Local Government Energy Audit Report

Meadowbrook School

October 9, 2020

Prepared for:
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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 reviewed the energy conservation measures and estimates of energy savings 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. Cost estimates include material and labor pricing associated with installation of primary recommended equipment only. Cost estimates do not include demolition or removal of hazardous waste. We encourage the owner of the facility 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 (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.

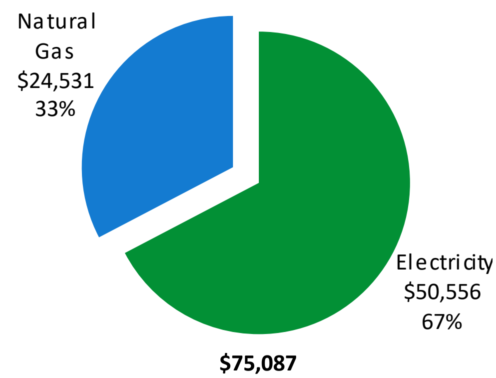
The customer and their respective contractor(s) are responsible to implement energy conservation measures in complete conformance with all applicable local, state and federal requirements.

Table of Contents

1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Meadowbrook 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 to help protect our environment by reducing statewide energy consumption.

BUILDING PERFORMANCE REPORT

Annual Utilities	Costs: $75,087 Electricity: 344,373 kWh Natural Gas: 27,959 Therms	
ENERGY STAR® Benchmarking Score	55 *(1-100 scale)*	Congratulations, your building performs better than the national average. This report has suggestions about how to keep your building running efficiently, further improve performance and lower your energy bills even more.

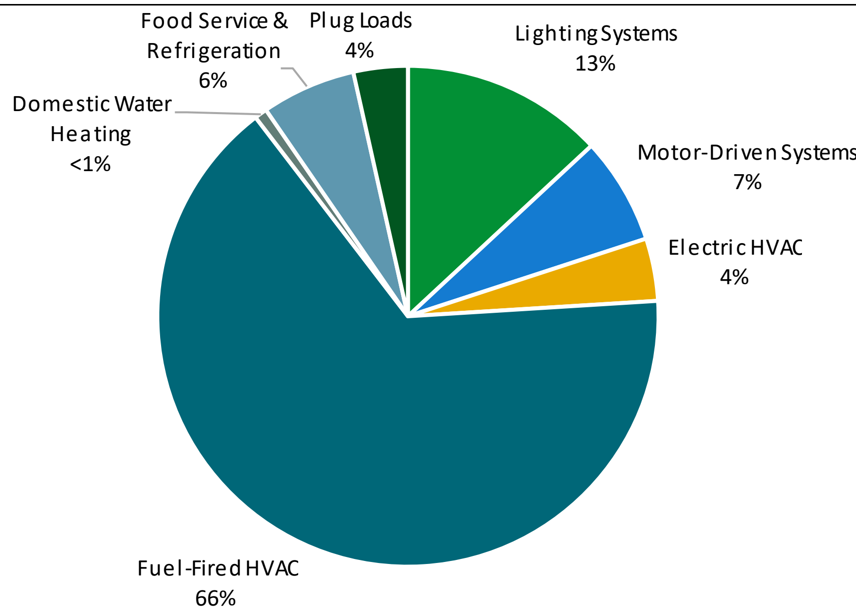


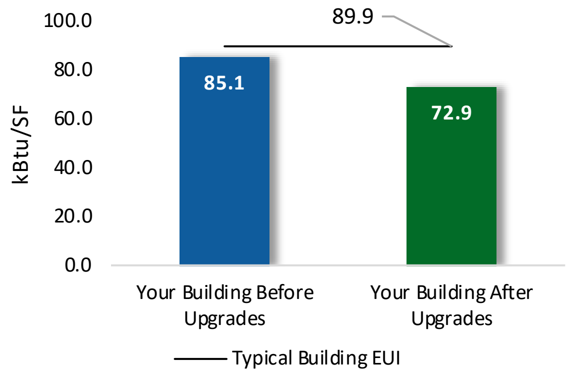
Figure 1 - Energy Use by System

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.

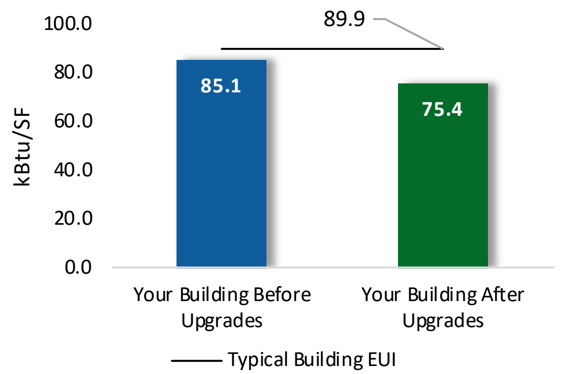
Scenario 1: Full Package (all evaluated measures)

Installation Cost	$200,907
Potential Rebates & Incentives[1]	$38,184
Annual Cost Savings	$19,864
Annual Energy Savings	Electricity: 127,395 kWh Natural Gas: 1,324 Therms
Greenhouse Gas Emission Savings	72 Tons
Simple Payback	8.2 Years
Site Energy Savings (all utilities)	14%



Scenario 2: Cost Effective Package[2]

Installation Cost	$90,933
Potential Rebates & Incentives	$36,574
Annual Cost Savings	$18,020
Annual Energy Savings	Electricity: 120,450 kWh Natural Gas: 384 Therms
Greenhouse Gas Emission Savings	63 Tons
Simple Payback	3.0 Years
Site Energy Savings (all utilities)	11%



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			**90,211**	**24.8**	**-15**	**$13,114**	**$49,986**	**$24,352**	**$25,634**	**2.0**	**89,118**
ECM 1	Install LED Fixtures	Yes	22,326	0.5	-1	$3,272	$14,880	$5,560	$9,320	2.8	22,407
ECM 2	Retrofit Fixtures with LED Lamps	Yes	67,885	24.2	-14	$9,842	$35,106	$18,792	$16,314	1.7	66,711
Lighting Control Measures			**18,644**	**6.2**	**-4**	**$2,703**	**$26,000**	**$10,480**	**$15,520**	**5.7**	**18,318**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	11,956	5.0	-2	$1,733	$20,600	$5,530	$15,070	8.7	11,747
ECM 4	Install High/Low Lighting Controls	Yes	6,687	1.2	-1	$969	$5,400	$4,950	$450	0.5	6,570
Motor Upgrades			**1,382**	**0.4**	**0**	**$203**	**$6,538**	**$0**	**$6,538**	**32.2**	**1,392**
ECM 5	Premium Efficiency Motors	No	1,382	0.4	0	$203	$6,538	$0	$6,538	32.2	1,392
Variable Frequency Drive (VFD) Measures			**6,564**	**0.9**	**23**	**$1,165**	**$23,170**	**$650**	**$22,520**	**19.3**	**9,293**
ECM 6	Install VFDs on Constant Volume (CV) Fans	Yes	3,937	0.7	0	$578	$5,989	$300	$5,689	9.8	3,965
ECM 7	Install VFDs on Heating Water Pumps	No	1,443	0.2	0	$212	$13,920	$150	$13,770	65.0	1,453
ECM 8	Install VFDs on Kitchen Hood Fan Motors	Yes	1,184	0.0	23	$375	$3,261	$200	$3,061	8.2	3,875
Electric Unitary HVAC Measures			**4,120**	**1.3**	**0**	**$605**	**$17,821**	**$1,460**	**$16,361**	**27.0**	**4,149**
ECM 9	Install High Efficiency Air Conditioning Units	No	4,120	1.3	0	$605	$17,821	$1,460	$16,361	27.0	4,149
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**94**	**$825**	**$71,694**	**$0**	**$71,694**	**86.9**	**11,004**
ECM 10	Install High Efficiency Hot Water Boilers	No	0	0.0	94	$825	$71,694	$0	$71,694	86.9	11,004
HVAC System Improvements			**502**	**0.0**	**17**	**$223**	**$647**	**$384**	**$263**	**1.2**	**2,501**
ECM 11	Install Occupancy-Controlled Thermostats	Yes	502	0.0	0	$74	$477	$300	$177	2.4	506
ECM 12	Install Pipe Insulation	Yes	0	0.0	17	$150	$169	$84	$85	0.6	1,995
Domestic Water Heating Upgrade			**0**	**0.0**	**17**	**$150**	**$258**	**$258**	**$0**	**0.0**	**2,000**
ECM 13	Install Low-Flow DHW Devices	Yes	0	0.0	17	$150	$258	$258	$0	0.0	2,000
Food Service & Refrigeration Measures			**5,972**	**0.7**	**0**	**$877**	**$4,792**	**$600**	**$4,192**	**4.8**	**6,014**
ECM 14	Replace Refrigeration Equipment	Yes	5,972	0.7	0	$877	$4,792	$600	$4,192	4.8	6,014
TOTALS (COST EFFECTIVE MEASURES)			**120,450**	**32.4**	**38**	**$18,020**	**$90,933**	**$36,574**	**$54,358**	**3.0**	**125,790**
TOTALS (ALL MEASURES)			**127,395**	**34.1**	**132**	**$19,864**	**$200,907**	**$38,184**	**$162,722**	**8.2**	**143,788**

* - 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

For more detail on each evaluated energy improvement and a break out of cost-effective improvements, see **Section 4: Energy Conservation Measures**.

