Local Government Energy Audit Report

Belmont Runyon Elementary School

August 26, 2019

Prepared for:
Newark Public Schools
1 Belmont Runyon Way
Newark, NJ 07108

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Disclaimer

The goal of this audit report is to identify potential energy efficiency opportunities, help prioritize specific measures for implementation, and provide information about financial incentives that may be available. Most energy conservation measures have received preliminary analysis of feasibility that identifies expected ranges of savings and costs. This level of analysis is usually considered sufficient to establish a basis for further discussion and to help prioritize energy measures.

TRC Energy Services (TRC) reviewed the energy conservation measures and estimates of energy savings were reviewed for technical accuracy. Actual, achieved energy savings depend on behavioral factors and other uncontrollable variables and, therefore, estimates of final energy savings are not guaranteed. TRC and the New Jersey Board of Public Utilities (NJBPU) shall in no event be liable should the actual energy savings vary.

TRC bases estimated installation costs on our experience at similar facilities, pricing from local contractors and vendors, and/or cost estimates from RS Means. We encourage the owner of the facility is encouraged to independently confirm these cost estimates and to obtain multiple estimates when considering measure installations. Actual installation costs can vary widely based on individual measures and conditions. TRC and NJBPU do not guarantee installed cost estimates and shall in no event be held liable should actual installed costs vary from estimates.

New Jersey's Clean Energy Program's (NJCEP) incentive values provided in this report are estimates based on program information available at the time of the report. Incentive levels are not guaranteed. The NJBPU reserves the right to extend, modify, or terminate programs without prior notice. Please review all available program incentives and eligibility requirements prior to selecting and installing any energy conservation measures.

The customer and their respective contractor(s) are responsible to implement energy conservation measures in complete conformance with all applicable local, state, and federal requirements.

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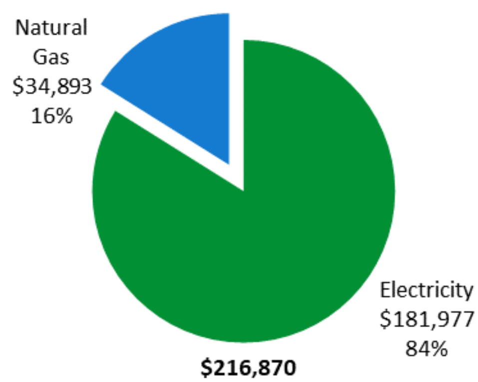
1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Belmont Runyon Elementary School. This report provides you with information about your facility's energy use, identifies energy conservation measures (ECMs) that can reduce your energy use, and provides information and assistance to help make changes in your facility. TRC conducted this study as part of a comprehensive effort to assist New Jersey school districts and local governments in controlling their energy costs and help protect our environment by reducing statewide energy consumption.

BUILDING PERFORMANCE REPORT

Annual Utilities	Costs: $216,870 Electricity: 1,500,048 kWh Natural Gas: 38,065 Therms	
ENERGY STAR® Benchmarking Score	16 *(1-100 scale)*	This building performs at or below the national average. This report contains suggestions about how to improve building performance and reduce energy costs.

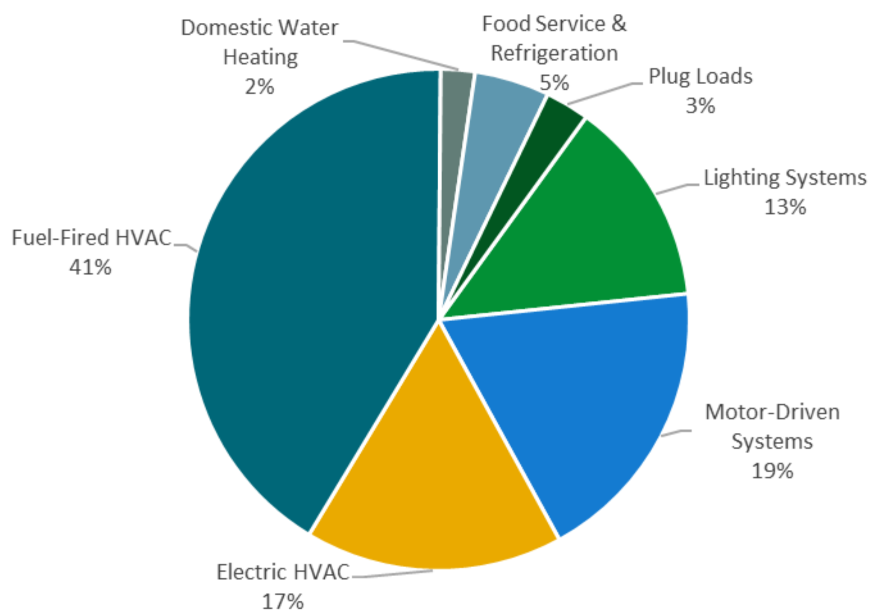


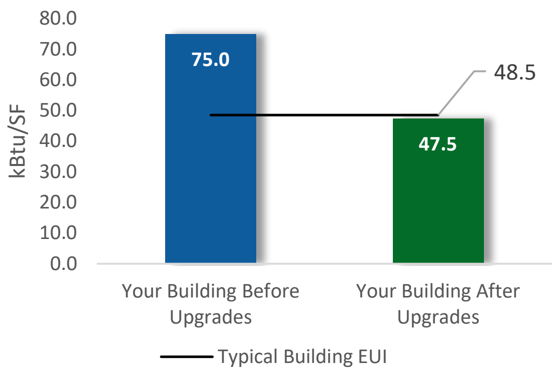
Figure 1 - Energy Use by System

POTENTIAL IMPROVEMENTS

This energy audit considered a range of potential energy improvements in your building. Costs and savings will vary between improvements. Presented below are two potential scopes of work for your consideration.

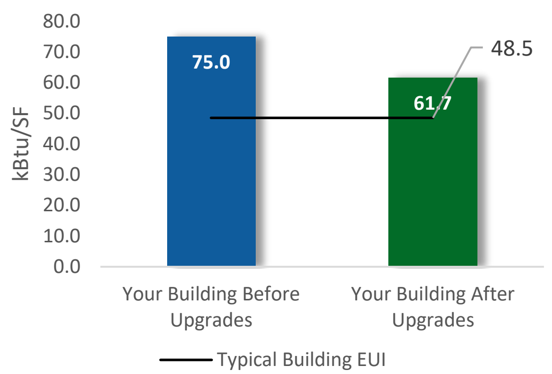
Scenario 1: Full Package (all evaluated measures)

Installation Cost	$1,478,094
Potential Rebates & Incentives[1]	$85,929
Annual Cost Savings	$76,442
Annual Energy Savings	Electricity: 515,348 kWh Natural Gas: 15,188 Therms
Greenhouse Gas Emission Savings	348 Tons
Simple Payback	18.2 Years
Site Energy Savings (all utilities)	37%



Scenario 2: Cost Effective Package[2]

Installation Cost	$473,387
Potential Rebates & Incentives	$38,555
Annual Cost Savings	$54,575
Annual Energy Savings	Electricity: 444,285 kWh Natural Gas: 738 Therms
Greenhouse Gas Emission Savings	228 Tons
Simple Payback	8.0 Years
Site Energy Savings (all utilities)	18%



On-site Generation Potential

Photovoltaic	High
Combined Heat and Power	None

[1] Incentives are based on current SmartStart Prescriptive incentives. Other Program incentives may apply.

[2] A cost-effective measure is defined as one where the simple payback does not exceed two-thirds of the expected proposed equipment useful life. Simple payback is based on the net measure cost after potential incentives.

#	Energy Conservation Measure	*Cost Effective*	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**135,001**	**26.9**	**-31**	**$16,094**	**$118,816**	**$21,035**	**$97,781**	**6.1**	**132,319**
ECM 1	Install LED Fixtures	Yes	49,098	5.5	-3	$5,928	$67,128	$9,600	$57,528	9.7	49,074
ECM 2	Retrofit Fixtures with LED Lamps	Yes	85,903	21.4	-28	$10,166	$51,688	$11,435	$40,253	4.0	83,245
Lighting Control Measures			**20,546**	**4.9**	**-6**	**$2,442**	**$29,134**	**$3,485**	**$25,649**	**10.5**	**20,040**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	15,667	4.6	-5	$1,854	$26,534	$3,485	$23,049	12.4	15,183
ECM 4	Install Daylight Dimming Controls	Yes	3,416	0.2	0	$414	$1,200	$0	$1,200	2.9	3,440
ECM 5	Install High/Low Lighting Controls	Yes	1,463	0.2	0	$173	$1,400	$0	$1,400	8.1	1,418
Motor Upgrades			**2,600**	**0.8**	**0**	**$315**	**$24,278**	**$0**	**$24,278**	**77.0**	**2,618**
ECM 6	Premium Efficiency Motors	Yes	2,600	0.8	0	$315	$24,278	$0	$24,278	77.0	2,618
Variable Frequency Drive (VFD) Measures			**147,978**	**39.3**	**0**	**$17,952**	**$79,682**	**$10,320**	**$69,362**	**3.9**	**149,013**
ECM 7	Install VFDs on Constant Volume (CV) Fans	Yes	85,431	24.3	0	$10,364	$48,010	$6,720	$41,290	4.0	86,028
ECM 8	Install VFDs on Chilled Water Pumps	Yes	41,698	11.1	0	$5,059	$19,003	$3,600	$15,403	3.0	41,990
ECM 9	Install VFDs on Heating Water Pumps	Yes	20,849	3.8	0	$2,529	$12,669	$0	$12,669	5.0	20,995
Electric Unitary HVAC Measures			**15,334**	**6.7**	**0**	**$1,860**	**$92,356**	**$5,952**	**$86,404**	**46.4**	**15,441**
ECM 10	Install High Efficiency Air Conditioning Units	No	15,334	6.7	0	$1,860	$92,356	$5,952	$86,404	46.4	15,441
Electric Chiller Replacement			**55,729**	**31.0**	**0**	**$6,761**	**$331,351**	**$31,464**	**$299,887**	**44.4**	**56,118**
ECM 11	Install High Efficiency Chillers	No	55,729	31.0	0	$6,761	$331,351	$31,464	$299,887	44.4	56,118
HVAC System Improvements			**4,479**	**0.0**	**83**	**$1,304**	**$12,235**	**$0**	**$12,235**	**9.4**	**14,227**
ECM 12	Implement Demand Control Ventilation (DCV)	Yes	4,479	0.0	83	$1,304	$12,235	$0	$12,235	9.4	14,227
Domestic Water Heating Upgrade			**45,000**	**13.5**	**-194**	**$3,681**	**$20,654**	**$3,315**	**$17,339**	**4.7**	**22,605**
ECM 13	Install Gas-Fired Booster Water Heater	Yes	45,000	13.5	-195	$3,672	$20,611	$3,315	$17,296	4.7	22,483
ECM 14	Install Low-Flow DHW Devices	Yes	0	0.0	1	$10	$43	$0	$43	4.5	123
Food Service & Refrigeration Measures			**10,341**	**0.9**	**0**	**$1,255**	**$6,288**	**$400**	**$5,888**	**4.7**	**10,413**
ECM 15	Refrigerator/Freezer Case Electrically Commutated Motors	Yes	1,966	0.2	0	$239	$1,213	$0	$1,213	5.1	1,980
ECM 16	Refrigeration Controls	Yes	3,540	0.1	0	$429	$4,385	$250	$4,135	9.6	3,564
ECM 17	Vending Machine Control	Yes	4,836	0.6	0	$587	$690	$150	$540	0.9	4,869
Custom Measures			**78,340**	**0.0**	**1,666**	**$24,778**	**$763,300**	**$9,958**	**$753,342**	**30.4**	**273,993**
ECM 18	Computer Power Management Software	Yes	5,964	0.0	0	$723	$4,300	$0	$4,300	5.9	6,005
ECM 19	Installation of an Energy Management System	Yes	72,376	0.0	221	$10,809	$178,000	$0	$178,000	16.5	98,794
ECM 20	Heating System Upgrades	No	0	0.0	1,445	$13,246	$581,000	$9,958	$571,042	43.1	169,194
TOTALS (COST EFFECTIVE MEASURES)			**444,285**	**86.3**	**74**	**$54,575**	**$473,387**	**$38,555**	**$434,832**	**8.0**	**456,036**
TOTALS (ALL MEASURES)			**515,348**	**124.0**	**1,519**	**$76,442**	**$1,478,094**	**$85,929**	**$1,392,165**	**18.2**	**696,789**

* - All incentives presented in this table are based on NJ SmartStart equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

Figure 2 – Evaluated Energy Improvements

1.1 Planning Your Project

Careful planning makes for a successful energy project. When considering this scope of work, you will have some decisions to make, such as:

- How will the project be funded and/or financed?
- Is it best to pursue individual ECMs, groups of ECMs, or use a comprehensive approach where all ECMs are installed together?
- Are there other facility improvements that should happen at the same time?

Pick Your Installation Approach

New Jersey's Clean Energy Programs give you the flexibility to do a little or a lot. Rebates, incentives, and financing are available to help reduce both your installation costs and your energy bills. If you are planning to take advantage of these programs, make sure to review incentive program guidelines before proceeding. This is important because in most cases you will need to submit applications for the incentives before purchasing materials or starting installation.

The potential ECMs identified for this building likely qualify for multiple incentive and funding programs. Based on current program rules and requirements, your measures are likely to qualify for the following programs:

Energy Conservation Measure		SmartStart	Direct Install	Pay For Performance
ECM 1	Install LED Fixtures	x		x
ECM 2	Retrofit Fixtures with LED Lamps	x		x
ECM 3	Install Occupancy Sensor Lighting Controls	x		x
ECM 4	Install Daylight Dimming Controls			x
ECM 5	Install High/Low Lighting Controls			x
ECM 6	Premium Efficiency Motors			x
ECM 7	Install VFDs on Constant Volume (CV) HVAC	x		x
ECM 8	Install VFDs on Chilled Water Pumps	x		x
ECM 9	Install VFDs on Hot Water Pumps			x
ECM 10	Implement Demand Control Ventilation			x
ECM 11	Install Gas-Fired Booster Water Heater	x		x
ECM 12	Install Low-Flow Domestic Hot Water Devices			x
ECM 13	Refrigerator/Freezer Case Electrically Commutated Motors	x		x
ECM 14	Refrigeration Controls	x		x
ECM 15	Vending Machine Control	x		x
ECM 16	Computer Power Management Software			x
ECM 17	Installation of an Energy Management System			x

Figure 3 – Funding Options

New Jersey's Clean Energy Programs At-A-Glance

	SmartStart Flexibility to install at your own pace	**Direct Install** Turnkey installation	**Pay for Performance** Whole building upgrades
Who should use it?	Buildings installing individual measures or small group of measures.	Small to mid-size facilities that can bundle multiple measures together. Average peak demand should be below 200 kW. Not suitable for significant building shell issues.	Mid to large size facilities looking to implement as many measures as possible at one time. Peak demand should be over 200 kW.
How does it work?	Use in-house staff or your preferred contractor.	Pre-approved contractors pass savings along to you via reduced material and labor costs.	Whole-building approach to energy upgrades designed to reduce energy use by at least 15%. The more you save, the higher the incentives.
What are the Incentives?	Fixed incentives for specific energy efficiency measures.	Incentives pay up to 70% of eligible costs, up to $125,000 per project. You pay the remaining 30% directly to the contractor.	Up to 25% of installation cost, calculated based on level of energy savings per square foot.
How do I participate?	Submit an application for the specific equipment to be installed.	Contact a participating contractor in your region.	Contact a pre-qualified partner to develop your energy reduction plan and set your energy savings targets.

Take the next step by visiting **www.njcleanenergy.com** for program details, applications, and to contact a qualified contractor.

Individual Measures with SmartStart

For facilities wishing to pursue only selected individual measures (or planning to phase implementation of selected measures over multiple years), incentives are available through the SmartStart program. To participate, you can use internal resources or an outside firm or contractor to perform the final design of the ECM(s) and install the equipment. Program pre-approval is required for some SmartStart incentives, so only after receiving pre-approval should you proceed with ECM installation.

Turnkey Installation with Direct Install

The Direct Install program provides turnkey installation of multiple measures through an authorized network of participating contractors. This program can provide substantially higher incentives than SmartStart, up to 70% of the cost of selected measures. Direct Install contractors will assess and verify individual measure eligibility, and in most cases, they perform the installation work. The Direct Install program is available to sites with an average peak demand of less than 200 kW.

Whole Building Approach with Pay for Performance

Pay for Performance can be a good option for medium to large sized facilities to achieve deep energy savings. Pay for Performance allows you to install as many measures as possible under a single project as well as address measures that may not qualify for other programs. Many facilities pursuing an Energy Savings Improvement Program (ESIP) loan also use this program. Pay for Performance works for larger customers with a peak demand over 200 kW. The minimum installed scope of work must include at least two unique measures resulting in at least 15% energy savings, where lighting cannot make up the majority of the savings.

More Options from Around the State

Financing and Planning Support with the Energy Savings Improvement Program (ESIP)

For larger facilities with limited capital availability to implement ECMs, project financing may be available through the ESIP. Supported directly by the NJBPU, ESIP provides government agencies with project development, design, and implementation support services, as well as, attractive financing for implementing ECMs. You have already taken the first step as an LGEA customer, because this report is required to participate in ESIP.

Resiliency with Return on Investment through Combined Heat & Power (CHP)

The CHP program provides incentives for combined heat and power (aka cogeneration) and waste heat to power projects. Combined heat and power systems generate power on-site and recover heat from the generation system to meet on-site thermal loads. Waste heat to power systems use waste heat to generate power. You will work with a qualified developer who will design a system that meets your building's heating and cooling needs.

Ongoing Electric Savings with Demand Response

The Demand Response Energy Aggregator program reduces electric loads at commercial facilities when wholesale electricity prices are high or when the reliability of the electric grid is threatened due to peak power demand. By enabling commercial facilities to reduce their electric demand during times of peak demand, the grid is made more reliable and overall transmission costs are reduced for all ratepayers. Curtailment service providers provide regular payments to medium and large consumers of electric power for their participation in demand response (DR) programs. Program participation is voluntary, and facilities receive payments regardless of whether they are called upon to curtail their load during times of peak demand.

2 Existing Conditions

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for Belmont Runyon Elementary School. This report provides information on how your facility uses energy, identifies energy conservation measures (ECMs) that can reduce your energy use, and provides information and assistance to help you implement the ECMs. This report also contains valuable information on financial incentives from New Jersey's Clean Energy Program (NJCEP) for implementing ECMs. TRC conducted this study as part of a comprehensive effort to assist New Jersey educational and local government facilities in controlling energy costs and protecting our environment by offering a wide range of energy management options and advice.

Appendix A: Equipment Inventory & Recommendations provides a detailed list of the locations and recommended upgrades for each energy conservation measure.

2.1 Site Overview

On November 14, 2018, TRC performed an energy audit at Belmont Runyon Elementary School located in Newark, New Jersey. TRC met with Ms. Porter to review the facility's operations and help focus our investigation on specific energy-using systems.

Belmont Runyon Elementary School is a two-story, 118,936 square foot building built in 2004. Spaces include: classrooms, gymnasium, media center, auditorium, offices, cafeteria, kitchen, corridors, stairwells, and mechanical space. The facility is 100 percent heated and 100 percent cooled. The distribution system is a two-pipe system. It includes the use of steam boilers, shell, and tube as well as a plate frame heat exchanger, which serves the building's hydronic heating system. It also includes the use of two chillers that serve the building's chilled water system. Classrooms are conditioned by fan coil units. Offices are cooled by split air-conditioning (AC) systems. Vestibules and stairwells are conditioned by cabinet unit heaters. There are also air handling units (AHUs), roof top units (RTUs), heat recovery units (HRUs) systems throughout the building.

