days**	**Tue 3/1/22**	**Mon 7/4/22**
129	Lead Time	12 wks	Tue 3/1/22	Mon 5/23/22
130	Installation	30 days	Tue 5/24/22	Mon 7/4/22
131	**Building Envelope Weatherization**	**10 days**	**Fri 10/1/21**	**Fri 10/15/21**
132	Lead Time	0 days	Fri 10/1/21	Fri 10/1/21
133	Installation	10 days	Mon 10/4/21	Fri 10/15/21
134	**Mechanical Insulation**	**10 days**	**Mon 7/4/22**	**Mon 7/18/22**
135	Lead Time	0 days	Mon 7/4/22	Mon 7/4/22
136	Installation	10 days	Tue 7/5/22	Mon 7/18/22
137	**Plug Load Controls**	**2 days**	**Wed 9/8/21**	**Fri 9/10/21**
138	Lead Time	0 days	Wed 9/8/21	Wed 9/8/21
139	Installation	2 days	Thu 9/9/21	Fri 9/10/21
140	**Refrigeration Controls**	**1 day**	**Tue 7/5/22**	**Wed 7/6/22**
141	Lead Time	0 days	Tue 7/5/22	Tue 7/5/22
142	Installation	1 day	Wed 7/6/22	Wed 7/6/22
143	**BAS Upgrade**	**219 days**	**Wed 9/1/21**	**Tue 7/5/22**
144	Lead Time	0 days	Wed 9/1/21	Wed 9/1/21
145	Installation	1 day	Tue 7/5/22	Tue 7/5/22
146	**Retro-Commissioning Study & HVAC Improvements**	**1 day**	**Tue 7/5/22**	**Wed 7/6/22**
147	Lead Time	0 days	Tue 7/5/22	Tue 7/5/22
148	Installation	1 day	Wed 7/6/22	Wed 7/6/22
149	**IT Center**	**237 days**	**Tue 8/24/21**	**Wed 7/20/22**
150	Comprehensive LED Lighting Upgrades + Controls (DI)	2 days	Tue 8/24/21	Wed 8/25/21
151	**Building Envelope Weatherization**	**2 days**	**Fri 10/15/21**	**Tue 10/19/21**
152	Lead Time	0 days	Fri 10/15/21	Fri 10/15/21
153	Installation	2 days	Mon 10/18/21	Tue 10/19/21
154	**Mechanical Insulation - DI**	**2 days**	**Mon 7/18/22**	**Wed 7/20/22**
155	Lead Time	0 days	Mon 7/18/22	Mon 7/18/22
156	Installation	2 days	Tue 7/19/22	Wed 7/20/22
157	**Plug Load Controls**	**1 day**	**Fri 9/10/21**	**Mon 9/13/21**
158	Lead Time	0 days	Fri 9/10/21	Fri 9/10/21
159	Installation	1 day	Mon 9/13/21	Mon 9/13/21
160	**BAS Upgrade**	**1 day**	**Tue 7/5/22**	**Wed 7/6/22**
161	Lead Time	0 days	Tue 7/5/22	Tue 7/5/22
162	Installation	1 day	Wed 7/6/22	Wed 7/6/22
163	**Retro-Commissioning Study & HVAC Improvements**	**1 day**	**Wed 9/1/21**	**Thu 9/2/21**
164	Lead Time	0 days	Wed 9/1/21	Wed 9/1/21
165	Installation	1 day	Thu 9/2/21	Thu 9/2/21
166	**Thurgood Marshall School**	**249 days**	**Thu 9/2/21**	**Wed 8/17/22**
167	Comprehensive LED Lighting Upgrades	20 days	Tue 9/7/21	Mon 10/4/21
168	**Electrical Transformers**	**3 days**	**Fri 11/19/21**	**Wed 11/24/21**
169	Lead Time	0 days	Fri 11/19/21	Fri 11/19/21
170	Installation	3 days	Mon 11/22/21	Wed 11/24/21
171	**Building Envelope Weatherization**	**9 days**	**Tue 10/19/21**	**Mon 11/1/21**
172	Lead Time	0 days	Tue 10/19/21	Tue 10/19/21
173	Installation	9 days	Wed 10/20/21	Mon 11/1/21
174	**Mechanical Insulation**	**6 days**	**Mon 11/1/21**	**Tue 11/9/21**
175	Lead Time	0 days	Mon 11/1/21	Mon 11/1/21
176	Installation	6 days	Tue 11/2/21	Tue 11/9/21
177	**Plug Load Controls**	**2 days**	**Mon 9/13/21**	**Wed 9/15/21**
178	Lead Time	0 days	Mon 9/13/21	Mon 9/13/21
179	Installation	2 days	Tue 9/14/21	Wed 9/15/21
180	**Refrigeration Controls**	**1 day**	**Wed 7/6/22**	**Thu 7/7/22**
181	Lead Time	0 days	Wed 7/6/22	Wed 7/6/22
182	Installation	1 day	Thu 7/7/22	Thu 7/7/22
183	**BAS Upgrade**	**30 days**	**Wed 7/6/22**	**Wed 8/17/22**
184	Lead Time	0 days	Wed 7/6/22	Wed 7/6/22
185	Installation	30 days	Thu 7/7/22	Wed 8/17/22
186	**Retro-Commissioning Study & HVAC Improvements**	**3 days**	**Thu 9/2/21**	**Tue 9/7/21**
187	Lead Time	0 days	Thu 9/2/21	Thu 9/2/21
188	Installation	3 days	Fri 9/3/21	Tue 9/7/21



Page 3 Fri 1/15/21

SECTION 8. SAMPLE ENERGY PERFORMANCE CONTRACT

A sample Energy Performance Contract has been provided electronically to the District for review.

Condensing Hot Water Boiler Plant (Direct Install)

ECM Summary

Steam boilers are used to provide heating, through the use of a hot water heat exchanger, to various areas throughout the building. In schools where the boilers are old and in a poor condition, the replacement of existing boilers with a similar output of new greater efficiency units will provide efficiency gains that will generate operating and fuel cost savings. The radiant and convective heat losses will also be reduced with the installation of new boilers which makes the entire hot water system more efficient. Where applicable, the steam boilers that are recommended for replacement will be replaced by condensing boilers with increased efficiencies (including thermal and combustion losses).

The replacement of the single boiler in these boiler plants with multiple new high-efficiency units will generate significant energy savings as well as provide redundancy to the heating system. Each new boiler will be slightly smaller than the existing single boiler but as a whole central plant will meet or exceed the heating capacity of the current boiler. The installation of the smaller boilers will increase the efficiency of the entire plant by operating more efficiently at low loads than the single boiler.

Facilities Recommended for this Measure

- Barack Elementary School

Scope of Work

Barack Obama Elementary School

Demolition and Removal Work

- Replace (2) each non-condensing boilers with (2) new high efficiency AERCO Benchmark Standard 3000 condensing boilers
- Demolition of (2) existing non-condensing boilers.
- Demolition of all asbestos-containing materials
- Demolition of existing feed water tank and pumps – cut up for removal, if necessary
- Disconnect, remove and properly dispose of hot water supply and return piping for boilers to nearest isolation valves or as required for new installation.
- Disconnect, remove and properly dispose of gas flue for boilers as required.
- Disconnect all electric, controls, gas piping, water lines, pressure reliefs and drains.
- Remove all demolished materials from premises and dispose of in accordance with local regulations.

New Installation Work:

Proposed are the following:

- Furnish & install (F&I) (2) each high-efficiency AERCO Benchmark Standard 3000 condensing boilers set on existing concrete pad.

Details of installation to include the following:

- F&I Qty. (2) new AERCO Benchmark Standard 3000 condensing hot water boilers
- F&I new pumps, piping, and insulation.

- F&I new hot water, supply and return piping from new boilers to existing main steam condensate lines.
- F&I new boiler drains, pressure reliefs piped to floor drains, water supply, blow down drains piped over to existing floor drains.
- F&I new 2" fiberglass insulation on all new and existing hot water supply and return piping "that has no insulation".
- F&I new gas line piping from existing gas line to new boilers with new shut off valves.
- F&I new CPVC combustion air intake and flue exhaust piping for each boiler.
- F&I proper pipe suspensions for all piping.
- F&I pipe identification and tags for all pipe, valves, etc.
- Re-connect existing line voltage electrical circuits to new boilers.
- Provide factory startup; assist during startup and testing of both new boilers.

Savings Methodology

In general, savings calculations for boiler replacement are calculated using the following methodology:

Boiler Replacement

E_E $= \sum_{i=1}^{8760}(Q_i \div \square_E)$

E_P $= \sum_{i=1}^{8760}(Q_i \div \square_P)$

E_S $= E_E - E_P$

C_S $= E_S \times FUR$

Where,

E_E = Annual energy (fuel) use of existing system

E_P = Annual energy use of proposed system

E_S = Annual energy savings

C_S = Annual cost savings

Q_i = Hourly heating demand, modeled as a linear fit of OA DBT (dry-bulb temperature), with a cut-off temperature above which there is no heating

$\square$ = Combustion efficiency of heating system based on field data, manufacturer's rating or snap-shot measurements

FUR = Fuel unit utility rate, determined from baseline utility rate analysis

Subscript "i" denotes the number of hours in a year. Subscripts "E" and "P" stand for Existing and Proposed system, respectively.

Maintenance

Follow manufacturers' recommendations for preventative maintenance.

Benefits

- Natural Gas savings
- Operational savings through new equipment and preventative maintenance plan

Unit Ventilator Refurbishment – Barack Obama Elementary School

ECM Summary

Energy Systems Group proposes to refurbish the existing standard efficiency motors with high efficiency EC motors in the unit ventilators throughout the District. The advantages of replacing existing permanent split capacity (PSC) motors with electronically commutated motors (ECM) is the increase in control ability of the motor. EC Motors may be programmed to vary speed and can reach efficiencies up to 80% above standard PSC motors.

Facilities Recommended for this Measure

- Barack Obama Elementary School

Scope of Work

Concept is to refurbish unit ventilators on throughout the building. Components to be replaced will include fan deck assembly (motor, fan wheels and shaft), replacement of existing pneumatic control valve with new 2-way DDC control valve as provided by controls contractor for mechanical contractor to install.

Demolition and Removal Work:

- Remove existing unit ventilator fan deck assemblies.
- The metal cabinet (shroud) of the existing Unit Ventilators will remain in place. Replacement components should fit within the allowed space of the existing metal cabinet.
- Components to remain consistent across all Unit Vent installations and interface with building control systems.
- Disconnect electrical, plumbing (hot water, etc.) and controls.
- Remove all demolished materials from premises and dispose of in accordance with local regulations.

New Installation Work:

- F&I high-efficiency EC motor-based fan deck assemblies (including motor / shaft and fan wheels inside unit ventilators.
- Install Only Qty. (37) new two-way DDC hot water heating valves ‘provided by controls contractor’ to connect existing hot water heating coil inside each unit ventilators.
- Install Only DDC actuators ‘provided by controls contractor’ for outside air damper on each unit ventilator.
- Clean and inspect outside air damper at each unit ventilator for proper mechanical movement and operation before installing new DDC actuator.
- Clean hot water coils, clean and service inside unit ventilators.
- Provide air test of each of the Unit Vent refurbishments.

Savings Methodology

Energy savings will result from reducing the amount of energy the fan motor will consume. In general, ESG uses the following approach to determine savings for this specific measure:

Savings Calculation Methodology		
Existing Motor Efficiency	=	Efficiency of existing motors based on technology and condition
Proposed Motor Efficiency	=	Proposed Efficiency of new motors
Energy Savings	=	Ventilation Savings (Proposed Efficiency – Existing Efficiency)

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Reduced energy consumption

Addition of Cooling - Asbury Park HS Gym

ECM Summary

The existing two rooftop units in place on top of the High School gym are both non-functioning and disconnected. Previously, they served to ventilate and heat the gymnasium and the locker room underneath. ESG proposed to replace the RTU which previously heated/ventilated the gymnasium and installed a new RTU with additional ability to cool the space as well. A second RTU would replace the other nonfunctioning RTU and would have served to cool the locker room.

Facilities Recommended for this Measure

- Asbury Park High School

Scope of Work

Asbury Park High School – Large Gym

Install (2) HE gas-electric rooftop units to replace the service of (2) heating-only RTUs. New RTU's shall be integrated with DDC controls, air side economizer, DCV/CO2, modulating gas-heat, and multi-stage compressors. The proposed rooftop units shall match the total cooling and heating) capacity of the existing equipment, will require a new roof curb (including structural supports), and will require that natural gas pipe is extended from the main service. Provide stand-alone RTU controls that can be interfaced with the proposed BMS by the control contractor. The installation will require that ducting is provided from the new rooftop equipment down through the building to the existing ducting.

Demolition and Removal Work

- Replace (1) existing Des Champs Model MZ4070 and (1) existing Reznor RPBL1200-8-S and install new high efficiency replacement units to set on existing roof steel with new custom manufacturers curb adapters.
- Disconnect electrical, gas piping, and controls.
- Reclaim refrigerant.
- Crane units off roof onto flatbed trailer for disposal.
- Remove all demolished materials from premises and dispose of in accordance with local regulations.

New Installation Work:

Proposed are the following:

- Furnish & install (F&I) (2) new, York packed gas heating/electric cooling rooftop units, matching total heating and cooling capacity of current units:
- York Model # ZYG12E or approved equal. (1) each to replace Des Champs Model MZ4070
- York Model # ZJ300S40 or approved equal. (1) each to replace Reznor RPB1200-8-S
- Units to include air side economizer with single enthalpy control.
- Units to include modulating gas heat and multi-stage compressors.
- Units to include return and supply smoke detectors.
- Units to include CO2 sensor/Demand Controlled Ventilation (DCV)
- Units to be integrated with DDC controls - stand-alone RTU controls that can be interfaced with the proposed BMS by the control contractor.
- Units will each require new roof curbs, including structural supports.
- Natural gas lines to be extended to new units as required from main service.

- Ducting to be provided from each new rooftop unit down through the building to the existing ductwork.
- Reconnect line voltage and any disconnected controls to the new motors.
- Provide air test and balance of each of the new RTU's only.

Savings Methodology

Savings Calculation Method		
Cooling Increase (kWh)	=	Unit-Size (Tons) x Cooling gradient (%) x (New Unit kW/Ton) x Bin Hours

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Improved occupant comfort

Addition of Cooling – Martin Luther King Jr. Middle School Gym

ECM Summary

Presently, the Martin Luther King Jr. Middle School Gym is served by two ceiling mounted heating and ventilation units. They employ hot water coils to heat and ventilate the space. ESG proposes removing these two units and installing (2) new rooftop units to heat, ventilate, and now cool the gym space.

Facilities Recommended for this Measure

- Martin Luther King Jr. Middle School

Scope of Work

Install (2) HE gas-electric rooftop units to replace the service of (2) heating-only H&V units. New RTUs shall be integrated with DDC controls, air side economizer, DCV/CO2, modulating gas-heat, and multi-stage compressors. The proposed rooftop units shall match the total cooling and heating) capacity of the existing equipment, will require a new roof curb (including structural supports), and will require that natural gas pipe is extended from the main service. Provide stand-alone RTU controls that can be interfaced with the proposed BMS by the control contractor. The installation will require that ducting is provided from the new rooftop equipment down through the building to the existing ducting.

Demolition and Removal Work

- Remove (2) existing ceiling mounted H&V units in the interior of the gym
- Disconnect electrical, hydronic piping, and controls.
- Remove all demolished materials from premises and dispose of in accordance with local regulations.

New Installation Work:

Proposed are the following:

- Furnish & install (F&I) (2) new, gas heating/electric cooling rooftop units, matching total heating and cooling capacity of current units:
- Units to include air side economizer with single enthalpy control.
- Units to include modulating gas heat and multi-stage compressors.
- Units to include return and supply smoke detectors.
- Units to include CO2 sensor/Demand Controlled Ventilation (DCV)
- Units to be integrated with DDC controls - stand-alone RTU controls that can be interfaced with the proposed BMS by the control contractor.
- Units will each require new roof curbs, including structural supports.
- Natural gas lines to be extended to new units as required from main service.
- Ducting to be provided from each new rooftop unit down through the building to the existing ductwork.
- Reconnect line voltage and any disconnected controls to the new motors.
- Provide air test and balance of each of the new RTU's only.

Savings Methodology

Savings Calculation Method		
Cooling Increase (kWh)	=	Unit-Size (Tons) x Cooling gradient (%) x (New Unit kW/Ton) x Bin Hours

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Improved occupant comfort

Addition of Cooling – Martin Luther King Jr. Middle School Cafeteria

ECM Summary

Presently, the Martin Luther King Jr. Middle School Cafeteria is heated using wall mounted HW radiators. There are several nonfunctioning TRANE Fan Coil Units (FCUs) in the adjacent hallway, above the ceiling. ESG proposes installing (1) new RTU which would serve to heat, ventilate, and cool the cafeteria.

Facilities Recommended for this Measure

- Martin Luther King Jr. Middle School

Scope of Work

Install (1) HE gas-electric rooftop units. New RTU shall be integrated with DDC controls, air side economizer, DCV/CO2, modulating gas-heat, and multi-stage compressors. The proposed rooftop unit swill require a new roof curb (including structural supports) and will require that natural gas pipe is extended from the main service. Provide stand-alone RTU controls that can be interfaced with the proposed BMS by the control contractor. The installation will require that ducting is provided from the new rooftop equipment down through the building to the existing ducting.

New Installation Work:

Proposed are the following:

- Furnish & install (F&I) (1) new, gas heating/electric cooling rooftop unit
- Units to include air side economizer with single enthalpy control.
- Units to include modulating gas heat and multi-stage compressors.
- Units to include return and supply smoke detectors.
- Units to include CO2 sensor/Demand Controlled Ventilation (DCV)
- Units to be integrated with DDC controls - stand-alone RTU controls that can be interfaced with the proposed BMS by the control contractor.
- Units will each require new roof curbs, including structural supports.
- Natural gas lines to be extended to new units as required from main service.
- Ducting to be provided from each new rooftop unit down through the building to the existing ductwork.
- Provide air test and balance of each of the new RTU's only.

Savings Methodology

Savings Calculation Method		
Cooling Increase (kWh)	=	Unit-Size (Tons) x Cooling gradient (%) x (New Unit kW/Ton) x Bin Hours

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Improved occupant comfort

Addition of Cooling - Asbury Park High School College Wing

ECM Summary

The College Wing of the High School is comprised of 4 classrooms. Three of the classrooms are located on one side of the building and are referred to as the shop classroom, the police classroom, and the nursing classroom. The fourth room is the band room across the hall. Presently, a UV in the band room provides heating, ventilation and cooling to the space with the cooling being accomplished via chilled water supply by the air cooled chiller. Of the three other classrooms, only the police classroom has cooling which is provided by an aged condensing unit located just outside of the exterior room. The other two classrooms do not have cooling.

ESG proposes installing a new HVAC system in each of the three non-band classrooms. They would have dedicated ceiling-mounted fan coil units and associated condensing units. These new units would have provided the heating, cooling, and ventilation for each classroom.

Facilities Recommended for this Measure

- Asbury Park High School

Scope of Work

Each classroom would have a new fan coil unit installed inside the space mounted to the ceiling. The FCU would have hot water heating provided by the existing HW loop and cooling provided by an associated condensing unit.

Demolition and Removal Work

- Remove existing exposed ductwork in each of the classrooms
- Safe-off existing AHUs above the ceilings of each office

New Installation Work:

Proposed are the following:

- Furnish and install (3) new FCUs (one in each classroom)
- Reroute existing HW loop to feed each
- Install (3) new condensing units exterior to the building on the ground of the service driveway
- Complete necessary roof and wall penetration to for outdoor air ducting of each FCU

Savings Methodology

Savings Calculation Method		
Cooling Increase (kWh)	=	Unit-Size (Tons) x Cooling gradient (%) x (New Unit kW/Ton) x Bin Hours

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Improved occupant comfort

Addition of Cooling – Barack Obama Elementary School – 3rd Floor

ECM Summary

Presently, the classrooms on the 3rd floor of the Barack Obama Elementary School have Unit Ventilators which serve to heat and ventilate those spaces. There is no cooling for these rooms. ESG proposes installing Variable Refrigerant Flow (VRF) cassette units in each of the classrooms which would have provided cooling as well as the primary heating source for the classrooms. While the UVs would remain in place, they only serve to ventilate the space and temper the outdoor air being introduced.

Facilities Recommended for this Measure

- Barack Obama Elementary School

Scope of Work

Each classroom on the 3rd floor of the Barack Obama Elementary School would have had a VRF cassette installed on an interior wall. There would have been two separate VRF system, each serving approximately half of the building. The associated condensing units would have been installed on the roof on each side of the building.

New Installation Work:

Proposed are the following:

- Furnish and install (14) new VRF cassettes
- Furnish and install (2) new VRF condensing units

Savings Methodology

Savings Calculation Method		
Cooling Increase (kWh)	=	Unit-Size (Tons) x Cooling gradient (%) x (New Unit kW/Ton) x Bin Hours

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Improved occupant comfort

Install VFD's and Premium Motor Upgrades for HVAC

ECM Summary

This measure will replace constant volume pumping systems with a variable flow system through the installation of Variable Frequency Drive(s) (VFD) on electric motor(s) for hot water pumps, where prudent. Constant volume systems are equipped with a differential pressure sensor and bypass valve that diverts water not being used at the terminal units back to the pump inlet. While this enables the system to properly control flow at the units, the central pumps continually operate at full speed/flow. Varying the speed of a motor to match the actual load at the terminal units reduces the pumps electrical motor power (kW), which results in significant electrical energy savings.

Any single speed or two speed inverter-duty pump motor (typically greater than 5 to 10 HP) that has fluctuating loads is a good candidate for a variable speed drive. Heating hot water pumps are ideal candidates for VFD control due to the varying loads on building heating demand and motors which are typically larger than 10 HP.

Facilities Recommended for this Measure

- Dr. Martin Luther King Middle School
- Thurgood Marshall Elementary School
- Bradley Elementary School

Scope of Work by School

Dr. Martin Luther King Middle School

Install VFD in-line with the existing heating hot water pump motors. The VFD shall be capable of feeding two pumps (lead-lag, equal run-time) and be equipped with an (electrical) by-pass. Provide differential pressure sensor and control wiring as required for a stand-alone pump/VFD operation. VFD will be interfaced into the BMS by the control contractor.

Demolition and Removal Work

- Replace (2) each 7.5 HP standard-duty AC motor on HHW pumps with (2) each premium-efficiency, inverter-duty, 7.5 HP AC motor with VFD system (standalone).
- Shut off main electrical power to the unit to be replaced.
- Disconnect electrical and controls.
- Disconnect and remove existing motor.
- Remove mounting and drive components as necessary.
- Remove all demolished materials from premises and dispose of in accordance with local regulations.

New Installation Work:

Proposed are the following:

- Furnish & install (F&I) (2) each premium-efficiency, inverter-duty 7.5-HP motors in place of existing motors. Motors are to be specified to match process, electrical and controls requirements.
- Inspect the mounting area and install the replacement motor.
- F&I all motor mounting adapters required for new motors.

- F&I all power transmission components required to adapt motors to pumps.
- F&I (1) ABB Variable Frequency Drive (VFD) systems to allow for independent operation of each pump in a lead-lag (equal run-time) setup.
    - VFD system shall include a bypass to allow the motor to operate at full speed "in-hand" in the event of a VFD failure.
    - VFD system shall be supplied complete with an open protocol communications card for integration with existing or newly installed Energy Management System (EMS).
    - VFD system will be controlled by the EMS to the maintain hot water heating loop differential pressure set point.
    - As required, 3-way valves at terminal units will be converted to 2-way valves in order to ensure proper operation of the system.
- F&I differential pressure transducer in pump output (supply and return) line and connect to VFD system
- F&I automatic isolation valves at the supply of each boiler to isolate flow through boilers when not required to meet the building heat load.
- Reuse existing concrete pad, electrical and other infrastructure.
- Re-route all line voltage as necessary to install VFDs near pumps.
- Reconnect line voltage and any disconnected controls to the new motors.
- Inspect operation, proper rotation, and perform necessary electrical tests
- Provide factory startup of each of the VFDs.

Bradley Elementary School

Demolition and Removal Work

- Shut off main electrical power to the unit to be replaced.
- Disconnect electrical and controls.
- Remove all demolished materials from premises and dispose of in accordance with local regulations.

New Installation Work:

Proposed are the following:

- F&I all power transmission components required to adapt motors to pumps.
- F&I (1) ABB Variable Frequency Drive (VFD) systems to allow for independent operation of each pump in a lead-lag (equal run-time) setup.
    - VFD system shall include a bypass to allow the motor to operate at full speed "in-hand" in the event of a VFD failure.
    - VFD system shall be supplied complete with an open protocol communications card for integration with existing or newly installed Energy Management System (EMS).
    - VFD system will be controlled by the EMS to the maintain hot water heating loop differential pressure set point.

  - As required, 3-way valves at terminal units will be converted to 2-way valves in order to ensure proper operation of the system.
- F&I differential pressure transducer in pump output (supply and return) line and connect to VFD system
- F&I automatic isolation valves at the supply of each boiler to isolate flow through boilers when not required to meet the building heat load.
- Reuse existing concrete pad, electrical and other infrastructure.
- Re-route all line voltage as necessary to install VFDs near pumps.
- Reconnect line voltage and any disconnected controls to the new motors.
- Inspect operation, proper rotation, and perform necessary electrical tests
- Provide factory startup of each of the VFDs.

Thurgood Marshall Elementary School

<u>Demolition and Removal Work</u>

- Replace (1) each 7.5 HP and (1) each 10 HP standard-duty AC motor on HHW pumps with (2) each premium-efficiency, inverter-duty, 7.5 HP AC motor with VFD system (standalone).
- Shut off main electrical power to the unit to be replaced.
- Disconnect electrical and controls.
- Disconnect and remove existing motor.
- Remove mounting and drive components as necessary.
- Remove all demolished materials from premises and dispose of in accordance with local regulations.