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 High/Low Lighting Controls	x	x	
ECM 5	Premium Efficiency Motors		x	
ECM 6	Install VFDs on Constant Volume (CV) Fans	x		
ECM 7	Install VFDs on Heating Water Pumps	x		
ECM 8	Install VFDs on Kitchen Hood Fan Motors	x		
ECM 9	Install High Efficiency Air Conditioning Units	x	x	
ECM 10	Install High Efficiency Hot Water Boilers			
ECM 11	Install Occupancy-Controlled Thermostats	x		
ECM 12	Install Pipe Insulation	x	x	
ECM 13	Install Low-Flow DHW Devices	x	x	
ECM 14	Replace Refrigeration Equipment	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 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 Meadowbrook 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.

2.1 Site Overview

On July 28, 2020, TRC performed an energy audit at Meadowbrook School located in Hillsdale, New Jersey. TRC met with Michael Amuso to review the facility operations and help focus our investigation on specific energy-using systems.

Meadowbrook School is a two-story, 45,183 square foot building built in 1963. Spaces include: classrooms, offices, faculty rooms, reading rooms, gymnasium, kitchen, library, rest rooms, corridors, atrium, lobbies, vestibules, storage rooms, closets, server rooms, electrical rooms, and mechanical spaces. There is also a separate 1,500 square foot maintenance shop in the back of the building that is used by maintenance staff as needed.

Please note that we have estimated electric billing data for this site, operating under the assumption that there is a billing error on the utility company's side. We believe that the utility company billed electricity usage for this site incorrectly because the stated usage is far below expectations and inconsistent with previously reported data. Our estimate is based on actual electric data readings multiplied by 60. The adjusted results compare favorably with electricity usage data reported in a 2012 energy study conducted for the site.

Facility concerns include: replacing the old boiler, evaluate solar potential, replace old exhaust fan motors, upgrading current lighting technology to LED, and EMS upgrades. With exception of the solar potential that is covered in Section 6, all of the other concerns are addressed in Section 4.

2.2 Building Occupancy

Meadowbrook School

The facility is occupied year-round. Typical weekday occupancy is 79 staff and 309 students.

Typical school hours are from 9:00 AM to 3:00 PM, Monday through Friday, and 10:00 AM to 8:00 PM on weekends for events. The typical custodial hours are from 6:30 AM to 11:30 PM, Monday through Friday. Summer occupancy includes a summer school from 9:00 AM to 2:00 PM, and continuing maintenance activities from 6:30 AM to 11:30 PM.

Building Name	Weekday/Weekend	Operating Schedule
Meadowbrook School (School Hours)	Weekday	9:00 AM - 3:00 PM
	Weekend	10:00 AM - 8:00 PM
	Summer	9:00 AM - 2:00 PM
Meadowbrook School (Custodial Hours)	Weekday	6:30 AM - 11:30 PM
	Weekend	Closed
	Summer	6:30 AM - 11:30 PM

Figure 4 - Building Occupancy Schedule

Maintenance Shop

The maintenance shop does not have set occupancy hours and is only used as needed.

2.3 Building Envelope

Meadowbrook School

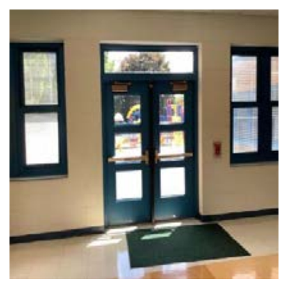
Building walls are brick and in good condition. The roof is flat with insulation in some areas. The roof is supported by steel trusses and covered in a mixture of white stone and black membrane. The new wing's roof is pitched and has a metal finish. The roof over the new wing is in good condition, and the original roof is in fair condition.

Most of the windows are double pane, clear, operable, and have metal frames. Most windows have internal shading. The glass-to-frame seals are in good condition. The operable window weather seals are in good condition, showing little evidence of excessive wear. Exterior doors are metal and glass with metal frames and are in good condition with undamaged door seals.


Building Envelope


Roof Material


Exterior Windows


Exterior Doors

Maintenance Shop

Building walls are brick and in good condition. The roof is pitched and covered in shingles.

There are no windows, and the exterior door is metal with a metal frame. There are also three overhead doors.

2.4 Lighting Systems

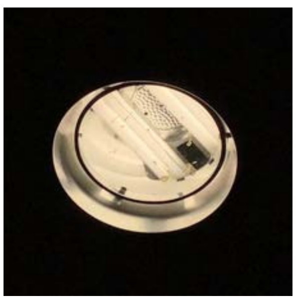
Meadowbrook School

The primary interior lighting system uses 32-Watt linear and U-bend fluorescent T8 lamps. Additionally, there are some compact fluorescent lamps (CFL), incandescent, halogen incandescent, metal halide, and LED general purpose lamps.

Fixture types include 1-lamp, 2-lamp, 3-lamp or 4-lamp, 2-foot or 4-foot long troffer, recessed, and surface mounted fixtures. Additionally, there are also other fixture types including: direct/indirect, recessed, can, pendent mounted, wall wash, panel, ceiling mounted, and 2-foot fixtures with U-bend tube lamps.

Gymnasium fixtures have high bay LED lamps and are manually controlled. Maintenance shop fixtures have linear fluorescent T8 lamps that are manually controlled. Most fixtures are in good condition. Interior lighting levels were generally sufficient.

All exit signs are LED.



Hallway Recessed Can Fixture

Classroom Pendent Mounted Fixture

Atrium Wall Wash Fixture

Classroom LED Panel Fixtures

Most lighting fixtures are controlled manually by wall switches and the remainder by occupancy sensors.

Wall Switch

Gymnasium Wall Switches

Exterior fixtures include wall packs, pole mounted, and under canopy types with a mix of high intensity discharge (HID), CFL, and LED lamps.

The pole mounted flood fixtures have high intensity discharge (HID) lamps.

Exterior light fixtures are controlled by a time clock, switch, or photocell, depending on the fixture.


CFL Wall Pack Fixture


HID Pole Mounted Fixture

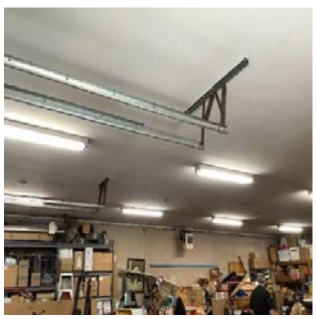

LED Wall Pack Fixture


Exterior Lighting Timeclock

Maintenance Shop

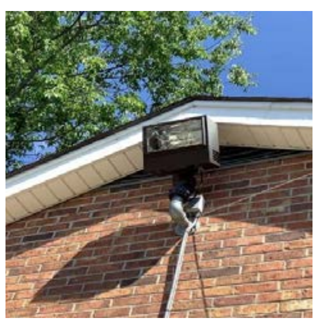
The primary interior lighting system uses 14-Watt LED linear tube lamps. Fixture types include 2-lamp, 4-foot long ceiling mounted fixtures. Fixtures are in good condition. Interior lighting levels were generally sufficient.

All fixtures are manually controlled by wall switches.


Ceiling Mounted Fixtures


LED Linear Tube Lamps

Exterior fixtures include an arm-mounted fixture with a high intensity discharge (HID) lamp controlled manually by a wall switch.