Facility concerns include the lack of control over the steam and hot water heating system and the constant need for replacing thermostats tied to fan coil units. Facility staff indicated that the chillers are deteriorating and that the coils are in poor condition. Staff reports that they often need to manually spray the coils to keep the equipment cool. Based on conversations with facility personnel, there originally was an energy management system (EMS) that had partial building coverage. However, this system no longer accessible, and therefore, its functionality is unknown.

2.2 Building Occupancy

The facility is occupied from September through June. Typical weekday occupancy is 71 staff and 525 students. Summer occupancy includes continuing custodial and maintenance activities. The site is used by the Newark Public School District for summer school varies on an annual basis. It should be noted that the energy and economic analysis for this building is based on the use of the building during the utility billing period, and results will vary based on changes to building use patterns.

Occupancy	Weekday/Weekend	Operating Schedule
Normal School Day	Weekday	8:15AM-3:00PM
	Weekend (Saturday)	7:00AM-3:30PM
After Hours Cleaning	Weekday	3:00PM-11:00PM
	Weekend	Rare Use
Summer School	Weekday	No Use
	Weekend	No Use

Figure 4 - Building Occupancy Schedule

2.3 Building Envelope

The building envelope is in good condition. The building is constructed of structural steel framing with masonry block and brick exterior and masonry block interior walls. Exterior walls are adequately insulated. The roof is steel framing, steel deck, and rigid insulation under a white colored rubber membrane. The roof is in good condition. Windows are either operable or fixed, and they are double pane with metal frames. The windows are in good condition. Exterior doors are either double pane with metal frames or windowless metal doors, and they are generally in good condition. The caulk around window frames and the weather-stripping on exterior doors are beginning to show signs of deterioration. Degraded window and door seals increase drafts and outside air infiltration.

Main Entrance Facade

Media Center Glass Pane Facade

Exterior Door with Air Gap

Building Facade

Building Facade

Building Facade

2.4 Lighting Systems

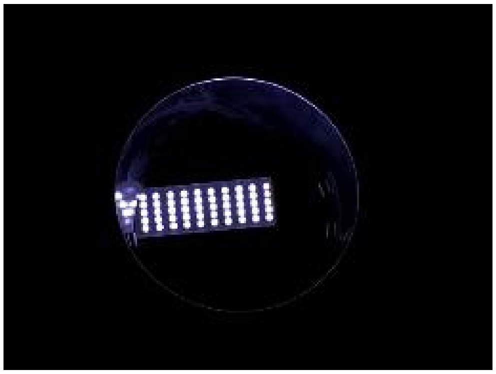
The primary interior lighting system uses 2', 17-Watt and 4', 32-Watt linear fluorescent T8 lamps. Fixture types include recessed troffer fixtures with prismatic or parabolic lenses and pendant mounted direct/indirect fixtures. There are several U-lamp fixtures with T8 lamps as well. The hallways are mostly lit by recessed can fixtures with compact fluorescent (CFL) plug-in lamps. About 25 percent of these fixtures have been re-lamped with LED plug-in lamps. In lobby and stair areas as well as the auditorium, there are high-output CFL screw-in lamp pendant mounted fixtures. The cafeteria is lit by linear fluorescent T5 high output fixtures. The gym is also lit by these T5 high output fixtures as well as by metal halide high bay fixtures. All fluorescent fixtures have electronic ballasts. All exit signs throughout the building are LED. All interior lighting levels were generally sufficient. Interior light fixtures are manually controlled via wall switches.

Linear T8 Recessed Troffer Fixtures

High Output Compact Fluorescent Lamp Fixtures

Recessed Can Fixtures

Linear T8 Pendant Mounted Fixtures



LED plug in lamp

Linear T8 Parabolic Lens Troffer

Manual Wall Switches

Exterior lighting is provided by flood fixtures and pole mounted area light fixtures with metal halide lamps and ballasts. Building mounted exterior lighting is provided by wall pack fixtures and surface mounted fixtures that are all LED. Exterior light fixtures are controlled by a time clock or photocells.

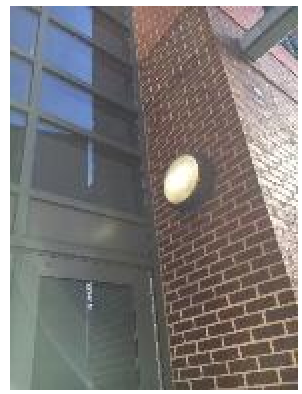
HID Wall Pack Fixture

LED Wall Mounted Fixture

Timeclocks

Wall Mounted Exterior Lighting

HID Pole Mounted and Flood Fixtures



LED Lamp Dome Fixture

2.5 Air Handling Systems

Fan Coil Units

Fan coil units condition the classrooms and have fractional horsepower supply fan motors and fan coil valves that operate with a control system. This system is original to the building and appears to be in poor operating condition. Vestibules and stairwell are conditioned by cabinet unit heaters.

Split Air-Conditioning Systems

Split air-conditioning systems condition the offices. There are a total of eight systems, each three tons in cooling capacity. They are in fair condition, and they feature standard efficiency.

HVAC Systems and Equipment

There are also AHUs, RTUs, and HRUs that serve the larger areas in the building. AHUs have either steam or hot water coils and use direct expansion (DX) or chilled water sources for cooling. All of this equipment was originally controlled by an EMS; however, this system's functionality is unknown. A summary of HVAC system is as follows:

Unit	Area Served	Size / Type
ACCU-1 & AC-1	Gym	16 Tons - DX Cooling
ACCU-2 & AC-2	Locker Rooms	8 Tons - DX Cooling
ACCU-3 & AC-3	Cafeteria	24 Tons - DX Cooling
RTU-3	Media Center	15 Tons - DX Cooling
AHU-1	Main Office/Guidance	Chilled Water Cooling
AHU-2	Classrooms	Chilled Water Cooling
AHU-3	Media Center	Chilled Water Cooling
RTU-1	Music / Performing Arts	Chilled Water Cooling
RTU-2	Auditorium	Chilled Water Cooling
HRU-1 & HRU-2	Whole Building	Ventilation with Steam Re-heat Coils

Air Cooled Condensing Units (ACCUs)

Air Handling Unit with Chilled Water and Steam Coils

Roof Top Unit with Chilled Water Coil

Air Handling Unit

Outdoor Condensing Units for Split AC Systems

Outdoor Condensing Units for Split AC Systems

2.6 Heating Hot Water/Steam Systems

There are two Weil McLain 5,230 MBh steam boilers that serve the building heating load. The boiler burners are fully-modulating with a nominal efficiency of 80 percent. The boilers are configured in an automated control scheme. Only one boiler is required under high load conditions. Installed in 2004, they are in fair condition. A one-pipe steam distribution system serves a few AHUs. There are two 1.5 hp boiler feed pumps and a total of five fractional horsepower condensate return pumps in the mechanical room. There are three shell and tube, as well as one plate frame heat exchanger. Heat exchangers are used to transfer heat to water, which is circulated to AHUs and fan coil units. The hydronic distribution system is a two-pipe heating and cooling system. The hydronic heating system has primary distribution with two 20 hp constant speed hot water pumps operating with lead-lag control scheme. Pipe insulation is beginning to show signs of wear and should be repaired/replaced in the future.

At the time of the audit, the outdoor air temperature was 40°F, and the heating system was in operation. Hot water at the heat exchangers was 132°F and steam was at 250°F. The exact control logic is unknown. The hot water supply temperature was read at 189°F, and the return water temperature was read at 165°F. Some read out values appeared to be mislabeled at the control panel.

Steam Boilers

Mechanical Linkage Boiler Burner Controls

Boiler Feed and Condensate Return Pumps & Motors

Shell and Tube Heat Exchanger

Hot Water Pumps and Motors

Plate and Frame Heat Exchanger

2.7 Chilled Water Systems

The chiller plant consists of two 171-ton, McQuay, air-cooled screw chillers (CH1 and CH2). The chillers are configured in a primary distribution loop with three 20 hp constant flow primary pumps (CHW1, 2, and 3). The chillers are in poor condition and require frequent maintenance. Per discussions with facility personnel, the coils are deteriorating.

The chilled water distribution system is a two-pipe heating and cooling system. Chilled water is treated with glycol and is isolated from the non-glycol dual temp systems using a frame and plate heat exchanger. Three 20 hp constant speed hot water pumps operating with lead-lag control scheme to supply chilled water to fan coil units, roof top units, an air handling unit and heat recovery units. One of the pumps is for back-up only.

Air-Cooled Chiller

Chilled Water Pumps and Motors

2.8 Building EMS

A Johnson Controls, Metasys EMS was installed to provide direct digital control of the HVAC equipment: boilers, chillers, air handlers, and package units. The EMS was intended to provide equipment scheduling control and monitors space temperatures, supply air temperatures, humidity, heating water loop temperatures, and chilled water loop temperatures. However, according to facility staff, this system is not functioning properly and does not appear to be operating to its fullest capacity. The boilers and chillers and associated pumps are being manually operated by the custodial staff based on weather conditions. Some AHUs were turned off and, therefore, no economizers were functioning.

The site staff expressed concern about the existing EMS as they no longer have access to the system. Many of the thermostats throughout the building are said to need constant replacement. The site staff expressed an interest in replacing the EMS.

Door Propped Open due to Overheating

Temperature Sensor

2.9 Domestic Hot Water

Hot water is produced with a Lochinvar gas-fired boiler and stored in a 400-gallon storage tank. This system is estimated to operate at an 80 percent thermal efficiency. Three fractional horsepower circulation pumps distribute water to end uses. The circulation pumps are likely to operate continuously; however, the current level of control is unknown. The domestic hot water pipes are insulated, and the insulation is in fair condition. Hot water is provided to hand washing sinks throughout the building and to the kitchen. Showers in the locker rooms are not used.

Domestic Hot Water Boiler and Storage Tank

High Flow Faucet Aerator

2.10 Food Service Equipment

The kitchen has mixed gas and electric equipment that is used to prepare meals for students. Most cooking is done using a convection gas-fired oven. There is also a gas steamer, steam cooker, and griddle. There is also an electric fryer and bulk prepared foods are held in electric holding cabinets. Equipment is high efficiency and is in good condition. The dishwasher is an ENERGY STAR® high temperature, single rack type unit. The dishwasher has a 45kW electric booster water heater.

Visit https://www.energystar.gov/products/commercial_food_service_equipment for the latest information on high efficiency food service equipment.

Cooking Equipment

Dishwasher with Electric Booster Heater

2.11 Refrigeration

The kitchen has several energy efficient, stand-up, solid-door refrigerators, and there is one in the cafeteria that is currently broken. There is also an energy efficient, stand-up, solid-door freezer.

The walk-in refrigerator and medium temperature freezer have an estimated two to three ton compressor located on the roof, and each has a two-fan evaporator. This walk-in refrigeration equipment does not appear to currently have controls.

Visit https://www.energystar.gov/products/commercial_food_service_equipment for the latest information on high efficiency food service equipment.

Indoor Evaporator Units for Walk-In Equipment

Outdoor Condensing Units for Walk-In Equipment

Stand Up Solid Door Freezer

2.12 Plug Load & Vending Machines

The utility bill analysis indicates that plug loads consume approximately three percent of total building energy use. This is lower than a typical building. You seem to already be doing a great job managing your electrical plug loads. This report makes additional suggestions for ECMs in this area as well as energy efficient best practices.

There are approximately 120 computer work stations throughout the facility and an estimated number of 105 Chromebooks®. Plug loads throughout the building include general cafe and office equipment. There are classroom typical loads such as smart boards, projectors, fans, and small printers.

There are several residential style refrigerators and mini-fridges throughout the building, which vary in condition and efficiency.

There are three refrigerated beverage vending machines. Vending machines are not equipped with occupancy-based controls.

Vending Machines

Computer Desktops

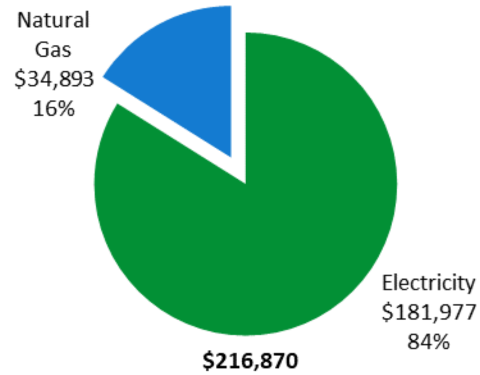
2.13 Water-Using Systems

There are restrooms with toilets, urinals, and sinks throughout the building. Faucet flow rates are low flow 0.5 gallons per minute (gpm) or higher flow at 2.2 gpm. Showers in the locker rooms are not used. Toilets and urinals vary in rated gallons per flush (gpf).

3 Energy Use and Costs

Twelve months of utility billing data are used to develop annual energy consumption and cost data. This information creates a profile of the annual energy consumption and energy costs.

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	1,500,048 kWh	$181,977
Natural Gas	38,065 Therms	$34,893
Total		**$216,870**



An energy balance identifies and quantifies energy use in your various building systems. This can highlight areas with the most potential for improvement. This energy balance was developed using calculated energy use for each of the end uses noted in the figure.

The energy auditor collects information regarding equipment operating hours, capacity, efficiency and other operational parameters from facility staff, drawings, and on-site observations. This information is used as the inputs to calculate the existing conditions energy use for the site. The calculated energy use is then compared to the historical energy use and the initial inputs are revised, as necessary, to balance the calculated energy use to the historical energy use.

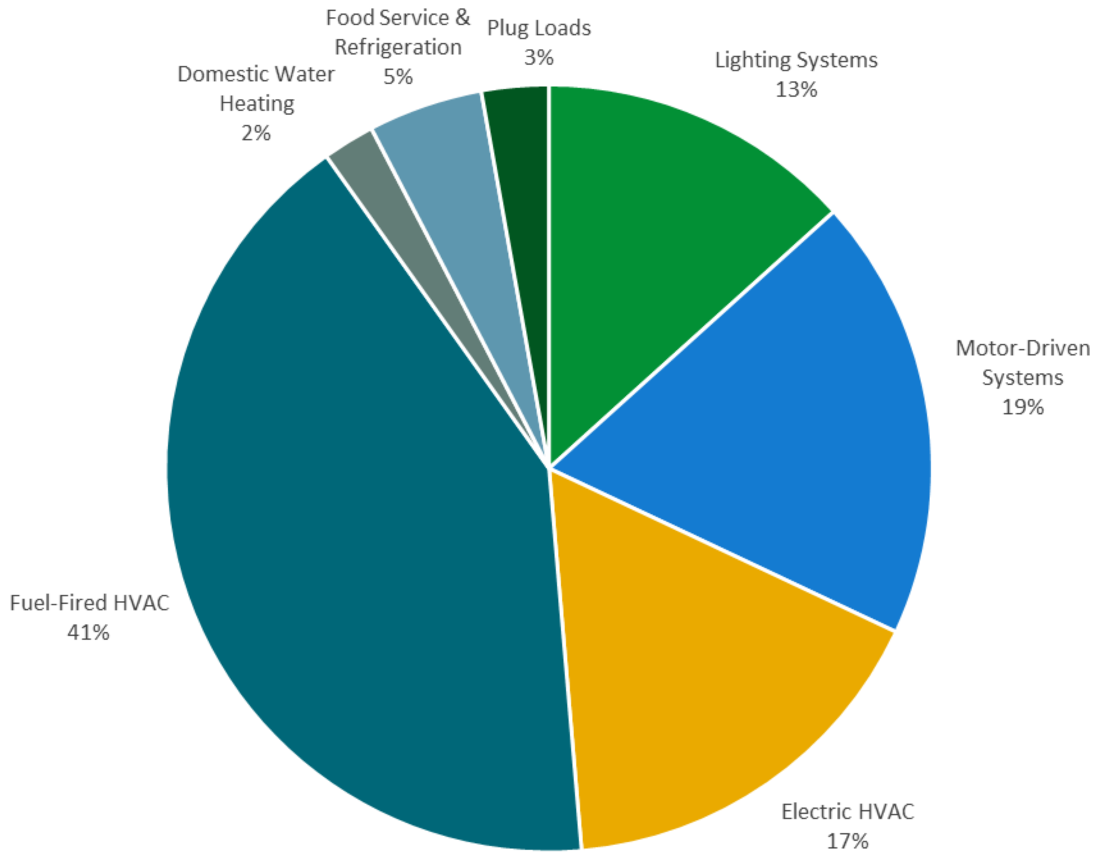
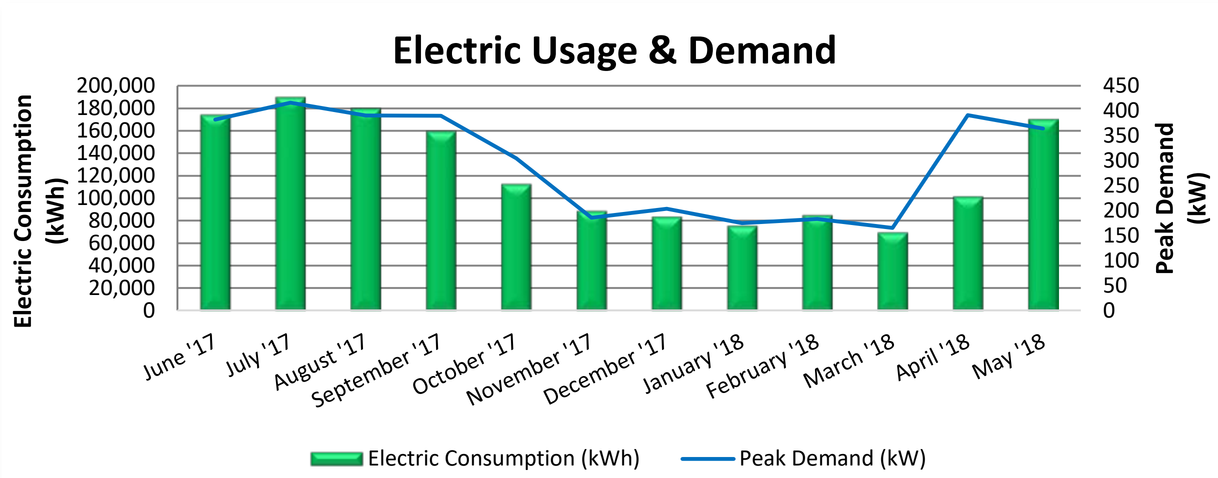


Figure 5 - Energy Balance

3.1 Electricity

PSE&G supplies and delivers electricity under rate class LPLS.