<u>New Installation Work:</u>

Proposed are the following:

- Furnish & install (F&I) (2) each premium-efficiency, inverter-duty 7.5-HP motors in place of existing motors. Motors are to be specified to match process, electrical and controls requirements.
- Inspect the mounting area and install the replacement motor.
- F&I all motor mounting adapters required for new motors.
- F&I all power transmission components required to adapt motors to pumps.
- F&I (1) ABB Variable Frequency Drive (VFD) systems to allow for independent operation of each pump in a lead-lag (equal run-time) setup.
  - VFD system shall include a bypass to allow the motor to operate at full speed “in-hand” in the event of a VFD failure.
  - VFD system shall be supplied complete with an open protocol communications card for integration with existing or newly installed Energy Management System (EMS).
  - VFD system will be controlled by the EMS to the maintain hot water heating loop differential pressure set point.

Savings Methodology

Motor (kW) =	(Motor Horsepower x 0.746 (kW/HP) x Load Factor) = or = (Motor Amperage x Volts x 1.732 x Power Factor) / 1000
Speed Ratio Correction Factor =	((New RPM)/(Existing RPM)) ^ 3
Existing Energy Use (kWh)=	(Existing kW /Existing Efficiency) x Hours of Use
Existing Demand Use (kW) =	(Existing kW /Existing Efficiency) x Peak Load Months x Utilization factor
New Energy Use (kWh) =	(New kW /New Efficiency) x Hours of Use x Speed Ratio Correction Factor
New Demand Use (kW) =	(New kW /New Efficiency) x Peak Load Months x Utilization factor x Speed Ratio Correction Factor
Total Savings (kWh, kW) =	(kWh existing - kWh new) x $/kWh + (kW existing - kW new) x $/kW

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Minimizes pump unit energy efficiency
- Lower operating cost

Fuel Use Economizers

ECM Summary

A heating system must be able to provide acceptable comfort at the lowest anticipated outdoor temperature. Most commercial/industrial boilers have a heating capacity 1.5 to 2 times larger than needed to maintain space temperature on extreme days. Due to this oversizing of the boiler, the burner will cycle on and off to prevent overheating of the system water during any call for heat.

Intellidyne Heating System Economizers increase system efficiency, thus, the heating system uses less fuel to generate the same amount of heat. This is done by dynamically changing the aquastat's effective dead-band based on the measured heating load. This causes the average water temperature to be varied (depending on the measured load) and is accomplished by extending the burner's off-time. Extending the off-time also results in longer, more efficient burns and a reduction in burner cycling. Just as computer control has increased the gas mileage of automobiles, Intellidyne Heating System Economizers improve the fuel utilization of heating systems by supplementing the antiquated on/off control action of the aquastat with the analysis and control capabilities of a computer.

Facilities Recommended for this Measure

- Asbury Park High School
- Bradley Elementary School
- Thurgood Marshall Elementary School

Scope of Work

Asbury Park High School

New Installation Work:
Proposed are the following:

- Furnish & install (F&I) (4) each Intellidyne IntelliCon Controls at the boiler burners (existing only)
- Provide connection to existing, or newly installed, building Energy Management System (EMS)
- Provide factory commissioning of system (start up and testing).

Dr. Martin Luther King Middle School

New Installation Work:
Proposed are the following:

- Furnish & install (F&I) (1) each Intellidyne IntelliCon Controls at each of the (2) boiler burners (existing only)
- Provide connection to existing, or newly installed, building Energy Management System (EMS)
- Provide factory commissioning of system (start up and testing).

Bradley Elementary School

New Installation Work:
Proposed are the following:

- Furnish & install (F&I) (1) each Intellidyne IntelliCon Controls at each of the (2) boiler burners (existing only)
- Provide connection to existing, or newly installed, building Energy Management System (EMS)
- Provide factory commissioning of system (start up and testing).

Barack Obama Elementary School

New Installation Work:
Proposed are the following:

- Furnish & install (F&I) (1) each Intellidyne IntelliCon Controls at each of the (2) boiler burners (existing or new burners)
- Provide connection to existing, or newly installed, building Energy Management System (EMS)
- Provide factory commissioning of system (start up and testing).

Savings Methodology

Energy savings will result from reducing the compressor cycling. In general, ESG uses the following approach to determine savings for this specific measure:

Savings Calculation Method		
Total Existing Boiler Natural Gas Usage (Therms)	=	Therms
Savings (% of Total)	=	13%*
Factor of Safety	=	50%
Total Natural Gas Savings (Therms)	=	(Existing Usage)*(Savings %)*(Factor of Safety)

The savings estimate (%) matches the value stipulated by the New Jersey Board of Public Utilities New Jersey Clean Energy Program Protocols to Measure Resource Savings. ESG has also applied a 50% factor of safety to lower the estimated savings.

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Natural Gas saving

Direct Install Program Fuel Use Economizers

ECM Summary

A heating system must be able to provide acceptable comfort at the lowest anticipated outdoor temperature. Most commercial/industrial boilers have a heating capacity 1.5 to 2 times larger than needed to maintain space temperature on extreme days. Due to this oversizing of the boiler, the burner will cycle on and off to prevent overheating of the system water during any call for heat.

Intellidyne Heating System Economizers increase system efficiency, thus, the heating system uses less fuel to generate the same amount of heat. This is done by dynamically changing the aquastat's effective dead-band based on the measured heating load. This causes the average water temperature to be varied (depending on the measured load) and is accomplished by extending the burner's off-time. Extending the off-time also results in longer, more efficient burns and a reduction in burner cycling. Just as computer control has increased the gas mileage of automobiles, Intellidyne Heating System Economizers improve the fuel utilization of heating systems by supplementing the antiquated on/off control action of the aquastat with the analysis and control capabilities of a computer.

Facilities Recommended for this Measure

- Barack Obama Elementary School
- Dr. Martin Luther King Middle School

Scope of Work

School	Measure Description / Location	Quantity
MLK ES	Dual Enthalpy Economizers / rtu's	3
Barack Obama	Electronic Fuel-Use Economizers (for AC) / 7.5 ton ac	1
MLK ES	Electronic Fuel-Use Economizers (for AC) / rtu's	3

Savings Methodology

Energy savings will result from reducing the compressor cycling. In general, ESG uses the following approach to determine savings for this specific measure:

Savings Calculation Method		
Total Existing Boiler Natural Gas Usage (Therms)	=	Therms
Savings (% of Total)	=	13%*
Factor of Safety	=	50%
Total Natural Gas Savings (Therms)	=	(Existing Usage)*(Savings %)*(Factor of Safety)

The savings estimate (%) matches the value stipulated by the New Jersey Board of Public Utilities New Jersey Clean Energy Program Protocols to Measure Resource Savings. ESG has also applied a 50% factor of safety to lower the estimated savings.

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Natural Gas saving

Direct Install Program Low-flow Domestic Hot Water Devices

ECM Summary

Bathroom and kitchen fixtures offer good water saving opportunities because many of these fixtures can be retrofit to reduce the amount of water consumed per flush (toilets and urinals) or per minute of use (sinks and showers). Reducing sink water usage also saves the thermal energy used to make hot water.

Facilities Recommended for this Measure

- Barack Obama Elementary School
- Dorothy McNish Parent Center
- Dr. Martin Luther King Jr Middle School
- Buildings & Grounds
- Information Technology Center

Scope of Work

Sink Faucets –

- Existing high flow faucets on 98 sinks will be retrofit to 1.0 gpm:
- For those faucets from which existing aerators cannot be removed without damaging the faucet, a replacement aerator will not be installed. The replacement aerator will be turned over to Owner with the project's shelf stock.
- Where possible, tamper resistant aerator will be installed. For faucets that cannot accept a tamper resistant aerator, a regular aerator will be installed.

Proposed Aerator Replacements by School			
Building	Lavatory Fixtures	Kitchen Fixtures	Toilet & Shower Fixtures
Barack Obama Elementary School	25	2	0
Buildings & Grounds	1	0	0
Dorothy McNish Parent Center	2	1	0
Information Technology Center	4	0	0
Dr. Martin Luther King Jr Middle School	15	2	0

Savings Methodology

Thermal energy savings for sink usage is based on the following assumptions: the ratio of hot-to-cold water use, average hot and cold-water temperatures, and the domestic hot water heater efficiency.

Savings Calculation Method		
Frequency of Use	=	Number of users x % year-round occupancy x fixture uses/day/person
Water Savings (gal/yr)	=	Frequency of Use x (Baseline – Estimated Flow Rate) (gpm or gpf per fixture) x days/year x % high-flow fixtures
Sink/Shower Energy Savings (MMBtu/yr)	=	Water Savings (gal/yr) x (Tmixed -Tcold) (°F) x (1 Btu/lb °F X 8.34 (lb/gal) x 1 MMBtu/1,000,000 Btu
Sink/Shower Energy Savings (kWh/yr)	=	= Energy Savings (MMBtu/yr) x 293.1 kWh/1 MMBtu
Cost Savings ($/yr)	=	[Water Savings] (kgal/yr) x [water rate + sewer rate] ($/kgal) + [(Sink/Shower Energy Savings (MMbtu/yr)] x 1/boiler efficiency (%) x Thermal Rate ($/MMbtu)] + [(Sink/Shower Energy Savings (kWh/yr)] x 1/boiler efficiency (%) x Electric Rate ($/kWh)]

Maintenance

Periodically the equipment should be checked to ensure proper operation.

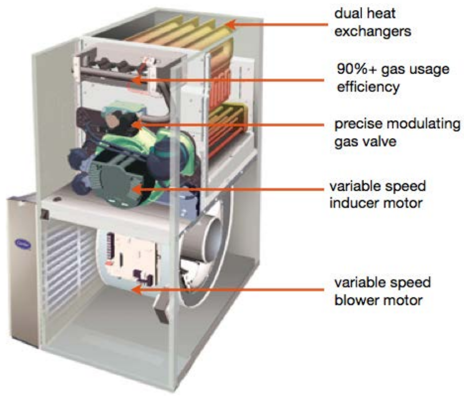
Benefits

- Incentives available under NJ Direct Install Program
- Reducing water will result in natural gas (heated hot water) savings
- Decreased water usage

Install High Efficiency Furnaces

ECM Summary

We recommend replacing existing standard efficiency furnaces with condensing furnaces. Improved combustion technology and heat exchanger design optimize heat recovery from the combustion gases which can significantly improve furnace efficiency. The proposed systems will reduce heating costs compared to the existing equipment and will include DDC controls that can be easily integrated into the proposed Building Management System.



Facilities Recommended for this Measure

- Building & Grounds
- Dorothy McNish Parent Center

Scope of Work

Dorothy Parent McNish Center

Replace existing 80% AFUE up-flow furnace with high-efficiency, modulating, variable-speed up-flow 97% AFUE furnace.

Demolition and Removal Work

- Replace (2) existing gas furnace (York Model TG8S130D20MP11B) and install new high efficiency replacement unit to set in existing location.
- Disconnect electrical, gas piping, and controls.
- Remove unit for disposal.
- Remove all demolished materials from premises and dispose of in accordance with local regulations.

New Installation Work:

Proposed are the following:

- Furnish & install (F&I) (2) new, AirEase Model A97USMV110***S-01 furnace (97% AFUE), matching total heating output capacity of current unit.
- Units to include modulating gas heat, if applicable.
- F&I new return air base positioned for proper air flow.
- F&I manufacturer designated venting for unit

- Units to include return air smoke detector.
- Units to be integrated with DDC controls - stand-alone furnace controls that can be interfaced with the proposed BMS by the control contractor.
- Natural gas lines to be extended to new units as required from existing unit.
- Ducting to be provided as required to adapt to the existing ductwork.
- Reconnect line voltage and any disconnected controls to the new units.
- Provide air test and balance of each of the new furnace only.

Buildings and Grounds

Replace existing 80% AFUE up-flow furnace with high-efficiency, modulating, variable-speed up-flow 97% AFUE furnace.

Demolition and Removal Work

- Replace (1) existing gas furnace (Coleman Model 263B – 80,000 btu/hr input) and install new high efficiency replacement unit to set in existing location.
- Disconnect electrical, gas piping, and controls.
- Remove unit for disposal.
- Remove all demolished materials from premises and dispose of in accordance with local regulations.

New Installation Work:

Proposed are the following:

- Furnish & install (F&I) (1) new, AirEase Model A97USMV070B12S-01 furnace (97% AFUE), matching total heating output capacity of current unit. (unit also includes 3-tons nominal cooling capacity)
- Units to include modulating gas heat, if applicable.
- F&I new return air base positioned for proper air flow.
- F&I manufacturer designated venting for unit
- F&I condensate drain
- Units to include return air smoke detector.
- Units to be integrated with DDC controls - stand-alone furnace controls that can be interfaced with the proposed BMS by the control contractor.
- Natural gas lines to be extended to new units as required from existing unit.
- Ducting to be provided as required to adapt to the existing ductwork.

- Reconnect line voltage and any disconnected controls to the new units.
- Provide air test and balance of each of the new furnace only.

Savings Methodology

Savings Calculation Methodology		
Existing Furnace Efficiency	=	Existing Heat Production/ Existing Fuel Input
Proposed Furnace Efficiency	=	Proposed Heat Production/ Proposed Fuel Input
Energy Savings	=	Heating Production (Proposed Efficiency – Existing Efficiency)

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Natural gas savings

Replace RTUs with High Efficiency RTUs

ECM Summary

Rooftop units through the Asbury Park Board of Education vary based on age and condition. Replacing aged rooftop HVAC units will reduce the operating and maintenance costs of these systems. Both heating and cooling efficiencies of packaged rooftop equipment have significantly increased in the past 10 years. ESG has identified several older units that still utilize R22 refrigerant as the prime candidates for replacement.

Facilities Recommended for this Measure

- Dr. Martin Luther King Middle School
- Bradley Elementary School

Scope of Work

Dr. Martin Luther King Middle School

Install (2) HE gas-electric rooftop units to replace the service of (2) existing, gas-electric rooftop units. New RTU's shall be integrated with DDC controls, air side economizer, DCV/CO2, modulating gas-heat, and multi-stage compressors. The proposed rooftop units shall match the total cooling and heating) capacity of the existing equipment, will require a new roof curb (including structural supports), and will require that natural gas pipe is extended from the main service. Provide stand-alone RTU controls that can be interfaced with the proposed BMS by the control contractor. The installation will require that ducting is provided from the new rooftop equipment down through the building to the existing ducting.

Demolition and Removal Work

- Replace (2) existing 10-ton RTUs and install new high efficiency replacement units to set on existing roof steel with new custom manufacturers curb adapters.
- Disconnect electrical, gas piping, and controls.
- Reclaim refrigerant.
- Crane units off roof onto flatbed trailer for disposal.
- Remove all demolished materials from premises and dispose of in accordance with local regulations.

New Installation Work

- Furnish & install (F&I) (2) new, York packed gas heating/electric cooling rooftop units, matching total heating and cooling capacity of current units:
    - York Model # ZYG12E or approved equal. (2) each to replace (2) current RTUs
- Units to include air side economizer with single enthalpy control.
- Units to include modulating gas heat and multi-stage compressors.
- Units to include return and supply smoke detectors.

- Units to include CO2 sensor/Demand Controlled Ventilation (DCV)
- Units to be integrated with DDC controls - stand-alone RTU controls that can be interfaced with the proposed BMS by the control contractor.
- Units will each require new roof curbs, including structural supports.
- Natural gas lines to be extended to new units as required from main service.
- Ducting to be provided from each new rooftop unit down through the building to the existing ductwork.
- Reconnect line voltage and any disconnected controls to the new motors.
- Provide air test and balance of each of the new RTU's only.

Bradley Elementary School

Install (1) HE gas-electric rooftop units, (1) split system heat pump, and (5) mini-split heat pumps to replace the service of (7) existing roof top units. New RTU's shall be integrated with DDC controls, air side economizer, DCV/CO2, modulating gas-heat, and multi-stage compressors. The proposed rooftop units shall match the total cooling and heating) capacity of the existing equipment, will require a new roof curb (including structural supports), and will require that natural gas pipe is extended from the main service. Provide stand-alone RTU controls that can be interfaced with the proposed BMS by the control contractor. The installation will require that ducting is provided from the new rooftop equipment down through the building to the existing ducting.

Demolition and Removal Work

- Replace (1) existing gas/electric RTU and (5) split systems and install new high efficiency replacement units to set on existing roof steel with new custom manufacturers curb adapters.
- Disconnect electrical, gas piping, and controls.
- Reclaim refrigerant.
- Crane units off roof onto flatbed trailer for disposal.
- Remove all demolished materials from premises and dispose of in accordance with local regulations.

New Installation Work:

Proposed are the following:

- Furnish & install (F&I) (1) new, York packed gas heating/electric cooling rooftop units and (5) split system heat pumps, matching total heating and cooling capacity of current units:
    - York Model # ZJ240S40 or approved equal. (1) each to replace 20-Ton McQuay RPS020CSY unit
    - York 4-ton high-effeciency (12 EER or higher) split system approved equal. (1) each to replace 4-Ton Trane split system unit

- York 1.5-ton mini-split units or approved equal. (1) each to replace (3) 1.5-Ton York and (1) Sanyo mini-split units

- Units to include air side economizer with single enthalpy control, if applicable.
- Units to include modulating gas heat and multi-stage compressors, if applicable.
- Units to include return and supply smoke detectors, if applicable.
- Units to include CO2 sensor/Demand Controlled Ventilation (DCV), if applicable.
- Units to be integrated with DDC controls - stand-alone RTU controls that can be interfaced with the proposed BMS by the control contractor.
- Units will each require new roof curbs, including structural supports.
- Natural gas lines to be extended to new units as required from main service.
- Ducting to be provided from each new rooftop unit down through the building to the existing ductwork.
- Reconnect line voltage and any disconnected controls to the new motors.
- Provide air test and balance of each of the new RTU's only.

Savings Methodology

Savings Calculation Method		
Cooling Savings (kWh)	=	RTU-Size (Tons) x Cooling gradient (%) x (Existing RTU kW/Ton – New RTU kW/Ton) x Bin Hours
Heating Savings (Therm)	=	((RTU-Size (Btu/h)/Existing RTU Eff.) – (RTU-Size (Btu/h)/ New RTU Eff.)) x Heating gradient (%) x Bin Hours/100000

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electric and Natural Gas savings

Install High Efficiency Unit Heaters - Garages

ECM Summary

The School District desires to bring a three-phase electric service to the Building & Grounds Maintenance Shop so that they can utilize three-phase equipment (air compressors, etc.). The building has (2) 120/240V single phase services that will be combined into a single service. The existing main service panels will be back fed from the new electric service.

Facilities Recommended for this Measure

- Buildings and Grounds

Scope of Work

Replace existing 80% AFUE unit heaters in the garages area with high-efficiency, modulating, variable-speed 93% AFUE furnace.

Demolition and Removal Work

- Replace (2) existing gas unit heaters ((1) 145 KBH & (1) 207.5 KBH) and install new high efficiency replacement unit to set in existing location.
- Disconnect electrical, gas piping, and controls.
- Remove unit for disposal.
- Remove all demolished materials from premises and dispose of in accordance with local regulations.

New Installation Work:

Proposed are the following:

- Furnish & install (F&I) (2) new, Modine Effinity 93 unit heater (93% AFUE), or approved equivalent, matching total heating output capacity of current unit.
- Units to include modulating gas heat, if applicable.
- F&I new return air base positioned for proper air flow.
- F&I manufacturer designated venting for unit
- Units to include return air smoke detector.
- Units to be integrated with DDC controls - stand-alone furnace controls that can be interfaced with the proposed BMS by the control contractor.
- Natural gas lines to be extended to new units as required from existing unit.
- Ducting to be provided as required to adapt to the existing ductwork.
- Reconnect line voltage and any disconnected controls to the new units.
- Provide air test and balance of each of the new furnace only.

Savings Methodology

Savings Calculation Methodology		
Existing Furnace Efficiency	=	Existing Heat Production/ Existing Fuel Input
Proposed Furnace Efficiency	=	Proposed Heat Production/ Proposed Fuel Input
Energy Savings	=	Heating Production (Proposed Efficiency – Existing Efficiency)

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Natural Gas Savings

Replacement/Refurbishment of Unit Ventilators

ECM Summary

In the Martin Luther King Jr. Middle School, the existing unit ventilator which ventilate and heat the classrooms are old and in some cases, no working properly. ESG proposes either replaced or refurbished the units and brought them back into working order-

Facilities Recommended for this Measure

- Martin Luther King Jr. Elementary School

Scope of Work

- Refurbishment
  - Disassemble motor boards
  - Clean and paint unit
  - Install new motors
  - Install new Blower Wheels
- Replacement
  - New Unit Ventilator
  - Hot Water Heat Only 115 Volts
  - DDC ready
    - Transformer, Terminal Strip, and Damper Actuator
  - Spare filters

Savings Methodology

Savings Calculation Methodology		
Existing Motor Efficiency	=	Efficiency of existing motors based on technology and condition
Proposed Motor Efficiency	=	Proposed Efficiency of new motors
Energy Savings	=	Ventilation Savings (Proposed Efficiency – Existing Efficiency)

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Ventilation electrical savings

APPENDIX 2. ENERGY SAVINGS CALCULATIONS

Energy Savings

Energy savings were calculated using an Excel based bin calculation workbook developed by Energy Systems Group; all savings calculations and field measurements will be provided electronically.

Operational Savings

New LED Fixtures

Annual operational savings are calculated based on the reduced amount of material needed for replacement of the lighting system. This is calculated by comparing the existing lifetime of the T8, HID and halogen lamps to the new lifetime of LED lighting. The calculations are based on replacements of T8 fixtures every three years, T8 ballasts every 5 years, HID lamps every 5 years and halogen lamps being replaced every 2 years. The table below highlights the various lamp types and associated replacement timing as well as total cost with replacement. These savings do not include any costs for labor to replace the bulbs or additional material needed for replacement such as lifts, replacement fixtures, new sockets, etc.

Material Type	Lifetime	Cost/ Unit
Linear fluorescent (T8)	3 years	$5
Electronic Ballast	5 years	$25
HID Lamp	5 years	$25
HID Ballast	5 years	$75
Halogen, PARs, BRs	2 years	$10
Incandescent, CFLs, MRs	2 years	$2

This methodology is used to determine the annual savings through the replacement of all lamp types with new LED lamps and fixtures. The fixture warranty associated with each of these replacements is 10 years. Operational savings have been claimed for a total of 5 years per the BPU regulations.

Mechanical Upgrades (Boiler Replacement & Controls Upgrades)

The annual operating expenses for Asbury Park Board of Education was provided to Energy Systems Group in order to determine the amount of emergency repair maintenance conducted annually at the District. The installation of new equipment along with manufacturers' warranties will effectively eliminate the need for these emergency repair costs. The operational savings for these measures have been claimed for 2 years per the BPU regulations. A complete breakdown of the operational analysis for the District is included on the following pages.

Operational Savings Summary

Energy Systems Group has worked with the District to quantify the exact sources of savings by going through past invoices and expenses. The table below summarizes the cost savings estimated from invoices provided by the District; these invoices are summarized only by the applicable ECMs and any non-recurring charge. Any preventative maintenance or service contracts that will remain were not factored into this analysis. The complete list of invoices is provided electronically. The operational savings will not be escalated.