HID Arm-Mounted Fixture

2.5 Air Handling Systems

Unit Ventilators

Meadowbrook School

Serving classrooms and offices are 25-unit ventilators (UV) equipped with estimated 1/8 hp constant speed supply fan motors, outside air dampers, and hot water coils that operate with a pneumatic control system. There are also six cabinet unit heaters equipped with estimated 1/15 hp constant speed supply fan motors, outside air dampers, and hot water coils.

Additionally, there are two fan-coil units with estimated ¼ hp constant speed supply fan motors. One fan coil unit serving a storage room has electric resistance heating, with an 11.26 MBh heating capacity while the other serving the kitchen has hot water coils served by the boiler.

The HVAC system uses pneumatic and digital controls. A 0.5 hp air compressor located in the boiler room serves the pneumatic system.

Maintenance Shop

This building is heated by two electric resistance fan coil units (FCUs). The data for these units has been estimated due to lack of nameplate information. Both units are estimated to have a heating capacity of 34.12-MBh each with a ¼ hp constant speed supply fan motor. One unit that is controlled by a manual thermostat is used much more frequently than the other unit, which is controlled by a breaker panel.

There is one air compressor in the maintenance shop with an estimated 0.5 hp motor used for cleaning, tools, and filling tires.

Packaged Units

Meadowbrook School

There are six packaged terminal air conditioning (PTAC) units serving six classrooms. These units are equipped with 1.0 hp constant speed supply fan motors, fractional hp constant speed exhaust fan motors, outside air dampers, direct expansion (DX) coils, and hot water coils served by the boiler. These units are all controlled through the EMS. Please note that the efficiency of these units have been de-rated to more accurately represent their current efficiencies based on age and condition. Additional information about each unit is detailed below:

Area Served	Unit Tag	Cooling Capacity (Tons)	Cooling Efficiency (SEER)	Supply Fan Motor (HP)
Classroom 100	UV-1	4.00	12.34	1.0
Classroom 101	UV-2	4.00	12.34	1.0
Classroom 102	UV-3	4.00	12.34	1.0
Classroom 103	UV-4	4.00	12.34	1.0
Classroom 104	UV-5	4.00	12.34	1.0
Classroom 105	UV-6	4.00	12.34	1.0

The atrium and hallway are served by a packaged AC equipped with a 2.0 hp constant speed supply fan motor, a fractional hp constant speed exhaust fan motor, an economizer, DX coils, and hot water coils. This unit has a 10.0-ton cooling capacity and 9.28 EER cooling efficiency after de-rating.

Refer to Appendix A for detailed information about each unit.

Air Conditioners

Meadowbrook School

There are three ductless mini-split system ACs serving various areas of the building. Additional information about each unit is detailed below:

Area Served	Unit Tag	Cooling Capacity (Tons)	Cooling Efficiency (SEER)
Server Room	-	1.0	17.00
Room 121A	CAC-1	2.0	9.83*
Classroom 108	-	1.0	9.92*

*Please note that the efficiencies of the units marked with an asterisk have been de-rated based on age and condition.

The facility is equipped with 28 window ACs which provide cooling to selected areas as noted. Some of the information has been estimated about these units due to lack of nameplate data. Additional information about each unit is detailed below:

Area Served	Quantity	Cooling Capacity (Tons)	Cooling Efficiency (SEER)
Library Office	1	0.83	9.80
Nurse's Office & Principal's Office	2	1.00	10.70
Faculty Room	1	1.00	9.15*
Main Office	1	2.00	9.74*
Classrooms 117, 119-124, 126-137 & Library	22	2.00	11.75
Classroom 125	1	2.02	10.28

*Please note that the efficiencies of the units marked with an asterisk have been de-rated based on age and condition.

Window AC

Unit Ventilator

Packaged AC

Ductless Mini-Split System AC

2.6 Heating Hot Water Systems

Meadowbrook School

One Buderus 2,532 MBh non-condensing hot water boiler and one Cleaver Brooks 4,184 MBh non-condensing hot water boiler serve the building's heating load. The burners are fully modulating with efficiencies of 83.54% and 76.09%, respectively. The boilers are configured in a lead-lag control scheme. The Cleaver Brooks boiler has a 3.0 hp combustion air fan motor while the Buderus boiler has a 1.0 hp combustion air fan motor. Typically, only one boiler is needed, but both are required under high load conditions. Installed in 1982, the Cleaver Brooks boiler is in poor condition, while the Buderus boiler was installed in 2004 and is in good condition.

The boilers are configured in a variable flow primary distribution with two 3.0 hp VFD controlled hot water pumps operating in a lead-lag control scheme. There are also three other constant speed heating hot water pumps, one 1.5 hp pump and two 0.5 hp pumps. The boilers provide hot water to baseboard heaters, cabinet unit heaters, unit ventilators, packaged AC units, and fan coil units throughout the building.

Hot water is supplied at approximately 180°F.

Non-Condensing Hot Water Boilers

Combustion Air Fan Motor

Hot Water Pumps

Hot Water Pump VFDs

2.7 Building Energy Management Systems (EMS)

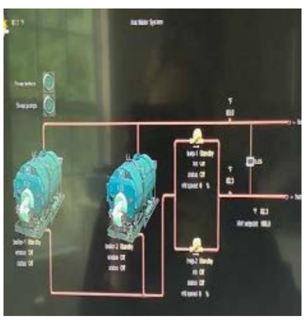
Meadowbrook School

An Automated Logic EMS controls some of the HVAC equipment including the boilers, hot water pumps, packaged terminal ACs, packaged AC, and one ductless mini-split AC. The EMS provides equipment scheduling control, set-back temperature setpoints, monitors supply air temperatures, humidity, outside air temperatures, heating water loop temperatures, pump operation statuses, pump speed statuses, cooling and heating operation statuses, percent outside air dampers are open, supply fan motor operation statuses, and monitors and controls space temperatures.

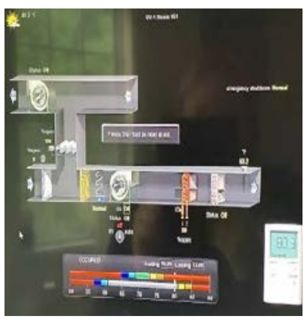
The EMS equipment operating schedules were noted to be from 4:00 AM to 11:00 PM, Monday through Friday. We recommend setting the schedules to match the building occupancy schedule more closely, which would lead to savings from reducing HVAC operation hours. However, there may be a reason the schedules are set as they currently are, and proposed programming revisions should be discussed with facility management before implementation.

The site staff expressed an interest in expanding the level of EMS control and including additional equipment for control since the EMS currently controls mainly equipment in the new wing. We also recommend upgrading the EMS to replace the use of pneumatic controls in some areas of the building.

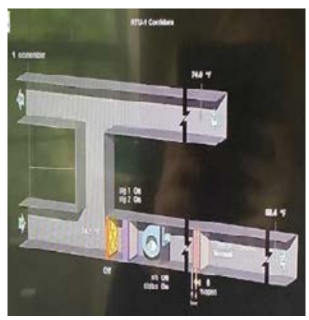
Section 4.10 includes a measure for future consideration, "Upgrade/Replace Energy Management System," providing further information about proposed upgrades.



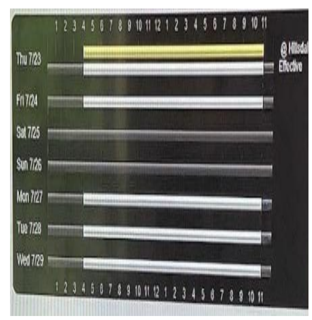
EMS Display Heating Hot Water System



EMS Display Packaged Terminal AC



EMS Display Packaged AC



Occupancy Schedule

2.8 Domestic Hot Water

Meadowbrook School

Hot water is produced with a 75-gallon, 80% efficient, 199.9-MBh gas-fired storage water heater.

Two fractional hp circulation pumps distribute water to end uses. The circulation pumps operate continuously. The domestic hot water pipes are partially insulated, and the insulation is in fair condition.

Gas-Fired Storage Water Heater

DHW Circulation Pumps

2.9 Food Service Equipment

Meadowbrook School

The kitchen has a mix of gas and electric equipment that is used to prepare meals for students and staff. Most cooking is done using a gas-fired convection oven and a gas-fired rack oven. Bulk prepared foods are held in a high efficiency electric food holding cabinet. Equipment is not high efficiency and is in fair condition.