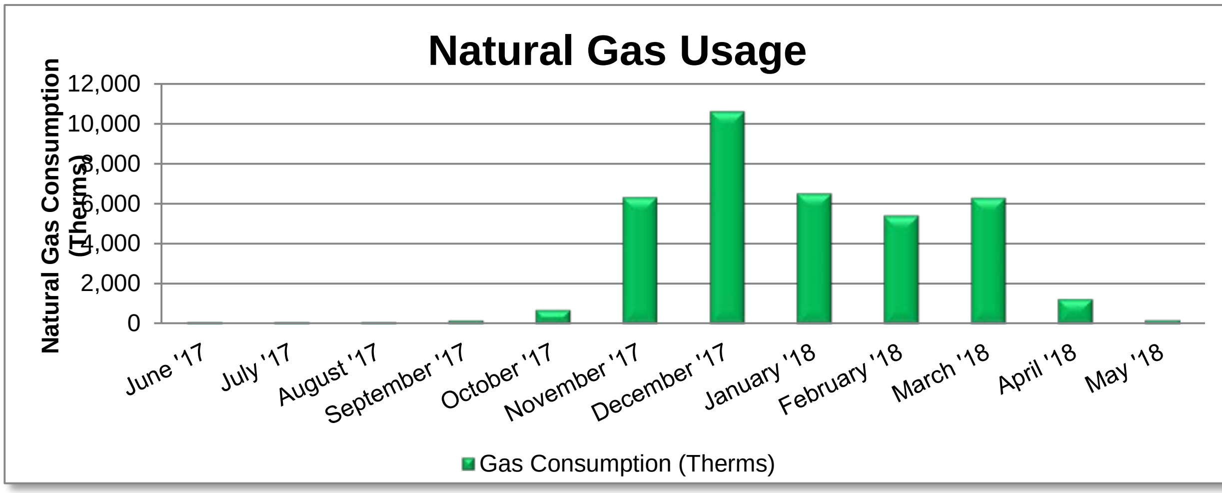
Electric Billing Data					
Period Ending	**Days in Period**	**Electric Usage (kWh)**	**Demand (kW)**	**Demand Cost**	**Total Electric Cost**
7/12/17	29	174,461	383	$1,442	$21,008
8/10/17	29	190,298	416	$1,568	$22,090
9/11/17	32	180,261	391	$1,471	$19,934
10/10/17	29	159,879	390	$1,470	$14,798
11/8/17	29	113,163	305	$1,149	$11,446
12/11/17	33	89,200	186	$700	$10,927
1/11/18	31	84,164	204	$768	$11,419
2/9/18	29	76,046	175	$660	$11,216
3/13/18	32	85,618	184	$692	$12,068
4/12/18	30	70,225	165	$622	$10,645
5/11/18	29	102,039	391	$1,474	$14,052
6/12/18	32	170,584	365	$1,374	$21,876
Totals	**364**	**1,495,938**	**416**	**$13,389**	**$181,479**
Annual	**365**	**1,500,048**	**416**	**$13,426**	**$181,977**

Notes:

- Peak demand of 416 kW occurred in July '17.
- The average electric cost over the past 12 months was $0.121/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.
- The average demand across these twelve months of data is 296 kW.
- The annual electric kWh use has decreased by -1.5% since 2014.

3.2 Natural Gas

PSE&G supplies and delivers natural gas under rate class LVG.



Gas Billing Data			
Period Ending	**Days in Period**	**Natural Gas Usage (Therms)**	**Natural Gas Cost**
7/12/17	30	97	$170
8/10/17	29	99	$170
9/11/17	31	101	$171
10/10/17	29	177	$218
11/8/17	29	709	$1,593
12/11/17	33	6,355	$5,725
1/11/18	31	10,660	$9,482
2/9/18	29	6,545	$6,505
3/13/18	32	5,442	$5,806
4/12/18	30	6,321	$3,866
5/11/18	29	1,258	$865
6/12/18	32	197	$228
Totals	**364**	**37,961**	**$34,797**
Annual	**365**	**38,065**	**$34,893**

Notes:

- The average gas cost for the past 12 months is $0.917/therm, which is the blended rate used throughout the analysis.
- The annual gas use has increased by 36% since 2014.

3.3 Benchmarking

Your building was benchmarked using the United States Environmental Protection Agency's (EPA) *Portfolio Manager®* software. Benchmarking compares your building's energy use to that of similar buildings across the country, while neutralizing variations due to location, occupancy, and operating hours. Some building types can be scored with a 1-100 ranking of a building's energy performance relative to the national building market. A score of 50 represents the national average and a score of 100 is best.

This ENERGY STAR® benchmarking score provides a comprehensive snapshot of your building's energy performance. It assesses the building's physical assets, operations, and occupant behavior, which is compiled into a quick and easy-to-understand score.

Benchmarking Score	16

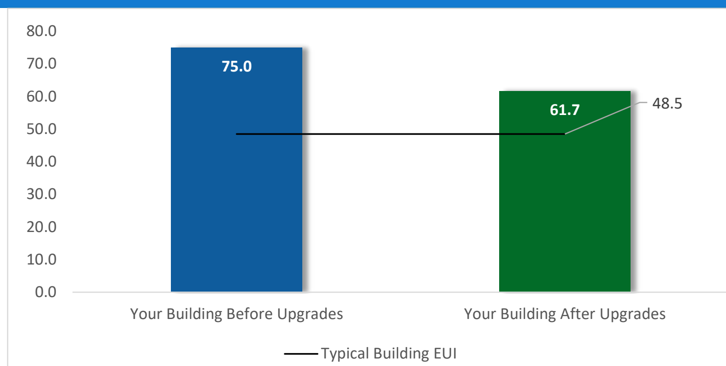


Figure 6 - Energy Use Intensity Comparison

This building performs at, or below the national average. This report contains suggestions about how to improve building performance and reduce energy costs.

Energy use intensity (EUI) measures energy consumption per square foot and is the standard metric for comparing buildings' energy performance. A lower EUI means better performance and less energy consumed. A number of factors can cause as building to vary from the "typical" energy usage. Local weather conditions, building age and insulation levels, equipment efficiency, daily occupancy hours, changes in occupancy throughout the year, equipment operating hours, and occupant behavior all contribute to a building's energy use and the benchmarking score.

Tracking Your Energy Performance

Keeping track of your energy use on a monthly basis is one of the best ways to keep energy costs in check. Update your utility information in Portfolio Manager® regularly, so that you can keep track of your building's performance.

We have created a Portfolio Manager® account for your facility and we have already entered the monthly utility data shown above for you. Account login information for your account will be sent via email.

Free online training is available to help you use ENERGY STAR® Portfolio Manager® to track your building's performance at: https://www.energystar.gov/buildings/training. For more information on ENERGY STAR® and Portfolio Manager®, visit their website[3].

[3] https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1

4 ENERGY CONSERVATION MEASURES

The goal of this audit report is to identify and evaluate potential energy efficiency improvements, provide information about the cost effectiveness of those improvements, and recognize potential financial incentives from NJBPU. Most energy conservation measures have received preliminary analysis of feasibility which identifies expected ranges of savings and costs. This level of analysis is typically sufficient to demonstrate project cost-effectiveness and help prioritize energy measures.

Calculations of energy use and savings are based on the current version of the *New Jersey's Clean Energy Program Protocols to Measure Resource Savings*, which is approved by the New Jersey Board of Public Utilities. Further analysis or investigation may be required to calculate more precise savings based on specific circumstances.

Operation and maintenance costs for the proposed new equipment will generally be lower than the current costs for the existing equipment—especially if the existing equipment is at or past its normal useful life. We have conservatively assumed there to be no impact on overall maintenance costs over the life of the equipment.

Financial incentives are based on the current NJCEP prescriptive SmartStart program. A higher level of investigation may be necessary to support any SmartStart Custom, Pay for Performance, or Direct Install incentive applications. Some measures and proposed upgrades may be eligible for higher incentives than those shown below through other NJCEP programs described in a following section of this report.

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**135,001**	**26.9**	**-31**	**$16,094**	**$118,816**	**$21,035**	**$97,781**	**6.1**	**132,319**
ECM 1	Install LED Fixtures	49,098	5.5	-3	$5,928	$67,128	$9,600	$57,528	9.7	49,074
ECM 2	Retrofit Fixtures with LED Lamps	85,903	21.4	-28	$10,166	$51,688	$11,435	$40,253	4.0	83,245
Lighting Control Measures		**20,546**	**4.9**	**-6**	**$2,442**	**$29,134**	**$3,485**	**$25,649**	**10.5**	**20,040**
ECM 3	Install Occupancy Sensor Lighting Controls	15,667	4.6	-5	$1,854	$26,534	$3,485	$23,049	12.4	15,183
ECM 4	Install Daylight Dimming Controls	3,416	0.2	0	$414	$1,200	$0	$1,200	2.9	3,440
ECM 5	Install High/Low Lighting Controls	1,463	0.2	0	$173	$1,400	$0	$1,400	8.1	1,418
Motor Upgrades		**2,600**	**0.8**	**0**	**$315**	**$24,278**	**$0**	**$24,278**	**77.0**	**2,618**
ECM 6	Premium Efficiency Motors	2,600	0.8	0	$315	$24,278	$0	$24,278	77.0	2,618
Variable Frequency Drive (VFD) Measures		**147,978**	**39.3**	**0**	**$17,952**	**$79,682**	**$10,320**	**$69,362**	**3.9**	**149,013**
ECM 7	Install VFDs on Constant Volume (CV) Fans	85,431	24.3	0	$10,364	$48,010	$6,720	$41,290	4.0	86,028
ECM 8	Install VFDs on Chilled Water Pumps	41,698	11.1	0	$5,059	$19,003	$3,600	$15,403	3.0	41,990
ECM 9	Install VFDs on Heating Water Pumps	20,849	3.8	0	$2,529	$12,669	$0	$12,669	5.0	20,995
Electric Unitary HVAC Measures		**15,334**	**6.7**	**0**	**$1,860**	**$92,356**	**$5,952**	**$86,404**	**46.4**	**15,441**
ECM 10	Install High Efficiency Air Conditioning Units	15,334	6.7	0	$1,860	$92,356	$5,952	$86,404	46.4	15,441
Electric Chiller Replacement		**55,729**	**31.0**	**0**	**$6,761**	**$331,351**	**$31,464**	**$299,887**	**44.4**	**56,118**
ECM 11	Install High Efficiency Chillers	55,729	31.0	0	$6,761	$331,351	$31,464	$299,887	44.4	56,118
HVAC System Improvements		**4,479**	**0.0**	**83**	**$1,304**	**$12,235**	**$0**	**$12,235**	**9.4**	**14,227**
ECM 12	Implement Demand Control Ventilation (DCV)	4,479	0.0	83	$1,304	$12,235	$0	$12,235	9.4	14,227
Domestic Water Heating Upgrade		**45,000**	**13.5**	**-194**	**$3,681**	**$20,654**	**$3,315**	**$17,339**	**4.7**	**22,605**
ECM 13	Install Gas-Fired Booster Water Heater	45,000	13.5	-195	$3,672	$20,611	$3,315	$17,296	4.7	22,483
ECM 14	Install Low-Flow DHW Devices	0	0.0	1	$10	$43	$0	$43	4.5	123
Food Service & Refrigeration Measures		**10,341**	**0.9**	**0**	**$1,255**	**$6,288**	**$400**	**$5,888**	**4.7**	**10,413**
ECM 15	Refrigerator/Freezer Case Electrically Commutated Motors	1,966	0.2	0	$239	$1,213	$0	$1,213	5.1	1,980
ECM 16	Refrigeration Controls	3,540	0.1	0	$429	$4,385	$250	$4,135	9.6	3,564
ECM 17	Vending Machine Control	4,836	0.6	0	$587	$690	$150	$540	0.9	4,869
Custom Measures		**78,340**	**0.0**	**1,666**	**$24,778**	**$763,300**	**$9,958**	**$753,342**	**30.4**	**273,993**
ECM 18	Computer Power Management Software	5,964	0.0	0	$723	$4,300	$0	$4,300	5.9	6,005
ECM 19	Installation of an Energy Management System	72,376	0.0	221	$10,809	$178,000	$0	$178,000	16.5	98,794
ECM 20	Heating System Upgrades	0	0.0	1,445	$13,246	$581,000	$9,958	$571,042	43.1	169,194
TOTALS		**515,348**	**124.0**	**1,519**	**$76,442**	**$1,478,094**	**$85,929**	**$1,392,165**	**18.2**	**696,789**

* - All incentives presented in this table are based on NJ SmartStart equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

Figure 7 – All Evaluated ECMs

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**135,001**	**26.9**	**-31**	**$16,094**	**$118,816**	**$21,035**	**$97,781**	**6.1**	**132,319**
ECM 1	Install LED Fixtures	49,098	5.5	-3	$5,928	$67,128	$9,600	$57,528	9.7	49,074
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Lighting Control Measures		**20,546**	**4.9**	**-6**	**$2,442**	**$29,134**	**$3,485**	**$25,649**	**10.5**	**20,040**
ECM 3	Install Occupancy Sensor Lighting Controls	15,667	4.6	-5	$1,854	$26,534	$3,485	$23,049	12.4	15,183
ECM 4	Install Daylight Dimming Controls	3,416	0.2	0	$414	$1,200	$0	$1,200	2.9	3,440
ECM 5	Install High/Low Lighting Controls	1,463	0.2	0	$173	$1,400	$0	$1,400	8.1	1,418
Motor Upgrades		**2,600**	**0.8**	**0**	**$315**	**$24,278**	**$0**	**$24,278**	**77.0**	**2,618**
ECM 6	Premium Efficiency Motors	2,600	0.8	0	$315	$24,278	$0	$24,278	77.0	2,618
Variable Frequency Drive (VFD) Measures		**147,978**	**39.3**	**0**	**$17,952**	**$79,682**	**$10,320**	**$69,362**	**3.9**	**149,013**
ECM 7	Install VFDs on Constant Volume (CV) Fans	85,431	24.3	0	$10,364	$48,010	$6,720	$41,290	4.0	86,028
ECM 8	Install VFDs on Chilled Water Pumps	41,698	11.1	0	$5,059	$19,003	$3,600	$15,403	3.0	41,990
ECM 9	Install VFDs on Heating Water Pumps	20,849	3.8	0	$2,529	$12,669	$0	$12,669	5.0	20,995
HVAC System Improvements		**4,479**	**0.0**	**83**	**$1,304**	**$12,235**	**$0**	**$12,235**	**9.4**	**14,227**
ECM 12	Implement Demand Control Ventilation (DCV)	4,479	0.0	83	$1,304	$12,235	$0	$12,235	9.4	14,227
Domestic Water Heating Upgrade		**45,000**	**13.5**	**-194**	**$3,681**	**$20,654**	**$3,315**	**$17,339**	**4.7**	**22,605**
ECM 13	Install Gas-Fired Booster Water Heater	45,000	13.5	-195	$3,672	$20,611	$3,315	$17,296	4.7	22,483
ECM 14	Install Low-Flow DHW Devices	0	0.0	1	$10	$43	$0	$43	4.5	123
Food Service & Refrigeration Measures		**10,341**	**0.9**	**0**	**$1,255**	**$6,288**	**$400**	**$5,888**	**4.7**	**10,413**
ECM 15	Refrigerator/Freezer Case Electrically Commutated Motors	1,966	0.2	0	$239	$1,213	$0	$1,213	5.1	1,980
ECM 16	Refrigeration Controls	3,540	0.1	0	$429	$4,385	$250	$4,135	9.6	3,564
ECM 17	Vending Machine Control	4,836	0.6	0	$587	$690	$150	$540	0.9	4,869
Custom Measures		**78,340**	**0.0**	**221**	**$11,532**	**$182,300**	**$0**	**$182,300**	**15.8**	**104,799**
ECM 18	Computer Power Management Software	5,964	0.0	0	$723	$4,300	$0	$4,300	5.9	6,005
ECM 19	Installation of an Energy Management System	72,376	0.0	221	$10,809	$178,000	$0	$178,000	16.5	98,794
TOTALS		**444,285**	**86.3**	**74**	**$54,575**	**$473,387**	**$38,555**	**$434,832**	**8.0**	**456,036**

* - All incentives presented in this table are based on NJ SmartStart equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

Figure 8 – Cost Effective ECMs

4.1 Lighting

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**135,001**	**26.9**	**-31**	**$16,094**	**$118,816**	**$21,035**	**$97,781**	**6.1**	**132,319**
ECM 1	Install LED Fixtures	49,098	5.5	-3	$5,928	$67,128	$9,600	$57,528	9.7	49,074
ECM 2	Retrofit Fixtures with LED Lamps	85,903	21.4	-28	$10,166	$51,688	$11,435	$40,253	4.0	83,245

When considering lighting upgrades, we suggest using a comprehensive design approach that simultaneously upgrades lighting fixtures and controls to maximize energy savings and improve occupant lighting. Comprehensive design will also consider appropriate lighting levels for different space types to make sure that the right amount of light is delivered where needed. If conversion to LED light sources are proposed, we suggest converting all of a specific lighting type (e.g. linear fluorescent) to LED lamps to minimize the number of lamp types in use at the facility, which should help reduce future maintenance costs.

ECM 1: Install LED Fixtures

Replace existing fixtures containing HID and high output compact fluorescent lamps with new LED light fixtures. This measure saves energy by installing LEDs which use less power than other technologies with a comparable light output.

In some cases, fixtures could be retrofitted with screw-based LED lamps. Replacing an existing HID fixture with a new LED fixture will generally provide better overall lighting optics; however, replacing the HID or CFL lamp with a LED screw-in lamp is typically a less expensive improvement. We recommend you work with your lighting contractor to determine which retrofit solution is best suited to your needs.

Maintenance savings may also be achieved since LED lamps last longer than other light sources and therefore do not need to be replaced as often.

Affected building areas: gymnasium, auditorium, hallways, stairwells, lobby, and exterior fixtures.

ECM 2: Retrofit Fixtures with LED Lamps

Replace fluorescent T8 and compact fluorescent lamps with reduced wattage LED lamps. Replace fluorescent T5HO lamp high bay fixtures with reduced wattage LED lamps. Many LED tubes are direct replacements for existing fluorescent tubes and can be installed while leaving the fluorescent fixture ballast in place. LED lamps can be used in existing fixtures as a direct replacement for most other lighting technologies.

This measure saves energy by installing LEDs which use less power than other lighting technologies yet provide equivalent lighting output for the space. Maintenance savings may also be available, as longer-lasting LEDs lamps will not need to be replaced as often as the existing lamps.

Affected building areas: all areas with fluorescent fixtures with T8 tubes, general purpose compact fluorescent lamps, T5HO lamp fixtures in the gymnasium and cafeteria.

4.2 Lighting Controls

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**20,546**	**4.9**	**-6**	**$2,442**	**$29,134**	**$3,485**	**$25,649**	**10.5**	**20,040**
ECM 3	Install Occupancy Sensor Lighting Controls	15,667	4.6	-5	$1,854	$26,534	$3,485	$23,049	12.4	15,183
ECM 4	Install Daylight Dimming Controls	3,416	0.2	0	$414	$1,200	$0	$1,200	2.9	3,440
ECM 5	Install High/Low Lighting Controls	1,463	0.2	0	$173	$1,400	$0	$1,400	8.1	1,418

Lighting controls reduce energy use by turning off or lowering, lighting fixture power levels when not in use. A comprehensive approach to lighting design should upgrade the lighting fixtures and the controls together for maximum energy savings and improved lighting for occupants.

ECM 3: Install Occupancy Sensor Lighting Controls

Install occupancy sensors to control lighting fixtures in areas that are frequently unoccupied, even for short periods. For most spaces, we recommend lighting controls use dual technology sensors, which reduce the possibility of lights turning off unexpectedly.

Occupancy sensors detect occupancy using ultrasonic and/or infrared sensors. When an occupant enters the space, the lighting fixtures switch to full lighting levels. Most occupancy sensor lighting controls allow users to manually turn fixtures on/off, as needed. Some controls can also provide dimming options.

Occupancy sensors can be mounted on the wall at existing switch locations, mounted on the ceiling, or in remote locations. In general, wall switch replacement sensors are best suited to single occupant offices and other small rooms. Ceiling-mounted or remote mounted sensors are used in large spaces, locations without local switching, and where wall switches are not in the line-of-sight of the main work area.

This measure provides energy savings by reducing the lighting operating hours.

Affected building areas: offices, conference rooms, classrooms, gymnasium, library, restrooms, and storage rooms.

ECM 4: Install Photocell Controls

Install controls that use photosensors to reduce electric lighting on the exterior of the building when ample daylight lighting is present. The use of a photocell control for exterior light fixtures ensures the fixtures do not operate during daylight hours.