Operational Savings for Financial Model	
LED Lighting Upgrades & Occupancy Sensors – District Wide	**$29,821**
Reduction in replacement parts and maintenance expenses – District Wide	$33,161
Totals	**$62,982**

Appendix 3. Building Envelope Scope Drawings

ASBURY PARK SD, NJ

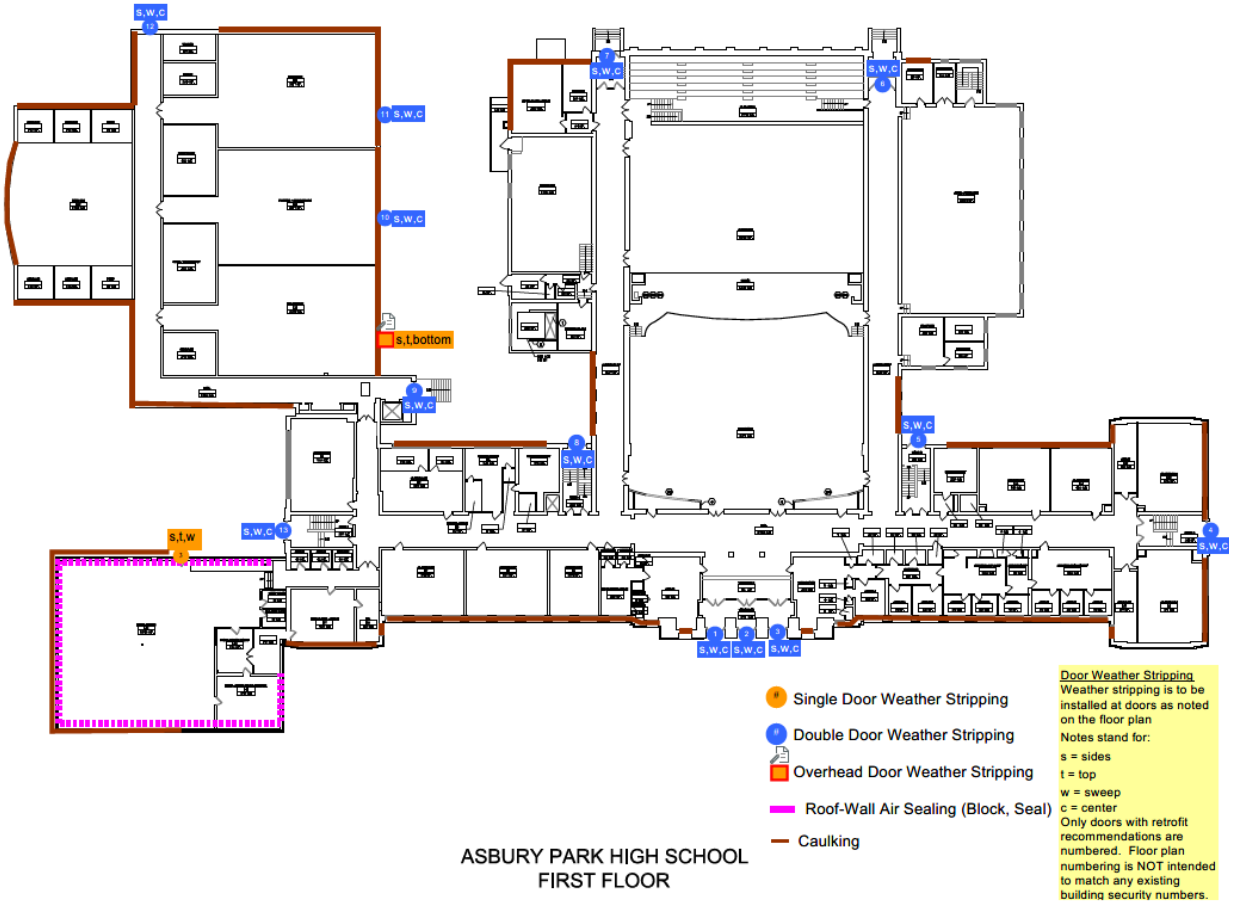
DETAILED WORK SUMMARY

Building	Report Group	Location	Units to be Installed
Asbury Park High School	Caulking		
	Interior Seal (LF)	See Floor Plan	11,567
	Door Weather Stripping		
	Single Door - Sides, Sweep (UT)	See Floor Plan	2
	Single Door - Sides, Top, Sweep (UT)	See Floor Plan	1
	Double Door - Sides, Sweep, Center (UT)	See Floor Plan	13
	Garage Door Weather Stripping		
	Overhead Door Weather Strip - Sides, Top, Bottom	See Floor Plan	1
	Roof-Wall Intersection Air Sealing		
	Seal (LF)	See Floor Plan	246
Asbury Park Middle School	Caulking		
	Interior Seal (LF)	See Floor Plan	13,974
	Interior Seal Oversized (LF)	See Floor Plan	88
	Door Weather Stripping		
	Single Door - Sides, Sweep (UT)	See Floor Plan	7
	Single Door - Sides, Top, Sweep (UT)	See Floor Plan	2
	Double Door - Sides, Sweep, Center (UT)	See Floor Plan	8
	Single Door - Sweep (UT)	See Floor Plan	2
	Double Door - Sweep, Center (UT)	See Floor Plan	1
	Garage Door Weather Stripping		
	Roll-Up Door Weather Strip - Sides, Top, Bottom	See Floor Plan	1
	Roof-Wall Intersection Air Sealing		
	Seal (LF)	See Floor Plan	341
	Block, Seal (LF)	See Floor Plan	766
	Seal Paint (LF)	See Floor Plan	290
Barack Obama Elementary Schoo	Buck Frame Air Sealing		
	Seal (LF)	See Floor Plan	1,287
	Caulking		
	Interior Seal (LF)	See Floor Plan	5,514
	Door Weather Stripping		
	Single Door - Sides, Sweep (UT)	See Floor Plan	1
	Single Door - Sides, Top, Sweep (UT)	See Floor Plan	3
	Double Door - Sides, Sweep, Center (UT)	See Floor Plan	4
	Double Door - Sides, Top, Sweep, Center (UT)	See Floor Plan	2
Bradley Elementary School	Caulking		
	Interior Seal (LF)	See Floor Plan	1,985
	Door Weather Stripping		
	Single Door - Sides, Top, Sweep (UT)	See Floor Plan	9
	Double Door - Sweep, Center (UT)	See Floor Plan	2
	Overhang Air Sealing		
	Seal (LF)	See Floor Plan	8
	Roof-Wall Intersection Air Sealing		
	Seal (LF)	See Floor Plan	14
	Seal Firestop (LF)	See Floor Plan	42
	Block, Seal (SF)	See Floor Plan	620
	Block, Seal Paint (LF)	See Floor Plan	290

ASBURY PARK SD, NJ
DETAILED WORK SUMMARY

Building	Report Group	Location	Units to be Installed
Buildings & Grounds	Attic Bypass Air Sealing		
	Attic Air Barrier Retrofit (SF)	See Floor Plan	3,760
	Install New Attic Hatch (UT)	See Floor Plan	4
	Install Soffit Baffles (UT)	See Floor Plan	254
	Attic Insulation		
	12" Open Blow Cellulose (SF)	See Floor Plan	3,760
	Door Weather Stripping		
	Single Door - Sides, Sweep (UT)	See Floor Plan	1
	Garage Door Weather Stripping		
	Overhead Door Weather Strip - Sides, Top, Bottom	See Floor Plan	1
	Overhead Door Weather Strip - Sides, Top	See Floor Plan	2
	Roof-Wall Intersection Air Sealing		
	Block, Seal (LF)	See Floor Plan	47
	Wall Air Sealing		
	Seal Exposed (LF)	See Floor Plan	11
Dorothy McNish	Door Weather Stripping		
	Single Door - Sides, Top, Sweep (UT)	See Floor Plan	5
	Roof-Wall Intersection Air Sealing		
	Block, Seal (LF)	See Floor Plan	185
	Block, Seal Paint (LF)	See Floor Plan	14
IT Center	Attic Bypass Air Sealing		
	Retrofit Existing Attic Hatch (UT)	See Floor Plan	1
	Attic Insulation		
	12" Open Blow Cellulose (SF)	See Floor Plan	2,200
	Door Weather Stripping		
	Single Door - Sides, Sweep (UT)	See Floor Plan	1
	Single Door - Sides, Top, Sweep (UT)	See Floor Plan	2
	Install Door Jamb Spacer (UT)	See Floor Plan	1
	Single Door - Sweep (UT)	See Floor Plan	2
	Wall Air Sealing		
	Block, Seal (LF)	See Floor Plan	75
Thurgood Marshall Elementary S	Door Weather Stripping		
	Single Door - Sides, Top, Sweep (UT)	See Floor Plan	5
	Single Door - Sweep (UT)	See Floor Plan	12
	Double Door - Sides, Sweep (UT)	See Floor Plan	8
	Overhang Air Sealing		
	Seal (LF)	See Floor Plan	9
	Block, Seal (LF)	See Floor Plan	44
	Roof-Wall Intersection Air Sealing		
	Seal (LF)	See Floor Plan	483
	Block, Seal (LF)	See Floor Plan	385
	Block, Seal Paint (LF)	See Floor Plan	25

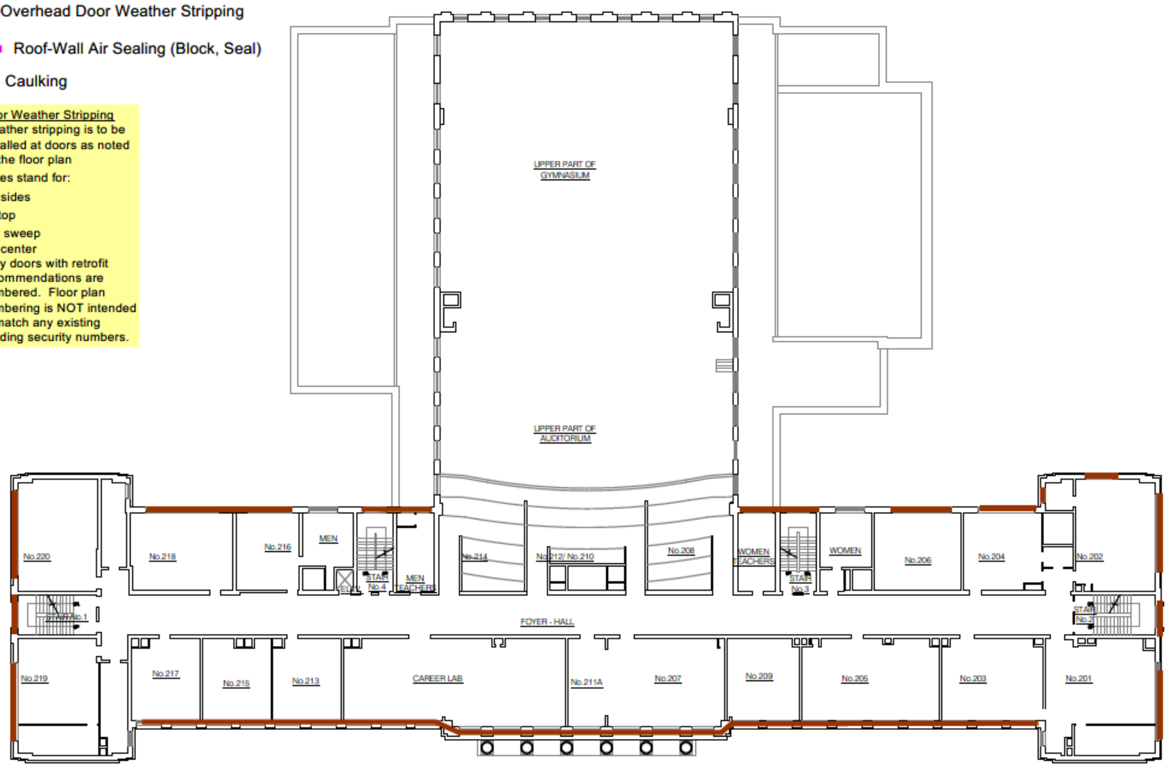
ASBURY PARK HIGH SCHOOL



ASBURY PARK HIGH SCHOOL
FIRST FLOOR

- Single Door Weather Stripping
- Double Door Weather Stripping
- Overhead Door Weather Stripping
- Roof-Wall Air Sealing (Block, Seal)
- Caulking

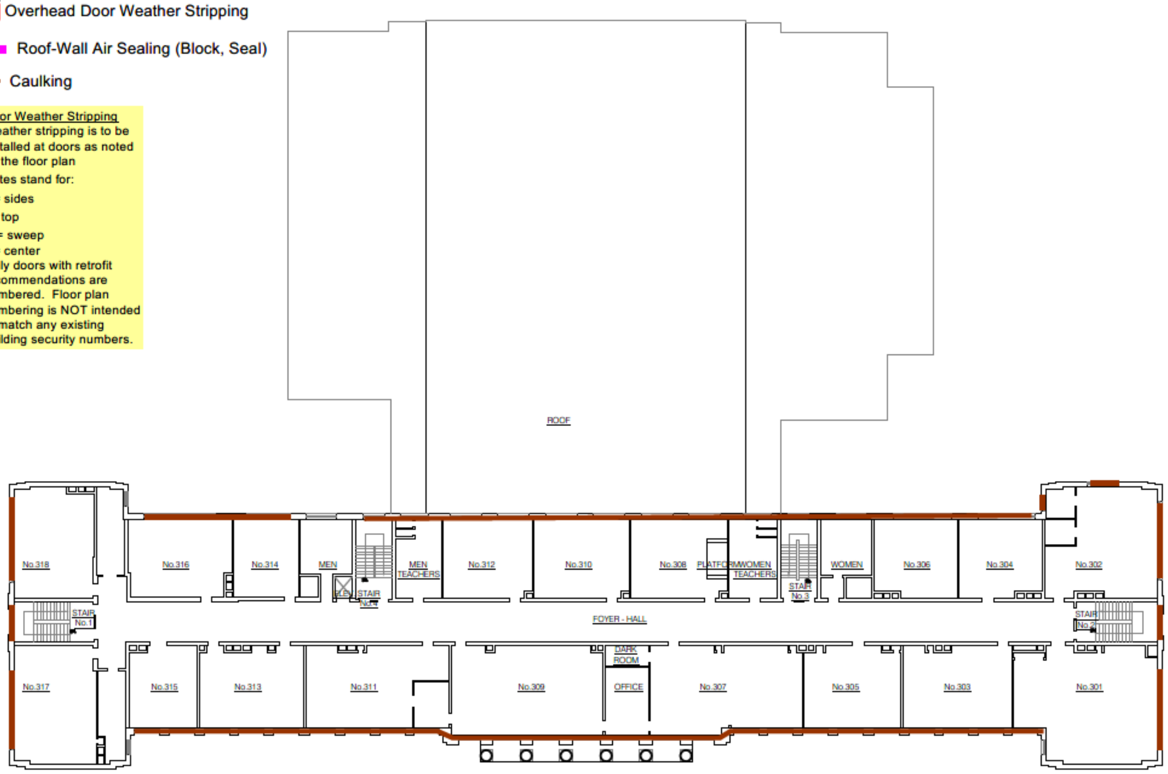
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.



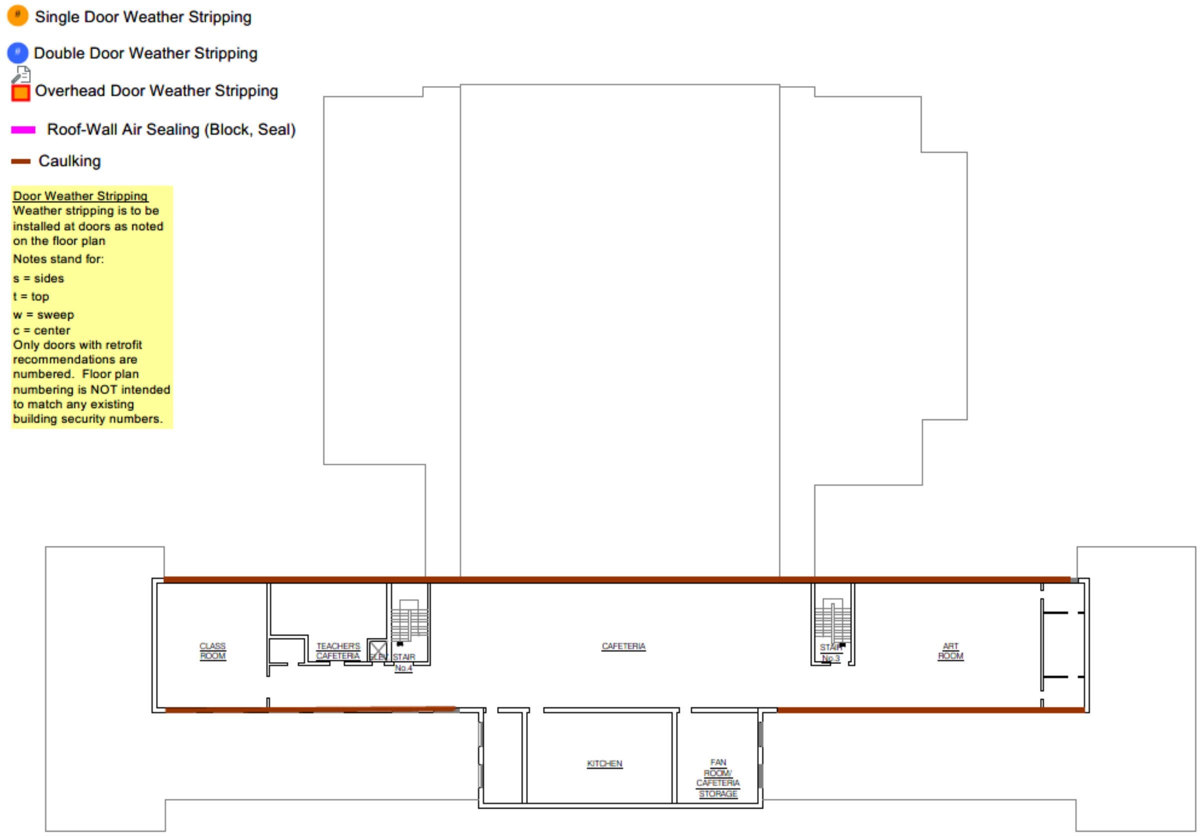
ASBURY PARK HIGH SCHOOL
SECOND FLOOR

- Single Door Weather Stripping
- Double Door Weather Stripping
- Overhead Door Weather Stripping
- Roof-Wall Air Sealing (Block, Seal)
- Caulking

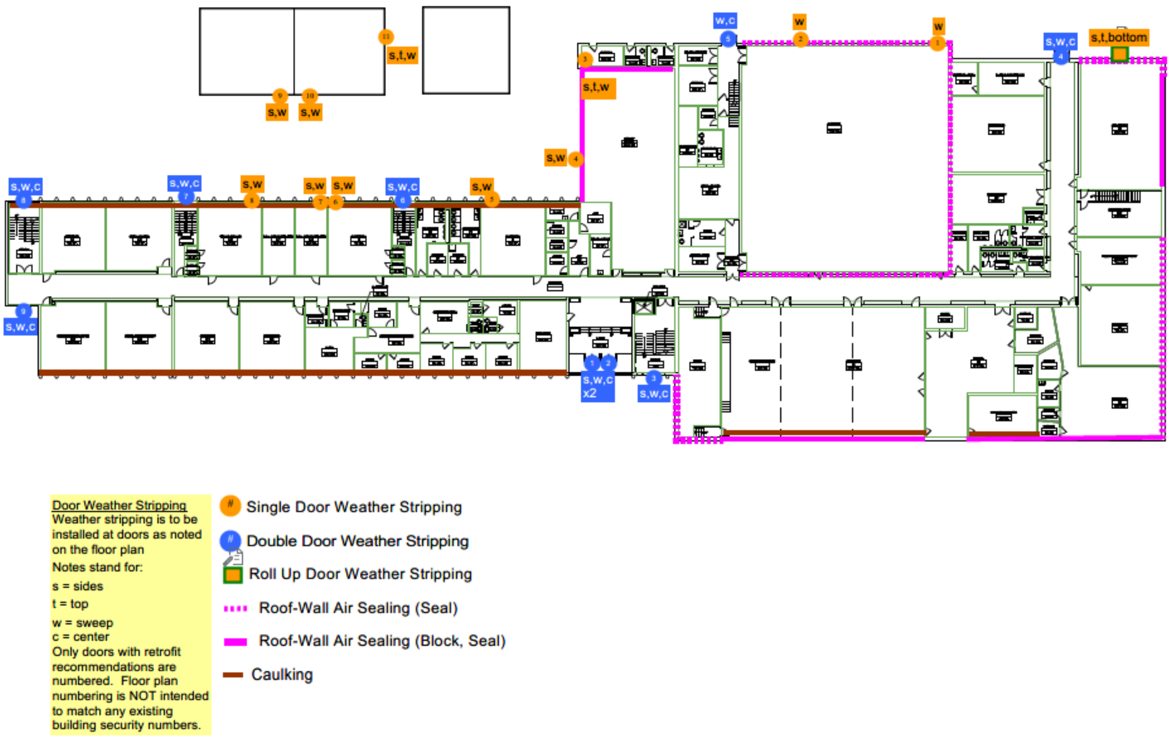
<u>Door Weather Stripping</u>
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.



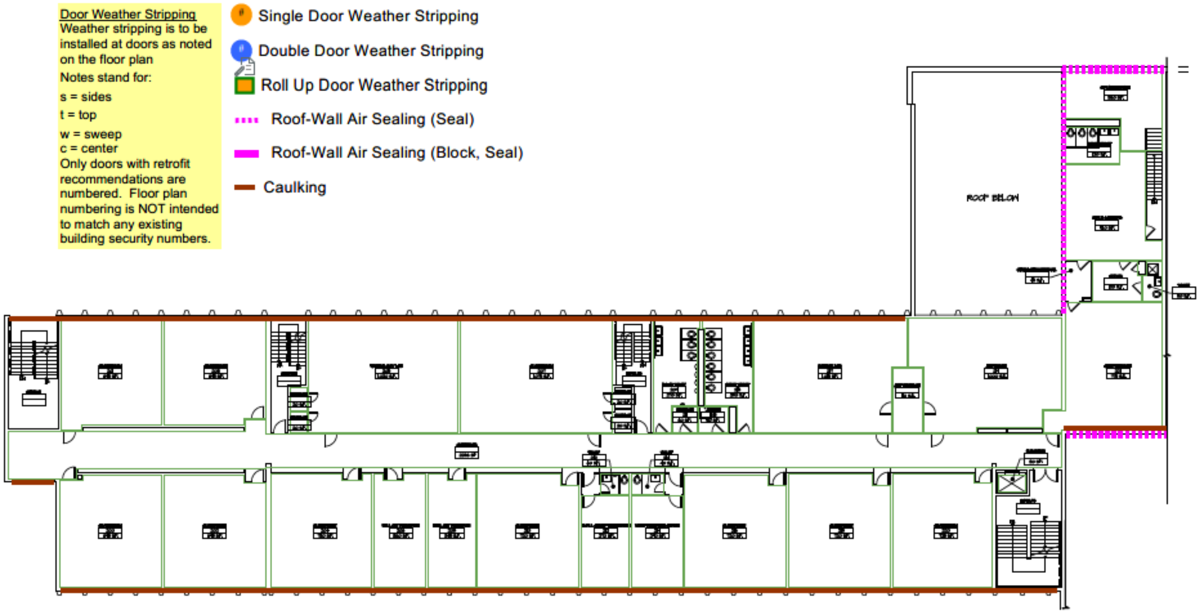
ASBURY PARK HIGH SCHOOL
THIRD FLOOR



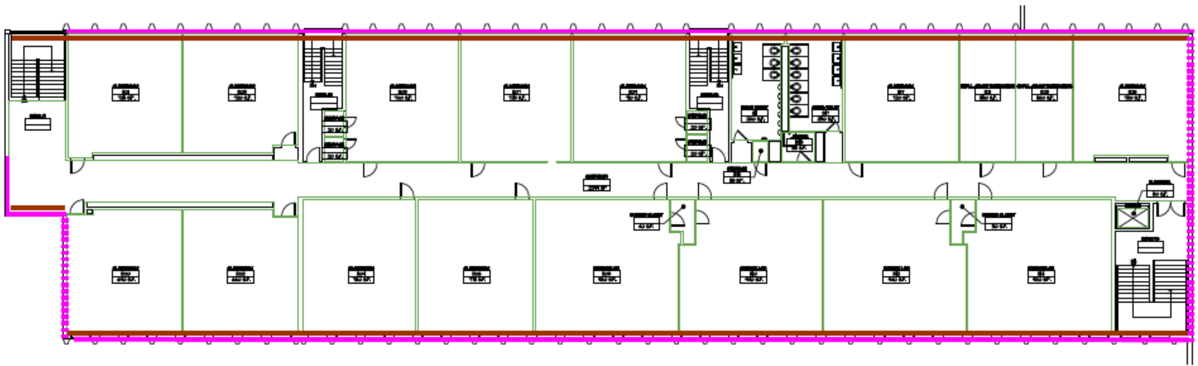
ASBURY PARK HIGH SCHOOL
FOURTH FLOOR



ASBURY PARK MIDDLE SCHOOL
FIRST FLOOR



ASBURY PARK MIDDLE SCHOOL
SECOND FLOOR



Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.

- Single Door Weather Stripping
- Double Door Weather Stripping
- Roll Up Door Weather Stripping
- Roof-Wall Air Sealing (Seal)
- Roof-Wall Air Sealing (Block, Seal)
- Caulking

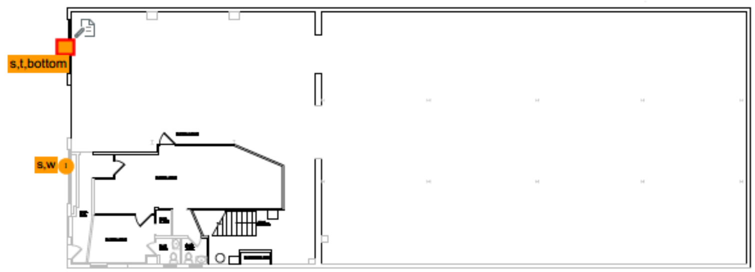
ASBURY PARK MIDDLE SCHOOL
THIRD FLOOR

Buildings & Grounds

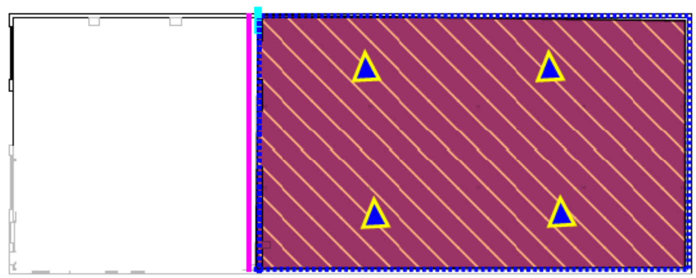
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.