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

Gas-Fired Convection Oven

Gas-Fired Rack Oven

Insulated Food Holding Cabinet

2.10 Refrigeration

Meadowbrook School

The kitchen has a stand-up refrigerator with solid doors. There are also two stand-up solid door freezers. Additionally, there is one freezer chest and one refrigerator chest. All equipment is standard efficiency and in fair condition.

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


Refrigerator Chest


Stand-Up Freezer


Stand-Up Refrigerator


Freezer Chest

2.11 Plug Load & Vending Machines

Meadowbrook School

The location is doing a great job managing their electrical plug loads. This report makes additional suggestions for ECMs in this area as well as Energy Efficient Best Practices.

There are 297 computer and laptop workstations throughout the facility. Plug loads throughout the building include general classroom, office, and café equipment. There are typical loads such as coffee machines, fans, microwaves, paper shredders, printers, projectors, mini fridges, TVs and toaster ovens.

There are also loads that are not very typical, such as an electric space heater, refrigerated table, steam table, and laminator.

There are several residential-style refrigerators throughout the building that are used to store personal food and beverage items. These vary in condition and efficiency.


Mini Fridge and Microwave


Residential Refrigerator


Portable Fan


Large Printers

Maintenance Shop

The plug loads at the maintenance shop consist of ceiling fans, a drill press, a grinder, a saw, and a dust collector.

			
Ceiling Fan	*Saw*	*Dust Collector*	*Drill Press*

2.12 Water-Using Systems

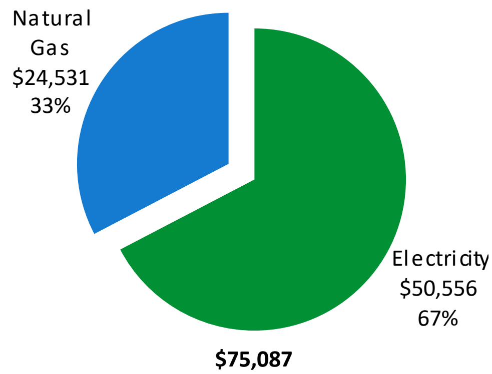
There are 19 restrooms with toilets, urinals, and sinks. Faucet flow rates range from 0.5 gallons per minute (gpm) to 2.2 gpm or higher.

Faucet Flow

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	344,373 kWh	$50,556
Natural Gas	27,959 Therms	$24,531
Total		**$75,087**



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.

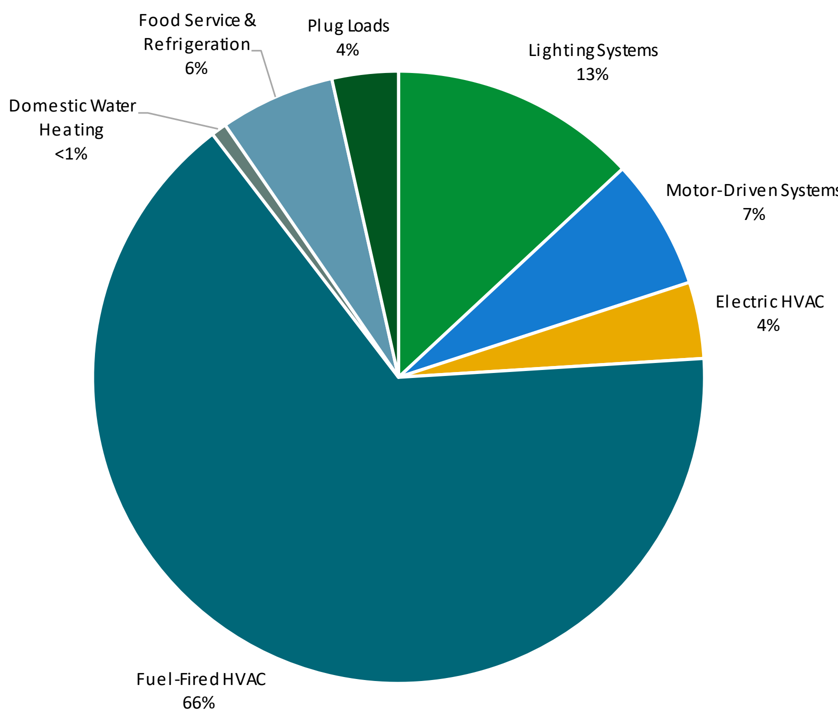
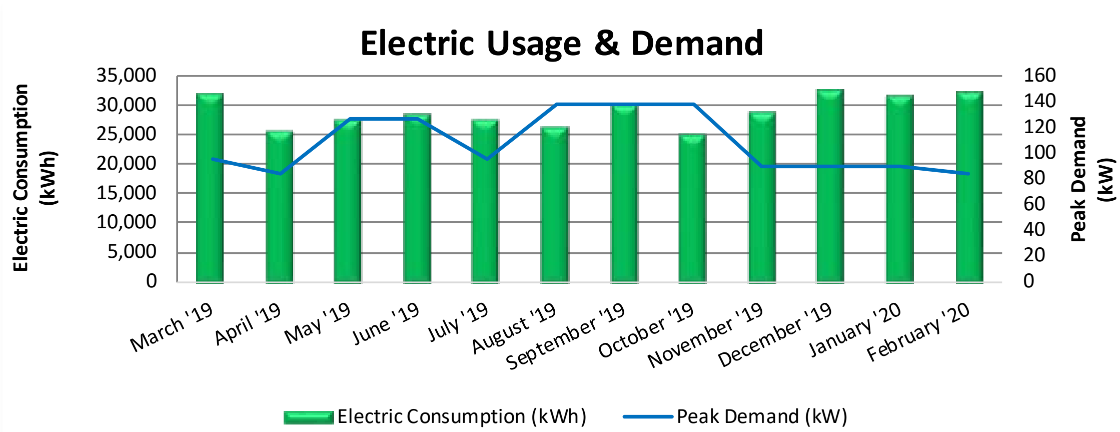


Figure 5 - Energy Balance

3.1 Electricity

Electric Data Estimated

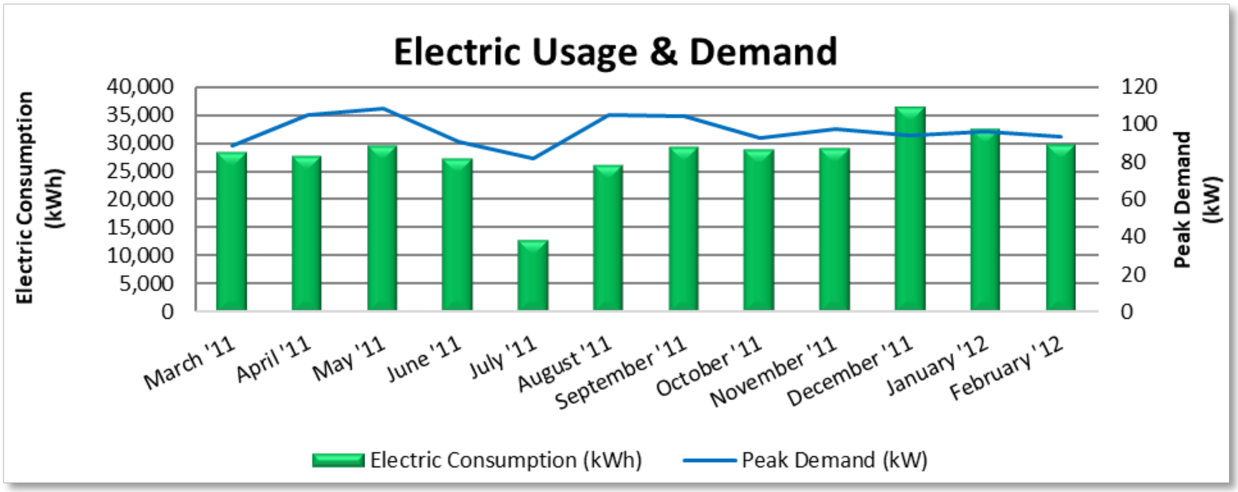
PSE&G delivers electricity under rate class General Lighting & Power, with electric production provided by East Coast Power & Gas, a third-party supplier.