The method of dimming or on/off control should be determined during lighting design. The timeclock may be replaced, or control could be integrated into a new EMS. Alternatively, fixture mounted photocell sensors could be installed.

Affected building areas: exterior.

ECM 5: Install High/Low Lighting Controls

Install occupancy sensors to provide dual level lighting control for lighting fixtures in spaces that are infrequently occupied but may require some level of continuous lighting for safety or security reasons.

Lighting fixtures with these controls operate at default low levels when the area is unoccupied to provide minimal lighting to meet security or safety requirements. Sensors detect occupancy using ultrasonic and/or infrared sensors. When an occupant enters the space, the lighting fixtures switch to full lighting levels. Fixtures automatically switch back to low level after a predefined period of vacancy.

The controller lowers the light level by dimming the fixture output. Therefore, the controlled fixtures need to have a dimmable ballast or driver. This will need to be taken into account when selecting retrofit lamps and bulbs for the areas proposed for high/low control.

This measure provides energy savings by reducing the light fixture power draw when reduced light output is appropriate.

Affected building areas: hallways.

For this type of measure the occupancy sensors will generally be ceiling or fixture mounted. Sufficient sensor coverage must be provided to ensure that lights turn on in each area as an occupant approaches.

4.3 Motors

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Motor Upgrades		**2,600**	**0.8**	**0**	**$315**	**$24,278**	**$0**	**$24,278**	**77.0**	**2,618**
ECM 6	Premium Efficiency Motors	2,600	0.8	0	$315	$24,278	$0	$24,278	77.0	2,618

ECM 6: Premium Efficiency Motors

Replace standard efficiency motors with IHP 2014 efficiency motors. This evaluation assumes that existing motors will be replaced with motors of equivalent size and type. In some cases, additional savings may be possible by downsizing motors to better meet the motor's current load requirements.

Savings are based on the difference between baseline and proposed efficiencies and the assumed annual operating hours. The base case motor energy consumption is estimated using the efficiencies found on nameplates or estimated based on the age of the motor and our best estimates of motor run hours. Efficiencies of proposed motor upgrades are obtained from the current *New Jersey's Clean Energy Program Protocols to Measure Resource Savings*.

This measure is recommended as it is coupled with the variable frequency drive (VFD) measures that follow.

Affected motors:

Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor
Roof	RTU-3	1	Supply Fan	7.5
Roof	RTU-3	1	Return Fan	5.0

Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor
Mechanical Room	HWP-3	1	Heating Hot Water Pump	20.0
Mechanical Room	HWP-4	1	Heating Hot Water Pump	20.0
Mechanical Room	CHW-1	1	Chilled Water Pump	20.0
Mechanical Room	CHW-2	1	Chilled Water Pump	20.0
Mechanical Room	CHW-3	1	Chilled Water Pump	20.0
Mechanical Room	AC-1, AHU-1	2	Supply Fan	5.0
Mechanical Room	AC-1, AHU-1	2	Return Fan	2.0
Mechanical Room	AHU-2 & AHU-3	2	Supply Fan	7.5
Mechanical Room	AHU-2 & AHU-3	2	Return Fan	5.0
Roof	RTU-1	1	Supply Fan	7.5
Roof	RTU-1	1	Return Fan	5.0
Roof	RTU-2	1	Supply Fan	15.0
Roof	RTU-2	1	Return Fan	5.0

4.4 Variable Frequency Drives (VFD)

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**147,978**	**39.3**	**0**	**$17,952**	**$79,682**	**$10,320**	**$69,362**	**3.9**	**149,013**
ECM 7	Install VFDs on Constant Volume (CV) Fans	85,431	24.3	0	$10,364	$48,010	$6,720	$41,290	4.0	86,028
ECM 8	Install VFDs on Chilled Water Pumps	41,698	11.1	0	$5,059	$19,003	$3,600	$15,403	3.0	41,990
ECM 9	Install VFDs on Heating Water Pumps	20,849	3.8	0	$2,529	$12,669	$0	$12,669	5.0	20,995

Variable frequency drives control motors for fans, pumps, and process equipment based on the actual output required of the driven equipment. Energy savings result from more efficient control of motor energy usage when equipment operates at partial load. The magnitude of energy savings depends on the estimated amount of time that the motor would operate at partial load. For equipment with proposed VFDs, we have included replacing the controlled motor with a new motor —unless the existing motor meets or exceeds IHP 2014 standards—to conservatively account for the cost of an inverter duty rated motor. The savings and cost associated with the new motor are presented with the Premium Efficiency Motor measure. If the proposed VFD measure is not selected for implementation the motor replacement should be reevaluated.

ECM 7: Install VFDs on Constant Volume (CV) Fans

Install VFDs to control constant volume fan motor speeds. This converts a constant-volume, single-zone air handling system into a variable-air-volume (VAV) system. A separate VFD is usually required to control the return fan motor or dedicated exhaust fan motor, if the air handler has one.

Zone thermostats signal the VFD to adjust fan speed to maintain the appropriate temperature in the zone, while maintaining a constant supply air temperature.

VAV system controls should not raise the supply air temperature at the expense of the fan power. A common mistake is to reset the supply air temperature to achieve chiller energy savings, which can lead to additional air flow requirements. Supply air temperature should be kept low (e.g. 55°F) until the minimum fan speed (typically about 50%) is met. At this point, it is efficient to raise the supply air temperature as the load decreases, but not such that additional air flow and thus fan energy is required.

For air handlers with direct expansion (DX) cooling systems, the minimum air flow across the cooling coil required to prevent the coil from freezing must be determined during the final project design. The control system programming should maintain the minimum air flow whenever the compressor is operating.

Energy savings result from reducing the fan speed (and power) when conditions allow for reduced air flow.

ECM 8: Install VFDs on Chilled Water Pumps

Install VFDs to control chilled water pumps. Two-way valves must serve the chilled water coils being served and the chilled water loop must have a differential pressure sensor installed. If three-way valves or a bypass leg are used in the chilled water distribution, they will need to be modified when this measure is implemented. As the chilled water valves close, the differential pressure increases, and the VFD modulates the pump speed to maintain a differential pressure setpoint.

For systems with variable chilled water flow through the chiller, the minimum flow to prevent the chiller from tripping off will need to be determined during the final project design. The control system should be programmed to maintain the minimum flow through the chiller and to prevent pump cavitation.

Energy savings result from reducing the pump motor speed (and power) as chilled water valves close. The magnitude of energy savings is based on the estimated amount of time that the system operates at reduced loads.

ECM 9: Install VFDs on Heating Water Pumps

Install variable frequency drives (VFD) to control heating water pumps. Two-way valves must serve the hot water coils and the hot water loop must have a differential pressure sensor installed. If three-way valves or a bypass leg are used in the hot water distribution, they will need to be modified when this measure is implemented. As the hot water valves close, the differential pressure increases and the VFD modulates the pump speed to maintain a differential pressure setpoint.

Energy savings result from reducing pump motor speed (and power) as hot water valves close. The magnitude of energy savings is based on the estimated amount of time that the system will operate at reduced load.

4.5 Electric Unitary HVAC

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Electric Unitary HVAC Measures		**15,334**	**6.7**	**0**	**$1,860**	**$92,356**	**$5,952**	**$86,404**	**46.4**	**15,441**
ECM 10	Install High Efficiency Air Conditioning Units	15,334	6.7	0	$1,860	$92,356	$5,952	$86,404	46.4	15,441

Replacing the unitary HVAC units has a long payback period and may not be justifiable based simply on energy considerations. However, most of the units Belmont Runyon Elementary School are nearing or have reached the end of their normal useful life. Typically, the marginal cost of purchasing a high efficiency unit can be justified by the marginal savings from the improved efficiency. When the split AC systems are eventually replaced, consider purchasing equipment that exceeds the minimum efficiency required by building codes.

ECM 10: Install High Efficiency Air Conditioning Units

We evaluated replacement of standard efficiency packaged air conditioning units with high efficiency packaged air conditioning units. The magnitude of energy savings for this measure depends on the relative efficiency of the older unit versus the new high efficiency unit, the average cooling load, and the estimated annual operating hours.

4.6 Electric Chillers

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Electric Chiller Replacement		**55,729**	**31.0**	**0**	**$6,761**	**$331,351**	**$31,464**	**$299,887**	**44.4**	**56,118**
ECM 11	Install High Efficiency Chillers	55,729	31.0	0	$6,761	$331,351	$31,464	$299,887	44.4	56,118

Replacing the chillers has a long payback based on energy savings and may not be justifiable based simply on energy considerations. However, the chiller has reached the end of its normal useful life. Typically, the marginal cost of purchasing a high efficiency chiller can be justified by the marginal savings from the improved efficiency. When the chillers are eventually replaced, consider purchasing equipment that exceed the minimum efficiency required by building codes.

ECM 11: Install High Efficiency Chillers

We evaluated replacement of the older inefficient electric chillers with new high efficiency chillers. The type of chiller to be installed depends on the magnitude of the cooling load and variability of the cooling load profile, for example:

- Positive displacement chillers are usually under 600 tons of cooling capacity and centrifugal chillers generally start at 150 tons of cooling capacity.
- Constant speed chillers should be used to meet cooling loads with little or no variation while variable speed chillers are more efficient for variable cooling load profiles.
- Water cooled chillers are more efficient than air cooled chillers but require cooling towers and additional pumps to circulate the cooling water.
- In any given size range, variable speed chillers tend to have better partial load efficiency, but worse full load efficiency, than constant speed chillers.

Energy savings result from the improvement in chiller efficiency and matching the right type of chiller to the cooling load. The energy savings are calculated based on the cooling capacity of the new chiller, the improvement in efficiency compared with the base case equipment, the cooling load profile, and the estimated annual operating hours of the chiller before and after the upgrade.

For the purposes of this analysis, we evaluated the replacement of chillers on a one-for-one basis with equipment of the same capacity. We recommend that you work with your design team to select chillers that are sized appropriately for the cooling load. In some cases, the plant energy use can be reduced by selecting multiple chillers that match the facility load profile rather than one or two large chillers. This can also improve the chiller plant reliability through increased redundancy. Energy savings are maximized by proper selection of new equipment based on the cooling load profile.

4.7 HVAC

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
HVAC System Improvements		**4,479**	**0.0**	**83**	**$1,304**	**$12,235**	**$0**	**$12,235**	**9.4**	**14,227**
ECM 12	Implement Demand Control Ventilation (DCV)	4,479	0.0	83	$1,304	$12,235	$0	$12,235	9.4	14,227

ECM 12: Implement Demand Control Ventilation (DCV)

Demand control ventilation (DCV) monitors the indoor air's carbon dioxide (CO_2) content to measure room occupancy. This data is used to regulate the amount of outdoor air provided to the space for ventilation.

Standard ventilation systems often provide outside air based on a space's estimated maximum occupancy but not actual occupancy. During low occupancy periods, the space may then be over ventilated. This wastes energy through excessive fan motor usage as well as heating and cooling the excess outside air flow. DCV reduces unnecessary outdoor air intake by regulating ventilation based on actual occupancy levels. DCV is most suited for facilities where occupancy levels vary significantly from hour to hour and day to day.

Energy savings associated with DCV are based on hours of operation, space occupancy, system air flow, outside air reduction, and other factors. Energy savings results from eliminating unnecessary ventilation and space conditioning.

Affected building areas: media center, main office/guidance, classrooms, music/performing arts and, auditorium.

4.8 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**45,000**	**13.5**	**-194**	**$3,681**	**$20,654**	**$3,315**	**$17,339**	**4.7**	**22,605**
ECM 13	Install Gas-Fired Booster Water Heater	45,000	13.5	-195	$3,672	$20,611	$3,315	$17,296	4.7	22,483
ECM 14	Install Low-Flow DHW Devices	0	0.0	1	$10	$43	$0	$43	4.5	123

ECM 13: Install Gas-Fired Booster Water Heater

Replace the existing booster water heater in the kitchen to allow domestic water heater temperatures to be reduced while using less energy. Many domestic hot water systems are maintained at a high temperature to meet the needs of a single end-use, such as dishwashing. Using a smaller booster water heater to provide the required water temperature for the critical end use allows the temperature at the primary water heater to be reduced.

Energy savings result from reducing the system hot water temperature which reduces fuel used to heat the water and heat loss from the domestic hot water storage tank and distribution system.

ECM 14: Install Low-Flow DHW Devices

Install low-flow devices to reduce overall hot water demand. The following are low flow rates for devices. We are recommended to reduce hot water usage by replacing faucet aerators in restrooms.

Device	Flow Rate
Faucet aerators (lavatory)	0.5 gpm
Faucet aerator (kitchen)	1.5 gpm
Showerhead	2.0 gpm
Pre-rinse spray valve (kitchen)	1.28 gpm

Low-flow devices reduce the overall water flow from the fixture, while still providing adequate pressure for washing. Additional cost savings may result from reduced water usage.

Additional Considerations: Showers in the locker rooms are not used. There may be an opportunity to replace the existing boiler and 400 gallon oversized storage tank to a high efficiency gas fired condensing storage tank water heater with a smaller capacity, sized for current domestic hot water needs of the building. As the existing boiler is approaching the end of their useful life it is the recommended that resizing the domestic hot water system be evaluated.

4.9 Food Service & Refrigeration Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Food Service & Refrigeration Measures		**10,341**	**0.9**	**0**	**$1,255**	**$6,288**	**$400**	**$5,888**	**4.7**	**10,413**
ECM 15	Refrigerator/Freezer Case Electrically Commutated Motors	1,966	0.2	0	$239	$1,213	$0	$1,213	5.1	1,980
ECM 16	Refrigeration Controls	3,540	0.1	0	$429	$4,385	$250	$4,135	9.6	3,564
ECM 17	Vending Machine Control	4,836	0.6	0	$587	$690	$150	$540	0.9	4,869

ECM 15: Refrigerator/Freezer Case Electrically Commutated Motors

Replace shaded pole or permanent split capacitor (PSC) motors with electronically commutated (EC) motors in the walk-in cooler and freezer. Fractional horsepower EC motors are significantly more efficient than mechanically commutated, brushed motors, particularly at low speeds or partial load. By using variable-speed technology, EC motors can optimize fan usage. Because these motors are brushless and use DC power, losses due to friction and phase shifting are eliminated.

Savings for this measure consider both the increased efficiency of the motor as well as the reduction in refrigeration load due to motor heat loss.

ECM 16: Refrigeration Controls

Install additional controls to optimize the operation of walk-in coolers and freezers.

Many walk-in coolers and freezers have continuously operating electric heaters on the doors to prevent condensation formation. This measure adds a control system feature to shut off the door heaters when the humidity level is low enough that condensation will not occur if the heaters are off. This is done by measuring the ambient humidity and temperature of the store, comparing that to the dewpoint, and using pulse width modulation to control the anti-sweat door heaters.

Defrost controllers can be used to override defrost of evaporator fans when the defrost operation is not necessary, which reduces annual energy consumption. This measure is applicable to existing evaporator fans with a traditional electric defrost mechanism.

Many walk-in coolers and freezers have evaporator fans that run continuously. The measure adds a control system feature to automatically shut off evaporator fans when not needed.

Energy savings for each of the control measures account for reduction in compressor and fan operating hours as well as reduction in the refrigeration heat load as appropriate.

ECM 17: Vending Machine Control

Vending machines operate continuously, even during unoccupied hours. Install occupancy sensor controls to reduce energy use. These controls power down vending machines when the vending machine area has been vacant for some time, and, they power up the machines at necessary regular intervals or when the surrounding area is occupied. Energy savings are dependent on the vending machine and activity level in the area surrounding the machines.

4.10 Custom Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Custom Measures		**78,340**	**0.0**	**1,666**	**$24,778**	**$763,300**	**$9,958**	**$753,342**	**30.4**	**273,993**
ECM 18	Computer Power Management Software	5,964	0.0	0	$723	$4,300	$0	$4,300	5.9	6,005
ECM 19	Installation of an Energy Management System	72,376	0.0	221	$10,809	$178,000	$0	$178,000	16.5	98,794
ECM 20	Heating System Upgrades	0	0.0	1,445	$13,246	$581,000	$9,958	$571,042	43.1	169,194

ECM 18: Computer Power Management Software

We evaluated the implementation of computer power management software at a high level. The computing environment in most school and office facilities includes desktops, which are typically left on over nights, weekends, and holidays. Screen savers are commonly confused as a power management strategy. This contributes to excessive electrical energy consumption, which may be avoided by proper management. There are innovative software packages available in the market today that are designed to deliver significant energy saving and provide ongoing tracking measurements.

Operational and maintenance benefits are captured through the use of a central power management platform where issues may be diagnosed, and problematic devices may be isolated. Energy savings policies may be enforced as well as identifying and eliminating underutilized devices. This measure investigates the potential benefits to implementing computer power management software to better match the energy use to user needs.

This measure in effort to increase the plug load management of the school district was of interest for facility personnel. Further analysis should be conducted for the feasibility of this measure. An entire baseline tracking of existing computing fleet energy use would need to be performed to optimize proposed software strategies. This would need to be implemented in conjunction with the IT department. This is not an investment grade analysis nor should be used as a basis for design and construction.

ECM 19: Installation of an Energy Management System

The replacement of the existing EMS increases the efficiency of the building HVAC system operation. This evaluation is provided at a high level as it is of great interest for facility personnel.

Upgrade of controls to optimize the start/stop of all key HVAC equipment and tying in all space temperature controls will minimize the amount of wasted energy. Schedules may be put in place to limit system operation when the building is closed. Temperature set back controls may be applied to operate systems only to the point necessary. Ventilation and economizer controls and programming would allow air handling units to operate according to room schedules, occupancy, and availability for “free cooling” or “free heating”.

This measure is not recommended based solely on basis of energy and economic results. It should be considered as a capital improvement measure for future implementation. As such, it is recommended that an HVAC engineer or contractor who specializes in energy management systems be contacted for a detailed evaluation and implementation costs. For the purposes of this report, the potential energy savings and measure costs were estimated based on industry standards and previous project experience.

Further analysis should be conducted for the feasibility of this measure. This is not an investment grade analysis nor should be used as a basis for design and construction.

ECM 20: Heating System Upgrades

Replacement of older inefficient steam boilers and heat exchangers with natural gas fired, high efficiency condensing hot water boilers was of interest to facility personnel. The heating system upgrade was evaluated at a high level. Energy savings results from improved combustion efficiency and reduced standby losses at low loads. Further analysis should be conducted for the feasibility of this measure. For the purposes of this analysis, we evaluated the heating system upgrade based on the existing capacity of the boiler plant. Average heating system efficiency was estimated based on the distribution losses associated with steam to hot water heat exchangers which are in poor condition and are not easily controlled.

The most notable efficiency improvement is an upgrade to condensing hydronic boilers, which can achieve over 90% efficiency under the proper conditions. Condensing hydronic boilers typically operate at efficiencies between 85% and 87% (comparable to other high efficiency boilers) when the return water temperature is above 130°F. The boiler efficiency increases as the return water temperature drops below 130°F. Therefore, project design should evaluate whether the system return water temperature can be reduced from current levels in the new boiler configuration.

This measure is not recommended due to the long simple payback of replacing the existing boilers. Replacing the space heating boilers may not be justifiable based solely on energy considerations.

When the boilers are replaced, we recommend that you work with an HVAC design engineer or experienced implementation contractor to size the boilers to the school's current heating requirements. We also recommend that you consider installing multiple modular boilers to improve the heating water system part load performance and redundancy. These approaches may also improve the cost effectiveness of the boiler replacement.