- Single Door Weather Stripping
- Overhead Door Weather Stripping
- Air Barrier Retrofit + 12" Open Blow Cellulose
- Roof-Wall Air Sealing (Block, Seal)
- Wall Air Sealing/ Insulation (Seal)
- Install New Attic Hatch
- Attic Baffles

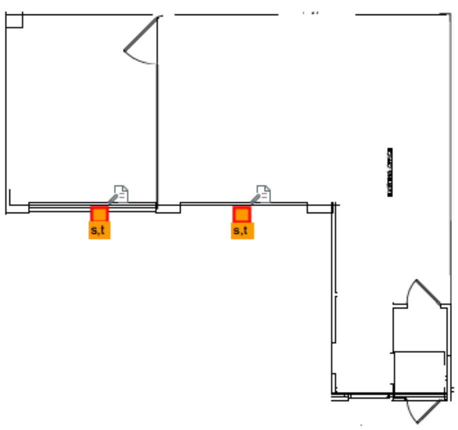
BOE 1st Floor

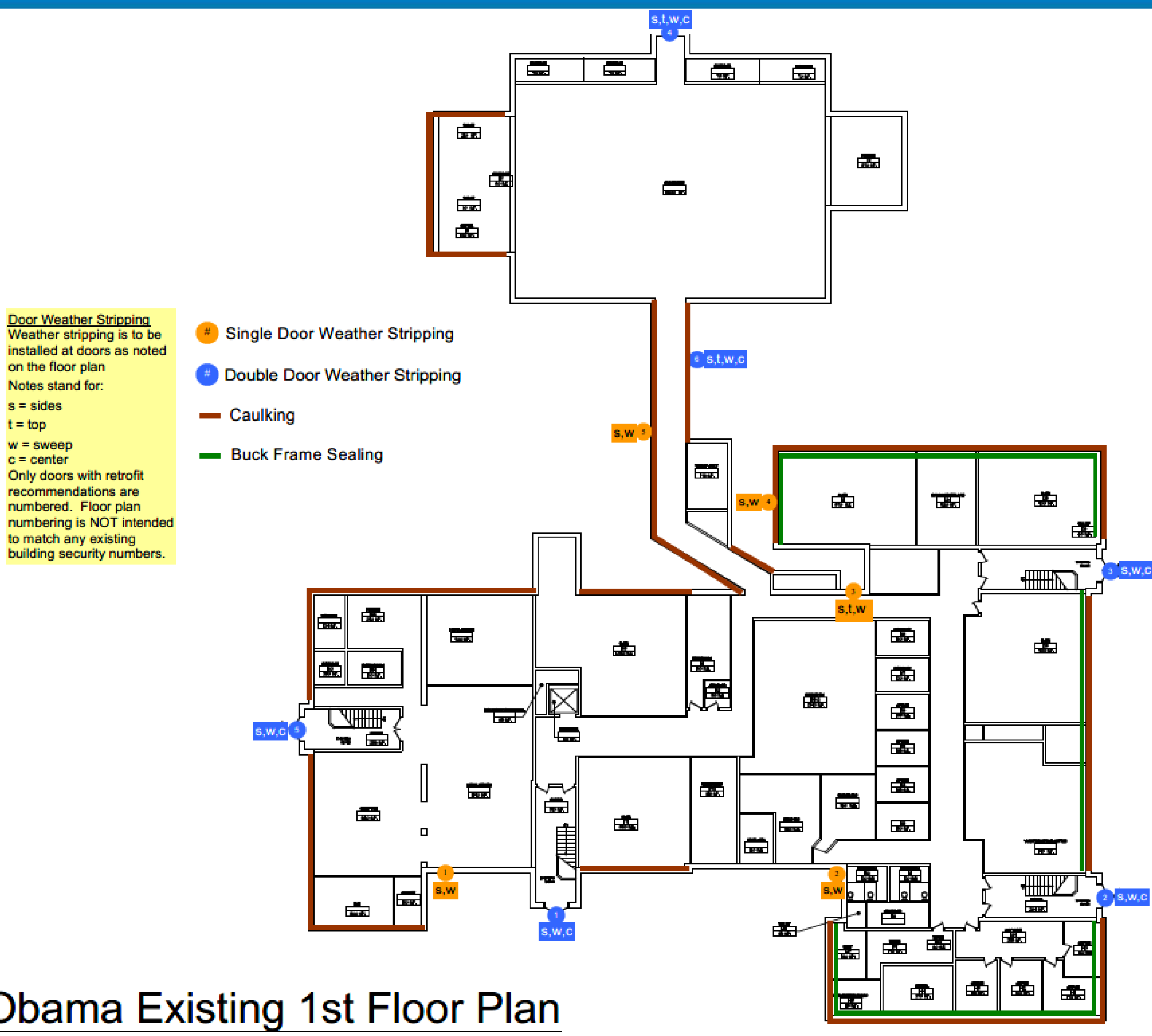


BOE Attic

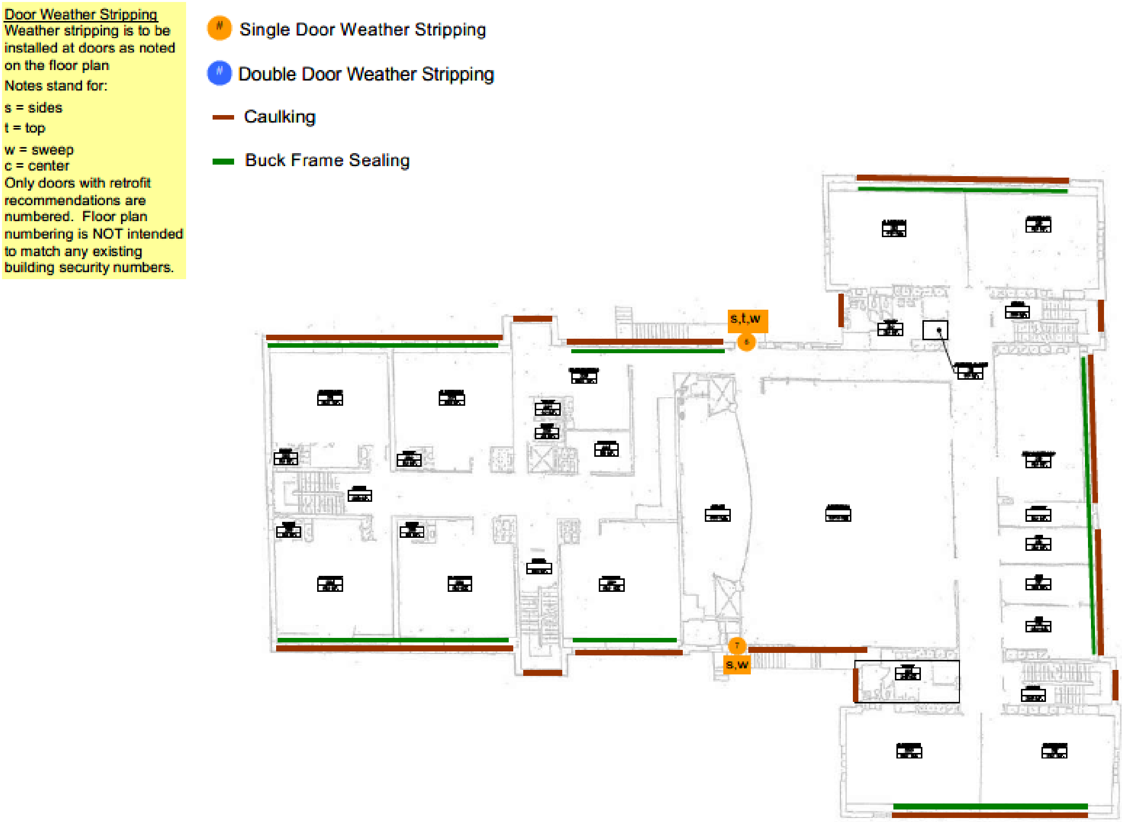


Grounds

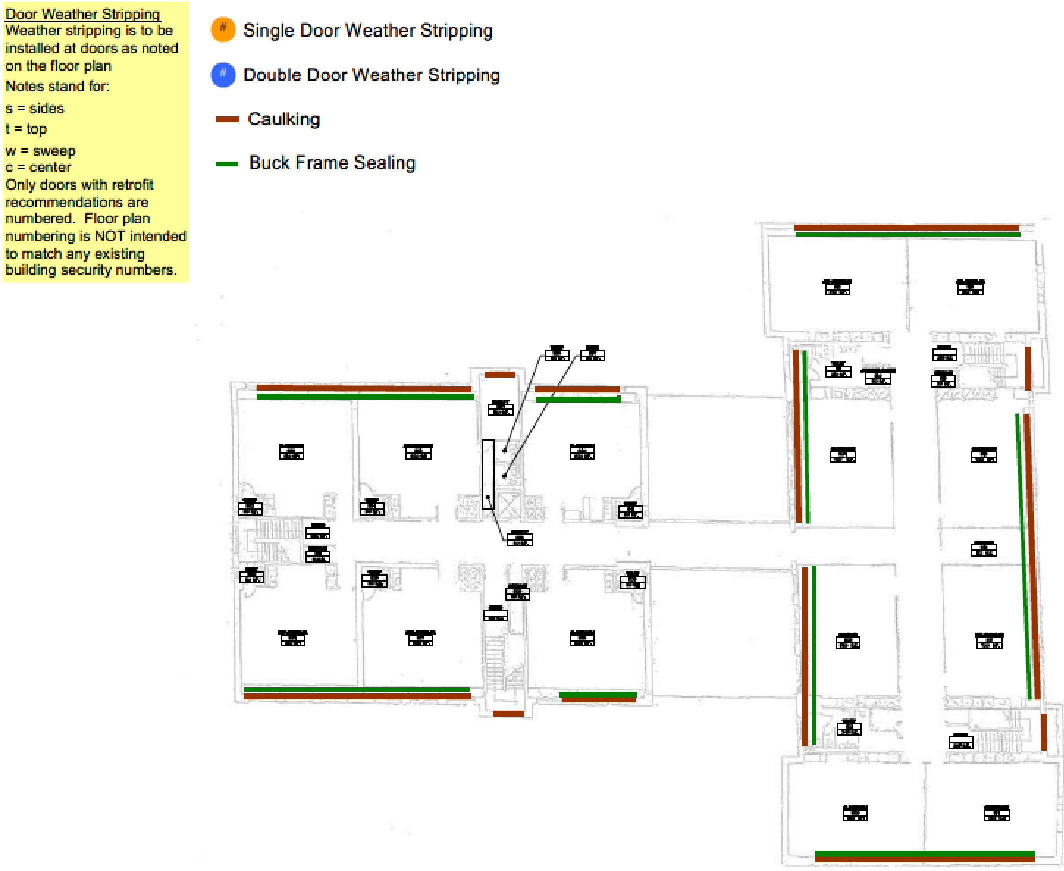




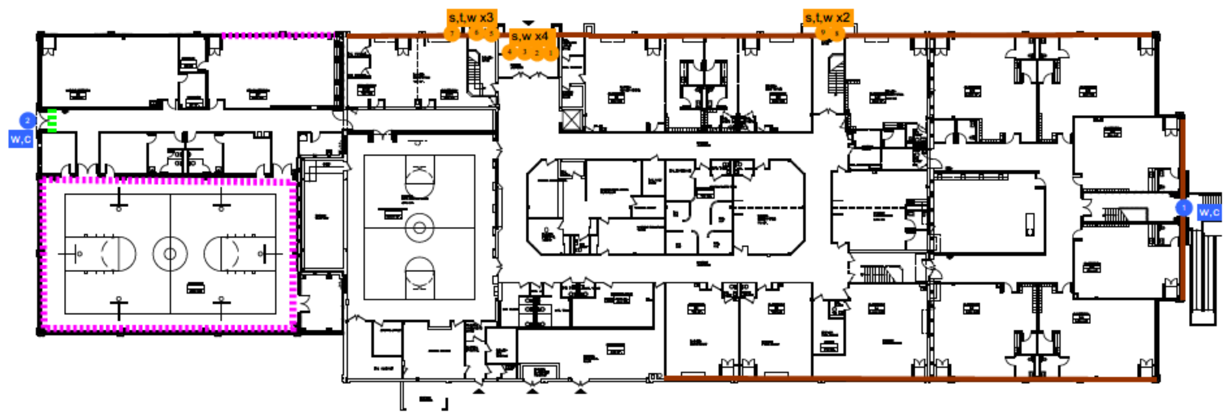
Obama Existing 1st Floor Plan



Obama Existing 2nd Floor Plan



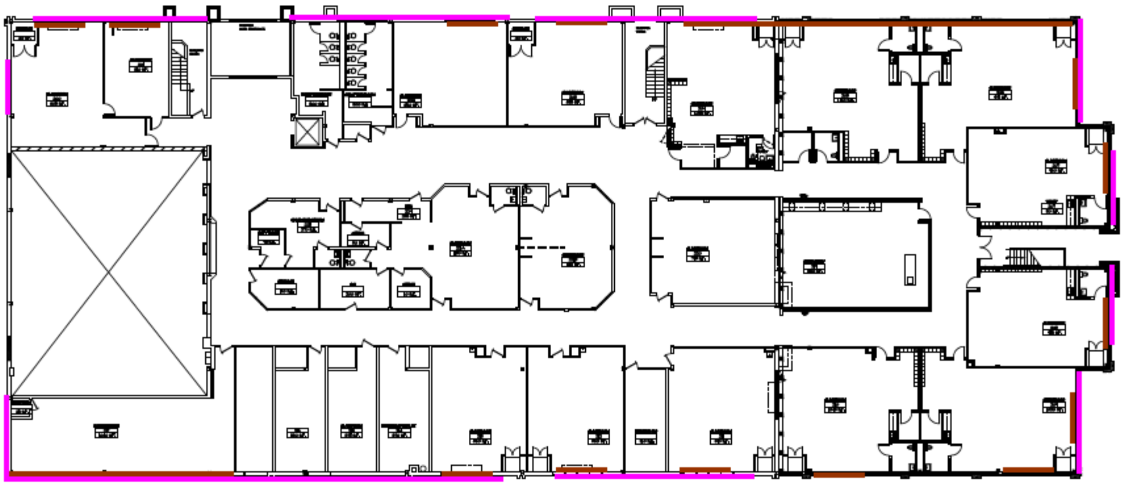
Obama Existing 3rd Floor Plan



Bradley Existing 1st Floor Plan

Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.

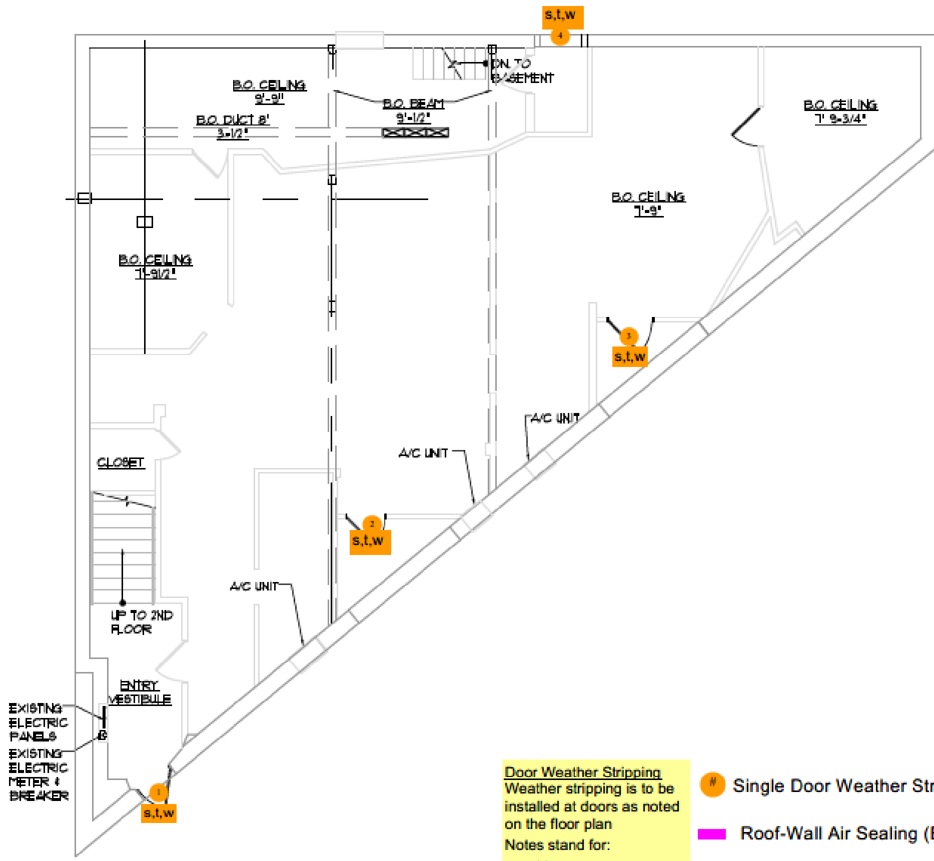
- Single Door Weather Stripping
- Double Door Weather Stripping
- Roof-Wall Air Sealing (Seal)
- Roof-Wall Air Sealing (Block, Seal)
- Overhang Air Sealing (Seal)
- Caulking



Bradley Existing 2nd Floor Plan

Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.

- Single Door Weather Stripping
- Double Door Weather Stripping
- Roof-Wall Air Sealing (Seal)
- Roof-Wall Air Sealing (Block, Seal)
- Overhang Air Sealing (Seal)
- Caulking

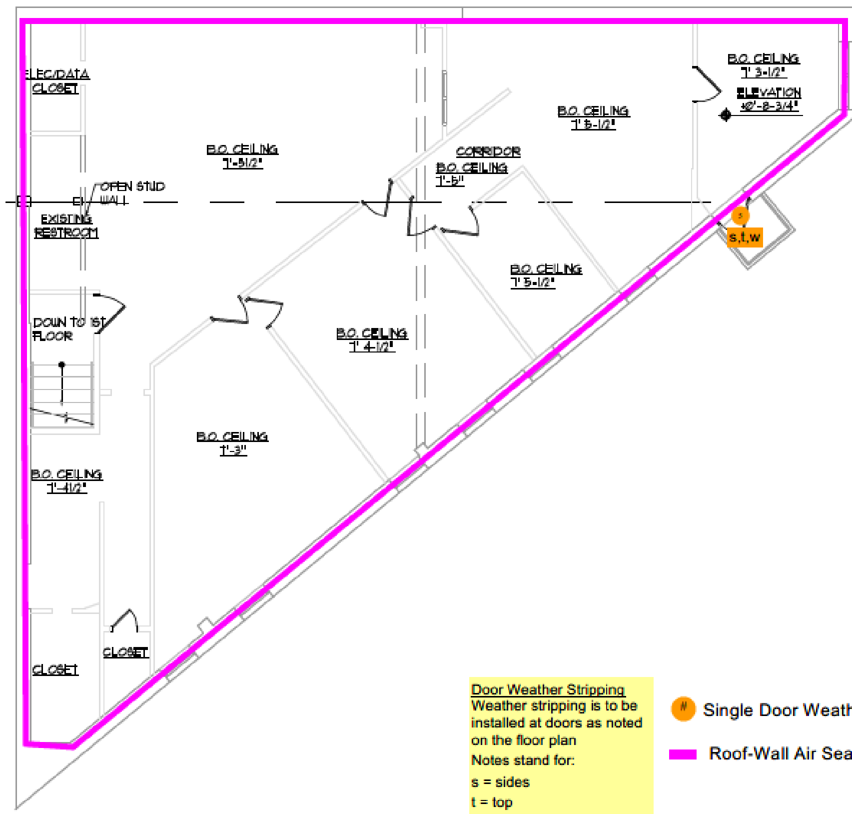


Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.

Single Door Weather Stripping

Roof-Wall Air Sealing (Block, Seal)

Dot McNish
1st Floor Plan

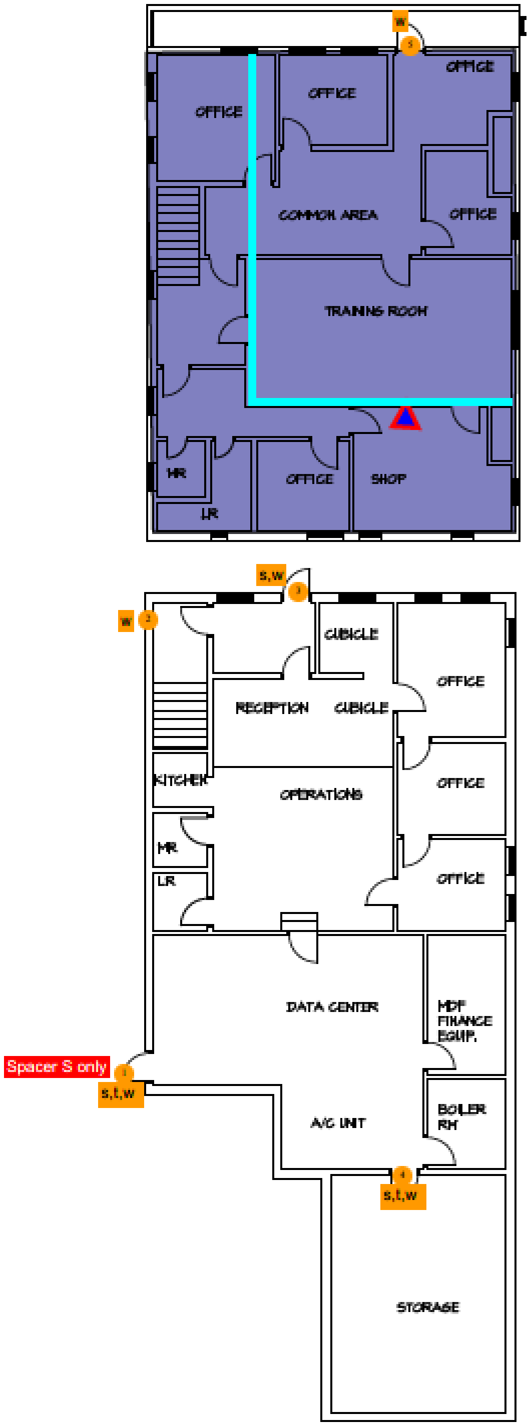


Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.

Single Door Weather Stripping

Roof-Wall Air Sealing (Block, Seal)

Dot McNish 2nd Floor Plan



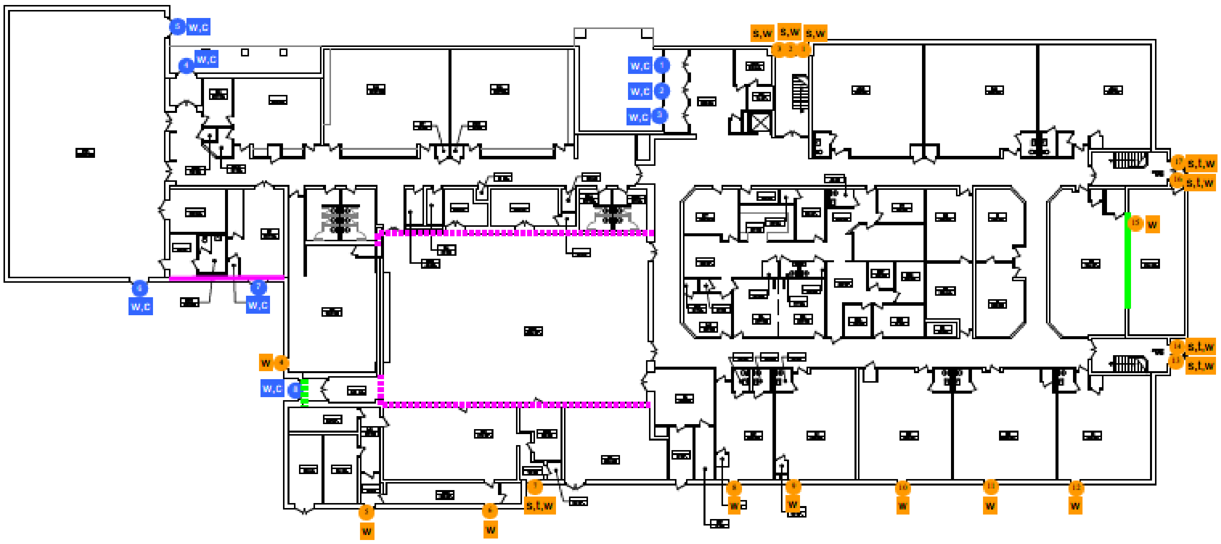
SECOND FLOOR

FIRST FLOOR

Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered.
Floor plan numbering is NOT intended to match any existing building security numbers.

- Single Door Weather Stripping
- Retrofit Access Hatch
- 12" Open Blow Cellulose
- Wall Air Sealing/ Insulation (Block, Seal)

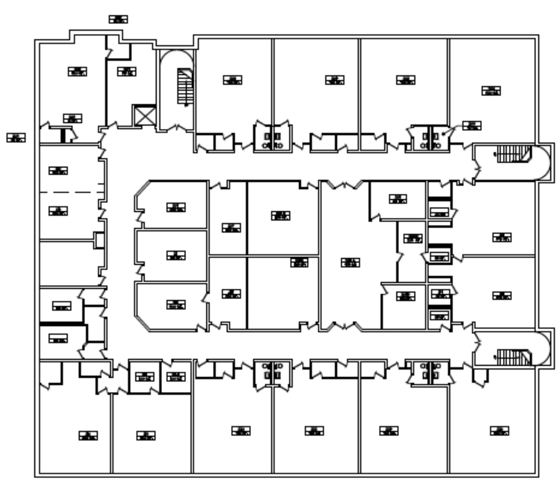
IT CENTER
1506 PARK AVE
ASBURY PARK, NJ



Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.

- Single Door Weather Stripping
- Double Door Weather Stripping
- Roof-Wall Air Sealing (Seal)
- Roof-Wall Air Sealing (Block, Seal)
- Overhang Air Sealing (Seal)
- Overhang Air Sealing (Block, Seal)

Thurgood Marshall Elementary 1st Floor Plan

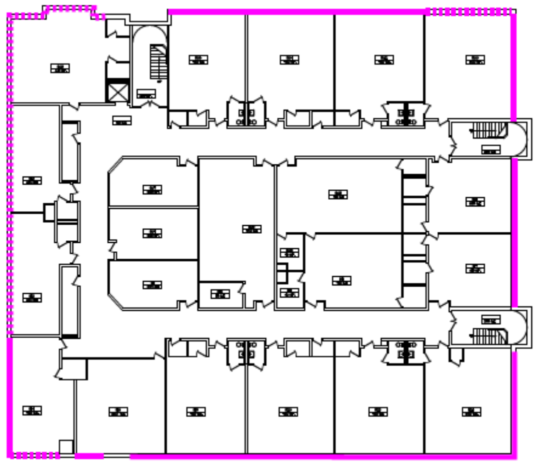


No Work Recommended on this Floor

Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.

- Single Door Weather Stripping
- Double Door Weather Stripping
- Roof-Wall Air Sealing (Seal)
- Roof-Wall Air Sealing (Block, Seal)
- Overhang Air Sealing (Seal)
- Overhang Air Sealing (Block, Seal)

Thurgood Marshall Elementary 2nd Floor Plan



Thurgood Marshall Elementary
3rd Floor Plan

Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.