Electric Billing Data						
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost	TRC Estimated Usage?
4/1/19	31	31,800	96	$377	$4,668	Yes
5/1/19	30	25,500	84	$330	$3,744	Yes
5/31/19	30	27,420	126	$495	$4,025	Yes
7/1/19	31	28,440	126	$495	$4,175	Yes
7/31/19	30	27,300	96	$377	$4,008	Yes
8/29/19	29	26,100	138	$542	$3,832	Yes
9/30/19	32	30,000	138	$542	$4,404	Yes
10/29/19	29	25,020	138	$542	$3,673	Yes
11/27/19	29	28,740	90	$354	$4,219	Yes
12/31/19	34	32,280	90	$354	$4,739	Yes
1/30/20	30	31,560	90	$354	$4,633	Yes
3/2/20	32	32,100	84	$330	$4,713	Yes
Totals	**367**	**346,260**	**138**	**$5,094**	**$50,833**	
Annual	**365**	**344,373**	**138**	**$5,066**	**$50,556**	

Notes:

- Peak demand of 138 kW occurred in August 2019.
- Average demand over the past 12 months was 108 kW.
- The average electric cost over the past 12 months was $0.147/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 information used in this analysis has been estimated based on the actual billed electric data, multiplied by 60. The electric rates used in this analysis are based on the actual billing data.
- This meter serves both the maintenance shop and the school building.
- Compared to the 2012 energy study, the electricity usage we estimate for this site increased by 11% and the electricity cost increased by 9%.



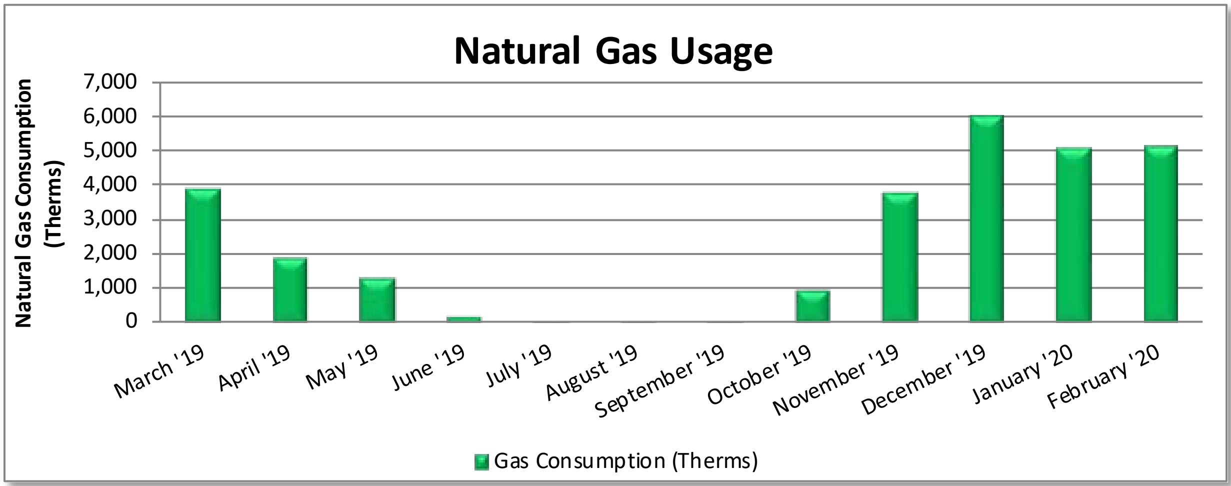
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Total Electric Cost	TRC Estimated Usage?
4/1/11	31	28,200	89	$3,930	No
5/1/11	30	27,540	105	$3,914	No
6/1/11	31	29,460	109	$5,196	No
7/1/11	30	27,060	91	$4,674	No
8/1/11	31	12,900	82	$2,705	No
9/1/11	31	25,980	105	$4,725	No
10/1/11	30	29,220	104	$4,138	No
11/1/11	31	28,740	93	$4,043	No
12/1/11	30	29,040	98	$4,103	No
1/1/12	31	36,360	94	$5,031	No
2/1/12	31	32,340	96	$4,630	No
3/1/12	29	29,580	94	$4,260	No
Totals	**366**	**336,420**	**109**	**$51,349**	
Annual	**365**	**335,501**	**109**	**$51,209**	

Notes:

- This is the historical data provided for the 2012 energy study. This is provided in this report for comparison reasons. Additionally, this data was used as a check on our approach to revise the data for the current historical period.
- Peak demand of 109 kW occurred in May '11.
- Average demand over this time period was 97 kW.
- The average electric cost over this time period was $0.153/kWh.

3.2 Natural Gas

PSE&G delivers natural gas under rate class General Service Gas & Large Volume Gas, with natural gas supply provided by Marathon Power, a third-party supplier.



Gas Billing Data			
Period Ending	**Days in Period**	**Natural Gas Usage (Therms)**	**Natural Gas Cost**
4/1/19	31	3,877	$3,261
5/1/19	30	1,876	$1,402
5/31/19	30	1,296	$945
7/1/19	31	177	$260
7/31/19	30	13	$163
8/29/19	29	10	$161
9/30/19	32	13	$163
10/29/19	29	947	$829
11/27/19	29	3,775	$3,344
12/31/19	34	5,968	$5,137
1/30/20	30	5,034	$4,463
3/2/20	32	5,127	$4,537
Totals	**367**	**28,112**	**$24,665**
Annual	**365**	**27,959**	**$24,531**

Notes:

- The average gas cost for the past 12 months is $0.877/therm, which is the blended rate used throughout the analysis.
- Compared to the 2012 energy study, the natural gas usage increased by 20% and the natural gas cost increased by 13%.

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	55

Congratulations, your building performs better than the national average. This report has suggestions about how to keep your building running efficiently, further improve performance, and lower your energy bills even more.

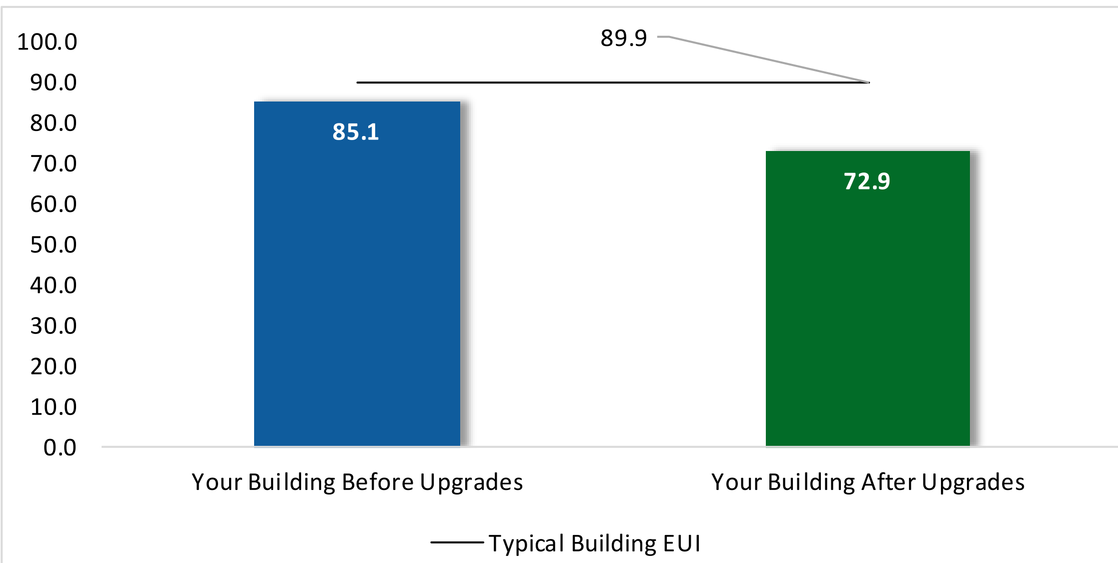


Figure 6 - Energy Use Intensity Comparison[3]

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 a 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.

[3] Based on all evaluated ECMs

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[4].

[4] 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 NJBPU. 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.