If the overall boiler plant capacity could be reduced, this measure may be cost effective. Modular boilers with input ratings of 1,000 to 2,000 kBtu/hr are readily available. Configuring a boiler plant around several modular boilers provides several advantages. The first is that the overall system operates better at low load conditions since only one or two modular boilers are operating at full load rather than one large boiler operating inefficiently at low load. A typical modular boiler plant for a school of this size will generally use three to five boilers which provides better redundancy than a plant with two large boilers. Finally, three to five modular boilers will often take less space than two old large boilers.

As the existing boilers are approaching the end of their useful life it is the recommended that reconfiguring the boiler plant be further evaluated. This is not an investment grade analysis, nor should be used as a basis for design and construction.

Additional Considerations: If the school district moves forward toward implementation of a comprehensive project under the Energy Savings Improvement Program (ESIP), we would recommend including this measure. We recommend that you work with your mechanical design team to select boilers that are sized appropriately for the heating load. In many cases installing multiple modular boilers rather than one or two large boilers will result in higher overall plant efficiency while providing additional system redundancy.

5 ENERGY EFFICIENT BEST PRACTICES

A whole building maintenance plan will extend equipment life; improve occupant comfort, health, and safety; and reduce energy and maintenance costs. You may already be doing some of these things— see our list below for potential additions to your maintenance plan. Be sure to consult with qualified equipment specialists for details on proper maintenance and system operation.

Energy Tracking with ENERGY STAR® Portfolio Manager®

You've heard it before - you can't manage what you don't measure. ENERGY STAR® Portfolio Manager® is an online tool that you can use to measure and track energy and water consumption, as well as greenhouse gas emissions.[4] Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

Weatherization

Caulk or weather strip leaky doors and windows to reduce drafts and loss of heated or cooled air. Sealing cracks and openings can reduce heating and cooling costs, improve building durability, and create a healthier indoor environment.

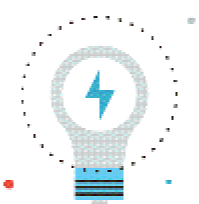
Doors and Windows

Close exterior doors and windows in heated and cooled areas. Leaving doors and windows open leads to a loss of heat during the winter and chilled air during the summer. Reducing air changes per hour (ACH) can lead to increased occupant comfort as well as heating and cooling savings, especially when combined with proper HVAC controls and adequate ventilation.

Window Treatments/Coverings

Use high-reflectivity films or cover windows with shades or shutters to reduce solar heat gain and reduce the load on cooling and heating systems. Older, single pane windows and east or west facing windows are especially prone to solar heat gain. In addition, use shades or shutters at night during cold weather to reduce heat loss.

Lighting Maintenance



Clean lamps, reflectors and lenses of dirt, dust, oil, and smoke buildup every six to twelve months. Light levels decrease over time due to lamp aging, lamp and ballast failure, and buildup of dirt and dust. Together, this can reduce total light output by up to 60% while still drawing full power.

In addition to routine cleaning, developing a maintenance schedule can ensure that maintenance is performed regularly, and it can reduce the overall cost of fixture re-lamping and re-ballasting. Group re-lamping and re-ballasting maintains lighting levels and minimizes the number of site visits by a lighting technician or contractor, decreasing the overall cost of maintenance.

[4] https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager

Motor Controls

Electric motors often run unnecessarily, and this is an overlooked opportunity to save energy. These motors should be identified and turned off when appropriate. For example, exhaust fans often run unnecessarily when ventilation requirements are already met. Whenever possible, use automatic devices such as twist timers or occupancy sensors to turn off motors when they are not needed.

Motor Maintenance

Motors have many moving parts. As these parts degrade over time, the efficiency of the motor is reduced. Routine maintenance prevents damage to motor components. Routine maintenance should include cleaning surfaces and ventilation openings on motors to prevent overheating, lubricating moving parts to reduce friction, inspecting belts and pulleys for wear and to ensure they are at proper alignment and tension, and cleaning and lubricating bearings. Consult a licensed technician to assess these and other motor maintenance strategies.

Fans to Reduce Cooling Load

Install ceiling fans to supplement your cooling system. Thermostat settings can typically be increased by 4°F with no change in overall occupant comfort due to the wind chill effect of moving air.

Destratification Fans

For areas with high ceilings, destratification fans f air balance the air temperature from floor to ceiling. They help reduce the recovery time needed to warm the space after nightly temperature setbacks and will increase occupants' the comfort level.

Areas with high ceilings require the heating system to heat a larger volume of space than that which is occupied. As the warm air rises, the warmest space is at the ceiling level, rather than floor level. Higher temperatures at the ceiling accelerate heat loss through the roof, which requires additional energy consumption by the heating equipment to compensate for this accelerated heat transfer.

Economizer Maintenance

Economizers can significantly reduce cooling system load. A malfunctioning economizer can increase the amount of heating and mechanical cooling required by introducing excess amounts of cold or hot outside air. Common economizer malfunctions include broken outdoor thermostat or enthalpy control, or dampers that are stuck or improperly adjusted.

Periodic inspection and maintenance will keep economizers working in sync with the heating and cooling system. This maintenance should be part of annual system maintenance, and it should include proper setting of the outdoor thermostat/enthalpy control, inspection of control and damper operation, lubrication of damper connections, and adjustment of minimum damper position.

Chiller Maintenance

Service chillers regularly to keep them operating properly. Chillers are responsible for a substantial portion of a commercial building's overall energy usage and when they do not work well, there is usually a noticeable increase in energy bills and increased occupant complaints. Regular diagnostics and service can save five to ten percent of the cost of operating your chiller. If you already have a maintenance contract in place, your existing service company should be able to provide these services.

AC System Evaporator/Condenser Coil Cleaning

Dirty evaporator and condenser coils restrict air flow and restrict heat transfer. This increases the loads on the evaporator and condenser fan and decreases overall cooling system performance. Keeping the coils clean allows the fans and cooling system to operate more efficiently.

HVAC Filter Cleaning and Replacement

Air filters should be checked regularly (often monthly) and cleaned or replaced when appropriate. Air filters reduce indoor air pollution, increase occupant comfort, and help keep equipment operating efficiently. If the building has a building management system, consider installing a differential pressure switch across filters to send an alarm about premature fouling or overdue filter replacement. Over time, filters become less effective as particulate buildup increases. Dirty filters also restrict air flow through the air conditioning or heat pump system, which increases the load on the distribution fans.

Duct Sealing

Duct leakage in commercial buildings can account for five to twenty-five percent of the supply airflow. In the case of rooftop air handlers, duct leakage can occur to the outside of the building wasting conditioned air. Eliminating duct leaks can improve ventilation system performance and reduce heating and cooling system operation.

Boiler Maintenance

Many boiler problems develop slowly over time, so regular inspection and maintenance is essential to keeping the heating system running efficiently and preventing expensive repairs. Annual tune-ups should include a combustion analysis to analyze the exhaust from the boilers and to ensure the boiler is operating safely. Boilers should be cleaned according to the manufacturer's instructions to remove soot and scale from the water side or fire side of the boiler.

Water Heater Maintenance

Preventative maintenance can extend the life of the system, maintain energy efficiency, and ensure safe operation. At least once a year, follow manufacturer instructions to drain a few gallons out of the water heater using the drain valve. If there is a lot of sediment or debris, then a full flush is recommended. Turn the temperature down and then completely drain the tank. Annual checks should include checks for:

- Leaks or heavy corrosion on the pipes and valves.
- Corrosion or wear on the gas line and on the piping. If you noticed any black residue, soot, or charred metal, this is a sign you may be having combustion issues and you should have the unit serviced by a professional.
- For electric water heaters, look for signs of leaking such as rust streaks or residue around the upper and lower panels covering the electrical components on the tank.
- For water heaters more than three years old, have a technician inspect the sacrificial anode annually.

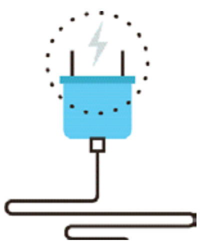
Compressed Air System Maintenance

Compressed air systems require periodic maintenance to operate at peak efficiency. A maintenance plan for compressed air systems should include:

- Inspection, cleaning, and replacement of inlet filter cartridges
- Cleaning of drain traps
- Daily inspection of lubricant levels to reduce unwanted friction
- Inspection of belt condition and tension
- Check for leaks and adjust loose connections
- Overall system cleaning

Contact a qualified technician for help with setting up periodic maintenance schedule.

Plug Load Controls



Reducing plug loads is a common way to decrease your electrical use. Limiting the energy use of plug loads can include increasing occupant awareness, removing under-used equipment, installing hardware controls, and using software controls. Consider enabling the most aggressive power settings on existing devices or install load sensing or occupancy sensing (advanced) power strips[5]. Your local utility may offer incentives or rebates for this equipment.

[5] For additional information refer to "Assessing and Reducing Plug and Process Loads in Office Buildings" http://www.nrel.gov/docs/fy13osti/54175.pdf, or "Plug Load Best Practices Guide" http://www.advancedbuildings.net/plug-load-best-practices-guide-offices

Water Conservation

Installing dual flush or low-flow toilets and low-flow/waterless urinals are ways to reduce water use. The EPA WaterSense™ ratings for urinals is 0.5 gpf and for flush valve toilets is 1.28 gpf (this is lower than the current 1.6 gpf federal standard).

For more information regarding water conservation go to the EPA's WaterSense™ website[6] or download a copy of EPA's "WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities"[7] to get ideas for creating a water management plan and best practices for a wide range of water using systems.

Water conservation devices that do not reduce hot water consumption will not provide energy savings at the site level, but they may significantly affect your water and sewer usage costs. Any reduction in water use does however ultimately reduce grid-level electricity use since a significant amount of electricity is used to deliver water from reservoirs to end users.

If the facility has detached buildings with a master water meter for the entire campus, check for unnatural wet areas in the lawn or water seeping in the foundation at water pipe penetrations through the foundation. Periodically check overnight meter readings when the facility is unoccupied, and there is no other scheduled water usage.

Manage irrigation systems to use water more effectively outside the building. Adjust spray patterns so that water lands on intended lawns and plantings and not on pavement and walls. Consider installing an evapotranspiration irrigation controller that will prevent over-watering.

Procurement Strategies

Purchasing efficient products reduces energy costs without compromising quality. Consider modifying your procurement policies and language to require ENERGY STAR® or WaterSense™ products where available.

[6] https://www.epa.gov/watersense

[7] https://www.epa.gov/watersense/watersense-work-0

6 On-site Generation

You don't have to look far in New Jersey to see one of the thousands of solar electric systems providing clean power to homes, businesses, schools, and government buildings. On-site generation includes both renewable (e.g., solar, wind) and non-renewable (e.g., fuel cells) technologies that generate power to meet all or a portion of the facility's electric energy needs. Also referred to as distributed generation, these systems contribute to greenhouse gas (GHG) emission reductions, demand reductions and reduced customer electricity purchases reduction, which results in improved electric grid reliability through better use of transmission and distribution systems.

Preliminary screenings were performed to determine if an on-site generation measure could be a cost-effective solution for your facility. Before deciding to install an on-site generation system, we recommend conducting a feasibility study to analyze existing energy profiles, siting, interconnection, and the costs associated with the generation project including interconnection costs, departing load charges, and any additional special facilities charges.

6.1 Solar Photovoltaic

Photovoltaic (PV) panels convert sunlight into electricity. Individual panels are combined into an array that produces direct current (DC) electricity. The DC current is converted to alternating current (AC) through an inverter. The inverter is then connected to the building's electrical distribution system.

A preliminary screening based on the facility's electric demand, size and location of free area, and shading elements shows that the facility has high potential for installing a PV array.

The amount of free area, ease of installation (location), and the lack of shading elements contribute to the high potential. A PV array located on the roof may be feasible. If you are interested in pursuing the installation of PV, we recommend conducting a full feasibility study.

The graphic below displays the results of the PV potential screening conducted as a part of this audit. The position of each slider indicates the potential (potential increases to the right) that each factor contributes to the overall site potential.

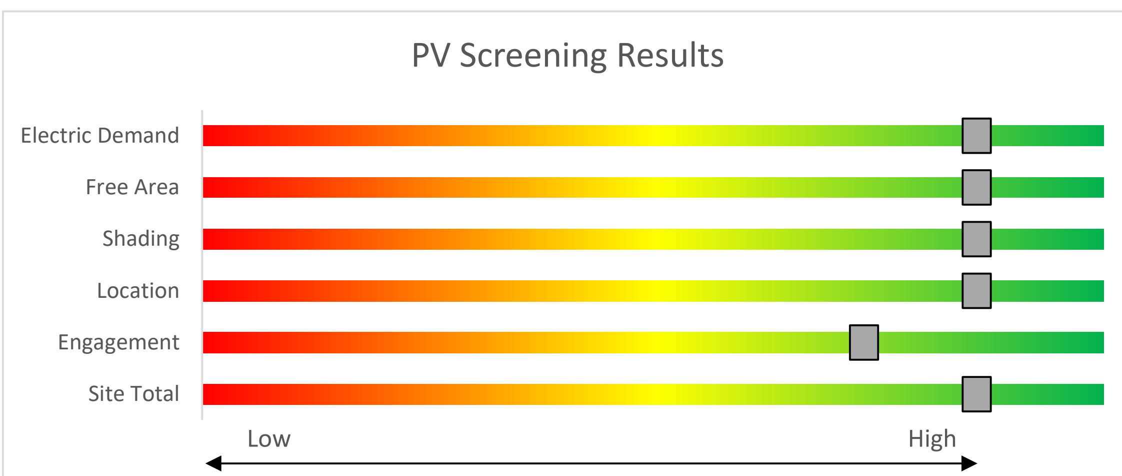


Figure 9 - Photovoltaic Screening

Solar Renewable Energy Certificate (SREC) Registration Program

Rebates are not available for solar projects, but owners of solar projects MUST register their projects in the SREC Registration Program before starting construction. Once your PV system is up and running, you periodically earn credits, which can then be sold on the open market for up to 15 years.

If you are considering installing solar photovoltaics on your building, visit www.njcleanenergy.com/srec for more information about the SREC Registration Program.

Get more information about solar power in New Jersey or find a qualified solar installer who can help you decide if solar is right for your building:

- **Basic Info on Solar PV in New Jersey**: www.njcleanenergy.com/whysolar
- **New Jersey Solar Market FAQs**: www.njcleanenergy.com/renewable-energy/program-updates-and-background-information/solar-transition/solar-market-faqs
- **Approved Solar Installers in the New Jersey Market**: www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/?id=60&start=1

6.2 Combined Heat and Power

Combined heat and power (CHP) generates electricity at the facility and puts waste heat energy to good use. Common types of CHP systems are reciprocating engines, microturbines, fuel cells, backpressure steam turbines, and (at large facilities) gas turbines.

CHP systems typically produce a portion of the electric power used on-site, with the balance of electric power needs supplied by the local utility company. The heat is used to supplement (or replace) existing boilers and provide space heating and/or domestic hot water heating. Waste heat can also be routed through absorption chillers for space cooling.

The key criteria used for screening is the amount of time that the CHP system would operate at full load and the facility's ability to use the recovered heat. Facilities with a continuous need for large quantities of waste heat are the best candidates for CHP.

A preliminary screening based on heating and electrical demand, siting, and interconnection shows that the facility has no potential for installing a cost-effective CHP system.

Based on a preliminary analysis, the facility does not appear to meet the minimum requirements for a cost-effective CHP installation. The lack of gas service, low or infrequent thermal load, and lack of space for siting the equipment are the most significant factors contributing to the lack of CHP potential.

The graphic below displays the results of the CHP potential screening conducted as a part of this audit. The position of each slider indicates the potential (potential increases to the right) that each factor contributes to the overall site potential.

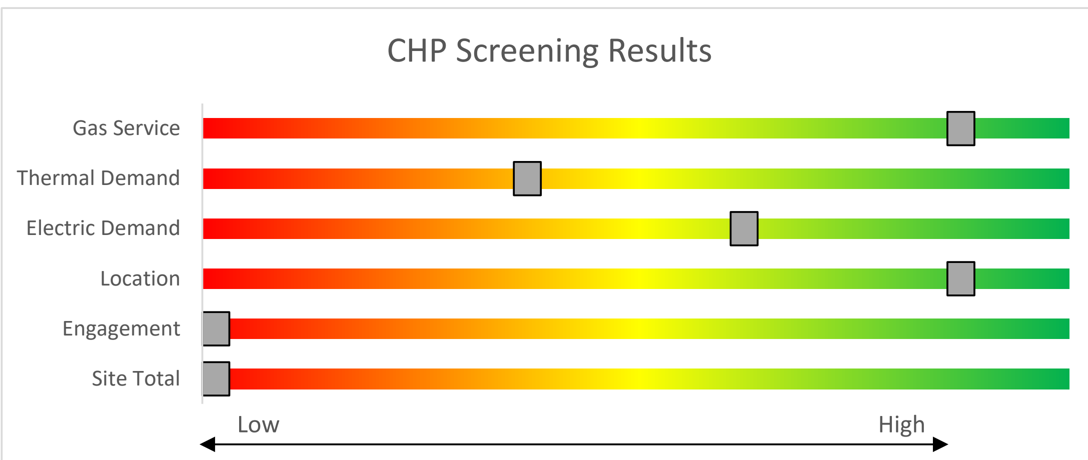


Figure 10 - Combined Heat and Power Screening

7 PROJECT FUNDING AND INCENTIVES

Ready to improve your building's performance? New Jersey's Clean Energy Programs can help. Pick the program that works best for you. Incentive programs that may apply to this facility are identified in the Executive Summary. This section provides an overview of currently available New Jersey's Clean Energy Programs.

	SmartStart *Flexibility to install at your own pace*	**Direct Install** *Turnkey installation*	**Pay for Performance** *Whole building upgrades*
Who should use it?	Buildings installing individual measures or small group of measures.	Small to mid-size facilities that can bundle multiple measures together. Average peak demand should be below 200 kW. Not suitable for significant building shell issues.	Mid to large size facilities looking to implement as many measures as possible at one time. Peak demand should be over 200 kW.
How does it work?	Use in-house staff or your preferred contractor.	Pre-approved contractors pass savings along to you via reduced material and labor costs.	Whole-building approach to energy upgrades designed to reduce energy use by at least 15%. The more you save, the higher the incentives.
What are the Incentives?	Fixed incentives for specific energy efficiency measures.	Incentives pay up to 70% of eligible costs, up to $125,000 per project. You pay the remaining 30% directly to the contractor.	Up to 25% of installation cost, calculated based on level of energy savings per square foot.
How do I participate?	Submit an application for the specific equipment to be installed.	Contact a participating contractor in your region.	Contact a pre-qualified Partner to develop your Energy Reduction Plan and set your energy savings targets.
Take the next step by visiting **www.njcleanenergy.com** for program details, applications, and to contact a qualified contractor.			

7.1 SmartStart

SmartStart offers incentives for installing prescriptive and custom energy efficiency measures at your facility. This program provides an effective mechanism for securing incentives for energy efficiency measures installed individually or as part of a package of energy upgrades. This program serves most common equipment types and sizes.

SmartStart routinely adds, removes, or modifies incentives from year-to-year for various energy efficiency equipment based on market trends and new technologies.

Equipment with Prescriptive Incentives Currently Available:

Electric Chillers
Electric Unitary HVAC
Gas Cooling
Gas Heating
Gas Water Heating
Ground Source Heat Pumps
Lighting
Lighting Controls
Refrigeration Doors
Refrigeration Controls
Refrigerator/Freezer Motors
Food Service Equipment
Variable Frequency Drives

Incentives

The SmartStart Prescriptive program provides fixed incentives for specific energy efficiency measures. Prescriptive incentives vary by equipment type.