- Single Door Weather Stripping
- Double Door Weather Stripping
- Roof-Wall Air Sealing (Seal)
- Roof-Wall Air Sealing (Block, Seal)
- Overhang Air Sealing (Seal)
- Overhang Air Sealing (Block, Seal)

Building Envelope Scope Inclusions/Exclusions

Building/ Measure	Project Inclusion?
Asbury Park Higb School	
Caulking	
Interior Seal (LF)	Included
Door Weather Stripping	
Double Door - Sides, Sweep, Center (UT)	Included
Single Door - Sides, Sweep (UT)	Included
Single Door - Sides, Top, Sweep (UT)	Included
Garage Door Weather Stripping	
Overhead Door Weather Strip - Sides, Top, Bottom	Included
Roof-Wall Intersection Air Sealing	
Seal (LF)	Included
Asbury Park Higb School Total	
Asbury Park Middle School	
Caulking	
Interior Seal (LF)	Included
Interior Seal Oversized (LF)	Included
Door Weather Stripping	
Double Door - Sides, Sweep, Center (UT)	Included
Double Door - Sweep, Center (UT)	Included
Single Door - Sides, Sweep (UT)	Included
Single Door - Sides, Top, Sweep (UT)	Included
Single Door - Sweep (UT)	Included
Garage Door Weather Stripping	
Roll-Up Door Weather Strip- Sides, Top, Bottom	Included
Roof-Wall Intersection Air Sealing	
Block, Seal (LF)	Included
Seal (LF)	Included
Seal Paint (LF)	Included
Asbury Park Middle School Total	
Barack Obama Elementary School	
Buck Frame Air Sealing	

Seal (LF)	Included
Caulking	
Interior Seal (LF)	Included
Door Weather Stripping	
Double Door - Sides, Sweep, Center (UT)	Included
Double Door - Sides, Top, Sweep, Center (UT)	Included
Single Door - Sides, Sweep (UT)	Included
Single Door - Sides, Top, Sweep (UT)	Included
Barack Obama Elementary School Total	
Bradley Elementary School	
Caulking	
Interior Seal (LF)	Included
Door Weather Stripping	
Double Door - Sweep, Center (UT)	Included
Single Door - Sides, Top, Sweep (UT)	Included
Overhang Air Sealing	
Seal (LF)	Included
Roof-Wall Intersection Air Sealing	
Block, Seal (SF)	Included
Block, Seal Paint (LF)	Included
Seal (LF)	Included
Seal Firestop (LF)	Included
Bradley Elementary School Total	
Buildings & Grounds	
Attic Bypass Air Sealing	
Attic Air Barrier Retrofit (SF)	Excluded
Install New Attic Hatch (UT)	Excluded
Install Soffit Bailes (UT)	Excluded
Attic Insulation	
12" Open Blow Cellulose (SF)	Excluded
Door Weather Stripping	
Single Door - Sides, Sweep (UT)	Included
Garage Door Weather Stripping	
Overhead Door Weather Strip - Sides, Top	Included
Overhead Door Weather Strip - Sides, Top, Bottom	Included
Roof-Wall Intersection Air Sealing	

Block, Seal (LF)	Included
Wall Air Sealing	
Seal Exposed (LF)	Included
Buildings & Grounds Total	
Dorothy McNish	
Door Weather Stripping	
Single Door - Sides, Top, Sweep (UT)	Included
Roof-Wall Intersection Air Sealing	
Block, Seal (LF)	Included
Block, Seal Paint (LF)	Included
Dorothy McNish Total	
IT Center	
Attic Bypass Air Sealing	
Retrofit Existing Attic Hatch (UT)	Included
Attic Insulation	
12" Open Blow Cellulose (SF)	Excluded
Door Weather Stripping	
Install Door Jamb Spacer (UT)	Included
Single Door - Sides, Sweep (UT)	Included
Single Door - Sides, Top, Sweep (UT)	Included
Single Door - Sweep (UT)	Included
Wall Air Sealing	
Block, Seal (LF)	Excluded
IT Center Total	
Thurgood Marshall Elementary School	
Door Weather Stripping	
Double Door - Sides, Sweep (UT)	Included
Single Door - Sides, Top, Sweep (UT)	Included
Single Door - Sweep (UT)	Included
Overhang Air Sealing	
Block, Seal (LF)	Included
Seal (LF)	Included
Roof-Wall Intersection Air Sealing	
Block, Seal (LF)	Included
Block, Seal Paint (LF)	Included
Seal (LF)	Included

Thurgood Marshall Elementary School Total	

APPENDIX 4. DETAILED SCOPE DESCRIPTIONS

Direct Install

School	Measure Description / Location	Quantity
IT Center	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / Foyer	1
IT Center	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / Stairwell	1
IT Center	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / Stairwell	1
IT Center	Relamp/Reballast: Plug & Play LED - 4-Lamp - 4-Foot T8 (Stand. - 12W) / Top of Steps	1
IT Center	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / 2nd Floor Hall	4
IT Center	Relamp/Reballast: Plug & Play LED - 3-Lamp - 4-Foot T8 (Stand. - 12W) / 2nd Flood Computer Repair	8
IT Center	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / 2nd Flood Conference Room	9
IT Center	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / Central Office Area	7
IT Center	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / Office 1	2
IT Center	Relamp/Reballast: Plug & Play LED - 4-Lamp - 4-Foot T8 (Stand. - 12W) / Office 1	2
IT Center	Relamp/Reballast: Plug & Play LED - 3-Lamp - 4-Foot T8 (Stand. - 12W) / Office 2	4
IT Center	Relamp/Reballast: Plug & Play LED - 3-Lamp - 4-Foot T8 (Stand. - 12W) / Office 3	2
IT Center	Relamp/Reballast: Plug & Play LED - 3-Lamp - 4-Foot T8 (Stand. - 12W) / Office 4	2
IT Center	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / Office 5	2
IT Center	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / Ladies Room	1
IT Center	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / Ladies Room	1
IT Center	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / Mens Room	1
IT Center	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / 1st Floor Main Office	6
IT Center	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / Office 1	4
IT Center	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / Office 2	2
IT Center	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / Office 3	2
IT Center	Relamp/Reballast: Plug & Play LED - 3-Lamp - 4-Foot T8 (Stand. - 12W) / Server Room	4

IT Center	Relamp: LED - A-Lamp (3 - 25W): 9 W / Boiler Room	3
IT Center	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / Back Storage Room	12
IT Center	Relamp: LED - A-Lamp (3 - 25W): 9 W / Back Storage Room	1
IT Center	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / Copier Storage Area	6
IT Center	Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / Mens Room	1
IT Center	Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / Ladies Room	1
IT Center	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / Break Room	1
IT Center	Install Controls: Dual Tech Wall Switch Occupancy Sensor / Foyer	1
IT Center	Install Controls: Dual Tech Wall Switch Occupancy Sensor / Top of Steps	1
IT Center	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / 2nd Floor Hall	1
IT Center	Install Controls: Dual Tech Wall Switch Occupancy Sensor / 2nd Flood Computer Repair	1
IT Center	Install Controls: Dual Tech Wall Switch Occupancy Sensor / 2nd Flood Conference Room	1
IT Center	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / Central Office Area	1
IT Center	Install Controls: Dual Tech Wall Switch Occupancy Sensor / Office 1	1
IT Center	Install Controls: Dual Tech Wall Switch Occupancy Sensor / Office 1	1
IT Center	Install Controls: Dual Tech Wall Switch Occupancy Sensor / Office 2	1
IT Center	Install Controls: Dual Tech Wall Switch Occupancy Sensor / Office 3	1
IT Center	Install Controls: Dual Tech Wall Switch Occupancy Sensor / Office 4	1
IT Center	Install Controls: Dual Tech Wall Switch Occupancy Sensor / Office 5	1
IT Center	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / 1st Floor Main Office	1
IT Center	Install Controls: Dual Tech Wall Switch Occupancy Sensor / Office 1	1
IT Center	Electric Split System A/C (Single-Phase): 3-Tons / ac 01	1
IT Center	Electric Split System A/C (Single-Phase): 3-Tons / ac 02	1
IT Center	Electric Split System A/C (Single-Phase): 5-Tons / ac 3	1
IT Center	Low-Flow Aerators (Lavatory) / various	4
IT Center	Pipe Wrap Insulation / wh	1
IT Center	Gas-Fired Boiler (Conversion) / Boiler 01	1
IT Center	Programmable Thermostats / tstat	3
IT Center	Pipe Wrap Insulation / boiler	1
IT Center	Pipe Wrap Insulation / boiler	1
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / LOBBY	4
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / BOILER ROOM	8
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / FITNESS ROOM	33
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / FITNESS STORAGE	11

MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / 1ST FLOOR HALL	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / PAPER STORAGE	4
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / PAPER STORAGE	14
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / STORAGE ROOM	1
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / LADIES ROOM	3
MLK MS	Relamp/Reballast: Plug & Play LED - 4-Lamp - 4-Foot T8 (Stand. - 12W) / OFFICE ROOM 138	7
MLK MS	Relamp/Reballast: Plug & Play LED - 3-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 128	14
MLK MS	Relamp/Reballast: Plug & Play LED - 3-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 126	16
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / BAND ROOM	24
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / BAND ROOM	2
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / BAND STORAGE	6
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / STAFF RESTROOM	2
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / KITCHEN OFFICE	2
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / KITCHEN	28
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / KITCHEN STORAGE	2
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / KITCHEN OFFICE 2	3
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 2-Foot T8 / TEACHER'S LOUNGE	9
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CAFETERIA	65
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / STAGE	4
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / CUSTODIAL STORAGE	2
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / BOYS ROOM	2
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / GIRLS ROOM	2
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / RESTROOM ENTRANCE	1
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / ATHLETIC OFFICE	4
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / ATHLETIC STORAGE	2
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 2-Foot T8 / ATHLETIC RESTROOM	1

MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / BOYS LOCKER	21
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / ATHLETIC STORAGE	6
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 2-Foot T8 / GYM STAIRWELL	3
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / GYM STAIRWELL	2
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / ATHLETIC OFFICE UPPER	4
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 2-Foot T8 / UPSTAIRS RESTROOM	2
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / UPSTAIRS LOCKER	12
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / UPSTAIRS LOCKER	1
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 2-Foot T8 / UPSTAIRS RESTROOM	1
MLK MS	Relamp: LED - A-Lamp (3 - 25W): 15 W / SHOWERS	6
MLK MS	Fixture Replacement: LED High/Low Bay (90 - 480W): 104 W / GYM	18
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / GYM	18
MLK MS	Relamp/Reballast: 2' T8 3-lamp with electronic ballast and add reflector / LIBRARY 125A	45
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / LIBRARY Storage	3
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / STORAGE ROOM	1
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 121	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / WOMEN'S ROOM	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / ELECTRIC ROOM	1
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / STORAGE ROOM	1
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / BOYS ROOM	5
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / ROOM 111	15
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / ROOM 111 CLOSET	1
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 109	6
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 107	6
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 106	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 104	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 105	15

MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 103	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 102	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSOOM 100	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / NURSES OFFICE 108	7
MLK MS	Relamp: LED - A-Lamp (3 - 25W): 15 W / NURSES OFFICE 108	3
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / NURSES EXAM ROOM 1	2
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / NURSES EXAM ROOM 2	2
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / 7TH GRADE OFFICE	2
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / 6TH GRADE OFFICE	2
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / COUNSELOR'S OFFICE	7
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CONFERENCE ROOM	6
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / PRINCIPAL'S OFFICE	4
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / VICE PRINCIPAL'S OFFICE	4
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / RESTROOM 1	1
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / RESTROOM 2	1
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / VICE PRINCIPAL'S OFFICE 2	4
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / MAIN OFFICE	16
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / ISS TRAILER	12
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / POLICE SUBSTATION	12
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 325	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 323	6
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 314	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 321	6
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 312	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 319	15

MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / RESTROOM	1
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / MOP CLOSET	1
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / 3RD FLOOR HALL	22
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 310	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 308	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 308 OFFICE	1
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 309	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 307	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 304	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 305	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 303	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 302	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 300	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 301	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 305	15
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSES 200-204, 201,216, 218 220	135
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSES 205, 207, 217, 219	120
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSES 206 & 208	12
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / RESTROOM	1
MLK MS	Relamp: LED - A-Lamp (3 - 25W): 15 W / RESTROOM	1
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / 2ND FL HALL	23
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / BOYS ROOM	6
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / GIRLS ROOM	6
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / DEAN'S OFFICE	6
MLK MS	Relamp/Reballast: Plug & Play LED - 1-Lamp - 4-Foot T8 (Stand. - 12W) / RESTROOM	1

MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / CLASSROOM 221	10
MLK MS	Fixture Replacement: LED Architectural Flood/Spot (25 - 150W): 111 W / FLAG POLE	1
MLK MS	Relamp/Reballast: LED 2-Lamp PL 4-Pin / FRONT DOOR	4
MLK MS	Fixture Replacement: LED Architectural Flood/Spot (25 - 150W): 148 W / ROOF LINE	17
MLK MS	Fixture Replacement: LED Outdoor Wall Mount (14 - 60W): 22 W / TRAILER ENTRANCES	4
MLK MS	Fixture Replacement: LED Architectural Flood/Spot (25 - 150W): 148 W / FRONT ENTRANCE	3
MLK MS	Relamp/Reballast: Plug & Play LED - 2-Lamp - 4-Foot T8 (Stand. - 12W) / STEM TRAILER	12
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / FITNESS ROOM	1
MLK MS	Install Controls: Dual Tech Wall Switch Occupancy Sensor / OFFICE ROOM 138	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 128	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 126	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / BAND ROOM	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / BOYS LOCKER	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / UPSTAIRS LOCKER	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 121	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / ROOM 111	1
MLK MS	Install Controls: Dual Tech Wall Switch Occupancy Sensor / CLASSROOM 109	1
MLK MS	Install Controls: Dual Tech Wall Switch Occupancy Sensor / CLASSROOM 107	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 106	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 104	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 105	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 103	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 102	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSOOM 100	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 325	1
MLK MS	Install Controls: Dual Tech Wall Switch Occupancy Sensor / CLASSROOM 323	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 314	1
MLK MS	Install Controls: Dual Tech Wall Switch Occupancy Sensor / CLASSROOM 321	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 312	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 319	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 310	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 308	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 309	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 307	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 304	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 305	1

MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 303	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 302	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 300	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 301	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 305	1
MLK MS	Install Controls: Dual Tech Wall Switch Occupancy Sensor / CLASSES 200-204, 201,216, 218, 220	4
MLK MS	Install Controls: Dual Tech Wall Switch Occupancy Sensor / CLASSES 205, 207, 217, 219	4
MLK MS	Install Controls: Dual Tech Wall Switch Occupancy Sensor / CLASSES 206 & 208	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 221	1
MLK MS	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / STEM TRAILER	1
MLK MS	Packaged RTU (Electric Only): 10-Tons / rtu 01	1
MLK MS	Packaged RTU (Electric Only): 10-Tons / rtu 02	1
MLK MS	Packaged RTU (Electric Only): 10-Tons / rtu 03	1
MLK MS	Dual Enthalpy Economizers / rtu's	3
MLK MS	Electronic Fuel-Use Economizers (for AC) / rtu's	3
MLK MS	Demand Control Ventilation / Rtus	3
MLK MS	Gas-Fired Boiler / Boiler 01	1
MLK MS	Gas-Fired Boiler / Boiler 02	1
MLK MS	Low-Flow Aerators (Lavatory) / various	15
MLK MS	Low-Flow Aerators (Kitchen) / kitchen	2
MLK MS	Pre-Rinse Spray Valves / kitchen	1
MLK MS	Pipe Wrap Insulation / boiler	1
MLK MS	Pipe Wrap Insulation / boiler	1
MLK MS	Pipe Wrap Insulation / boiler	1
MLK MS	Pipe Wrap Insulation / wh	1
Dorothy McNish	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Main Office	10
Dorothy McNish	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Office	2
Dorothy McNish	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Storage Room	2
Dorothy McNish	Relamp: LED - A-Lamp (3 - 25W): 10 W / Supply Closet	1
Dorothy McNish	Relamp: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / Restroom	1
Dorothy McNish	Relamp: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / Mop Closet	1
Dorothy McNish	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Stairwell	2
Dorothy McNish	Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Stairwell	1

Dorothy McNish	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom	6
Dorothy McNish	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Pre-School Area	2
Dorothy McNish	Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / 2nd Floor Investigative Office	2
Dorothy McNish	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 2nd Floor Investigative Office	2
Dorothy McNish	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 2nd Floor Hallway	1
Dorothy McNish	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 2nd Floor Small Office	2
Dorothy McNish	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 2nd Floor Large Office	4
Dorothy McNish	Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / 2nd Floor Large Office	2
Dorothy McNish	Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Room Office 1-48	1
Dorothy McNish	Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / 2nd Floor Office	4
Dorothy McNish	Relamp: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / 2nd Floor Restroom	1
Dorothy McNish	Relamp: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / Custodial Closet	1
Dorothy McNish	Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / 2nd Floor Front Hall	2
Dorothy McNish	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Kitchen	1
Dorothy McNish	Relamp: LED - A-Lamp (3 - 25W): 9 W / Basement	4
Dorothy McNish	Fixture Replacement: LED Outdoor Wall Mount (14 - 60W): 49 W / Front	7
Dorothy McNish	Fixture Replacement: LED Outdoor Wall Mount (14 - 60W): 40 W / Doorways	2
Dorothy McNish	Fixture Replacement: LED Outdoor Wall Mount (14 - 60W): 22 W / Back Door	1
Dorothy McNish	Gas-Fired Furnace / First Floor Furnace	1
Dorothy McNish	Gas-Fired Furnace / Second Floor Furnace	1
Dorothy McNish	Programmable Thermostats / heaters	2
Dorothy McNish	Low-Flow Aerators (Lavatory) / various	2
Dorothy McNish	Low-Flow Aerators (Kitchen) / various	1
Dorothy McNish	Pipe Wrap Insulation / w/h	1

Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / MAIN OFFICE	7
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CONFERENCE ROOM	4
Barack Obama	Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / MEN'S ROOM	1
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / OFFICE ROOM 131	2
Barack Obama	Relamp: LED 1-Lamp PL 4-Pin / CLOSET	1
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / PRINCIPAL'S OFFICE	4
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / FRONT HALLWAY	11
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 125	11
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / SMALL RESTROOM	1
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROM 124-1	6
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROM 121	15
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / SMALL RESTROOM	1
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 4X/FOYER STAIRWELL	28
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 128	12
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / SMALL RESTROOM	1
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / OFFICE ROOM 157	2
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / OFFICE ROOM 156	2
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / OFFICE ROOM 155	2
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / OFFICE ROOM 154	2
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / NURSE'S OFFICE	4
Barack Obama	Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / STORAGE ROOM	2
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / DENTAL OFFICE	4
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / EXAM ROOM 145	2
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / EXAM ROOM 147	2
Barack Obama	Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / SMALL RESTROOM	1

Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / OFFICE ROOM 139	3
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / OFFICE ROOM 142	2
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / OFFICE ROOM 140	2
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / OFFICE ROOM 141	3
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / OFFICE ROOM 153	2
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / WOMEN'S ROOM	2
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / MEN'S ROOM	1
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / SERVER ROOM 158	2
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 123	5
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / GYM	48
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / BOYS ROOM	3
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / GIRLS ROOM	2
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / JANITOR'S CLOSET	2
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / KITCHEN	8
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / BACK HALLWAY	12
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / LIBRARY	30
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / LIBRARY CLASSROOM	15
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / COMPUTER ROOM	18
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / LIBRARY CLASSROOM 2	4
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / STORAGE ROOM 168	4
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / LIBRARY BREAK ROOM	5
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 171	16
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 163	16
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / ELEVATOR ROOM	1
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / BOYS ROOM	3

Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / GIRLS ROOM	3
Barack Obama	Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / BOILER ROOM	13
Barack Obama	Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / JANITOR'S ROOM 162	1
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 234	14
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 234 RESTROOM	1
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 231	14
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 231 RESTROOM	1
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 236	13
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 236 RESTROOM	1
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 229	13
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 229 RESTROOM	1
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / FACULTY ROOM 225	8
Barack Obama	Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / 2X FACULTY RESTROOMS	2
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 234	14
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / STORAGE 224	1
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 2ND FLOOR HALLWAYS	23
Barack Obama	Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / AUDITORIUM	18
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / STAGE	13
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / AUDITORIUM CLOSET	1
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 212	12
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / GIRLS ROOM	3
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 213	12
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 2014	12
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 214 STORAGE	1
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / SMALL CLASSROOM 216	3

Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / SMALL CLASSROOM 217	3
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / SMALL CLASSROOM 218	3
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 219	12
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / BOYS ROOM	2
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 220	12
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 319	12
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 320	12
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / BOYS ROOM	2
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 312	12
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / STORAGE 316	3
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 315	3
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 309	3
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 313	3
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 317	3
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / COMPUTER CLASS 323	9
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 325	12
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 325 RESTROOM	1
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / FACULTY OFFICE	2
Barack Obama	Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / FACULTY OFFICE RESTROOMS	2
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 335	13
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 335 RESTROOM	1
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 327	13
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 327 RESTROOM	1
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 329	13
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 329 RESTROOM	1

Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 333	13
Barack Obama	Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 333 RESTROOM	1
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 3RD FLOOR HALLWAY	17
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 340	12
Barack Obama	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / CLASSROOM 340 RESTROOM	1
Barack Obama	Fixture Replacement: LED Outdoor Wall Mount (14 - 60W): 59 W / EXTERIOR PERIMETER 1	12
Barack Obama	Fixture Replacement: LED Outdoor Wall Mount (14 - 60W): 30 W / EXTERIOR PERIMETER 2	1
Barack Obama	Relamp: LED - A-Lamp (3 - 25W): 17 W / EXTERIOR PERIMETER 3	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / CONFERENCE ROOM	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / OFFICE ROOM 131	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / PRINCIPAL'S OFFICE	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 125	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROM 124-1	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROM 121	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 128	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / OFFICE ROOM 157	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / OFFICE ROOM 156	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / OFFICE ROOM 155	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / OFFICE ROOM 154	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / DENTAL OFFICE	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / EXAM ROOM 145	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / EXAM ROOM 147	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / OFFICE ROOM 139	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / OFFICE ROOM 142	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / OFFICE ROOM 140	1

Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / OFFICE ROOM 141	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / OFFICE ROOM 153	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 123	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / LIBRARY CLASSROOM	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / COMPUTER ROOM	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / LIBRARY CLASSROOM 2	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / LIBRARY BREAK ROOM	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 171	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 163	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 234	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 231	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 236	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 229	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / FACULTY ROOM 225	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 234	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / STORAGE 224	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 212	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 213	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 2014	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / SMALL CLASSROOM 216	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / SMALL CLASSROOM 217	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / SMALL CLASSROOM 218	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 219	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 220	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 319	1

Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 320	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 312	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / CLASSROOM 315	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / CLASSROOM 309	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / CLASSROOM 313	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / CLASSROOM 317	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / COMPUTER CLASS 323	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 325	1
Barack Obama	Install Controls: Dual Tech Wall Switch Occupancy Sensor / FACULTY OFFICE RESTROOMS	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 335	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 327	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 329	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 333	1
Barack Obama	Install Controls: Ceiling Mount Occupancy Sensor (Low Volt) / CLASSROOM 340	1
Barack Obama	Electric Split System A/C: 7.5-Tons / ac 01	1
Barack Obama	Electronic Fuel-Use Economizers (for AC) / 7.5 ton ac	1
Barack Obama	Gas-Fired Boiler / Boiler 01	1
Barack Obama	Gas-Fired Boiler / Boiler 02	1
Barack Obama	Low-Flow Aerators (Lavatory) / various	25
Barack Obama	Low-Flow Aerators (Kitchen) / kitchen	2
Barack Obama	Pre-Rinse Spray Valves / kitchen	1
Barack Obama	Pipe Wrap Insulation / boiler	1
Barack Obama	Pipe Wrap Insulation / boiler	1
Barack Obama	Pipe Wrap Insulation / boiler	1
Barack Obama	Pipe Wrap Insulation / wh	1

Buildings and Grounds	Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Office	6
Buildings and Grounds	Relamp: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / Office	3
Buildings and Grounds	Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Restroom	1
Buildings and Grounds	Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Foyer	1
Buildings and Grounds	Relamp: Plug & Play LED - 4-Lamp - 4-Foot T5HO / Shop Area	7
Buildings and Grounds	Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Shop Area	2
Buildings and Grounds	Relamp: Plug & Play LED - 4-Lamp - 4-Foot T5HO / Main Storage Area	11
Buildings and Grounds	Relamp: LED - A-Lamp (3 - 25W): 5.5 W / Main Storage Area	6
Buildings and Grounds	Relamp: Plug & Play LED - 4-Lamp - 4-Foot T5HO / Behind Office	1
Buildings and Grounds	Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / 2nd Floor Attic	12
Buildings and Grounds	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 2nd Floor Attic	12
Buildings and Grounds	Relamp: LED - A-Lamp (3 - 25W): 9 W / 2nd Floor Attic	8
Buildings and Grounds	Fixture Replacement: LED High/Low Bay (90 - 480W): 104 W / Garage	4
Buildings and Grounds	Relamp: LED - A-Lamp (3 - 25W): 9 W / Garage	1
Buildings and Grounds	Relamp: Plug & Play LED - 3-Lamp - 4-Foot T5HO / Back Garage	24
Buildings and Grounds	Relamp/Reballast: Plug & Play LED - 8 Conversion Kit - (4) 4-Foot T8 Lamps (Stand. - 12W) / Back Garage	4
Buildings and Grounds	Relamp: LED - A-Lamp (3 - 25W): 9 W / Back Garage Restroom	1
Buildings and Grounds	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Back Garage Office	1
Buildings and Grounds	Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Back Garage Office	2
Buildings and Grounds	Relamp: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / Office Back Room	4
Buildings and Grounds	Fixture Replacement: LED Outdoor Wall Mount (14 - 60W): 59 W / Exterior	3
Buildings and Grounds	Fixture Replacement: LED Parking Garage Fixture (35 - 150W): 37 W / Exterior	5
Buildings and Grounds	Install Controls: Dual Tech Wall Switch Occupancy Sensor / Office	1
Buildings and Grounds	Install Controls: Dual Tech Wall Switch Occupancy Sensor / Office	1