For a detailed list of the locations and recommended energy conservation measures for all inventoried equipment, see **Appendix A: Equipment Inventory & Recommendations.**

#	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			**90,211**	**24.8**	**-15**	**$13,114**	**$49,986**	**$24,352**	**$25,634**	**2.0**	**89,118**
ECM 1	Install LED Fixtures	Yes	22,326	0.5	-1	$3,272	$14,880	$5,560	$9,320	2.8	22,407
ECM 2	Retrofit Fixtures with LED Lamps	Yes	67,885	24.2	-14	$9,842	$35,106	$18,792	$16,314	1.7	66,711
Lighting Control Measures			**18,644**	**6.2**	**-4**	**$2,703**	**$26,000**	**$10,480**	**$15,520**	**5.7**	**18,318**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	11,956	5.0	-2	$1,733	$20,600	$5,530	$15,070	8.7	11,747
ECM 4	Install High/Low Lighting Controls	Yes	6,687	1.2	-1	$969	$5,400	$4,950	$450	0.5	6,570
Motor Upgrades			**1,382**	**0.4**	**0**	**$203**	**$6,538**	**$0**	**$6,538**	**32.2**	**1,392**
ECM 5	Premium Efficiency Motors	No	1,382	0.4	0	$203	$6,538	$0	$6,538	32.2	1,392
Variable Frequency Drive (VFD) Measures			**6,564**	**0.9**	**23**	**$1,165**	**$23,170**	**$650**	**$22,520**	**19.3**	**9,293**
ECM 6	Install VFDs on Constant Volume (CV) Fans	Yes	3,937	0.7	0	$578	$5,989	$300	$5,689	9.8	3,965
ECM 7	Install VFDs on Heating Water Pumps	No	1,443	0.2	0	$212	$13,920	$150	$13,770	65.0	1,453
ECM 8	Install VFDs on Kitchen Hood Fan Motors	Yes	1,184	0.0	23	$375	$3,261	$200	$3,061	8.2	3,875
Electric Unitary HVAC Measures			**4,120**	**1.3**	**0**	**$605**	**$17,821**	**$1,460**	**$16,361**	**27.0**	**4,149**
ECM 9	Install High Efficiency Air Conditioning Units	No	4,120	1.3	0	$605	$17,821	$1,460	$16,361	27.0	4,149
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**94**	**$825**	**$71,694**	**$0**	**$71,694**	**86.9**	**11,004**
ECM 10	Install High Efficiency Hot Water Boilers	No	0	0.0	94	$825	$71,694	$0	$71,694	86.9	11,004
HVAC System Improvements			**502**	**0.0**	**17**	**$223**	**$647**	**$384**	**$263**	**1.2**	**2,501**
ECM 11	Install Occupancy-Controlled Thermostats	Yes	502	0.0	0	$74	$477	$300	$177	2.4	506
ECM 12	Install Pipe Insulation	Yes	0	0.0	17	$150	$169	$84	$85	0.6	1,995
Domestic Water Heating Upgrade			**0**	**0.0**	**17**	**$150**	**$258**	**$258**	**$0**	**0.0**	**2,000**
ECM 13	Install Low-Flow DHW Devices	Yes	0	0.0	17	$150	$258	$258	$0	0.0	2,000
Food Service & Refrigeration Measures			**5,972**	**0.7**	**0**	**$877**	**$4,792**	**$600**	**$4,192**	**4.8**	**6,014**
ECM 14	Replace Refrigeration Equipment	Yes	5,972	0.7	0	$877	$4,792	$600	$4,192	4.8	6,014
TOTALS			**127,395**	**34.1**	**132**	**$19,864**	**$200,907**	**$38,184**	**$162,722**	**8.2**	**143,788**

* - 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		**90,211**	**24.8**	**-15**	**$13,114**	**$49,986**	**$24,352**	**$25,634**	**2.0**	**89,118**
ECM 1	Install LED Fixtures	22,326	0.5	-1	$3,272	$14,880	$5,560	$9,320	2.8	22,407
ECM 2	Retrofit Fixtures with LED Lamps	67,885	24.2	-14	$9,842	$35,106	$18,792	$16,314	1.7	66,711
Lighting Control Measures		**18,644**	**6.2**	**-4**	**$2,703**	**$26,000**	**$10,480**	**$15,520**	**5.7**	**18,318**
ECM 3	Install Occupancy Sensor Lighting Controls	11,956	5.0	-2	$1,733	$20,600	$5,530	$15,070	8.7	11,747
ECM 4	Install High/Low Lighting Controls	6,687	1.2	-1	$969	$5,400	$4,950	$450	0.5	6,570
Variable Frequency Drive (VFD) Measures		**5,121**	**0.7**	**23**	**$953**	**$9,250**	**$500**	**$8,750**	**9.2**	**7,840**
ECM 6	Install VFDs on Constant Volume (CV) Fans	3,937	0.7	0	$578	$5,989	$300	$5,689	9.8	3,965
ECM 8	Install VFDs on Kitchen Hood Fan Motors	1,184	0.0	23	$375	$3,261	$200	$3,061	8.2	3,875
HVAC System Improvements		**502**	**0.0**	**17**	**$223**	**$647**	**$384**	**$263**	**1.2**	**2,501**
ECM 11	Install Occupancy-Controlled Thermostats	502	0.0	0	$74	$477	$300	$177	2.4	506
ECM 12	Install Pipe Insulation	0	0.0	17	$150	$169	$84	$85	0.6	1,995
Domestic Water Heating Upgrade		**0**	**0.0**	**17**	**$150**	**$258**	**$258**	**$0**	**0.0**	**2,000**
ECM 13	Install Low-Flow DHW Devices	0	0.0	17	$150	$258	$258	$0	0.0	2,000
Food Service & Refrigeration Measures		**5,972**	**0.7**	**0**	**$877**	**$4,792**	**$600**	**$4,192**	**4.8**	**6,014**
ECM 14	Replace Refrigeration Equipment	5,972	0.7	0	$877	$4,792	$600	$4,192	4.8	6,014
TOTALS		**120,450**	**32.4**	**38**	**$18,020**	**$90,933**	**$36,574**	**$54,358**	**3.0**	**125,790**

* - 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		**90,211**	**24.8**	**-15**	**$13,114**	**$49,986**	**$24,352**	**$25,634**	**2.0**	**89,118**
ECM 1	Install LED Fixtures	22,326	0.5	-1	$3,272	$14,880	$5,560	$9,320	2.8	22,407
ECM 2	Retrofit Fixtures with LED Lamps	67,885	24.2	-14	$9,842	$35,106	$18,792	$16,314	1.7	66,711

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 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, HID fixtures can be retrofit 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 lamp with a LED screw-in lamp is typically a less expensive retrofit. We recommend you work with your lighting contractor to determine which retrofit solution is best suited to your needs and will be compatible with the existing fixtures.

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: Meadowbrook School: atrium and exterior fixtures, Maintenance Shop: exterior fixture.

ECM 2: Retrofit Fixtures with LED Lamps

Replace fluorescent, HID, or incandescent lamps with 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: Meadowbrook School: atrium, classrooms, hallways, principal’s office, rest room 117, exterior fixtures, and all areas with fluorescent fixtures with T8 tubes.

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		**18,644**	**6.2**	**-4**	**$2,703**	**$26,000**	**$10,480**	**$15,520**	**5.7**	**18,318**
ECM 3	Install Occupancy Sensor Lighting Controls	11,956	5.0	-2	$1,733	$20,600	$5,530	$15,070	8.7	11,747
ECM 4	Install High/Low Lighting Controls	6,687	1.2	-1	$969	$5,400	$4,950	$450	0.5	6,570

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 that 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: Meadowbrook School: classrooms, offices, faculty room, group reading room, gymnasium, kitchen, library, main office, and rest rooms.

ECM 4: 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 code requirements for egress. 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. In parking lots and parking garages with significant ambient lighting, this control can sometimes be combined with photocell controls to turn the lights off when there is sufficient daylight.

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: Meadowbrook School: hallways, atrium, and lobby.

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		**1,382**	**0.4**	**0**	**$203**	**$6,538**	**$0**	**$6,538**	**32.2**	**1,392**
ECM 5	Premium Efficiency Motors	1,382	0.4	0	$203	$6,538	$0	$6,538	32.2	1,392

ECM 5: Premium Efficiency Motors

We evaluated replacing 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.