SmartStart Custom provides incentives for more unique or specialized technologies or systems that are not addressed through prescriptive incentives. Custom incentives are calculated at $0.16/kWh and $1.60/therm based on estimated annual savings. Incentives are capped at 50% of the total installed incremental project cost, or a project cost buy down to a one-year payback (whichever is less). Program incentives are capped at $500,000 per electric account and $500,000 per natural gas account, per fiscal year.

How to Participate

Submit an application for the specific equipment to be installed. Many applications are designed as rebates, although others require application approval prior to installation. You can work with your preferred contractor or use internal staff to install measures.

Visit www.njcleanenergy.com/SSB for a detailed program description, instructions for applying, and applications.

7.2 Pay for Performance - Existing Buildings

Pay for Performance works for larger customers with a peak demand over 200 kW. The minimum installed scope of work must include at least two unique measures that results in at least 15% source energy savings, and lighting cannot make up the majority of the savings. P4P is a generally a good option for medium-to-large sized facilities looking to implement as many measures as possible under a single project to achieve deep energy savings. This program has an added benefit of addressing measures that may not qualify for other programs. Many facilities pursuing an Energy Savings Improvement Program loan also use this program.

Incentives

Incentives are based on estimated and achieved energy savings ranging from \$0.18-\$0.22/kWh and \$1.80-\$2.50/therm, capped at the lesser of 50% total project cost, or \$1 million per electric account and \$1 million per natural gas account, per fiscal year, not to exceed \$2 million per project. An incentive of \$0.15/square foot is also available to offset the cost of developing the Energy Reduction Plan (see below) contingent on the project moving forward with measure installation.

How to Participate

Contact one of the pre-approved consultants and contractors ("Partners"). Under direct contract to you, they will help further evaluate the measures identified in this report through development of the energy reduction plan), assist you in implementing selected measures, and verify actual savings one year after the installation. Your Partner will also help you apply for incentives.

Approval of the final scope of work is required by the program prior to installation. Installation can be done by the contractor of your choice (some P4P Partners are also contractors) or by internal staff, but the Partner remains involved throughout construction to ensure compliance with the program requirements.

Detailed program descriptions, instructions for applying, applications and list of Partners can be found at: [www.njcleanenergy.com/P4P.](www.njcleanenergy.com/P4P)

7.3 Energy Savings Improvement Program

The Energy Savings Improvement Program (ESIP) serves New Jersey's government agencies by financing energy projects. An ESIP is a type of performance contract, whereby school districts, counties, municipalities, housing authorities and other public and state entities enter in to contracts to help finance building energy upgrades. Annual payments are lower than the savings projected from the ECMs, ensuring that ESIP projects are cash flow positive for the life of the contract.

ESIP provides government agencies in New Jersey with a flexible tool to improve and reduce energy usage with minimal expenditure of new financial resources. NJCEP incentive programs described above can also be used to help further reduce the total project cost of eligible measures.

How to Participate

This LGEA report is the first step to participating in ESIP. Next, you will need to select an approach for implementing the desired ECMs:

(1) Use an energy services company or "ESCO."

(2) Use independent engineers and other specialists, or your own qualified staff, to provide and manage the requirements of the program through bonds or lease obligations.

(3) Use a hybrid approach of the two options described above where the ESCO is used for some services and independent engineers, or other specialists or qualified staff, are used to deliver other requirements of the program.

After adopting a resolution with a chosen implementation approach, the development of the energy savings plan (ESP) can begin. The ESP demonstrates that the total project costs of the ECMs are offset by the energy savings over the financing term, not to exceed 15 years. The verified savings will then be used to pay for the financing.

The ESIP approach may not be appropriate for all energy conservation and energy efficiency improvements. Carefully consider all alternatives to develop an approach that best meets your needs. A detailed program descriptions and application can be found at: www.njcleanenergy.com/ESIP.

ESIP is a program delivered directly by the NJBPU and is not an NJCEP incentive program. As mentioned above, you can use NJCEP incentive programs to help further reduce costs when developing the energy savings plan. Refer to the ESIP guidelines at the link above for further information and guidance on next steps.

7.4 SREC Registration Program

The SREC Registration Program (SRP) is used to register the intent to install solar projects in New Jersey. Rebates are not available for solar projects, but owners of solar projects *must* register their projects prior to the start of construction to establish the project's eligibility to earn SRECs. Registration of the intent to participate in New Jersey's solar marketplace provides market participants with information about the pipeline of anticipated new solar capacity and insight into future SREC pricing.

After the registration is accepted, construction is complete, and final paperwork has been submitted and is deemed complete, the project is issued a New Jersey certification number, which enables it to generate New Jersey SRECs. SREC's are generated once the solar project has been authorized to be energized by the Electric Distribution Company (EDC).

Each time a solar installation generates 1,000 kilowatt-hours (kWh) of electricity, an SREC is earned. Solar project owners report the energy production to the SREC Tracking System. This reporting allows SREC's to be placed in the customer's electronic account. SRECs can then be sold on the SREC Tracking System, providing revenue for the first 15 years of the project's life.

Electricity suppliers, the primary purchasers of SRECs, are required to pay a Solar Alternative Compliance Payment (SACP) if they do not meet the requirements of New Jersey's Solar Renewable Portfolio Standard. Purchasing SRECs can help them meet those requirements. As SRECs are traded in a competitive market, the price may vary significantly. The actual price of an SREC during a trading period fluctuates depending on supply and demand.

Information about the SRP can be found at: www.njcleanenergy.com/srec.

8 Energy Purchasing and Procurement Strategies

8.1 Retail Electric Supply Options

Energy deregulation in New Jersey has increased energy buyers' options by separating the function of electricity distribution from that of electricity supply. So, though you may choose a different company from which to buy your electric power, responsibility for your facility's interconnection to the grid and repair to local power distribution will still reside with the traditional utility company serving your region.

If your facility is not purchasing electricity from a third-party supplier, consider shopping for a reduced rate from third-party electric suppliers. If your facility already buys electricity from a third-party supplier, review and compare prices at the end of each contract year.

A list of licensed third-party electric suppliers is available at the NJBPU website[8].

8.2 Retail Natural Gas Supply Options

The natural gas market in New Jersey is also deregulated. Most customers that remain with the utility for natural gas service pay rates that are market-based and that fluctuate monthly. The utility provides basic gas supply service (BGSS) to customers who choose not to buy from a third-party supplier for natural gas commodity.

A customer's decision about whether to buy natural gas from a retail supplier typically depends on whether a customer prefers budget certainty and/or longer-term rate stability. Customers can secure longer-term fixed prices by signing up for service through a third-party retail natural gas supplier. Many larger natural gas customers may seek the assistance of a professional consultant to assist in their procurement process.

If your facility does not already purchase natural gas from a third-party supplier, consider shopping for a reduced rate from third-party natural gas suppliers. If your facility already purchases natural gas from a third-party supplier, review and compare prices at the end of each contract year.

A list of licensed third-party natural gas suppliers is available at the NJBPU website[9].

[8] www.state.nj.us/bpu/commercial/shopping.html.

[9] www.state.nj.us/bpu/commercial/shopping.html

Appendix A: Equipment Inventory & Recommendations

Lighting Inventory & Recommendations

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Roof Outdoor Lighting	12	Metal Halide: (1) 175W Lamp	Wall Switch	S	215	8,760	1, 4	Fixture Replacement	Yes	12	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	65	4,380	1.1	19,184	0	$2,327	$12,792	$1,200	5.0
Roof Outdoor Lighting	8	Metal Halide: (1) 175W Lamp	Wall Switch	S	215	4,380	1	Fixture Replacement	No	8	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	65	4,380	0.6	5,256	0	$638	$7,728	$800	10.9
Building Mounted	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	S	22	8,760		None	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	22	8,760	0.0	0	0	$0	$0	$0	0.0
Building Mounted	20	LED - Linear Tubes: Plug in Lamp Wall Pack Fixture	Timeclock	S	14	5,840		None	No	20	LED - Linear Tubes: Plug in Lamp Wall Pack Fixture	Timeclock	14	5,840	0.0	0	0	$0	$0	$0	0.0
Building Mounted	15	LED - Linear Tubes: Plug in Lamp Surface Mount Fixture	Timeclock	S	14	5,840		None	No	15	LED - Linear Tubes: Plug in Lamp Surface Mount Fixture	Timeclock	14	5,840	0.0	0	0	$0	$0	$0	0.0
Parking Lots	12	Metal Halide: (1) 175W Lamp	Wall Switch	S	215	4,380	1	Fixture Replacement	No	12	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	65	4,380	0.9	7,884	0	$956	$11,592	$1,200	10.9
Basketball Courts	10	Metal Halide: (1) 175W Lamp	Wall Switch	S	215	4,380	1	Fixture Replacement	No	10	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	65	4,380	0.8	6,570	0	$797	$9,660	$1,000	10.9
Playground	6	Metal Halide: (1) 175W Lamp	Wall Switch	S	215	4,380	1	Fixture Replacement	No	6	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	65	4,380	0.5	3,942	0	$478	$5,796	$600	10.9
Basement Hallway	11	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 5	Relamp	Yes	11	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,283	0.2	610	0	$72	$802	$110	9.6
Storage Room 003	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.1	218	0	$26	$183	$50	5.1
Elevator Machine Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.0	44	0	$5	$37	$10	5.1
Generator Storage 004	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.1	174	0	$21	$146	$40	5.1
Boiler Room	27	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,394	2	Relamp	No	27	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,394	0.4	882	0	$104	$986	$270	6.9
North MER Mechanical Room	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,394	2	Relamp	No	10	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,394	0.2	327	0	$39	$365	$100	6.9
South MER Mechanical Room	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,394	2	Relamp	No	9	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,394	0.1	294	0	$35	$329	$90	6.9
Garage	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.1	218	0	$26	$183	$50	5.1
Custodian Office	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.1	333	0	$39	$489	$95	10.0
Hallways	55	LED Screw-In Lamps: Screw in Lamp	Wall Switch	S	9	8,760		None	No	55	LED Screw-In Lamps: Screw in Lamp	Wall Switch	9	8,760	0.0	0	0	$0	$0	$0	0.0
Library / Media Center	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.5	1,596	-1	$189	$1,416	$310	5.9
Library / Media Center	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.4	1,397	0	$165	$1,307	$280	6.2
Library / Media Center	24	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	2,231	2, 3	Relamp	Yes	24	LED Screw-In Lamps: Screw in Lamp	Occupancy Sensor	18	1,539	0.2	516	0	$61	$683	$59	10.2
M219A Storage Areas	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.1	222	0	$26	$306	$40	10.1
M219 B Storage Areas	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.1	222	0	$26	$306	$40	10.1
M219 C Storage Areas	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.1	222	0	$26	$306	$40	10.1
M219 D Storage Areas	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.1	222	0	$26	$306	$40	10.1

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
M220 Math Lab Classrooms	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.3	998	0	$118	$818	$185	5.4
M221A Storage Areas	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.1	222	0	$26	$306	$40	10.1
M218 Classrooms	16	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,231	2, 3	Relamp	Yes	16	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,539	0.6	1,875	-1	$222	$1,438	$355	4.9
M217 Classrooms	16	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,231	2, 3	Relamp	Yes	16	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,539	0.6	1,875	-1	$222	$1,438	$355	4.9
M221 Computer Lab Classrooms	19	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	19	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.4	1,264	0	$150	$964	$225	4.9
M222 Classrooms	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.3	998	0	$118	$818	$185	5.4
M222 A Storage Areas	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.1	222	0	$26	$306	$40	10.1
M222 A Storage Areas	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	1,859	2	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	1,859	0.0	21	0	$2	$33	$6	10.6
M222 Offices	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.1	222	0	$26	$262	$60	7.7
B211 Restroom	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	8,760	2	Relamp	No	2	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	8,760	0.0	361	0	$43	$145	$20	2.9
B212 Restroom	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	8,760	2	Relamp	No	2	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	8,760	0.0	361	0	$43	$145	$20	2.9
M213 Classrooms	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.3	1,064	0	$126	$854	$195	5.2
M212 Classrooms	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.3	798	0	$94	$708	$155	5.9
M214 Classrooms	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.3	1,064	0	$126	$854	$195	5.2
M218 Classrooms	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.3	798	0	$94	$708	$155	5.9
M217 Classrooms	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.3	798	0	$94	$708	$155	5.9
M216 Classrooms	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.3	798	0	$94	$708	$155	5.9
M215 Classrooms	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.3	798	0	$94	$708	$155	5.9
M214 Classrooms	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.3	798	0	$94	$708	$155	5.9
M210 Classrooms	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.3	1,064	0	$126	$854	$195	5.2
M209 Classrooms	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.3	1,064	0	$126	$854	$195	5.2
M208 Classrooms	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.3	998	0	$118	$818	$185	5.4
B219 Classrooms	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,231	2	Relamp	No	2	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	2,231	0.0	92	0	$11	$145	$20	11.5
B220 Classrooms	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,231	2	Relamp	No	2	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	2,231	0.0	92	0	$11	$145	$20	11.5
M206 Classrooms	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.1	200	0	$24	$380	$65	13.3

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
M207 Classrooms	15	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	15	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,539	0.3	932	0	$110	$1,357	$185	10.6
B223 Classrooms	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,231	2	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,231	0.0	28	0	$3	$18	$5	4.0
B224 Classrooms	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,231	2	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,231	0.0	28	0	$3	$18	$5	4.0
M205 Classrooms	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.3	798	0	$94	$708	$155	5.9
M204 Classrooms	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.3	798	0	$94	$708	$155	5.9
M203 Classrooms	13	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	13	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.3	865	0	$102	$745	$165	5.7
M202 Classrooms	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.2	532	0	$63	$562	$115	7.1
M201 Classrooms	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.2	665	0	$79	$635	$135	6.4
B225A Storage Areas	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.0	87	0	$10	$73	$20	5.1
B225B Storage Areas	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.0	87	0	$10	$73	$20	5.1
Hallways	65	Compact Fluorescent: Screw in Lamp	Wall Switch	S	13	8,760	2	Relamp	No	65	LED Screw-In Lamps: Screw in Lamp	Wall Switch	9	8,760	0.1	1,617	-1	$191	$1,120	$65	5.5
Hallways	6	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	8,760	2, 5	Relamp	Yes	6	LED - Linear Tubes: (2) U-Lamp	High/Low Control	33	6,044	0.1	1,464	0	$173	$635	$60	3.3
Stair A Stairway	3	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	8,760	2	Relamp	No	3	LED Screw-In Lamps: Screw in Lamp	Wall Switch	18	8,760	0.0	149	0	$18	$52	$3	2.8
Stair A Stairway	3	Compact Fluorescent: High Output Screw in Lamp	Wall Switch	S	200	8,760	1	Fixture Replacement	No	3	LED - Fixtures: Low-Bay	Wall Switch	120	8,760	0.1	1,493	0	$177	$1,876	$450	8.1
Hallways	2	Compact Fluorescent: High Output Screw in Lamp	Wall Switch	S	200	8,760	1	Fixture Replacement	No	2	LED - Fixtures: Low-Bay	Wall Switch	120	8,760	0.1	995	0	$118	$1,251	$300	8.1
Stair B Stairway	10	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	8,760	2	Relamp	No	10	LED Screw-In Lamps: Screw in Lamp	Wall Switch	18	8,760	0.0	498	0	$59	$172	$10	2.8
Stair B Stairway	1	Compact Fluorescent: High Output Screw in Lamp	Wall Switch	S	200	8,760	1	Fixture Replacement	No	1	LED - Fixtures: Low-Bay	Wall Switch	120	8,760	0.0	498	0	$59	$625	$150	8.1
Stair C Stairway	10	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	8,760	2	Relamp	No	10	LED Screw-In Lamps: Screw in Lamp	Wall Switch	18	8,760	0.0	498	0	$59	$172	$10	2.8
Stair C Stairway	1	Compact Fluorescent: High Output Screw in Lamp	Wall Switch	S	200	8,760	1	Fixture Replacement	No	1	LED - Fixtures: Low-Bay	Wall Switch	120	8,760	0.0	498	0	$59	$625	$150	8.1
Kitchen Storage Areas	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,417	2	Relamp	No	8	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,417	0.1	453	0	$54	$292	$80	4.0
Restroom	2	Linear Fluorescent - T8: 3' T8 (25W) - 2L	Wall Switch	S	48	1,859	2	Relamp	No	2	LED - Linear Tubes: (2) 3' Lamps	Wall Switch	21	1,859	0.0	71	0	$8	$73	$20	6.3
Kitchen Storage	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	2	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	1,859	0.0	77	0	$9	$145	$20	13.8
N113 Gymnasium	5	Metal Halide: (1) 400W Lamp	Wall Switch	S	458	2,417	1, 3	Fixture Replacement	Yes	5	LED - Fixtures: High-Bay	Occupancy Sensor	140	1,668	0.9	3,101	-1	$367	$4,974	$925	11.0
N113 Gymnasium	7	Linear Fluorescent - T5HO: 4' T5HO (54W) - 6L	Wall Switch	S	358	2,417	2, 3	Relamp	Yes	7	LED - Linear Tubes: (6) 4' T5HO (25W) Lamps	Occupancy Sensor	153	1,668	0.9	3,032	-1	$359	$2,409	$245	6.0
N11 Storage Areas	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.0	87	0	$10	$73	$20	5.1

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
N110 Office	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.1	166	0	$20	$226	$50	8.9
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	8,760	2	Relamp	No	2	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	8,760	0.0	218	0	$26	$37	$10	1.0
Main Office Corridor	20	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	8,760	2	Relamp	No	20	LED Screw-In Lamps: Screw in Lamp	Wall Switch	18	8,760	0.1	995	0	$118	$345	$20	2.8
Copy Area Copy Room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.0	87	0	$10	$73	$20	5.1
Main Office	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,417	2, 3	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,668	0.2	649	0	$77	$599	$125	6.2
Main Office	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,417	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	2,417	0.0	50	0	$6	$72	$10	10.6
Kitchenette/Lunch Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,417	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,417	0.0	57	0	$7	$37	$10	4.0
Principal Offices	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,417	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,668	0.1	432	0	$51	$335	$80	5.0
M110F TR Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	8,760	2	Relamp	No	2	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	8,760	0.0	218	0	$26	$37	$10	1.0
M110G TR Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	8,760	2	Relamp	No	2	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	8,760	0.0	218	0	$26	$37	$10	1.0
M110D Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,417	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,417	0.0	113	0	$13	$73	$20	4.0
M110E Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,417	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,417	0.0	113	0	$13	$73	$20	4.0
M110C VP Office	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,417	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,668	0.1	432	0	$51	$335	$80	5.0
M110 Workroom Offices	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,417	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,668	0.1	432	0	$51	$335	$80	5.0
M110F Conference Room	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,673	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,154	0.1	299	0	$35	$335	$80	7.2
Hallways	21	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	8,760	2	Relamp	No	21	LED Screw-In Lamps: Screw in Lamp	Wall Switch	18	8,760	0.1	1,045	0	$124	$362	$21	2.8
Hallways	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,760	2, 5	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	6,044	0.1	1,045	0	$124	$346	$40	2.5
Auditorium	18	Compact Fluorescent: High Output Screw in Lamp	Wall Switch	S	200	2,417	1	Fixture Replacement	No	18	LED - Fixtures: Low-Bay	Wall Switch	120	2,417	0.7	2,471	-1	$292	$11,258	$2,700	29.3
Stage Auditorium	16	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,417	2	Relamp	No	16	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,417	0.1	480	0	$57	$292	$80	3.7
Boys Lockeroom	8	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	2,417	2	Relamp	No	8	LED Screw-In Lamps: Screw in Lamp	Wall Switch	18	2,417	0.0	110	0	$13	$138	$8	10.0
Girls Lockeroom	8	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	2,417	2	Relamp	No	8	LED Screw-In Lamps: Screw in Lamp	Wall Switch	18	2,417	0.0	110	0	$13	$138	$8	10.0
Vestibule	4	LED Screw-In Lamps: High Output Screw in Lamp	Wall Switch	S	65	8,760		None	No	4	LED Screw-In Lamps: High Output Screw in Lamp	Wall Switch	65	8,760	0.0	0	0	$0	$0	$0	0.0
Stairs Stairway	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,760	2	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.1	821	0	$97	$146	$40	1.1
Tele Room 009A	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,760	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.0	205	0	$24	$37	$10	1.1
Water Meter Room 009	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.1	261	0	$31	$219	$60	5.1