Buildings and Grounds	Install Controls: Dual Tech Wall Switch Occupancy Sensor / Restroom	1
Buildings and Grounds	Install Controls: Dual Tech Wall Switch Occupancy Sensor / Foyer	1
Buildings and Grounds	Install Controls: Dual Tech Wall Switch Occupancy Sensor / Behind Office	1
Buildings and Grounds	Install Controls: Wall Switch Occupancy Sensor / Back Garage Office	1
Buildings and Grounds	Install Controls: Dual Tech Wall Switch Occupancy Sensor / Back Garage Office	1
Buildings and Grounds	Low-Intensity Infrared Gas Heater / unit heater	1
Buildings and Grounds	Low-Intensity Infrared Gas Heater / unit heater	1
Buildings and Grounds	Programmable Thermostats / IR's	2
Buildings and Grounds	Low-Flow Aerators (Lavatory) / various	1
Buildings and Grounds	Pipe Wrap Insulation / w/h	1

Plug Loads (By School)

Asbury Park High School	
Device	Quantity:
Projector	37
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	0
Small Printer	0
Medium Printer	6
Large Printer/Copier (110 only)	6
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	1
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	0
Water Fountain (plug on outside)	
AC-110 (15A)	0
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

Dr. Martin Luther King Middle School	
Device	Quantity:
Projector	23
Smartboard	0
Projector/Smartboard Combo	1
Amplifier	0
Charging Cart	13
Small Printer	0
Medium Printer	6
Large Printer/Copier (110 only)	2
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	0
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	0
Water Fountain (plug on outside)	0
AC-110 (15A)	8
AC-110 (20A)	1
AC-220 (<=20A)	0
Other Device not listed above	0

Bradley Elementary School	
Device	Quantity:
Projector	34
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	0
Small Printer	0
Medium Printer	2
Large Printer/Copier (110 only)	0
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	1
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	0
Water Fountain (plug on outside)	0
AC-110 (15A)	0
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

Barack Obama Elementary School	
Device	Quantity:
Projector	25
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	3
Small Printer	0
Medium Printer	5
Large Printer/Copier (110 only)	0
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	1
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	0
Water Fountain (plug on outside)	0
AC-110 (15A)	2
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

Thurgood Marshall Elementary School	
Device	Quantity:
Projector	41
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	5
Small Printer	0
Medium Printer	6
Large Printer/Copier (110 only)	1
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	1
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	0
Water Fountain (plug on outside)	0
AC-110 (15A)	0
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

Dorothy McNish Parent Center	
Device	Quantity:
Projector	2
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	0
Small Printer	0
Medium Printer	1
Large Printer/Copier (110 only)	1
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	0
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	0
Water Fountain (plug on outside)	0
AC-110 (15A)	2
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

Buildings and Grounds	
Device	Quantity:
Projector	0
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	0
Small Printer	0
Medium Printer	0
Large Printer/Copier (110 only)	1
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	0
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	0
Water Fountain (plug on outside)	0
AC-110 (15A)	0
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

IT Center	
Device	Quantity:
Projector	1
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	1
Small Printer	0
Medium Printer	2
Large Printer/Copier (110 only)	3
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	0
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	0
Water Fountain (plug on outside)	0
AC-110 (15A)	2
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

APPENDIX 5. LIGHTING UPGRADES

Asbury Park High School

#	Location	ExOpHrs	XQty	Existing Fixture / Bulb to be Replaced	Replacement Fixture / Bulb
1	CR 101	1715	10	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
2	CR 104	1715	3	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
3	CR 102	1715	9	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
4	File 103	2200	3	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
5	CR 106	1715	7	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
6	CR 108	1715	6	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
7	EC x 2	400	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
8	Girls Room	2450	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
9	Girls Bathroom	2450	1	*2' FIXTURE, 2-F17/T8/STD LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
10	Bathroom	2450	1	*2' FIXTURE, 1-F17/T8/STD LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
11	Guidance Office	2200	12	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
12	Small Offices X4	2200	8	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
13	Guidance	2200	14	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
14	1st floor halls(right)	2450	12	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
15	1st floor halls (left)	2450	12	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
16	1st floor Front cooridor	2450	16	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
17	1st floor front cooridor	2450	3	*4' FIXTURE, 1-F32/T8 LAMP, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
18	Front Entry	2450	27	1 L - A LAMP 10 WATT LED	**** ALREADY LED ****
19	Admin Conf Room	1715	9	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
20	Admin Hall	2450	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
21	Admin Closet	500	1	1L - A LAMP 60 WATT INCANDESCENT	ENCLOSED RATED 9W DIMMABLE LED OMNI A19 4000K GEN 8
22	Small offices x 7	2200	7	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
23	break room	1715	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED

#	Location	ExOpHrs	XQty	Existing Fixture / Bulb to be Replaced	Replacement Fixture / Bulb
24	Principal	2200	8	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
25	Principal Office	2200	3	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
26	Principal Office	2200	1	*4' FIXTURE, 1-F32/T8 LAMP, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
27	CR 113	1715	6	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
28	Health Office	2200	5	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
29	Health Office	2200	1	*4' FIXTURE, 1-F32/T8 LAMP, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
30	CR 115	1715	8	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
31	Mail Room	2200	6	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
32	Small offices	2200	4	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
33	CR 117	1715	8	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
34	End of Hall	2200	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
35	CR 118	1715	10	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
36	Exit	8760	16	2 - 7 WATT BI PIN FLUORESCENT FIXTURE WITH ELECTRONIC BALLAST	COOPER SURELITE LED EXIT/EMERGENCY COMBO (RED LETTERS)
37	Exit	8760	16	LED EXIT SIGN	**** ALREADY LED ****
38	End Corridor	2200	15	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
39	End Corridor	2450	1	*4' FIXTURE, 1-F32/T8 LAMP, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
40	End Corridor	2450	1	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
41	Media Center	1715	53	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
42	Media Center	2450	39	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
43	Media Center Hall	1715	4	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
44	Media Center Rest x 2	2450	2	1 L - A LAMP 10 WATT LED	**** ALREADY LED ****
45	Av Room	1715	4	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
46	Supply Closet	500	1	*4' FIXTURE, 1-F32/T8 LAMP, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
47	Copy Room	1715	3	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
48	IT Office	2200	6	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
49	HVAC	1715	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED

#	Location	ExOpHrs	XQty	Existing Fixture / Bulb to be Replaced	Replacement Fixture / Bulb
50	Librarian A & B	1715	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
51	CR S-1	1715	25	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
52	Shop Office	2200	6	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
53	Shop Supply	1715	4	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
54	Closet	500	1	1 - 13 WATT CFL QUAD PIN (WITH BALLAST)	ENCLOSED RATED 9W DIMMABLE LED OMNI A19 4000K GEN 8
55	Mens Room	2450	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
56	Mens Room	2450	1	1L - A LAMP 100 WATT INCANDESCENT	ENCLOSED RATED 9W DIMMABLE LED OMNI A19 4000K GEN 8
57	Womens Room	2450	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
58	Womens Room	2450	1	1L - A LAMP 100 WATT INCANDESCENT	ENCLOSED RATED 9W DIMMABLE LED OMNI A19 4000K GEN 8
59	Band Room 120	1715	30	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
60	Band Storage	800	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
61	Band Storage 2	800	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
62	Band Storage 3 & 4	800	2	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
63	CR 122	1715	35	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
64	CR 122	800	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
65	Dark Room	1000	2	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
66	CR 123	1715	36	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
67	Supply	1715	1	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
68	CR 123 Office	1715	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
69	Gym	2450	12	4' FIXTURE, 6-F54/T5/HO/LAMPS, 2-ELECTRONIC BALLASTS	CB4 LED HIGHBAY, 82.4W, 4000K, 120-277V WHITE - DLC LISTED
70	Athletic Director Office	2450	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
71	Boiler room	1000	29	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
72	Boiler room	1000	2	1 - 13 WATT CFL QUAD PIN (WITH BALLAST)	ENCLOSED RATED 9W DIMMABLE LED OMNI A19 4000K GEN 8
73	Boiler room files	500	2	1 - 13 WATT CFL QUAD PIN (WITH BALLAST)	ENCLOSED RATED 9W DIMMABLE LED OMNI A19 4000K GEN 8
74	Switch Gear	500	5	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED

#	Location	ExOpHrs	XQty	Existing Fixture / Bulb to be Replaced	Replacement Fixture / Bulb
75	Custodial OFfice	2200	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
76	ERV Room	500	2	1 - 13 WATT CFL QUAD PIN (WITH BALLAST)	ENCLOSED RATED 9W DIMMABLE LED OMNI A19 4000K GEN 8
77	ERV Room	400	2	6' FIXTURE, 2-F72/HO LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 12W, 3FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
78	Weight Room	2450	12	METAL HALIDE, 1-250 WATT LAMP	CB4 LED HIGHBAY, 82.4W, 4000K, 120-277V WHITE - DLC LISTED
79	Athletic Office	2200	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
80	Stair 2 & 3	2450	12	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
81	Stair 2 & 3	2450	8	*4' FIXTURE, 1-F32/T8 LAMP, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
82	CR 401	1715	40	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
83	Small Stage	2200	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
84	Cafeteria	1715	45	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
85	Cafeteria	1715	2	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
86	Faculty Dining	2450	9	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
87	4th Floor Back Hall	2450	7	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
88	Kitchen Supply	1715	4	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
89	Kitchen	1715	15	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
90	Elev Lobby 2nd & 3rd	2450	6	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
91	Elev Lobby 2nd & 3rd	2450	2	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
92	Stair 1 & 4	2450	12	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
93	CR 220 & 303	1715	20	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
94	CR219, 218, 206, 204, 306	1715	40	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
95	Office 221	2200	3	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
96	CR 217, 215, 216, 313, 314, 305, 304	1715	36	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
97	EC	400	3	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
98	Office 211B	2200	8	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
99	Office 211C	2200	5	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED

#	Location	ExOpHrs	XQty	Existing Fixture / Bulb to be Replaced	Replacement Fixture / Bulb
100	exit	8760	12	2 - 7 WATT BI PIN FLUORESCENT FIXTURE WITH ELECTRONIC BALLAST	COOPER SURELITE LED EXIT/EMERGENCY COMBO (RED LETTERS)
101	exit	8760	20	LED EXIT SIGN	**** ALREADY LED ****
102	CR 209	1715	8	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
103	CR 207	1715	8	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
104	CR 205	1715	9	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
105	CR 203	1715	12	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
106	CR 201	1715	15	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
107	CR 202	1715	15	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
108	Hall display case	2450	3	*4' FIXTURE, 1-F32/T8 LAMP, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
109	2nd floor corridor	2450	22	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
110	Girls Bathroom	2450	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
111	Girls bathroom	2450	1	*2' FIXTURE, 1-F17/T8/STD LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
112	Server Room	500	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
113	Boys Bathroom	2450	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
114	Boys bathroom	2450	1	*2' FIXTURE, 1-F17/T8/STD LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
115	Office	2200	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
116	Office restroom	2450	2	1 - 13 WATT CFL QUAD PIN (WITH BALLAST)	PL STAB-IN BALLAST BYPASS, VERTICAL, G24Q/G24D 6.5W, 4000K, 120-277V
117	CR 318, 309	1715	20	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
118	CR 316, 317, 308	1715	24	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
119	Supply room Office 319	2200	6	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
120	CR 315	1715	4	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
121	Boys Bathroom	2450	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
122	3rd floor faculty lounge	2450	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
123	Faculty RR	4380	1	*2' FIXTURE, 2-F17/T8/STD LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
124	CR 311, 312, 301	2450	36	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
125	Ante Room 310	2450	4	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED

#	Location	ExOpHrs	XQty	Existing Fixture / Bulb to be Replaced	Replacement Fixture / Bulb
126	CR307	2450	4	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
127	3rd floor corridor	2450	22	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
128	Faculty Lounge	2450	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
129	Womens room	2450	1	*2' FIXTURE, 2-F17/T8/STD LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
130	Girls room	2450	3	*4' FIXTURE, 1-F32/T8 LAMP, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
131	Display Cases	2450	2	*4' FIXTURE, 1-F32/T8 LAMP, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
132	Office Conference room	2450	10	*2' FIXTURE, 2-F17/T8/STD LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
133	small office	2200	1	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
134	Restroom x 2	1000	16	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
135	Boys locker room	1000	26	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
136	Boys Room	1000	3	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
137	Boys Room	1000	4	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
138	EC	400	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
139	JC	400	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
140	Coaches Office	1000	12	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
141	Coaches Office	1000	3	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
142	Girls Locker Room	1000	13	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
143	Girls Locker room	1000	2	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
144	Storage	500	6	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
145	School Perimeter	4380	10	1L - A LAMP 60 WATT INCANDESCENT	ENCLOSED RATED 9W DIMMABLE LED OMNI A19 4000K GEN 8
146	Wall Switch Sensors in Classrooms	4380	0	0 - N/A	MAESTRO DUAL TECH OCCUPANCY/VACANCY SENSING SWITCH
147	T8 sockets	4380	0	0 - N/A	T8 NON SHUNTED SOCKET - COMMON
148	T5 sockets	4380	0	0 - N/A	ETLIN DANIELS T5 NON SHUNTED SOCKET
149	1L T8 Harness Kits	4380	0	0 - N/A	1 LAMP UNIVERSAL TOMBSTONE KIT WITH BALLAST DISCONNECT T8
150	2L T8 Harness Kits	4380	0	0 - N/A	2 LAMP UNIVERSAL TOMBSTONE KIT WITH BALLAST DISCONNECT T8
151	3L T8 Harness Kits	4380	0	0 - N/A	3 LAMP UNIVERSAL TOMBSTONE KIT WITH BALLAST DISCONNECT T8

#	Location	ExOpHrs	XQty	Existing Fixture / Bulb to be Replaced	Replacement Fixture / Bulb
152	4L T8 Harness Kits	4380	0	0 - N/A	4 LAMP UNIVERSAL TOMBSTONE KIT WITH BALLAST DISCONNECT T8
153	3L T5 Harness Kits	4380	0	0 - N/A	3 LAMP UNIVERSAL TOMBSTONE KIT WITH BALLAST DISCONNECT T5
154	U-Tube Harness Kits	4380	0	0 - N/A	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)
155	Retro Kits for 6' Fixtures	4380	0	0 - N/A	RETROFIT CONVERSION KIT: FOR 8-FT FIXTURE, 4 LAMP, FOR LED'S
156	Classrooms missed	2450	100	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
157	EM Strips for EM Fixtures	4380	0	0 - N/A	ESPEN CONSTANT WATTAGE LED EMERGENCY BACKUP KIT 120-277V, 5W@90MIN
158	EM Ballast ready tubes for Boiler room EM Fixtures	4380	25	*4' FIXTURE, 1-F32/T8 LAMP, (.88) ELECTRONIC BALLAST	TUBE LIGHT, T8, 4FT, 10W, 4000K, G1 EZ-FIT, DEP, FROSTED NANO LENS
159	High School Stadium Interior	4380	20	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
160	High School Stadium Interior	4380	65	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
161	INC missed on Igea	4380	70	1L - A LAMP 60 WATT INCANDESCENT	ENCLOSED RATED 9W DIMMABLE LED OMNI A19 4000K GEN 8
		Existing:	**1556**	**New:**	

Thurgood Marshall Elementary School

#	Location	ExOpHrs	XQty	Existing Fixture / Bulb to be Replaced	Replacement Fixture / Bulb
1	100,101,102 ,103,104,	2080	6	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
2	100,101,102 ,103,104,	2080	75	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
3	100	4380	3	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
4	100,101,102 ,103,104,	2080	4	18 WATT BI PIN FLUORESCENT FIXTURE WITH ELECTRONIC BALLAST	COOPER SURELITE LED EXIT/EMERGENCY COMBO (RED LETTERS)
5	100	4380	5	METAL HALIDE, 1-150 WATT LAMP	MAXLITE: UNIVERSAL DOWNLIGHT 8" 18W 4000K-120-277V
6	105	4380	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
7	hall	4380	12	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
8	copy	4380	4	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
9	107, offices,113	4380	20	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
10	107, offices,113	4380	4	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
11	107, offices,113	4380	4	18 WATT BI PIN FLUORESCENT FIXTURE WITH ELECTRONIC BALLAST	COOPER SURELITE LED EXIT/EMERGENCY COMBO (RED LETTERS)
12	113	4380	1	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
13	113	4380	2	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
14	120	4380	2	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
15	118	4380	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
16	interior exterior vestibule	4380	17	1L - A LAMP 100 WATT INCANDESCENT	MAXLITE: UNIVERSAL DOWNLIGHT 8" 18W 4000K-120-277V
17	interior exterior vestibule	4380	2	1 - 26 WATT CFL SCREW-IN	ENCLOSED RATED 9W DIMMABLE LED OMNI A19 4000K GEN 8
18	108	4380	1	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
19	108	4380	6	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
20	108	4380	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
21	110, 112, 114, 116, 117, 119,	4380	74	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
22	110, 112, 114, 116, 117, 119,	4380	5	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
23	110, 112, 114, 116, 117, 119,	4380	4	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED

#	Location	ExOpHrs	XQty	Existing Fixture / Bulb to be Replaced	Replacement Fixture / Bulb
24	Hall	3500	53	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
25	Hall	4380	10	18 WATT BI PIN FLUORESCENT FIXTURE WITH ELECTRONIC BALLAST	COOPER SURELITE LED EXIT/EMERGENCY COMBO (RED LETTERS)
26	Hall to gym most led	4380	4	1L - A LAMP 100 WATT INCANDESCENT	MAXLITE: UNIVERSAL DOWNLIGHT 8" 18W 4000K-120-277V
27	Restroom/storage ec	3500	19	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
28	Restroom/storage ec	3500	13	1L - A LAMP 100 WATT INCANDESCENT	MAXLITE: UNIVERSAL DOWNLIGHT 8" 18W 4000K-120-277V
29	126,128,130,132,	2080	41	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
30	gym exit	4380	12	1 - 26 WATT CFL SCREW-IN	ENCLOSED RATED 9W DIMMABLE LED OMNI A19 4000K GEN 8
31	Gym	4380	24	HIGH BAY FIXTURE WITH 6-42 WATT CFL, 2 BALLASTS	CB4 LED HIGHBAY, 82.4W, 4000K, 120-277V WHITE - DLC LISTED
32	office / storage	4380	6	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
33	office	4380	2	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
34	Multi purpose	4380	15	4' FIXTURE, 6-F54/T5/HO/LAMPS, 2-ELECTRONIC BALLASTS	4-FT 25W SEP PLASTIC T5 H.O. LED TUBE LAMP, 4000K, 120-277V - DLC LISTED
35	stage	2500	26	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
36	120 stor	750	2	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
37	storage	750	4	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
38	exit	4380	3	2' 2-F40T8, BIAX ELECTRONIC BALLAST	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X2, 20W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
39	kitchen	4380	11	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
40	kitchen	4380	5	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	ESPEN CONSTANT WATTAGE LED EMERGENCY BACKUP KIT 120-277V, 5W@90MIN
41	kitchen	4380	4	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
42	kitchen	4380	18	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
43	kitchen	4380	6	1 - 26 WATT CFL SCREW-IN	ENCLOSED RATED 9W DIMMABLE LED OMNI A19 4000K GEN 8
44	kitchen	4380	2	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
45	boiler	2500	20	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
46	ballast ready tubes for em	4380	0	0 - N/A	TUBE LIGHT, T8, 4FT, 10W, 4000K, G1 EZ-FIT, DEP, FROSTED NANO LENS
47	2nd classrooms	2080	180	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
48	2nd classrooms	2080	20	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
49	2nd classrooms	2080	11	2 - 26 WATT CFL FIXTURE	PL STAB-IN BALLAST BYPASS, HORIZONTAL, G24Q/G24D 10.5W, 3000K, 120-277V

#	Location	ExOpHrs	XQty	Existing Fixture / Bulb to be Replaced	Replacement Fixture / Bulb
50	2nd classrooms	2080	5	2 - 26 WATT CFL FIXTURE	MAXLITE: UNIVERSAL DOWNLIGHT 8" 18W 4000K-120-277V
51	2nd classrooms	2080	28	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
52	em	4380	0	0 - N/A	ESPEN CONSTANT WATTAGE LED EMERGENCY BACKUP KIT 120-277V, 5W@90MIN
53	media	4380	28	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
54	media	4380	29	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
55	2nd classrooms	2080	17	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
56	2nd hall	4380	40	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
57	2nd hall	4380	6	18 WATT BI PIN FLUORESCENT FIXTURE WITH ELECTRONIC BALLAST	COOPER SURELITE LED EXIT/EMERGENCY COMBO (RED LETTERS)
58	3rd floor classrooms	2080	230	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
59	3rd floor classrooms	2080	30	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
60	3rd floor classrooms	2080	8	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
61	3rd floor classrooms	2080	4	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
62	3rd floor hall	4380	41	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
63	3rd floor hall	4380	8	18 WATT BI PIN FLUORESCENT FIXTURE WITH ELECTRONIC BALLAST	COOPER SURELITE LED EXIT/EMERGENCY COMBO (RED LETTERS)
64	stairs	4380	27	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
65	exterior cans	4380	15	METAL HALIDE, 1-150 WATT LAMP	MAXLITE - PAR38 23W, WET LISTED, DIMMABLE, 3000K, 120-277V, FLOOD 40° - ENERGY STAR
66	area lights	4380	8	METAL HALIDE, 1-250 WATT LAMP	IVELOT AREA LIGHT, TYPE 3, 67W, 7500 LUMENS, POLE MOUNT, 70CRI, 4000K BRONZE, 120-277V 0-10 DIM
67	floods	4380	2	METAL HALIDE, 1-250 WATT LAMP	X34 FLOOD 52W 5500LM LED 277V 3000K 80 CRI BRONZE - DLC LISTED
68	wall pack	4380	2	METAL HALIDE, 1-250 WATT LAMP	LPACK WALLPACK 52W WARM LED BRONZE - DLC LISTED
69	uplights in entry	4380	4	METAL HALIDE, 1-150 WATT LAMP	LED FLOOD 15W, 4000K, 0-10V DIM, 120-277V, 2143LM - DLC LISTED
70	T8 Sockets	4380	0	0 - N/A	T8 NON SHUNTED SOCKET - COMMON
71	T5 Sockets	4380	0	0 - N/A	ETLIN DANIELS T5 NON SHUNTED SOCKET
72	T8 2L Harness Kits	4380	0	0 - N/A	2 LAMP UNIVERSAL TOMBSTONE KIT WITH BALLAST DISCONNECT T8
73	T8 3L Harness Kits	4380	0	0 - N/A	3 LAMP UNIVERSAL TOMBSTONE KIT WITH BALLAST DISCONNECT T8
74	T8 4L Harness Kits	4380	0	0 - N/A	4 LAMP UNIVERSAL TOMBSTONE KIT WITH BALLAST DISCONNECT T8
75	T5 6L Harness Kits	4380	0	0 - N/A	6 LAMP UNIVERSAL TOMBSTONE KIT WITH BALLAST DISCONNECT T5

#	Location	ExOpHrs	XQty	Existing Fixture / Bulb to be Replaced	Replacement Fixture / Bulb
76	U-Tube Retro Kits	4380	0	0 - N/A	RETROFIT KIT FOR 2' U-TUBE (INCLUDES (3) SOCKETS)
77	em	4380	0	0 - N/A	ESPEN CONSTANT WATTAGE LED EMERGENCY BACKUP KIT 120-277V, 5W@90MIN
78	Extra tubes for attic stock	4380	0	0 - N/A	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
79	Extra tubes for attic stock	4380	0	0 - N/A	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
		Existing:	**1305**		

Bradley Elementary School

#	Location	ExOpHrs	XQty	Existing Fixture / Bulb to be Replaced	Replacement Fixture / Bulb
1	stair 3	3500	3	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
2	stair 3	3500	3	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
3	207	2080	14	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
4	207 closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
5	206	2080	15	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
6	206 closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
7	205	2080	15	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
8	205 closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
9	219	2080	6	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
10	closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
11	IDF	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
12	Restrooms x2	3500	6	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
13	204	2080	14	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
14	203	2080	9	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
15	221a	4380	18	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
16	202	2080	9	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
17	Restrooms x2	3500	6	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
18	closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
19	224	2080	9	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
20	Stair 1	3500	2	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
21	Stair 1	3500	3	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
22	201-200	2080	14	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
23	Copy	2500	3	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED

#	Location	ExOpHrs	XQty	Existing Fixture / Bulb to be Replaced	Replacement Fixture / Bulb
24	217	2080	17	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
25	closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
26	224 attached office	2500	2	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
27	225	2500	3	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
28	218	2080	6	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
29	216	2080	6	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
30	214	2080	6	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
31	213	2080	9	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
32	212	2080	9	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
33	office	2500	6	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
34	office	2500	8	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
35	lab	2080	6	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
36	221d	2080	6	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
37	221b	2080	6	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
38	220	2080	9	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
39	ec	750	4	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
40	211	2080	11	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
41	210	2080	15	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
42	closet1	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
43	209	2080	19	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
44	closet1	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
45	closet1	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
46	208	2080	13	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED

#	Location	ExOpHrs	XQty	Existing Fixture / Bulb to be Replaced	Replacement Fixture / Bulb
47	closet1	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
48	218	4380	3	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
49	Halls	3500	42	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
50	Halls	3500	30	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
51	106	2080	13	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
52	106 closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
53	113	2080	14	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
54	105	2080	15	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
55	105 closet	750	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
56	104	2080	15	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
57	104 closet	750	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
58	Restroom	4380	1	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
59	jc	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
60	114	2500	12	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
61	Restroom	4380	1	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
62	jc	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
63	103	2080	15	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
64	Restroom	4380	1	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
65	closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
66	Stair 2	3500	2	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
67	Stair 2	3500	3	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
68	115	2500	12	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
69	Restroom	4380	1	2 - 26 WATT CFL QUAD - PIN FIXTURE	ETI-14" I-SERIES SQUARE FLUSHMOUNT-22W-4000K-1550L
70	102	2500	15	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED

#	Location	ExOpHrs	XQty	Existing Fixture / Bulb to be Replaced	Replacement Fixture / Bulb
71	Restroom	4380	1	2 - 26 WATT CFL QUAD - PIN FIXTURE	ETI-14″ I-SERIES SQUARE FLUSHMOUNT-22W-4000K-1550L
72	closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
73	101	2500	19	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
74	Restroom	4380	1	2 - 26 WATT CFL QUAD - PIN FIXTURE	ETI-14″ I-SERIES SQUARE FLUSHMOUNT-22W-4000K-1550L
75	closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
76	closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
77	closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
78	Nurse	2500	9	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
79	Restroom	4380	1	2 - 26 WATT CFL QUAD - PIN FIXTURE	ETI-14″ I-SERIES SQUARE FLUSHMOUNT-22W-4000K-1550L
80	idf	750	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
81	100	2500	9	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
82	100a	2500	9	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
83	closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
84	closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
85	art	2080	18	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
86	closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
87	closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
88	Restroom x 2	3500	4	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
89	music	2080	18	*4' FIXTURE, 4-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
90	closet	750	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
91	locker x 2	3500	8	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
92	gym office	2500	4	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
93	gym	3500	20	HIGH BAY FIXTURE WITH 8-42 WATT CFL	HIGH BAY, G2 ECO LINEAR, 2X2, 141W, 4000K, 120-277VAC, DIMMABLE, GENERAL FROSTED OPTIC
94	gym	4380	0	0 - N/A	ACCESSORY, HIGH BAY, G2 ECO LINEAR, WIRE GUARD KIT, COMPATIBLE WITH 128XX3-3XX (141W), 128XX5-3XX (161W), AND 128XX6-3XX (201W 2FT)

#	Location	ExOpHrs	XQty	Existing Fixture / Bulb to be Replaced	Replacement Fixture / Bulb
95	gym office	2500	4	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
96	closet	750	4	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
97	gym office	2500	4	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
98	gym storage	750	6	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
99	Cafeteria	3500	12	4' FIXTURE, 8-F54/T5/HO/LAMPS, ELECTRONIC BALLAST	4-FT 25W SEP PLASTIC T5 H.O. LED TUBE LAMP, 4000K, 120-277V - DLC LISTED
100	Cafeteria	3500	12	1- 250 WATT QUARTZ LAMP	SYLVANIA-LED PAR 38 HIGH OUTPUT DIMMABLE 3000K 40° BEAM ANGLE - ENERGY STAR
101	stage not in notes	2080	10	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
102	ec	750	3	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
103	k office	2500	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
104	kitchen	2500	14	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
105	back hall	2500	3	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
106	bathroom x 2	3500	6	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
107	staff	3500	2	2 - 26 WATT CFL QUAD - PIN FIXTURE	ETI-14" I-SERIES SQUARE FLUSHMOUNT-22W-4000K-1550L
108	staff	3500	7	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
109	Main office	2500	24	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
110	Boiler room	4380	12	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
111	Boiler room outside sotrage	4380	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
112	112	2080	13	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
113	112 rr	2080	1	2 - 26 WATT CFL QUAD - PIN FIXTURE	ETI-14" I-SERIES SQUARE FLUSHMOUNT-22W-4000K-1550L
114	111	2080	13	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
115	111 rr	2080	1	2 - 26 WATT CFL QUAD - PIN FIXTURE	ETI-14" I-SERIES SQUARE FLUSHMOUNT-22W-4000K-1550L
116	speech	2500	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
117	110	2080	13	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
118	110	2080	2	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED

#	Location	ExOpHrs	XQty	Existing Fixture / Bulb to be Replaced	Replacement Fixture / Bulb
119	109	2080	14	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
120	109 closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
121	108	2080	15	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
122	108 closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
123	107	2080	14	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
124	107 closet	750	1	*4' FIXTURE, 2-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
125	1st floor hall	3500	69	*4' FIXTURE, 3-F32/T8 LAMPS, (.88) ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 10.5W, 4FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
126	1st floor hall	3500	20	*2' FIXTURE, 2-F32/T8/U6 LAMPS, ELECTRONIC BALLAST	TUBE LIGHT, G5 SEP, T8, 9W, 2FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
127	stair 3 exit	4380	5	2 - 26 WATT CFL QUAD - PIN FIXTURE	MAXLITE: UNIVERSAL DOWNLIGHT 8" 13W 4000K-120-277V
128	exterior wp	4380	24	METAL HALIDE, 1-250 WATT LAMP	WALLMAX OPEN FACE WALL PACK - 40W, 120-277V, 5000K, BRONZE
129	T8 Sockets	4380	0	0 - N/A	T8 NON SHUNTED SOCKET - COMMON
130	T5 Sockets	4380	0	0 - N/A	ETLIN DANIELS T5 NON SHUNTED SOCKET
131	2L T8 Harness Kits	4380	0	0 - N/A	2 LAMP UNIVERSAL TOMBSTONE KIT WITH BALLAST DISCONNECT T8
132	3L T8 Harness Kits	4380	0	0 - N/A	3 LAMP UNIVERSAL TOMBSTONE KIT WITH BALLAST DISCONNECT T8
133	4L T8 Harness Kits	4380	0	0 - N/A	4 LAMP UNIVERSAL TOMBSTONE KIT WITH BALLAST DISCONNECT T8
134	8L T5 Harness Kits	4380	0	0 - N/A	8 LAMP UNIVERSAL TOMBSTONE KIT WITH BALLAST DISCONNECT T5
		Existing:	**993**		

APPENDIX 6. RECOMMENDED PROJECT - ESP

ECM #	Building	Energy Conservation Measure "ECM"	ECM Hard Cost	Total Savings, $/yr	Simple Payback, yrs
01-1	Asbury Park High School	Comprehensive LED Lighting Upgrades + Controls	$231,315.60	$21,451.17	10.8
01-1	Bradley Elementary School	Comprehensive LED Lighting Upgrades	$172,227.00	$18,869.53	9.1
01-1	Thurgood Marshall Elementary School	Comprehensive LED Lighting Upgrades	$233,087.34	$23,751.22	9.8
01-2	Dr. Martin Luther King Jr MS	Comprehensive LED Lighting Upgrades - DI	$121,615.46	$12,811.93	9.5
01-2	Dr. Martin Luther King Jr MS	Install Occupancy Sensor Lighting Controls - DI	$6,330.17	$794.77	8.0
01-2	Barack Obama Elementary School	Comprehensive LED Lighting Upgrades - DI	$54,623.14	$7,814.84	7.0
01-2	Barack Obama Elementary School	Install Occupancy Sensor Lighting Controls - DI	$6,706.93	$1,034.01	6.5
01-2	Dorothy McNish Parent Center	Comprehensive LED Lighting Upgrades - DI	$6,055.59	$1,421.94	4.3
01-2	Buildings & Grounds	Comprehensive LED Lighting Upgrades - DI	$11,671.85	$2,128.66	5.5
01-2	Buildings & Grounds	Install Occupancy Sensor Lighting Controls - DI	$690.24	$151.43	4.6
01-2	Information Technology Center	Comprehensive LED Lighting Upgrades - DI	$6,765.50	$709.26	9.5
01-2	Information Technology Center	Install Occupancy Sensor Lighting Controls - DI	$1,531.51	$171.92	8.9
02-1	Asbury Park High School	High Efficiency Transformer Upgrade	$44,360.82	$4,062.19	10.9
02-1	Dr. Martin Luther King Jr MS	High Efficiency Transformer Upgrade	$52,357.62	$4,241.42	12.3
02-1	Bradley Elementary School	High Efficiency Transformer Upgrade	$26,094.66	$2,648.50	9.9
02-1	Thurgood Marshall Elementary School	High Efficiency Transformer Upgrade	$39,892.20	$3,835.37	10.4
04-1	Dr. Martin Luther King Jr MS	Condensing Hot Water Boiler Replacement - DI	$506,866.54	$117.22	4,324.0
07-1	Asbury Park High School	Building Envelope Weatherization	$38,376.48	$3,379.55	11.4
07-1	Dr. Martin Luther King Jr MS	Building Envelope Weatherization	$62,915.64	$4,807.56	13.1
07-1	Bradley Elementary School	Building Envelope Weatherization	$21,723.96	$2,172.71	10.0
07-1	Barack Obama Elementary School	Building Envelope Weatherization	$28,245.84	$1,995.61	14.2

ECM #	Building	Energy Conservation Measure "ECM"	ECM Hard Cost	Total Savings, $/yr	Simple Payback, yrs
07-1	Thurgood Marshall Elementary School	Building Envelope Weatherization	$23,625.24	$1,868.91	12.6
07-1	Dorothy McNish Parent Center	Building Envelope Weatherization	$5,636.52	$545.06	10.3
07-1	Buildings & Grounds	Building Envelope Weatherization	$3,120.18	$209.97	14.9
07-1	Information Technology Center	Building Envelope Weatherization	$1,352.52	$140.71	9.6
08-1	Asbury Park High School	Mechanical Insulation	$12,778.56	$1,513.43	8.4
08-1	Bradley Elementary School	Mechanical Insulation	$7,775.46	$838.32	9.3
08-1	Thurgood Marshall Elementary School	Mechanical Insulation	$6,035.34	$422.45	14.3
08-2	Dr. Martin Luther King Jr MS	Mechanical Insulation - DI	$19,438.65	$0.00	N/A
08-2	Barack Obama Elementary School	Mechanical Insulation - DI	$10,398.90	$0.00	N/A
08-2	Information Technology Center	Mechanical Insulation - DI	$6,349.50	$0.00	N/A
08-2	Buildings & Grounds	Mechanical Insulation - DI	$1,772.25	$0.00	N/A
11-1	Buildings & Grounds	Plug Load Controls	$132.41	$39.81	3.3
11-1	Dorothy McNish Parent Center	Plug Load Controls	$794.46	$82.33	9.6
11-1	Information Technology Center	Plug Load Controls	$1,191.68	$173.20	6.9
11-1	Asbury Park High School	Plug Load Controls	$6,620.46	$521.27	12.7
11-1	Dr. Martin Luther King Jr MS	Plug Load Controls	$7,150.10	$526.51	13.6
11-1	Bradley Elementary School	Plug Load Controls	$4,899.14	$359.65	13.6
11-1	Barack Obama Elementary School	Plug Load Controls	$4,766.73	$425.74	11.2
11-1	Thurgood Marshall Elementary School	Plug Load Controls	$7,150.10	$555.80	12.9
13-1	Asbury Park High School	Cogeneration 35 kW	$420,328.74	$7,095.93	59.2
14-1	Asbury Park High School	Refrigeration Controls	$4,092.24	$1,291.18	3.2
14-2	Dr. Martin Luther King Jr MS	Refrigeration Controls	$2,455.14	$509.09	4.8
14-3	Bradley Elementary School	Refrigeration Controls	$1,637.10	$330.90	4.9
14-4	Barack Obama Elementary School	Refrigeration Controls	$2,455.14	$506.10	4.9
14-5	Thurgood Marshall Elementary School	Refrigeration Controls	$2,455.14	$1,176.82	2.1

ECM #	Building	Energy Conservation Measure "ECM"	ECM Hard Cost	Total Savings, $/yr	Simple Payback, yrs
16-1	Asbury Park High School	Building Automation System -Core	$101,769.48	$152.68	666.5
16-1	Asbury Park High School	Building Automation System -Intermediate	$12,461.34	$18.70	666.5
16-1	Asbury Park High School	Building Automation System -Terminal	$28,612.02	$42.93	666.5
16-1	Dr. Martin Luther King Jr MS	Building Automation System -Core	$29,475.96	$44.56	661.5
16-1	Dr. Martin Luther King Jr MS	Building Automation System -Intermediate	$57,360.72	$86.71	661.5
16-1	Bradley Elementary School	Building Automation System -Core	$35,199.18	$51.88	678.5
16-1	Bradley Elementary School	Building Automation System -Intermediate	$116,700.24	$172.00	678.5
16-1	Bradley Elementary School	Building Automation System -Terminal	$120,114.18	$177.03	678.5
16-1	Thurgood Marshall Elementary School	Building Automation System -Core	$41,370.18	$60.80	680.4
16-1	Thurgood Marshall Elementary School	Building Automation System -Intermediate	$150,065.46	$220.54	680.4
16-1	Thurgood Marshall Elementary School	Building Automation System -Terminal	$259,940.88	$382.02	680.4
16-1	Dorothy McNish Parent Center	Complete Building Automation System	$19,901.22	$35.53	560.1
16-1	Information Technology Center	Complete Building Automation System	$12,595.98	$19.51	645.8
16-1	Buildings & Grounds	Complete Building Automation System	$18,559.92	$34.89	532.0
19-1	Bradley Elementary School	Replacement of Classroom UVs (HPs)	$1,037,952.00	$4,800.66	216.2
22-1	Asbury Park High School	Retrocommissioning	$30,738.05	$4,393.92	7.0
22-1	Dr. Martin Luther King Jr MS	Retrocommissioning	$27,455.37	$2,395.93	11.5
22-1	Bradley Elementary School	Retrocommissioning	$25,899.30	$2,973.16	8.7
22-1	Barack Obama Elementary School	Retrocommissioning	$21,523.75	$1,613.64	13.3
22-1	Thurgood Marshall Elementary School	Retrocommissioning	$29,587.29	$3,511.71	8.4
22-1	Dorothy McNish Parent Center	Retrocommissioning	$1,573.37	$171.87	9.2
22-1	Buildings & Grounds	Retrocommissioning	$4,323.63	$534.14	8.1
22-1	Information Technology Center	Retrocommissioning	$1,699.24	$514.88	3.3
23-1	Asbury Park High School	PC Power Management	$74,460.00	$5,400.81	13.8
24-1	District-Wide	Contingency	$425,000.00	$0.00	N/A
		TOTALS	**$4,922,204.54**	**$165,314.49**	**29.8**

APPENDIX 7. HVAC EQUIPMENT SCHEDULES

Asbury Park High School

Electric HVAC Inventory & Recommendations

		Existing Conditions			
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)
Mech Room	Trane TWE240	1	Split-System AC	20.00	
Roof	Media Center Condensing Unit	1	Split-System AC	20.00	
Ground	McQuay	1	Split-System AC	20.00	
Ground	Carrier 38AH	1	Split-System AC	20.00	
Ground	ICP	1	Split-System AC	7.50	
Windows	Classrooms & Offices	12	Window AC	2.00	
Windows	Classrooms & Offices	5	Window AC	1.00	
Windows	Classrooms & Offices	7	Window AC	0.75	

Barack Obama Elementary School

Electric HVAC Inventory & Recommendations

		Existing Conditions			
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)
Parking Lot	School	1	Split-System AC	7.50	
Parking Lot	School	1	Split-System AC	10.00	
Parking Lot	School	1	Split-System AC	15.00	
BOES	BOES	1	Window AC	0.75	
BOES	BOES	2	Window AC	1.00	

Bradley Elementary School

Electric HVAC Inventory & Recommendations

		Existing Conditions			
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)
Roof	York Split Systems	3	Split-System AC	1.50	
Mech Space	Gym ERU	1	Packaged AC	33.08	
Classrooms	Classrooms HVAC Airedale CMX-4	1	Split-System AC	0.75	
Classrooms	Classrooms HVAC Airedale CMX-5	1	Split-System AC	2.00	
Roof	RTU 1C - Carrier 50PM-C28	1	Packaged AC	25.00	
Roof	RTU 1E - McQuay RPS 020 CSY	1	Packaged AC	20.00	
Roof	RTU 2C - Carrier 50PG-C09	1	Packaged AC	8.50	
Roof	RTU 3C - Carrier 50PM-C24	1	Packaged AC	20.00	
Roof	RTU 4C Carrier 50PG-C08	1	Packaged AC	7.33	
Roof	Sanyo Mini Split	1	Ductless Mini-Split AC	1.46	
Roof	Trane Split	1	Split-System AC	4.00	

Buildings & Grounds

Electric HVAC Inventory & Recommendations

		Existing Conditions			
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)
Grounds building	Office	1	Through-The-Wall AC	1.50	
Garage	Office	1	Through-The-Wall AC	0.75	

Dorothy McNish Parent Center

Electric HVAC Inventory & Recommendations

		Existing Conditions			
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)
McNish	Building	3	Window AC	2.00	
McNish	Building	2	Window AC	1.50	
McNish	Building	1	Window AC	0.75	
McNish	Building	1	Window AC	1.00	

Information Technology Center

Electric HVAC Inventory & Recommendations

		Existing Conditions			
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)
Outside, Rear	Front Office - Carrier	1	Split-System AC	3.00	
Outside, Rear	Carrier	1	Split-System AC	3.00	
Outside, Rear	Server Room - Sanyo	1	Ductless Mini-Split AC	2.83	
Outside, Rear	Server Room - Arcoaire AHU3	1	Split-System AC	5.00	
Server Room	Server Room - Friedrich	2	Through-The-Wall AC	1.67	
Office	Office	3	Window AC	0.75	

Dr. Martin Luther King Jr Middle School

Electric HVAC Inventory & Recommendations

		Existing Conditions			
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)
Fitness Room	Fitness Room	4	Window AC	1.00	
Rm 130	Rm 130	1	Through-The-Wall AC	1.50	
Various	Various	12	Window AC	1.00	
Trailers	Trailers	2	Through-The-Wall HP	2.00	2.00
Roof	Various	2	Packaged AC	10.00	

Thurgood Marshall Elementary School

Electric HVAC Inventory & Recommendations

		Existing Conditions			
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)
Various	Class Room HP - G030VHN	6	Water Source HP	2.50	33.00
Various	Class Room HP - G036VHN	7	Water Source HP	3.00	38.00
Various	Class Room HP - G043VHN	7	Water Source HP	3.50	48.00
Various	Class Room HP - G052VHN	13	Water Source HP	4.33	52.90
Various	Class Room HP - G062VHN	6	Water Source HP	5.00	66.00
Various	Class Room HP - G072VHN	1	Water Source HP	6.00	76.90
Roof	RTU 1A & 5	2	Packaged AC	7.50	
Roof	RTU 1B	1	Packaged AC	8.50	
Roof	RTU 2	1	Packaged AC	12.50	
Roof	RTU 3	1	Packaged AC	15.00	
Roof	RTU 4A & B	2	Packaged AC	20.00	
Roof	RTU-1 (Trane Split)	1	Split-System AC	5.00	
Various	Class Room HP - G024VHN	2	Water Source HP	2.00	24.00

ASBURY PARK BOARD OF EDUCATION

ASBURY PARK BOARD OF EDUCATION - THIRD PARTY ENERGY SAVINGS PLAN REVIEW

February 9, 2021

Prepared by: DLB Associates
(dlb # 15064)

ASBURY PARK BOARD OF EDUCATION - THIRD PARTY

1.1 Executive Summary

1.1.1 Overview

DLB Associates has been commissioned by Asbury Park Board of Education to provide a Third-Party Review of an Energy Savings Plan (ESP) for conformance with State requirements for eight (8) of the Board's facilities. State requirements are set forth in P.L. 2009, Chapter 4, "Energy Savings Improvement Program" and Local Finance Notices 2009-11 and 2011-17. Amendments to P.L. 2009, Chapter 4, are included in P.L. 2012, Chapter 55.

DLB's review includes an analysis of the Energy Savings Plan for conformance with the New Jersey Board of Public Utilities (BPU) Standards and for verification that all required sections were submitted in the ESP Report. A review of the calculations methodology and plan savings as specified by the BPU protocol also was performed.

This report includes the summary and conclusions of DLB's Third-Party Review of the submitted Energy Savings Plan prepared by Energy Systems Group and dated January 18, 2021.

1.1.2 Energy Savings Plan Review

The ESP appears to be complete and contains the required components. DLB has indicated items for further review and expect that the comments can be incorporated without affecting the ESP results significantly.

1.1.3 Energy Savings Calculations Review

The review of the energy savings calculations included within the ESP concluded that the calculations were performed in accordance with industry standard practice and utilizing the intent of the BPU protocol. Spreadsheet analyses were used to calculate Energy Conservation Measure (ECM) savings. The equations used to determine savings follow the protocol's calculation methods for energy efficient construction, but DLB recommends a few areas be clarified as identified in this report.

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ASBURY PARK BOARD OF EDUCATION - THIRD PARTY

2.1 Executive Summary

2.1.1 Energy Savings Plan Overview

The ESP reviewed by DLB Associates was prepared by Energy Systems Group and dated March 13, 2020. The ESP Report includes an analysis for the following eight (8) facilities:

FACILITY INFORMATION	
Building Name	Street Address
Asbury Park High School	1003 Sunset Avenue, Asbury Park, NJ 07712
Barack Obama Elementary School	1300 Bangs Avenue, Asbury Park, NJ 07712
Bradley Elementary School	1100 Third Avenue, Asbury Park, NJ 07712
Dr. Martin Luther King Jr. Middle School	1200 Bangs Avenue, Asbury Park, NJ 07712
Thurgood Marshall Elementary	600 Monroe Avenue, Asbury Park, NJ 07712
Dorothy McNish Parent Center	304 Prospect Avenue, Asbury Park, NJ 07712
Buildings and Grounds	914 Second Avenue, Asbury Park, NJ 07712
Information Technology Center	1506 Park Avenue, Asbury Park, NJ 07712

ASBURY PARK BOARD OF EDUCATION - THIRD PARTY

3.1 Energy Savings Plan Review

3.1.1 Plan Components – Required By P.L. 2012, C.55

The Energy Savings Plan is the core of the Energy Savings Implementation Program (ESIP) process. Planned ECMs are described and the cost calculations supporting how the plan will pay for itself in reduced energy costs are provided. Under the law, the ESP must address the following elements:

- Energy audit results
- Energy conservation measure descriptions
- Greenhouse gas reduction calculations based on energy savings
- Design and compliance issue identification and identification of who will provide these services
- Risk assessment for the successful implementation of the plan
- Identification of eligibility, costs and revenues for demand response and curtailable service activities
- Schedules showing calculations of all costs of implementing the proposed energy conservation measures and the projected energy savings
- Maintenance requirements necessary to ensure continued energy savings
- Description and cost estimates for energy services company (ESCO) savings guarantee

3.1.2 Plan Components – Submitted Plan Review

The submitted ESP, dated January 18th, 2021, is the basis for the Third-Party Review. The table below lists the required elements of the ESP as required by the law, whether the items were addressed satisfactorily in the ESP, and any associated comments.

ASBURY PARK BOARD OF EDUCATION - THIRD PARTY

ENERGY SAVINGS PLAN COMPONENT REVIEW			
Plan Component	Included In Plan	Location In Plan	Comments
Energy Audit Results	Yes	Entire Plan	See Below
ECM Descriptions	Yes	Section 4, Pages 53 - 98	See Section 4 of this Report
Greenhouse Gas Calculations	Yes	Section 3, Page 52	See Section 4.1.6 of this Report
Design and Compliance Issues	Yes	Section 6, Page 109	None

ASBURY PARK BOARD OF EDUCATION - THIRD PARTY

ENERGY SAVINGS PLAN COMPONENT REVIEW			
Plan Component	Included In Plan	Location In Plan	Comments
Implementation Risk Assessment	Yes	Section 6, Page 109	None
Demand Response Program / Curtailable Energy Services	Yes	Section 3, Page 38	None
Implementation Costs	Yes	Section 3, Pages –42-52	See Section 4.1.5 of this Report
Projected Energy Savings	Yes	Section 3, Pages –42-46	See Section 4 of this Report
Maintenance Requirements	Yes	Section 6, Page 108	None
Savings Guarantee Information	Yes	Section 5, Pages 106 - 107	$27,725 in Year 1
Measurement and Verification Plan	Yes	Section 5, Pages –106-107	None

ASBURY PARK BOARD OF EDUCATION - THIRD PARTY

4.1 Energy Savings Calculations Review

4.1.1 Methodology of Submitted Calculations

The Energy Savings Improvement Plan included calculations that utilized BPU-acceptable equations and spreadsheet analyses.

The fourteen (14) ECMs analyzed and accepted in the base project include:

1-1 Comprehensive LED Lighting Upgrades

1-2 Direct Install Program (Lighting)

2-1 Transformer Replacement

4-1 Condensing Hot Water Boiler Plant (Direct Install)

7-1 Building Envelope Weatherization8-1 Mechanical Insulation

8-2 Mechanical Insulation (Direct Install)

11-1 Plug Load Controls

13-1 Cogeneration (CHP) 35 kW

14-1 Improved Temperature Sensor for Walk-In Coolers

16-1 Upgrade Building Management System

19-1 Replacement of Bradley Classroom UVs

22-1 Retro-commissioning

23-1 Install Computer Power Management

24-1Construction Contingency

4.1.2 General Calculation Quality

The quality of the energy savings calculations is satisfactory and representative sample sets were checked for accuracy. Spreadsheet analyses were provided by Energy Systems Group as separate appendix files and have been spot-checked by DLB.