Affected motors:

Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Additional Motor Description
Roof	Dishwasher	1	Exhaust Fan	1.0	Exhaust Fan Motor
Roof	Hallway	1	Exhaust Fan	2.0	Exhaust Fan Motor
Roof	Gym	1	Exhaust Fan	1.0	Exhaust Fan Motor
Roof	Hallway	1	Exhaust Fan	1.0	Exhaust Fan Motor
Roof	Hallway	1	Exhaust Fan	0.5	Exhaust Fan Motor
Roof	Hallway	1	Exhaust Fan	1.0	Exhaust Fan Motor
Roof	Rest Room	1	Exhaust Fan	0.5	Exhaust Fan Motor
Roof	Hallway	1	Exhaust Fan	1.0	Exhaust Fan Motor
Roof	Hallway	1	Exhaust Fan	1.0	Exhaust Fan Motor
Boiler Room	Heating Hot Water System	1	Heating Hot Water Pump	3.0	Heating Hot Water Pump
Boiler Room	Heating Hot Water System	1	Heating Hot Water Pump	3.0	Heating Hot Water Pump
Boiler Room	Heating Hot Water System	1	Heating Hot Water Pump	0.5	Heating Hot Water Pump
Boiler Room	Heating Hot Water System	1	Heating Hot Water Pump	0.5	Heating Hot Water Pump

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*.

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		**6,564**	**0.9**	**23**	**$1,165**	**$23,170**	**$650**	**$22,520**	**19.3**	**9,293**
ECM 6	Install VFDs on Constant Volume (CV) Fans	3,937	0.7	0	$578	$5,989	$300	$5,689	9.8	3,965
ECM 7	Install VFDs on Heating Water Pumps	1,443	0.2	0	$212	$13,920	$150	$13,770	65.0	1,453
ECM 8	Install VFDs on Kitchen Hood Fan Motors	1,184	0.0	23	$375	$3,261	$200	$3,061	8.2	3,875

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 inverter duty rated motor to conservatively account for the cost of an inverter duty rated motor.

ECM 6: 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.

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. Prior to implementation, verify minimum fan speed in cooling mode with the manufacturer. Note that savings will vary depending on the operating characteristics of each AHU.

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

Affected air handlers: Meadowbrook School: 10.0-ton packaged AC.

ECM 7: Install VFDs on Heating Water Pumps

We evaluated installing 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.

Affected pumps: Meadowbrook School: one 1.5 hp hot water pump.

ECM 8: Install VFDs on Kitchen Hood Fan Motors

Install VFDs and sensors to control the kitchen hood fan motors. The air flow of the hood is varied based on two key inputs: temperature and smoke/cooking fumes. The VFD controls the amount of exhaust (and kitchen make-up air) based on temperature—the lower the temperature the lower the flow. If the optic sensor is triggered by smoke or cooking fumes, the speed of the fan ramps up to 100%.

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

Affected motors: Meadowbrook School: one kitchen hood fan motor.

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		**4,120**	**1.3**	**0**	**$605**	**$17,821**	**$1,460**	**$16,361**	**27.0**	**4,149**
ECM 9	Install High Efficiency Air Conditioning Units	4,120	1.3	0	$605	$17,821	$1,460	$16,361	27.0	4,149

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 at this facility 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 packaged AC is eventually replaced, consider purchasing equipment that exceeds the minimum efficiency required by building codes.

ECM 9: Install High Efficiency Air Conditioning Units

We evaluated replacing 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.

Affected units: Meadowbrook School: one 10.0-ton packaged AC.

4.6 Gas-Fired 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)
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**94**	**$825**	**$71,694**	**$0**	**$71,694**	**86.9**	**11,004**
ECM 10	Install High Efficiency Hot Water Boilers	0	0.0	94	$825	$71,694	$0	$71,694	86.9	11,004

ECM 10: Install High Efficiency Hot Water Boilers

We evaluated replacing older inefficient hot water boilers with high efficiency hot water boilers. Energy savings results from improved combustion efficiency and reduced standby losses at low loads.

For the purposes of this analysis, we evaluated the replacement of boilers on a one-for-one basis with equipment of the same capacity. We recommend that you work with your mechanical design team to select boilers that are sized appropriately for the heating load at this facility. 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.

Replacing the boilers has a long payback and may not be justifiable based simply on energy considerations. However, the boiler has reached the end of its normal useful life. Typically, the marginal cost of purchasing high efficiency boilers can be justified by the marginal savings from the improved efficiency. When the boiler is eventually replaced, consider purchasing boilers that exceed the minimum efficiency required by building codes. We also recommend working with your mechanical design team to determine whether the heating system can operate with return water temperatures below 130°F, which would allow the use of condensing boilers.

Affected units: Meadowbrook School: one 4,184-MBh non-condensing hot water boiler.

4.7 HVAC Improvements

#	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		**502**	**0.0**	**17**	**$223**	**$647**	**$384**	**$263**	**1.2**	**2,501**
ECM 11	Install Occupancy-Controlled Thermostats	502	0.0	0	$74	$477	$300	$177	2.4	506
ECM 12	Install Pipe Insulation	0	0.0	17	$150	$169	$84	$85	0.6	1,995

ECM 11: Install Occupancy-Controlled Thermostats

Replace manual thermostats with occupancy-controlled thermostats. An occupancy-controlled thermostat is paired with a door detector and/or sensor to identify movement and determine if a room is occupied or unoccupied. When occupancy is detected, the thermostat enables the programmed temperature setpoint. If no occupancy is sensed, the thermostat switches to unoccupied mode after a set period of time and reduces the temperature setpoint.

By reducing heating temperature setpoints and increasing cooling temperature setpoints when the space is unoccupied, the operation of the HVAC equipment is reduced while still maintaining reasonable space temperatures for building usage. Occupancy controlled thermostats provide energy savings by reducing heating and cooling energy usage when rooms are unoccupied.

Affected units: Maintenance Shop: two, 34.12-MBh fan coil units.

ECM 12: Install Pipe Insulation

Install insulation on heating water and domestic hot water system piping. Distribution system losses are dependent on system fluid temperature, the size of the distribution system, and the level of insulation of the piping. Significant energy savings can be achieved when insulation has not been well maintained. When the insulation is exposed to water, when the insulation has been removed from some areas of the pipe, or when valves have not been properly insulated system efficiency can be significantly reduced. This measure saves energy by reducing heat transfer in the distribution system.

Affected piping: Meadowbrook School: 5.0-feet of 0.75-inch DHW piping, 4.0-feet of 3.0-inch HHW piping, 7.0-feet of 2.5-inch piping, and 5.0-feet of 1.5-inch piping all located in the boiler room.

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		**0**	**0.0**	**17**	**$150**	**$258**	**$258**	**$0**	**0.0**	**2,000**
ECM 13	Install Low-Flow DHW Devices	0	0.0	17	$150	$258	$258	$0	0.0	2,000

ECM 13: Install Low-Flow DHW Devices

Install low-flow devices to reduce overall hot water demand. The following low flow devices are recommended to reduce hot water usage:

Device	Flow Rate
Faucet aerators (lavatory)	0.5 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.

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		**5,972**	**0.7**	**0**	**$877**	**$4,792**	**$600**	**$4,192**	**4.8**	**6,014**
ECM 14	Replace Refrigeration Equipment	5,972	0.7	0	$877	$4,792	$600	$4,192	4.8	6,014

ECM 14: Replace Refrigeration Equipment

Replace an existing commercial freezer and freezer chest with new ENERGY STAR® rated equipment. The energy savings associated with this measure come from reduced energy usage, due to more efficient technology, and reduced run times.

Affected units: Meadowbrook School: one freezer chest and one Beverage Air solid-door stand-up freezer.

4.10 Measures for Future Consideration

There are additional opportunities for improvement that Hillsdale School District may wish to consider. These potential upgrades typically require further analysis, involve substantial capital investment and/or include significant system reconfiguration. These measures are therefore beyond the scope of this energy audit. These measures are described here to support a whole building approach to energy efficiency and sustainability.

Hillsdale School District may wish to consider the Energy Savings Improvement Program (ESIP) using a whole building approach. With interest in implementing comprehensive, largescale and/or complex system wide projects, these measures may be pursued during development of a future energy savings plan. We recommend that you work with your energy service company (ESCO) and/or design team to:

- evaluate these measures further
- develop firm costs
- determine measure savings
- prepare detailed implementation plans.

Other modernization or capital improvement funds may be leveraged for these types of refurbishments. As you plan for capital upgrades, be sure to consider the energy impact of the building systems and controls being specified.

Retro-Commissioning Study

Due to the complexity of today's HVAC systems and controls a thorough analysis and rebalance of heating, ventilation, and cooling systems should periodically be conducted. There are indications at this site that systems may be not be operating correctly or as efficiently as they could be. One important tool available to building operators to ensure proper system operation is retro-commissioning.