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Electric Room 010	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.1	261	0	$31	$219	$60	5.1
Storage Room 011	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.2	499	0	$59	$445	$90	6.0
Storage Room 010A	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.1	333	0	$39	$335	$60	7.0
Storage Room 008	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.1	222	0	$26	$262	$40	8.5
Locker Area Locker	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,673	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,673	0.0	39	0	$5	$37	$10	5.7
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	8,760	2	Relamp	No	2	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	8,760	0.0	218	0	$26	$37	$10	1.0
Storage Area	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.2	499	0	$59	$445	$90	6.0
Generator Room 011A	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.1	261	0	$31	$219	$60	5.1
Laundry Room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.0	87	0	$10	$73	$20	5.1
Stairs Stairway	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,760	2	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.1	821	0	$97	$146	$40	1.1
Performing Arts Vest Hallways	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,760	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.0	410	0	$49	$73	$20	1.1
N101 Classroom	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.3	998	0	$118	$818	$185	5.4
N102 Office	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.1	166	0	$20	$226	$50	8.9
N103 Storage Areas	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.0	87	0	$10	$73	$20	5.1
N104 Music Classrooms	26	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	26	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.5	1,729	-1	$205	$1,489	$330	5.7
N105 Storage Areas	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.0	44	0	$5	$37	$10	5.1
M101 Nurse Office	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,417	2	Relamp	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,417	0.0	170	0	$20	$110	$30	4.0
M101 Nurse Office	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,417	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	2,417	0.0	50	0	$6	$72	$10	10.6
Exam Offices	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.1	261	0	$31	$219	$60	5.1
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,760	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.0	410	0	$49	$73	$20	1.1
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,760	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.0	410	0	$49	$73	$20	1.1
M101A Exam Exam	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,673	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,673	0.0	78	0	$9	$73	$20	5.7
Hallways	18	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	8,760	2	Relamp	No	18	LED Screw-In Lamps: Screw in Lamp	Wall Switch	18	8,760	0.1	896	0	$106	$310	$18	2.8
Hallways	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,760	2, 5	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	6,044	0.1	783	0	$93	$310	$30	3.0
M102 Student Services Offices	6	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,283	0.1	311	0	$37	$705	$95	16.6

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
M102 Student Services Offices	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.3	831	0	$98	$818	$185	6.4
M102D Conference Room	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.1	166	0	$20	$226	$50	8.9
M102C Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.0	87	0	$10	$73	$20	5.1
M102B Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.0	87	0	$10	$73	$20	5.1
M102A Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.0	87	0	$10	$73	$20	5.1
M102 TR Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,760	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.0	410	0	$49	$73	$20	1.1
Storage Areas	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.0	87	0	$10	$73	$20	5.1
Telephone Closets	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,394	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,394	0.0	65	0	$8	$73	$20	6.9
Elect Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,394	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,394	0.0	33	0	$4	$37	$10	6.9
M103 Classroom	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,400	2, 3	Relamp	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,656	0.3	1,073	0	$127	$818	$185	5.0
M103 Classroom	3	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	2,400	2	Relamp	No	3	LED Screw-In Lamps: Screw in Lamp	Wall Switch	18	2,400	0.0	41	0	$5	$52	$3	10.1
Lobby Hallways	1	Compact Fluorescent: High Output Screw in Lamp	Wall Switch	S	200	8,760	1	Fixture Replacement	No	1	LED - Fixtures: Low-Bay	Wall Switch	120	8,760	0.0	498	0	$59	$625	$150	8.1
Hallways	1	Compact Fluorescent: High Output Screw in Lamp	Wall Switch	S	200	8,760	1	Fixture Replacement	No	1	LED - Fixtures: Low-Bay	Wall Switch	120	8,760	0.0	498	0	$59	$625	$150	8.1
M108 Classroom	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,400	2, 3	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,656	0.3	859	0	$102	$708	$155	5.4
M108 Classroom	3	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	2,400	2	Relamp	No	3	LED Screw-In Lamps: Screw in Lamp	Wall Switch	18	2,400	0.0	41	0	$5	$52	$3	10.1
M104 Classroom	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,400	2, 3	Relamp	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,656	0.3	1,073	0	$127	$818	$185	5.0
M104 Classroom	3	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	2,400	2	Relamp	No	3	LED Screw-In Lamps: Screw in Lamp	Wall Switch	18	2,400	0.0	41	0	$5	$52	$3	10.1
M105 Classroom	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,400	2, 3	Relamp	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,656	0.3	1,073	0	$127	$818	$185	5.0
M105 Classroom	3	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	2,400	2	Relamp	No	3	LED Screw-In Lamps: Screw in Lamp	Wall Switch	18	2,400	0.0	41	0	$5	$52	$3	10.1
M109 Classroom	13	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,400	2, 3	Relamp	Yes	13	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,656	0.3	930	0	$110	$745	$165	5.3
M109 Classroom	3	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	2,400	2	Relamp	No	3	LED Screw-In Lamps: Screw in Lamp	Wall Switch	18	2,400	0.0	41	0	$5	$52	$3	10.1
Janitors Closet	1	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	1,394	2	Relamp	No	1	LED Screw-In Lamps: Screw in Lamp	Wall Switch	18	1,394	0.0	8	0	$1	$17	$1	17.3
M110 Classroom	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,400	2, 3	Relamp	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,656	0.3	1,073	0	$127	$818	$185	5.0
M110 Classroom	3	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	2,400	2	Relamp	No	3	LED Screw-In Lamps: Screw in Lamp	Wall Switch	18	2,400	0.0	41	0	$5	$52	$3	10.1
M111 Classroom	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,400	2, 3	Relamp	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,656	0.3	1,073	0	$127	$818	$185	5.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
M111 Classroom	3	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	2,400	2	Relamp	No	3	LED Screw-In Lamps: Screw in Lamp	Wall Switch	18	2,400	0.0	41	0	$5	$52	$3	10.1
M112 Classroom	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,400	2, 3	Relamp	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,656	0.3	1,073	0	$127	$818	$185	5.0
M112 Classroom	3	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	2,400	2	Relamp	No	3	LED Screw-In Lamps: Screw in Lamp	Wall Switch	18	2,400	0.0	41	0	$5	$52	$3	10.1
Elec Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,394	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,394	0.0	33	0	$4	$37	$10	6.9
Hallways	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,760	2, 5	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	6,044	0.1	783	0	$93	$310	$30	3.0
M116 Faculty Lounge	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,400	2	Relamp	No	2	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	2,400	0.0	99	0	$12	$145	$20	10.7
M116 Faculty Lounge	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,400	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,656	0.1	286	0	$34	$416	$75	10.1
Restroom B102A	2	Linear Fluorescent - T8: 3' T8 (25W) - 2L	Wall Switch	S	48	8,760	2	Relamp	No	2	LED - Linear Tubes: (2) 3' Lamps	Wall Switch	21	8,760	0.0	336	0	$40	$73	$20	1.3
Restroom B102B	2	Linear Fluorescent - T8: 3' T8 (25W) - 2L	Wall Switch	S	48	8,760	2	Relamp	No	2	LED - Linear Tubes: (2) 3' Lamps	Wall Switch	21	8,760	0.0	336	0	$40	$73	$20	1.3
Restroom B103	4	Linear Fluorescent - T8: 3' T8 (25W) - 2L	Wall Switch	S	48	8,760	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 3' Lamps	Occupancy Sensor	21	6,044	0.1	834	0	$99	$416	$75	3.5
Restroom B103	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	8,760	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	8,760	0.0	180	0	$21	$72	$10	2.9
Restroom B104	4	Linear Fluorescent - T8: 3' T8 (25W) - 2L	Wall Switch	S	48	8,760	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 3' Lamps	Occupancy Sensor	21	6,044	0.1	834	0	$99	$416	$75	3.5
Restroom B104	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	8,760	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	8,760	0.0	180	0	$21	$72	$10	2.9
Cafeteria	12	Linear Fluorescent - T5HO: 4' T5HO (54W) - 6L	Wall Switch	S	358	3,718	2, 3	Relamp	Yes	12	LED - Linear Tubes: (6) 4' T5HO (25W) Lamps	Occupancy Sensor	153	2,565	1.5	7,996	-3	$946	$4,130	$420	3.9
Cafeteria	29	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	3,718	2, 3	Relamp	Yes	29	LED Screw-In Lamps: Screw in Lamp	Occupancy Sensor	18	2,565	0.2	1,040	0	$123	$1,040	$99	7.6
Cafeteria Hallway	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,760	2, 5	Relamp	Yes	7	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	6,044	0.1	1,828	-1	$216	$456	$70	1.8
Kitchen	14	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	14	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.2	610	0	$72	$511	$140	5.1
Kitchen	2	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	1,859	2	Relamp	No	2	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	1,859	0.0	42	0	$5	$65	$12	10.6
M113 Staff Development Offices	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.3	831	0	$98	$818	$185	6.4
M113 Staff Development Offices	3	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,283	0.1	155	0	$18	$333	$50	15.4
M114 Distance Learning Offices	20	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	20	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.4	1,108	0	$131	$1,000	$235	5.8
Student TR Restroom	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,760	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	6,044	0.1	1,045	0	$124	$416	$75	2.8
Student TR Restroom	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	8,760	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	8,760	0.0	180	0	$21	$72	$10	2.9
Janitor Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	930	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	930	0.0	22	0	$3	$37	$10	10.3
Hallways	60	Compact Fluorescent: Screw in Lamp	Wall Switch	S	26	8,760	2	Relamp	No	60	LED Screw-In Lamps: Screw in Lamp	Wall Switch	18	8,760	0.2	2,985	-1	$353	$1,034	$60	2.8

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Hallways	15	Compact Fluorescent: High Output Screw in Lamp	Wall Switch	S	42	8,760	2	Relamp	No	15	LED Screw-In Lamps: High Output Screw in Lamp	Wall Switch	29	8,760	0.1	1,213	0	$144	$258	$15	1.7
Student Offices	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.1	222	0	$26	$262	$60	7.7
Student Offices	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	1,859	0.0	38	0	$5	$72	$10	13.8
M115 Speech Offices	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.1	222	0	$26	$262	$60	7.7
S111 Preschool Classrooms	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.1	399	0	$47	$489	$95	8.3
S111 Preschool Classrooms	5	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	5	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,539	0.1	311	0	$37	$632	$85	14.9
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,760	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.0	410	0	$49	$73	$20	1.1
S113 Preschool Classrooms	5	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	5	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,539	0.1	311	0	$37	$632	$85	14.9
S113 Preschool Classrooms	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.1	399	0	$47	$489	$95	8.3
S115 Classroom	5	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	5	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,539	0.1	311	0	$37	$632	$85	14.9
S115 Classroom	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.1	399	0	$47	$489	$95	8.3
S110 Classroom	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.1	333	0	$39	$453	$85	9.3
S112 Classroom	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.1	333	0	$39	$453	$85	9.3
S111 Workroom	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,539	0.2	532	0	$63	$408	$100	4.9
S111 Workroom	3	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,231	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,539	0.1	186	0	$22	$333	$50	12.8
Storage	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	930	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	930	0.0	44	0	$5	$73	$20	10.3
S116 Tutor Offices	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.2	443	0	$52	$408	$100	5.9
S114 Tutor Offices	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2, 3	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,283	0.2	443	0	$52	$408	$100	5.9
Classroom S117	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,400	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,656	0.1	286	0	$34	$416	$75	10.1
Classroom S117	3	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,400	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,656	0.1	201	0	$24	$487	$65	17.8
Classroom S118	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,400	2, 3	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,656	0.2	644	0	$76	$599	$125	6.2
Classroom S120	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,400	2, 3	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,656	0.2	644	0	$76	$599	$125	6.2
Classroom S122	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,400	2, 3	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,656	0.2	644	0	$76	$599	$125	6.2
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.0	87	0	$10	$73	$20	5.1
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.0	87	0	$10	$73	$20	5.1

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
S123 Classroom	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,400	2, 3	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,656	0.3	859	0	$102	$708	$155	5.4
S125 Classroom	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,400	2, 3	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,656	0.3	859	0	$102	$708	$155	5.4
Classroom S124	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,400	2, 3	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,656	0.2	644	0	$76	$599	$125	6.2
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.0	87	0	$10	$73	$20	5.1
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,859	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,859	0.0	87	0	$10	$73	$20	5.1
Classrooms	41	Compact Fluorescent: Plug in Lamps	Wall Switch	S	26	2,400	2	Relamp	No	41	LED - Linear Tubes: Plug in Lamps	Wall Switch	10	2,400	0.3	1,118	0	$132	$923	$41	6.7
Transition Spaces	30	Exit Signs: LED - 2 W Lamp	None	S	6	8,760		None	No	30	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0

Motor Inventory & Recommendations

		Existing Conditions							Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Room	HWP-1	1	Boiler Feed Water Pump	1.5	84.0%	No	W	2,745		No	84.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	HWP-2	1	Boiler Feed Water Pump	1.5	84.0%	No	W	2,745		No	84.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	HWP-3	1	Heating Hot Water Pump	20.0	91.0%	No	W	1,696	6, 9	Yes	93.0%	Yes	1	2.1	10,828	0	$1,314	$8,582	$0	6.5
Mechanical Room	HWP-4	1	Heating Hot Water Pump	20.0	91.0%	No	W	1,696	6, 9	Yes	93.0%	Yes	1	2.1	10,828	0	$1,314	$8,582	$0	6.5
Mechanical Room	CHW-1	1	Chilled Water Pump	20.0	91.0%	No	W	3,391	6, 8	Yes	93.0%	Yes	1	3.9	21,656	0	$2,627	$8,582	$1,200	2.8
Mechanical Room	CHW-2	1	Chilled Water Pump	20.0	91.0%	No	W	1,696	6, 8	Yes	93.0%	Yes	1	3.9	10,828	0	$1,314	$8,582	$1,200	5.6
Mechanical Room	CHW-3	1	Chilled Water Pump	20.0	91.0%	No	W	1,696	6, 8	Yes	93.0%	Yes	1	3.9	10,828	0	$1,314	$8,582	$1,200	5.6
Mechanical Room	Boiler Burners	2	Combustion Air Fan	5.0	89.0%	No	W	2,745		No	89.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	Boiler Exhaust	2	Combustion Air Fan	0.3	74.0%	No	W	2,745		No	74.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	Domestic Hot Water	3	Water Supply Pump	0.8	74.0%	No	W	2,745		No	74.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	Condensate Return	3	Condensate Pump	0.8	74.0%	No	W	2,745		No	74.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	Condensate Return	2	Condensate Pump	0.5	74.0%	No	W	1,373		No	74.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	AC-1, AHU-1	2	Supply Fan	5.0	89.5%	No	W	3,391	6, 7	Yes	89.5%	Yes	2	2.9	10,599	0	$1,286	$8,152	$800	5.7
Mechanical Room	AC-1, AHU-1	2	Return Fan	2.0	86.5%	No	W	3,391	6, 7	Yes	86.5%	Yes	2	1.2	4,387	0	$532	$6,522	$320	11.7
Mechanical Room	AHU-2 & AHU-3	2	Supply Fan	7.5	91.7%	No	W	3,391	6, 7	Yes	91.7%	Yes	2	4.3	15,517	0	$1,882	$9,476	$1,200	4.4
Mechanical Room	AHU-2 & AHU-3	2	Return Fan	5.0	89.5%	No	W	3,391	6, 7	Yes	89.5%	Yes	2	3.0	10,599	0	$1,286	$8,152	$800	5.7
Roof	RTU-1	1	Supply Fan	7.5	91.7%	No	W	3,391	6, 7	Yes	91.7%	Yes	1	2.1	7,759	0	$941	$4,738	$600	4.4
Roof	RTU-1	1	Return Fan	5.0	89.5%	No	W	3,391	6, 7	Yes	89.5%	Yes	1	1.5	5,300	0	$643	$4,076	$400	5.7
Roof	RTU-2	1	Supply Fan	15.0	92.4%	No	W	3,391	6, 7	Yes	93.0%	Yes	1	4.3	15,579	0	$1,890	$7,041	$1,200	3.1
Roof	RTU-2	1	Return Fan	5.0	89.5%	No	W	3,391	6, 7	Yes	89.5%	Yes	1	1.5	5,300	0	$643	$4,076	$400	5.7

		Existing Conditions							Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Roof	AC-2	1	Supply Fan	3.0	89.5%	No	W	3,391		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	AC-2	1	Return Fan	1.0	85.5%	No	W	3,391		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	AC-3	1	Supply Fan	10.0	91.7%	No	W	3,391		No	91.7%	No		0.0	0	0	$0	$0	$0	0.0
Roof	AC-3	1	Return Fan	3.0	89.5%	No	W	3,391		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	HRU-1 & HRU-2	2	Supply Fan	7.5	91.7%	No	W	3,391		No	91.7%	No		0.0	0	0	$0	$0	$0	0.0
Roof	HRU-1 & HRU-2	2	Return Fan	5.0	89.5%	No	W	3,391		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	RTU-3	1	Supply Fan	7.5	91.7%	No	W	3,391	6, 7	Yes	91.7%	Yes	1	2.1	6,281	0	$762	$4,738	$600	5.4
Roof	RTU-3	1	Return Fan	5.0	89.5%	No	W	3,391	6, 7	Yes	89.5%	Yes	1	1.5	4,290	0	$520	$4,076	$400	7.1
Office & Locker Room	FCUs	1	Supply Fan	0.3	74.0%	No	W	2,745		No	74.0%	No		0.0	0	0	$0	$0	$0	0.0
Classrooms	FCUs	116	Supply Fan	0.3	74.0%	No	W	2,745		No	74.0%	No		0.0	0	0	$0	$0	$0	0.0
Stairwells	CAHs	5	Supply Fan	0.3	74.0%	No	W	2,745		No	74.0%	No		0.0	0	0	$0	$0	$0	0.0

Electric HVAC Inventory & Recommendations

		Existing Conditions					Proposed Conditions								Energy Impact & Financial Analysis						
Location	**Area(s)/System(s) Served**	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/EER)	Heating Mode Efficiency (COP)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Roof	CU-1	1	Split-System AC	3.00		B	NR	Yes	1	Split-System AC	3.00		14.00		0.5	991	0	$120	$4,489	$276	35.1
Roof	CU-2	1	Split-System AC	3.00		B	NR	Yes	1	Split-System AC	3.00		14.00		0.5	991	0	$120	$4,489	$276	35.1
Roof	CU-3	1	Split-System AC	3.00		B	NR	Yes	1	Split-System AC	3.00		14.00		0.5	991	0	$120	$4,489	$276	35.1
Roof	CU-4	1	Split-System AC	3.00		B	NR	Yes	1	Split-System AC	3.00		14.00		0.5	991	0	$120	$4,489	$276	35.1
Roof	CU-5	1	Split-System AC	3.00		B	NR	Yes	1	Split-System AC	3.00		14.00		0.5	991	0	$120	$4,489	$276	35.1
Roof	CU-6	1	Split-System AC	3.00		B	NR	Yes	1	Split-System AC	3.00		14.00		0.5	991	0	$120	$4,489	$276	35.1
Roof	CU-7	1	Split-System AC	3.00		B	NR	Yes	1	Split-System AC	3.00		14.00		0.5	991	0	$120	$4,489	$276	35.1
Roof	CU-8	1	Split-System AC	3.00		B	NR	Yes	1	Split-System AC	3.00		14.00		0.5	991	0	$120	$4,489	$276	35.1
Mechanical Room	ACCU-1	1	Split-System AC	16.00		B	NR	Yes	1	Split-System AC	16.00		11.50		1.3	3,618	0	$439	$18,558	$1,264	39.4
Mechanical Room	ACCU-2	1	Split-System AC	8.00		B	NR	Yes	1	Split-System AC	8.00		11.50		0.6	1,809	0	$219	$9,310	$584	39.8
Mechanical Room	ACCU-3	1	Split-System AC	24.00		B	NR	Yes	1	Split-System AC	24.00		10.50		0.7	1,981	0	$240	$28,579	$1,896	111.0
Roof	RTU-3	1	Packaged AC	15.00		B		No							0.0	0	0	$0	$0	$0	0.0