ASBURY PARK BOARD OF EDUCATION - THIRD PARTY

The approach and equations used were summarized broadly in the body of the report with no results given in the ECM description sections. References for equations were listed for some ECMs in the report body. The report body could be expanded to include more details on methodology and results for clarity, but they are included in the Appendix sections.

DLB notes the following comment for the overall report:

ASBURY PARK BOARD OF EDUCATION - THIRD PARTY

1. Any ECMs which propose to modify temperature setpoints or operation schedules of any equipment, including, but not limited to, HVAC equipment, equipment connected to plug load control devices, walk-in freezers or coolers or computing equipment, should be confirmed with the District to ensure there will be no detrimental operations impacts.

   Confirmed.

4.1.3 Mechanical and Electrical Energy Conservation Measures

ECMs were evaluated using spreadsheet analyses. The ECMs submitted agree with Standard Industry Practice and BPU protocol requirements.

DLB notes the following possible issues with the ECM analysis:

ECM 2-1 - Transformer Replacement (4 Buildings)

a) Would be beneficial to define where the "Baseline Transformer Losses" are based on. Not sure if these are based on estimated manufacturer published data or actual field measurements.

   The "Baseline Transformer Losses" were based on a combination of fielded measured loading and losses, estimated manufacturer published data, and a reference database compiled with field measurements of previous installations.

b) The calculations indicate all the transformers have the exact same operating load for all the schools independent of actual electric consumption. For example; Asbury Park HS uses twice the amount of electricity as DR Martin Luther King MS but the transformer calculations indicate the same losses, please verify.

   The operating load values used in the savings calculations were based on field observation made during the site visits.

c) If the "Baseline Transformer Losses" are not measures suggest that the BPU P4P approved table be used for Transformer Savings.

   The "Baseline Transformer Losses" were based on a combination of fielded measured loading and losses, estimated manufacturer published data, and a reference database compiled with field measurements of previous installations.

d) The age of the existing transformers to be replaced should be included in the report.

   Unfortunately, ages of existing transformers are not available. Some age-based information can be inferred from building or addition construction date but lacking definitive information, we chose not to make any assumption and omit transformer age from the report.

e) It appears the savings from this measure for DR Martin Luther King MS and Bradley ES are over 2x the savings predicted at the other two schools, calculations should be checked for consistency.

Savings were based on a combination of fielded measured loading and losses, estimated manufacturer published data, and a reference database compiled with field measurements of previous installations.

ECM 4-1 – Condensing Hot Water Boiler Replacement – DI (Dr Martin Luther King Jr MS)

a) This ECM is listed with a payback of over 4,000 years, well beyond the lifespan of this project. Can you confirm that this is included as a capital improvement project and not for its energy savings?

Correct. This ECM was included by request of the district despite its poor energy savings and payback.

ECM 7-1 – Building Envelope Weatherization (District Wide)

a) The supporting calculations include equations to demonstrate how savings were derived, however, some constants and factors used are not specified. DLB recommends including how the flow factor, wind pressure, heating efficiency, and enthalpy conditions used to calculate savings were derived. The units of measure for these points should be provided as well.

For all energy savings calculations, only the unit savings are pulled into our master cashflow calculations. Even if a dollar savings amount is referenced in a particular savings calculation, it is not used. In the master cashflow calculations, uniform utility rates are applied respective to each building. These rates can be seen in the ESP.

b) The cost and savings dollar values don't match the values reflected in the Energy Savings and Cost Summary table. ESG should highlight why the dollar amounts differ between the report and the calculations.

The scope of work was reduced in a few areas to eliminate a handful of very poorly performing ECMs which negatively affected the projected overall. An additional table in the Appendix has been added which details per building and per scope item if it is included or excluded from the project. This is what the ECM costs and savings is based off of.

c) The ESP includes savings equations for heating, but not cooling. The cooling equations should be included.

Cooling equations have been included in the ECM description.

ECM 8-1 – Mechanical Insulation (3 Buildings)

a) It appears that some of the unit quantities for the insulation installations at the various schools do not match in the 'BER Mechanical Insulation Report' and should be double checked. For example, the 'Mechanical Insulation Work Summary' under 'Straight Pipe Insulation (LF)' for Asbury Park High School on page 4 indicates 52 LF of insulation, however, the 'Mechanical Insulation Savings Summary' on page 8 indicates 6@4"Dia and 4@3"Dia for MTHW and 30@1-1/2"Dia for DHW (40 total LF).

There is an additional straight line pipe line for 12 LF in the table on page 8 making the numbers match the 52 LF listed on page 4.

b) Does the scope included any replacement / repair of corroded piping or failing valves? The insulation ECM would need these items corrected before insulation could be applied.

It does not. However, the contingency ECM is included to account for deficiencies such as this found during construction.

c) Is there any existing hazardous materials (Asbestos Abatement) that would impact the cost of this ECM?

No known asbestos piping insulation is to be affected by this ECM. Should some be found, contingency funds can be used for abatement.

d) Electrical cost is estimated at .096 / KWh that matches the ESIP but Natural gas cost is estimated at 1.18 / therm and the ESIP lists Natural gas as 0.74 / therm. These values should be coordinated.

For all energy savings calculations, only the unit savings are pulled into our master cashflow calculations. Even if a dollar savings amount is referenced in a particular savings calculation, it is not used. In the master cashflow calculations, uniform utility rates are applied respective to each building. These rates can be seen in the ESP.

ECM 8-2 – Mechanical Insulation – DI (4 Buildings)

e) The ESIP includes the same description for 8-1 and 8-2 but the ECMs listed as 8-2 indicate 0 savings. Is there 0 savings under Direct Install for this ECM?.

Several complications arose in determining precise savings associated with this ECM at this buildings. Firstly, the boiler plant at MLK is being replaced meaning while pipe insulation is going to be needed, it's not immediately clear what the associated savings are. For the other buildings, piping insulation is being completed but the associated savings are expected to be small. The Obama school is running in unoccupied mode compared to the baseline period of occupied and both the IT Center and the B&G building are small in consumption. It was determined that for the basis of a guarantee, it was better to the school district to anticipate no savings and benefit from the inevitable ones once the project is completed.

ECM 11-1 - Plug Load Controls (District Wide)

f) Would the plug load controllers integrated into the district's building management system occupancy controls or would they be a separate program that the maintenance folks would need to coordinate?

It will be a separate program that the IT department will manage. This has been discussed with the district and appropriate training has been planned.

g) Do the plug load controllers have a manual override or would they need to be removed to allow for off hour use?

Yes, there is a manually override on the plug load controller itself should the device need to be operated outside of the scheduled use period.

h) The calculations use a blended rate of $0.13 which should be adjusted to match the actual blended rate of the school utility bills from page 39.

For all energy savings calculations, only the unit savings are pulled into our master cashflow calculations. Even if a dollar savings amount is referenced in a particular savings calculation, it is not used. In the master cashflow calculations, uniform utility rates are applied respective to each building. These rates can be seen in the ESP.

i) In the Asbury Park Detailed Audit Workbook is appears the hours scheduled 'ON' is the same as hours schedule 'OFF', is this correct?

I confirmed that the workbook lists the on hours as 2,691 and the off hours as 6,069 for Asbury Park High School

j) The ESIP report notes an overall count of 246 'Berts' and the calculations note 247, they should be adjusted to coordinate.

The discrepancy has been corrected with the correct value of 247 being used throughout

k) How were the Scheduled ON and Scheduled OFF hours determined (Measured or Estimated)? For example, IT Center notes that the Projector is on 8760 hours Baseline and with Berts it is schedule to be off 8760 hours – does this mean it is not used?

For many of the devices, the savings associated are not from controlling it being on and off but rather from reducing the parasitic load of the device which is the power drawn while the device is turned off and not used.

ECM 13-1 –Cogeneration 35 kW (Asbury Park HS)

a) -The calculations indicate 12 months of Thermal load (10% from May – October and 90% for the remainder of the year). The ESIP notes that the CHP will tie into the Boiler Plant for Thermal load. It is recommended the boiler operations scheduled been confirmed with the Board Of Education (boiler run all year?)
The CHP is employing a thermal load module to be able to address both heating hot water laters as well as domestic hot water loads. In seasons where primary boilers are not used, the domestic hot water will be used as a sink for the CHP heat recovery

b) How are the TLF factors determined? These seem to be inconstant with actual therms used: for example May uses 2322 therms and is given a 10% TLF and October uses 477 therms and is given a 90% TLF.
For May, a conservative TLF of 10% was chosen to ensure that when applying the savings estimation over the full length of the ESIP term, the CHP savings wouldn't be too aggressive. While that May utility bills used in the baseline period showed significant gas usage similar to a month like November, May can be a quite low HDD month. By using 10% instead of 90%, we are erring on the side of caution and ensuring the CHP performance will meet and exceed the expectations the ESP lays out.

c) The Appendix notes a CHP efficiency of 88%, how is this used in the calculations?
The total efficiency value of 88% for the CHP includes both the thermal and electrical output of the unit. This value isn't used directly since the electrical and thermal components are calculated separately. The electrical savings uses an actual output of 34.2 kW after removing parasitic loads from its 35 kW nameplate value. The thermal components uses a 3.67 Therm input and 2.12 Therm for determining the thermal recovery.

d) The calculation methodology in the ESIP does not seem to match the Appendix calculation methodology, it is recommended these are updated to be consistent.
This has been corrected and the ESP methodology now matches that of the Appendix.

e) The ESIP energy savings and cost summary table indicates a savings of ~ $ 7,095 and the appendix calculations seem to indicate a savings of ~ $ 7,600. Please revise for consistency.
For all energy savings calculations, only the unit savings are pulled into our master cashflow calculations. Even if a dollar savings amount is referenced in a particular savings calculation, it is not used. In the master cashflow calculations, uniform utility rates are applied respective to each building. These rates can be seen in the ESP.

f) The electricity generated is reported as electric energy savings, however, the protocols state that the generation and capacity should be reported as Distributed Generation, separate from energy savings.

The savings numbers have been revised to clearly delineate between the ECMs providing energy savings and the kWh reduction in grid consumption as a result of the distributed generation from the CHP.

g) ESP calls for the installation of a Yanmar CHP but the appendix file uses the data for Tecogen CHP. Please make sure that the same unit is used for both ECM description and calculations.

The appendix file lists a few different CHP models depending on what size is selected. For Asbury Park HS, the 35 kW was the best fit and uses the same Yanmar unit the ESP lists. The Tecogen units are 75 and 100 kW and can be disregarded as they are not used in the calculations.

h) Has the annual maintenance costs / contract been reviewed with the Board Of Education for additional cost impact?

Yes. It has been discussed that the maintenance contract cannot be carried a part of the ESP and must be managed by the district.

i) It may be beneficial to note the total expected operating hours that the CHP Plant is planned to be run and verify with the BOE personnel. Appendix notes 8,760 annual operating hours which would indicate fully operational for the majority of the school year.

Correct. This was addressed during conversations with the district. The thermal load factor is used to address the unit running below maximum capacity during months were the thermal demand in particular is anticipated to be low.

ECM 14-1 –Refrigeration Controls (5 Buildings)

a) Annual baseline electric consumption values are provided for each type of unit, but no explanation of how these were determined is provided. DLB suggests providing a calculation or description stating how these values were obtained.

Additional documentation has been added to the electronic appendix to support the annual baseline electric consumption values. They are based on previous case studies with similar equipment and usages.

b) The calculations appear to utilize an electric rate 0f $ 0.1475 and should be adjusted to match the actual utility rate from the ESIP.

For all energy savings calculations, only the unit savings are pulled into our master cashflow calculations. Even if a dollar savings amount is referenced in a particular savings calculation, it is not used. In the master cashflow calculations, uniform utility rates are applied respective to each building. These rates can be seen in the ESP.

c) The calculations show maintenance savings, was this included in the ESIP.

This maintenance savings was included in our savings. Only the energy unit savings were included.

d) The calculations seem to calculate savings by applying a general 23% savings factor to the baseline consumption. Additional detail should be included to define how this savings factor is derived.

Additional documentation has been added to the electronic appendix to support this savings factor.

ASBURY PARK BOARD OF EDUCATION - THIRD PARTY

ECM 16-1 –Building Automation System (7 Buildings)

a) ESIP notes that the district currently has a BAS, will the new upgrade include any additional energy savings measures such as occupancy, demand control ventilation, etc?
The district has a BAS but it varies greatly from building to building. Some, like the HS, have a BAS that works well for the most part while others, like MLK, have a defunct pneumatic system which barely works. Additionally, several of the smaller buildings like the IT center use residential style thermostats. Savings are primarily driven by correctly scheduling buildings and their equipment.

b) The Appendix. includes an estimated 1% savings for this upgrade, it would be helpful to indicate what energy savings controls measures are anticipated that would provide these savings..
Savings are primarily driven by correctly scheduling and controlling HVAC equipment to ensure setpoints are kept when the building is occupied and are setback during periods that the building is unoccupied.

c) ECM description includes central boiler plant, terminal units and common area AHU units for most of the schools, may want to clarify if any other systems that would benefit from schedule control such as Exhaust Fans, Split Systems, etc are included in the DDC control scope (if applicable)
The ECM description details the complete BAS scope including items such as exhaust fans and split system units under “Scope of Work”

ECM 19-1 –Replacement of Classroom UV Units (Bradley Elementary School)

a) It appears the methodology described in the ESIP does not match the methodology used in the Appendix Calculations, they should be updated to match.
The methodology listed in the ESP has been updated to match.

b) The calculations appear to utilize an electric rate 0f $ 0.101 and should be adjusted to match the actual utility rate from the ESIP.

For all energy savings calculations, only the unit savings are pulled into our master cashflow calculations. Even if a dollar savings amount is referenced in a particular savings calculation, it is not used. In the master cashflow calculations, uniform utility rates are applied respective to each building. These rates can be seen in the ESP.

c) The Appendix appears to indicate only 40% of the UV Colling is currently functional, does the Replacement project include replacement of these units (cooling would become functional and use more energy)?
Correct. By request of the district, all of the existing UV units will be replaced. The cooling savings come from the increase in efficiency of the new units over the old combined with the baseline adjustment to account for the majority of the UVs not currently cooling.

ECM 22-1 –Retro-commissioning (District Wide)

a) The stipulated savings are shown as percentage reductions of Electric and Gas utilities. DLB recommends explaining the factors contributing to how the percentages were chosen for each facility. For example, are the sizes of the buildings, types of equipment, and existing control system types are considered in the value, these should be highlighted.

In the ECM savings caluclations, notes are included which list example of the deficinies found which led to the stipulated savings percentages being used.

b) It appears that the Retro-Cx scope is limited to the HVAC and Building Automation System components and it would be beneficial to include a short list of systems fall under this scope (Boiler, Heating, Cooling, Ventilation, BMS, Unit Ventilators, etc).

The ECM description lists examples of equipment to be included in the retrocomissioning work.

c) It is noted that the RCx Task 2 scope and fee will be re-evaluated after Task 1 is complete. Will the estimated savings also be reevaluated at this time?

Yes, savings will be reevaluated that that time.

d) ECM 16-1 includes replacement of existing district wide BMS system, would this not eliminate the savings achievable by this ECM?

No, the primary driver for savings of the BAS is scheduling and setpoint adjustment based on occupied/unoccupied. The Retrocommissioning will focus more on physical improvements. Examples of improvement opportunities include VFDs running in hand at 100%, reducing/eliminating equipment shortcycling (compressors/boilers) [savings for this not included in BAS savings], correcting deficiencies with equipment like RTU doors not shutting/sealing correctly, and more.

ECM 23-1 - Install Computer Power Management System (Asbury Park HS)

a) The ESIP description indicates that this upgrade covers 2,033 existing computers with current operating hours of ~ 4,230 per year. It may be beneficial to indicate how these hours were determined (Measured or Estimated) to verify the reduction in operating hours do not impact function.

Estimated based on previous computer management system installations and their associated pre-adjusted usages.

b) The vendor savings calculation shows a $13,387.02 savings per year and appears to only included Laptop Computers. Is this calculation based on actual laptop consumption and operating hours or is this an estimated value?

Estimated based on: number of computers to be addressed, estimated annual operating hours, proposed annual operating hours, and the estimated power reduction between active and dormant power states.

c) Do the calculations take into account operating hours for Laptop charging?

The active vs dormant laptop power consumption is based on the assumption that the laptops are on and plugged in. Laptops not plugged in will not consume power but will be conservative canceled out once plugged in to charge due to the much higher power consumption until the battery is fully charged.

d) The vendor's user manual mentions 1 year support and maintenance, is there an expected maintenance cost between years 2 and 20 for this ECM?, There is not. The expectation is the first year of support is to assist in any issues that arise once the system is set up. After that, the district's IT department will be able to manage and maintain the system as part of normal laptop maintenance.

e) Is the 'Business Edition License' cost included in the ECM cost and is this a annual fee that the school will need to budget each year?

The costs included perpetual licenses for all laptops addressed

e) Has the software compatibility and system been reviewed with the Asbury Park BOE IT Department for any specific concerns based on their systems?

While ESG has not had a specific discussion with the Asbury Park IT department, we have had several with the facilities manager and other district staff. This is because other ECMs, like the Plug Load Controls, rely on assistance from the IT department and we like to begin the process as early as possible. The district and ESG have had several productive discussions regarding the PC Power Management and they did not have any concerns that weren't already addressed or answered.

ECM -24-1 – Construction Contingency

a) This is listed as a recommended Energy Savings Measure in Section 3 with zero savings. Confirm this is part of the construction soft costs of the project and not an Energy Conservation Measure.
Correct. This is not an Energy Conservation Measure and is part of the construction soft costs.

b) The Contingency value is noted as $425,000, which is ~ 10% of the estimated construction cost. May be beneficial to review this value with the construction team to confirm it is acceptable for public bid.
We've worked closely with the construction team to ensure they were comfortable with the contingency carried.

4.1.4 Lighting Energy Conservation Measures

Lighting improvement savings calculations were performed in a satisfactory manner using a spreadsheet analysis and reviewed in a spot-check fashion.

DLB notes the following potential issues with the lighting ECM analysis:

ECM 1-1 - Comprehensive LED Lighting Upgrades (3 Buildings)

a) It may be beneficial to include the DLC listing cut sheet along with the fixture cut, DLC ratings are often tied to specific locations for each fixture and NJ Smart Start Incentives hinge on this certification.
The included cutsheets confirm DLC listing of the respective products.

b) It appears that this ECM is primarily Lamp replacement, with a limited number of complete fixture replacements. Can you confirm that this does not include fixture retrofits (removal of existing Ballasts
This will remove existing ballasts and the new LED lamps will be run off of line voltage.

c) If this measure does include bypassing or removing existing ballasts can you confirm that retrofit kits used will not void UL listing on lighting fixtures

The retrofit work to be completed will not void UL listing on the lighting fixtures.

d) Can you also confirm Operational and Maintenance savings does not include savings for ballasts ?

Correct, it is for lamps only.

e) Please, identify source of “Current Hours.” It appears that the entry areas use a variety of differing hours (example HS CR101 lists 1715 hours) and some of these differs from the suggested hours of operation in the BPU protocol.

The houses listed for current hours were determined with feedback from the district in order to most accurate capture typical usage despite the pandemic’s effect on school occupancy

f) It appears that some of the fixtures obtain savings from reduced operating hours, can you confirm the source of this reduction and how it it was calculated?

Bradley and Thurgood will not have occupancy controls installed and all savings are from the wattage reduction, not an operating hour reduction. The High School, however, does not have the same switching limitations as the other schools and will have some occupancy sensors installed leading to savings coming from both wattage reduction as well as operating hour reductions.

g) The energy savings calculations do not appear to utilize the coincidence factor (CF) or HVAC Interactive Factors used in the BPU Protocols.

There is a separate spreadsheet in the electronic appendix which calculates the HVAC interactions including whether or not buildings have cooling and to what extent.

h) The calculations detail replacement by room for Classrooms, Common Spaces, Bathrooms, Office space etc. Can you confirm that these include any Gymnasium or Auditorium special use spaces and if so has it been confirmed if the retrofit will integrate with any existing specialized controls for those spaces.

Auditoriums have been excluded in order to not interfere with existing controls, specialized lights, etc. Gymnasiums are being retrofit, generally with fixture replacements for their high bay lights.

i) It may be worth while to double check the calculations in the attachments vs the report or add a note clarifying all the pieces that add up to the final savings. Looking at Asbury Park HS the calculations indicate a savings of ~ 168,055 kWh at $ 0.098 computes to a savings of ~ $16,000 annually.

For all energy savings calculations, only the unit savings are pulled into our master cashflow calculations. Even if a dollar savings amount is referenced in a particular savings calculation, it is not used. In the master cashflow calculations, uniform utility rates are applied respective to each building. These rates can be seen in the ESP.

j) Would there be a need to re-evaluate the installation costs, operating ours due to current events (COVID-19) and how this will impact energy savings?

It is the intention of the district to return to standard operating hours once the pandemic is over and has begun that process. For savings spanning the length of the ESIP, we opted to maintain the baseline conditions as they are what is expected over the life of the project. Additionally, due to a longer installation period, we expect that the effects of the pandemic will be largely over when construction completes as vaccination have increased dramatically and infection rates have decreased.

k) It appears that “Controls” are only being installed at Asbury Park HS. It would be beneficial to clarify and indicate why these are not being considered at the other two schools that are receiving Lighting Upgrades

The other two schools employ bi-level switching which makes the installation of traditional, switch-based occupancy sensors financially infeasible and as such, have been dropped from the scope of work.

l) It is recommended to separate Lighting and Controls ECMs into separate line items (similar to the DI line items)

Lighting controls represent only a small portion of the savings for the entire lighting scope and are only being complete at the HS for non-DI buildings. A significant majority of the total lamps will not have OS installed on them even in the HS. As such, it was made sense to combine the two scopes into one ECM. The district is aware and understands that OS will not being installed in the other two schools.

ECM 1-2 - Direct Install Program (Lighting) (5 Buildings)

a) Confirm that this ECM falls under the current Direct Install Program, this program has been significantly changing each year.

We've confirmed with this with the DI vendor and have been working closely with them to navigate the various changes that have happened and that are expected to happen.

b) For the Direct install program the customer shall pay the contractor based Customer Unit Cost'. The unit costs should be reviewed, it appears the unit cost varies slightly from school to school For example ; (LED 4-Lamp – 4 foot T8) for the Buildings and Grounds SOW, for example, would be $206.19/6 = $34.37 where the unit cost per fixture for line item 2 (LED 2 Lamp – U-Bend) would be $56.17/3 = $18.72.

Cost difference noted above is for two different existing lighting fixtures with two different solutions required.

c) There is a similar unit cost variation between similar lighting controls among the different facilities. Dual technology wall switch for Barack Obama School is $62.53, while same switch description for Buildings and Grounds is $40.80. Please clarify.

The estimated incentive amount is lower for the Obama school than the Buildings and Grounds as calculated by the DI vendor causing the customer responsible component to increase.

ASBURY PARK BOARD OF EDUCATION - THIRD PARTY

4.1.5 Financial Calculations

Form VI - Energy Savings Plan has been included in the ESIP. This form includes the financing term of 20 years and the 2.25% interest rate for the loan. The BPU-required utility escalations of 2.2% electric and 2.4% for natural gas are shown.

DLB notes the following potential issues with the financial calculations:

1. In Form VI on page 39 of the report, the Annual Energy Savings column shows $269,948 of savings in Year 1 and $100,966 in Year -0. The Energy Savings and Cost Summary sheet shows a total energy savings of
$165,314. The reasoning behind this increase in projected savings should be included.

   Year 1 includes the savings obtained during the construction period.

2. Form VI shows a total of $342,906 Energy Rebates / Incentives with . The Potental Revenue Generation Estimates, seem to total over $350,000 for incentives from Smart Start, Cogeneration, and Demand Response programs. These values should be coordinated.
Cogeneration incentives were investigated and deemed not applicable due to the payback of the CHP ECM not meeting the requirements. It was included in the report for completeness but has a note at the end of the section saying the financial incentive is ineligible.

3. LFN 2009-11 requires that any capital improvements be paid through other appropriations (i.e., bonds or capital improvement funds), not energy savings obligations. DLB recommends confirming that any capital improvements are planned to be funded appropriately.
Any capital improvements being funded via energy savings should be well below the allowed percentage of total project costs as the vast majority of the project has energy savings associated with it.

4. Some ECMs have lengthy simple payback periods, beyond the overall ESP timeframe. Confirm that these measures have been selected by the BOE-as capital improvement projects (not for their energy savings).
Correct, several of the ECMs included in this project were done so at the request of the district.

ASBURY PARK BOARD OF EDUCATION - THIRD PARTY

4.1.6 Greenhouse Gas Calculations

Greenhouse gas calculations are provided, and the factors used to calculate savings are clearly called out in the report. The factors should be revised to meet the current BPU guidelines, shown on page 13 of the protocol:

- 1,374 lbs. CO_2 per MWh saved
- 1.11 lbs. NO_x per MWh saved
- 0.98 lbs. SO_2 per MWh saved
- 11.7 lbs. CO_2 per therm saved
- 0.0092 lbs. NO_x per therm saved

I confirmed that the factors shown above match those used in the GHG calculations and are shown in the ESP document.

ASBURY PARK BOARD OF EDUCATION - THIRD PARTY

5.1 Review Disclaimer

DLB Associates, as part of the Third-Party Review services, is providing our professional opinion in the evaluation of the energy savings calculations, ESP and any other supporting documentation provided.

This evaluation is not a guarantee that the savings and assumptions stated are valid. DLB Associates will not be responsible for any failure in achieving the predicted energy and cost savings detailed. Our intention is to complete our due diligence in verifying the energy savings calculations in accordance with the BPU protocols; however, it is impractical to review all inputs in detail. As a result, bottom line numbers and a limited number of parameters have been verified to conclude validity of savings.