Electric Chiller Inventory & Recommendations

		Existing Conditions				Proposed Conditions								Energy Impact & Financial Analysis						
Location	**Area(s)/System(s) Served**	Chiller Quantity	System Type	Cooling Capacity per Unit (Tons)	Remaining Useful Life	ECM #	Install High Efficiency Chillers?	Chiller Quantity	System Type	Constant/ Variable Speed	Cooling Capacity (Tons)	Full Load Efficiency (kW/Ton)	IPLV Efficiency (kW/Ton)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Roof	Chilled Water System	1	Air-Cooled Screw Chiller	171.00	W	NR	Yes	1	Air-Cooled Screw Chiller	Variable	171.00	1.24	0.73	15.5	27,864	0	$3,380	$165,676	$15,732	44.4
Roof	Chilled Water System	1	Air-Cooled Screw Chiller	171.00	W	NR	Yes	1	Air-Cooled Screw Chiller	Variable	171.00	1.24	0.73	15.5	27,864	0	$3,380	$165,676	$15,732	44.4

Fuel Heating Inventory & Recommendations

		Existing Conditions				Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Heating System	1	Forced Draft Steam Boiler	######	W		No						0.0	0	0	$0	$0	$0	0.0
Boiler Room	Heating System	1	Forced Draft Steam Boiler	######	W		No						0.0	0	0	$0	$0	$0	0.0

Demand Control Ventilation Recommendations

		Recommendation Inputs					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	ECM #	Number of Zones	Cooling Capacity of Controlled System (Tons)	Electric Heating Capacity of Controlled System (kBtu/hr)	Output Heating Capacity of Controlled System (MBh)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Room	AHU-1	10	2.00	16.00	0.00	523.00	0.0	963	14	$244	$2,719	$0	11.2
Mechanical Room	AHU-2	10	1.00	8.00	0.00	523.00	0.0	482	14	$185	$1,359	$0	7.3
Mechanical Room	AHU-3	10	2.00	24.00	0.00	523.00	0.0	1,445	14	$302	$2,719	$0	9.0
Roof	RTU-1	10	1.00	8.55	0.00	523.00	0.0	343	14	$168	$1,359	$0	8.1
Roof	RTU-2	10	1.00	8.55	0.00	523.00	0.0	343	14	$168	$1,359	$0	8.1
Roof	RTU-3	10	2.00	15.00	0.00	523.00	0.0	903	14	$236	$2,719	$0	11.5

DHW Inventory & Recommendations

		Existing Conditions			Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Remaining Useful Life	ECM #	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Mechcanial Room	Domestic Hot Water	1	Storage Tank Water Heater (> 50 Gal)	W		No						0.0	0	0	$0	$0	$0	0.0
Kitchen	Booster Water Heater	1	Booster Water Heater	W	11	Yes	1	Booster Water Heater	Natural Gas	85.00%	Et	13.5	45,000	-195	$3,672	$20,611	$3,315	4.7

Low-Flow Device Recommedations

	Recommedation Inputs					Energy Impact & Financial Analysis						
Location	**ECM #**	**Device Quantity**	**Device Type**	**Existing Flow Rate (gpm)**	**Proposed Flow Rate (gpm)**	**Total Peak kW Savings**	**Total Annual kWh Savings**	**Total Annual MMBtu Savings**	**Total Annual Energy Cost Savings**	**Total Installation Cost**	**Total Incentives**	**Simple Payback w/ Incentives in Years**
Restrooms	12	2	Faucet Aerator (Lavatory)	2.20	0.50	0.0	0	0	$3	$14	$0	4.1
Restrooms	12	4	Faucet Aerator (Lavatory)	2.00	0.50	0.0	0	1	$6	$29	$0	4.7

Walk-In Cooler/Freezer Inventory & Recommendations

	Existing Conditions		Proposed Conditions				Energy Impact & Financial Analysis						
Location	**Cooler/ Freezer Quantity**	**Case Type/Temperature**	**ECM #**	**Install EC Evaporator Fan Motors?**	**Install Electric Defrost Control?**	**Install Evaporator Fan Control?**	**Total Peak kW Savings**	**Total Annual kWh Savings**	**Total Annual MMBtu Savings**	**Total Annual Energy Cost Savings**	**Total Installation Cost**	**Total Incentives**	**Simple Payback w/ Incentives in Years**
Kitchen	1	Medium Temp Freezer (0F to 30F)	13, 14	Yes	Yes	Yes	0.2	2,928	0	$355	$2,799	$125	7.5
Kitchen	1	Cooler (35F to 55F)	13, 14	Yes	Yes	Yes	0.2	2,578	0	$313	$2,799	$125	8.6

Commercial Refrigerator/Freezer Inventory & Recommendations

	Existing Conditions			Proposed Conditions		Energy Impact & Financial Analysis						
Location	**Quantity**	**Refrigerator/ Freezer Type**	**ENERGY STAR Qualified?**	**ECM #**	**Install ENERGY STAR Equipment?**	**Total Peak kW Savings**	**Total Annual kWh Savings**	**Total Annual MMBtu Savings**	**Total Annual Energy Cost Savings**	**Total Installation Cost**	**Total Incentives**	**Simple Payback w/ Incentives in Years**
Kitchen	3	Stand-Up Refrigerator, Solid Door (31 - 50 cu. ft.)	Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Stand-Up Freezer, Solid Door (16 - 30 cu. ft.)	Yes		No	0.0	0	0	$0	$0	$0	0.0

Cooking Equipment Inventory & Recommendations

	Existing Conditions			Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Equipment Type	High Efficiency Equipement?	ECM #	Install High Efficiency Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Gas Combination Oven/Steam Cooker (<15 Pans)	Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Gas Steamer	Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Gas Convection Oven (Half Size)	Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Gas Griddle (≤2 Feet Width)	Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Electric Large Vat Fryer	Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Insulated Food Holding Cabinet (Full Size)	Yes		No	0.0	0	0	$0	$0	$0	0.0

Dishwasher Inventory & Recommendations

	Existing Conditions					Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Dishwasher Type	Water Heater Fuel Type	Booster Heater Fuel Type	ENERGY STAR Qualified?	ECM #	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Payback w/ Incentives in Years
Kitchen	1	Single Tank Conveyor (High Temp)	Natural Gas	Electric	Yes		No	0.0	0	0	$0	$0	$0	0.0

Plug Load Inventory

	Existing Conditions			
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
School	120	Computers	120.0	
School	105	Laptops	90.0	
School	49	Fan	100.0	
School	5	TV	150.0	
School	51	Smart Board / Projector	300.0	
School	54	Small Office Printers	50.0	
School	7	Large Xerox- Type Printers	515.0	
School	5	Coffee Maker	400.0	
School	8	Microwave	1,100.0	
School	6	Residential Refrigerator	690.0	
School	4	Mini Fridge	260.0	
School	1	Water Dispenser	300.0	
School	4	Large Speakers	500.0	
School	1	Misc. Sound Equipment	3,500.0	
School	1	Misc. IT Equipment	4,500.0	
School	1	Misc Kitchen Equipment	5,500.0	
School	1	Electric Stove	1,500.0	

Vending Machine Inventory & Recommendations

	Existing Conditions		Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Vending Machine Type	ECM #	Install Controls?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Cafeteria	1	Refrigerated	15	Yes	0.2	1,612	0	$196	$230	$50	0.9
Lounge	1	Refrigerated	15	Yes	0.2	1,612	0	$196	$230	$50	0.9
2nd Floor Lounge	1	Refrigerated	15	Yes	0.2	1,612	0	$196	$230	$50	0.9

Custom Recommendations (Preliminary Screening)

Computer Power Management Software

# of Desktops	Normal Running Mode					Idle Running Mode					Suspended/Off Mode				
120	*Mon - Fri 8AM-5PM*	*Mon - Fri 5PM-8AM*	*Weekends & Holidays*	Energy Rate (W)*	Weekly Run Hours	Mon - Fri 8AM-5PM	Mon - Fri 5PM-8AM	*Weekends & Holidays*	*Energy Rate (W)**	*Weekly Run Hours*	Mon - Fri 8AM-5PM	Mon - Fri 5PM-8AM	Weekends & Holidays	Energy Rate (W)*	*Weekly Run Hours*
Existing Conditions	30%	15%	5%	120	27	20%	10%	5%	80	19	50%	75%	90%	5	122
Proposed Conditions	30%	10%	0%	120	21	10%	5%	0%	80	8	60%	85%	100%	5	139

Usage per Device			Energy Impact & Financial Analysis					
Weeks of Use	Annual kWh Usage	*Diversity Factor***	Total Annual kWh Savings	Total Annual Energy Cost Savings	*Cost per Desktop*	*Add'l Hardware Cost*	Total Installation Cost	Simple Payback Period (Years)
44	237	75%	5,964	$723	$15.00	$2,500.0	$4,300	5.9
44	187							

Note: Diversity Factor is a conservative estimate of how many devices will operate with power management software and will not be manually overridden by users

Installation of an Energy Management System

Existing Conditions				Proposed Conditions			Energy Impact & Financial Analysis					
Annual Electric HVAC Energy Use (kWh)	*Annual Heating Gas Use (mmBtu)*	*Annual Heating Oil Use (mmBtu)*	*Annual Motor HVAC Energy Use (kWh)*	Assumed % Cooling Savings	Assumed % Heating Savings	Assumed % Motor Savings	Total Annual kWh Savings	Total Annual Gas mmBtu Savings	Total Annual Fuel mmBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Simple Payback Period (Years)
296,458	3,688.4	0.0	486,597	8%	6%	10%	72,376	221	0	$10,809	$178,000	16.5

Equations: (Based on Industry Standards)

Average Cost for EMS installation is $1.50/sqft

Based on a comprehensive study by the Environmental Protection Agency, Energy savings range between 10% and 30%.

The HVAC systems should have proper temperature set backs and operate according to occupancy schedules.

Air-handling units should be equipped with outdoor air damper controls and CO2 sensors to provide demand control ventilation.

HVAC Improvements revealed through a RCx study should be included within this measure.

Examples are as follows: Check Valve and Damper Operation, Economizer Controls, Temperature and Humidity Sensors, CO2 Sensors, etc.

The building currently has little to no funcional control for HVAC equipment and systems. This is a critical maintenance confrn/facility concern.

Heating System Upgrades

Replace Steam Boilers and Heat Exchangers with High Efficiency Gas Boilers

Existing Conditions					Proposed Conditions					Energy Impact & Financial Analysis					
Average Heating System Efficiency	*Heating Capacity Total (MBH)*	*Estimated Heating EFLH*	*Annual Gas HVAC Energy Use (mmBtu)*	*Annual Gas HVAC Energy Costs ($)*	Average Heating System Efficiency	Heating Capacity Total (MBH)	Estimated Heating EFLH	Annual Gas HVAC Energy Use (mmBtu)	Annual Gas HVAC Energy Costs ($)	Total Annual kWh Savings	Total Annual Gas mmBtu Savings	Total Annual Energy Cost Savings	Estimated Installation Cost	Estimated Incentive	Simple Payback Period (Years)
68%	8,891.0	283.9	3,688	$33,810	90%	7,112.8	283.9	2,243	$20,564	0	1,445	$13,246	$581,000	$9,958	43.1

Equations: (Based on Industry Standards)

Estimated Costs based on RS Means and includes material and labor ($46.7/MBH)

Estimated Costs include an increase of 40% engineering services and 25% contingency above what is stated above

Estimated Costs DO NOT INCLUDE costs for asbestos abatement or natural gas supply service installations

Estimated Incentive is based on SS program and evaluated at $1.40/MBH

Further analysis should be conducted for the feasibility of this measure. This is not an invvestment grade analysis or should be used as a basis for design and construction.

Average Heating System Effiecency is estimated based on the distribution losses associated with steam to hot water heat exchangers which are in poor condition and lack of control ability

Existing motor consumption associated with the heating system is assumed to be the same or insignificantly changed by this measure

Proposed Gas Consumption is based on the same estimated annual full load run hours in the existing case multipled by the estimated heating load of the building.

Per discussions with facility personnel- only one of the existing 2 large steam boilers are required to adequately heat the building on the coldest day in the winter heating season

The proposed heating capacity assumes a 0.8 oversize factor

Proposed boilers are natural gas fired, high efficiency condensing hot water boilers

APPENDIX B: ENERGY STAR® STATEMENT OF ENERGY PERFORMANCE

EUI is presented in terms of *site energy* and *source energy*. Site energy is the amount of fuel and electricity consumed by a building as reflected in utility bills. Source energy includes fuel consumed to generate electricity consumed at the site, factoring in electric production and distribution losses for the region.

LEARN MORE AT energystar.gov

ENERGY STAR® Statement of Energy Performance

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ENERGY STAR® Score[1]

Belmont-Runyon Elementary School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 118,936
Built: 2004

For Year Ending: May 31, 2018
Date Generated: December 22, 2018

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

Property & Contact Information

Property Address	Property Owner	Primary Contact
Belmont-Runyon Elementary School 1 Belmont-Runyon Way Newark, New Jersey 07108 **Property ID:** 3570058	______________ , (___)___-_____	____ _______ , (___)___-_____ ______________

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
74.5 kBtu/ft²

Source EUI
152.8 kBtu/ft²

Annual Energy by Fuel

Electric - Grid (kBtu)	5,065,264 (57%)
Natural Gas (kBtu)	3,795,967 (43%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	51.6
National Median Source EUI (kBtu/ft²)	105.8
% Diff from National Median Source EUI	44%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	715

Signature & Stamp of Verifying Professional

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

Signature: ____________________ Date: __________

Licensed Professional

____ _______
,
(___)___-_____
____

Professional Engineer Stamp (if applicable)

APPENDIX C: GLOSSARY

TERM	DEFINITION
Blended Rate	Used to calculate fiscal savings associated with measures. The blended rate is calculated by dividing the amount of your bill by the total energy use. For example, if your bill is $22,217.22, and you used 266,400 kilowatt-hours, your blended rate is 8.3 cents per kilowatt-hour.
Btu	*British thermal unit*: a unit of energy equal to the amount of heat required to increase the temperature of one pound of water by one-degree Fahrenheit.
CHP	*Combined heat and power*. Also referred to as cogeneration.
COP	*Coefficient of performance*: a measure of efficiency in terms of useful energy delivered divided by total energy input.
Demand Response	Demand response reduces or shifts electricity usage at or among participating buildings/sites during peak energy use periods in response to time-based rates or other forms of financial incentives.
DCV	*Demand control ventilation*: a control strategy to limit the amount of outside air introduced to the conditioned space based on actual occupancy need.
US DOE	*United States Department of Energy*
EC Motor	*Electronically commutated motor*
ECM	*Energy conservation measure*
EER	*Energy efficiency ratio*: a measure of efficiency in terms of cooling energy provided divided by electric input.
EUI	*Energy Use Intensity:* measures energy consumption per square foot and is a standard metric for comparing buildings' energy performance.
Energy Efficiency	Reducing the amount of energy necessary to provide comfort and service to a building/area. Achieved through the installation of new equipment and/or optimizing the operation of energy use systems. Unlike conservation, which involves some reduction of service, energy efficiency provides energy reductions without sacrifice of service.
ENERGY STAR®	ENERGY STAR® is the government-backed symbol for energy efficiency. The ENERGY STAR® program is managed by the EPA.
EPA	*United States Environmental Protection Agency*
Generation	The process of generating electric power from sources of primary energy (e.g., natural gas, the sun, oil).
GHG	*Greenhouse gas:* gases that are transparent to solar (short-wave) radiation but opaque to long-wave (infrared) radiation, thus preventing long-wave radiant energy from leaving Earth's atmosphere. The net effect is a trapping of absorbed radiation and a tendency to warm the planet's surface.
gpf	*Gallons per flush*

gpm	*Gallon per minute*
HID	*High intensity discharge:* high-output lighting lamps such as high-pressure sodium, metal halide, and mercury vapor.
hp	*Horsepower*
HPS	*High-pressure sodium*: a type of HID lamp.
HSPF	*Heating seasonal performance factor:* a measure of efficiency typically applied to heat pumps. Heating energy provided divided by seasonal energy input.
HVAC	*Heating, ventilating, and air conditioning*
IHP 2014	US DOE Integral Horsepower rule. The current ruling regarding required electric motor efficiency.
IPLV	*Integrated part load value:* a measure of the part load efficiency usually applied to chillers.
kBtu	One thousand British thermal units
kW	*Kilowatt*: equal to 1,000 Watts.
kWh	*Kilowatt-hour*: 1,000 Watts of power expended over one hour.
LED	*Light emitting diode*: a high-efficiency source of light with a long lamp life.
LGEA	*Local Government Energy Audit*
Load	The total power a building or system is using at any given time.
Measure	A single activity, or installation of a single type of equipment, that is implemented in a building system to reduce total energy consumption.
MH	*Metal halide*: a type of HID lamp.
MBh	*Thousand Btu per hour*
MBtu	*One thousand British thermal units*
MMBtu	*One million British thermal units*
MV	*Mercury Vapor:* a type of HID lamp.
NJBPU	*New Jersey Board of Public Utilities*
NJCEP	*New Jersey's Clean Energy Program:* NJCEP is a statewide program that offers financial incentives, programs and services for New Jersey residents, business owners and local governments to help them save energy, money, and the environment.
psig	Pounds per square inch gauge
Plug Load	Refers to the amount of power used in a space by products that are powered by means of an ordinary AC plug.
PV	*Photovoltaic:* refers to an electronic device capable of converting incident light directly into electricity (direct current).

SEER	*Seasonal energy efficiency ratio:* a measure of efficiency in terms of annual cooling energy provided divided by total electric input.
SEP	*Statement of energy performance:* a summary document from the ENERGY STAR® Portfolio Manager®.
Simple Payback	The amount of time needed to recoup the funds expended in an investment or to reach the break-even point between investment and savings.
SREC	*Solar renewable energy credit*: a credit you can earn from the state for energy produced from a photovoltaic array.
T5, T8, T12	A reference to a linear lamp diameter. The number represents increments of 1/8th of an inch.
Temperature Setpoint	The temperature at which a temperature regulating device (thermostat, for example) has been set.
therm	100,000 Btu. Typically used as a measure of natural gas consumption.
tons	A unit of cooling capacity equal to 12,000 Btu/hr.
Turnkey	Provision of a complete product or service that is ready for immediate use
VAV	*Variable air volume*
VFD	*Variable frequency drive*: a controller used to vary the speed of an electric motor.
WaterSense™	The symbol for water efficiency. The WaterSense program is managed by the EPA.
Watt (W)	Unit of power commonly used to measure electricity use.