Retro-commissioning is a common practice recommended by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) to be implemented every few years. We recommend that you contact a reputable engineering firm that specializes in energy control systems and retro-commissioning. Ask them to propose a scope of work and an outline of the procedures and processes to be implemented, including a schedule and the roles of all responsible parties.

Once goals and responsibilities are established, the objective of the investigation process is to understand how the building is currently operating, identify the issues, and determine the most cost-effective way to improve performance. The retro-commissioning agent will review building documentation, interview building occupants, and inspect and test the equipment. Information is then compiled into a report and shared with facility staff, who will select which recommendations to implement after reviewing the findings.

The implementation phase puts the selected processes into place. Typical measures may include sensor calibration, equipment schedule changes, damper linkage repair and similar relatively low-cost adjustments -- although more expensive sophisticated programming and building control system upgrades may be warranted. Approved measures may be implemented by the agent, the building staff, or by subcontractors. Typically, a combination of these individuals makes up the retro-commissioning team.

After the approved measures are implemented, the team will verify that the changes are working as expected. Baseline and post-case measurements will allow building staff to monitor equipment and ensure that the benefits are maintained.

Upgrade/Replace Energy Management System

Based on our site survey and on conversations with facility staff, it appears that the existing energy management system (EMS) is substantially limited in its capabilities, the equipment that it controls, means of control, monitoring/ reporting function, or condition relative to new systems available in the marketplace. A substantial upgrade to your site's EMS could increase the efficiency of your building HVAC system operation.

The current generation EMS typically provides building systems with a network of temperature and pressure sensors that obtain feedback about field conditions and provide signals to control systems to adjust system operation for optimal functioning. Thirty years ago, most control systems were pneumatic systems driven by compressed air, with pneumatic thermostats and air driven actuators for valves and dampers. Pneumatics controls have largely been replaced by direct digital control (DDC) systems, but many pneumatic systems remain. Contemporary DDC systems afford tighter controls and enhanced monitoring and trending capabilities as compared to the older systems.

A controls upgrade would enable automated equipment "start" and "stop" times, temperature setpoints, lockouts and deadbands to be programmed remotely using a graphic interface. Controls can be configured to optimize ventilation and outside air intake by adjusting economizer position, damper function and fan speed. Existing chilled and hot water distribution system controls are typically "tied in", including associated pumps and valves. Coordinated control of HVAC systems is dependent on a network of sensors and status points. A comprehensive building control system provides monitoring and control for all HVAC systems so operators can adjust system programming for optimal comfort and energy savings.

It is recommended that an HVAC engineer or contractor who specializes in energy management systems be contacted for a detailed evaluation and implementation costs. A controls expert will be able to tell you to what extent an existing system can be refurbished or expanded, what sensors should be replaced, what additional HVAC systems could be controlled, and what monitoring and graphic capabilities can be added. 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.

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.

Operation and maintenance (O&M) plans enhance the operational efficiency of HVAC and other energy intensive systems and could save between 5 to 20 percent of the energy usage in your building without substantial capital investment. A successful plan includes your records of energy usage trends and costs, building equipment lists, current maintenance practices, planned capital upgrades, and incorporates your ideas for improved building operation. Your plan will address goals for energy-efficient operation, provide detail on how to reach the goals, and will outline procedures for measuring and reporting whether goals have been achieved.

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[5]. Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

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.

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

Lighting Controls

As part of a lighting maintenance schedule, test lighting controls to ensure proper functioning. For occupancy sensors, this requires triggering the sensor and verifying that the sensor's timer settings are correct. For daylight and photocell sensors, maintenance involves cleaning sensor lenses and confirming that setpoints and sensitivity are configured properly. Adjust exterior lighting time clock controls seasonally as needed to match your lighting requirements.

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.

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 and 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.

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 and efficiently. Boilers should be cleaned according to the manufacturer's instructions to remove soot and scale from the boiler tubes to improve heat transfer.

Label HVAC Equipment

For improved coordination in maintenance practices, we recommend labeling or re-labeling the site HVAC equipment. Maintain continuity in labeling by following labeling conventions as indicated in the facility drawings or EMS building equipment list. Use weatherproof or heatproof labeling or stickers for permanence, but do not cover over original equipment nameplates, which should be kept clean and readable whenever possible. Besides equipment, label piping for service and direction of flow when possible. Ideally, maintain a log of HVAC equipment, including nameplate information, asset tag designation, areas served, installation year, service dates, and other pertinent information.

This investment in your equipment will enhance collaboration and communication between your staff and your contracted service providers and may help you with regulatory compliance.

Optimize HVAC Equipment Schedules

Energy Management Systems (EMS) typically provide advanced controls for building HVAC systems, including chillers, boilers, air handling units, rooftop units and exhaust fans. The EMS monitors and reports operational status, schedules equipment 'start' and 'stop' times, locks out equipment operation based on outside air or space temperature, and often optimizes damper and valve operation based on complex algorithms. These EMS features, when in proper adjustment, can improve comfort for building occupants and save substantial energy.

Know your EMS scheduling capabilities. Regularly monitor HVAC equipment operating schedules and match them to building operating hours in order to eliminate unnecessary equipment operation and save energy. Monitoring should be performed often at sites with frequently changing usage patterns – daily in some cases. We recommend using the 'Optimal Start' feature of the EMS, if available, to optimize the building warmup sequence. Most EMS scheduling programs provide for "Holiday" schedules which can be used during reduced use or shutdown periods. Finally, many systems are equipped with a one-time override function which can be used to provide additional space conditioning due to a one-time, special event. When available this override feature should be used rather than changing the base operating schedule.

Water Heater Maintenance

The lower the supply water temperature that is used for hand washing sinks, the less energy is needed to heat the water. Reducing the temperature results in energy savings and the change is often unnoticeable to users. Be sure to review the domestic water temperature requirements for sterilizers and dishwashers as you investigate reducing the supply water temperature.

Also, 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.

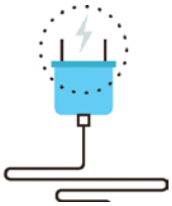
Compressed Air System Maintenance

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[6]. Your local utility may offer incentives or rebates for this equipment.

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 gallons per flush (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[7] or download a copy of EPA's "WaterSense® at Work: Best Management Practices for Commercial and Institutional Facilities"[8] 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.

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[6] 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.

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

[8] 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, 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.

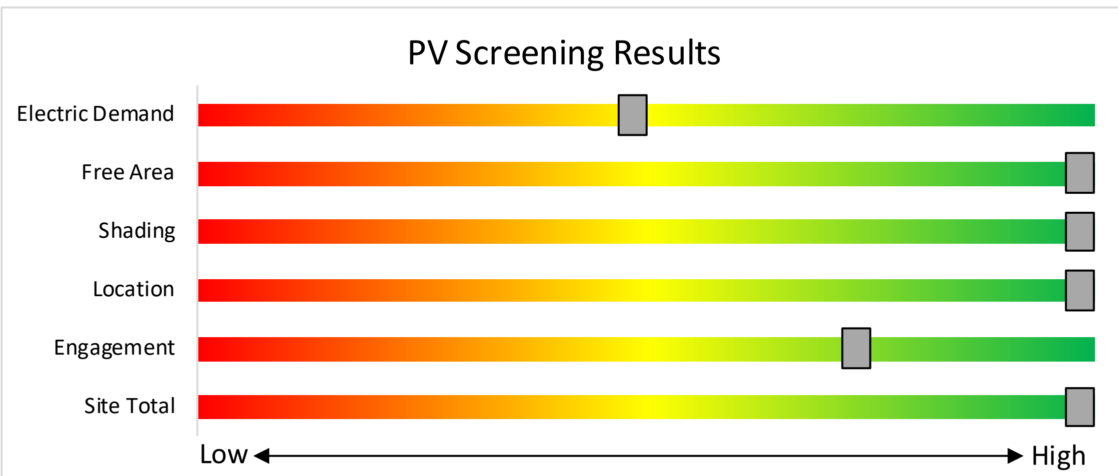
6.1 Solar Photovoltaic

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.



Potential	High	
System Potential	80	kW DC STC
Electric Generation	95,310	kWh/yr
Displaced Cost	$13,990	/yr
Installed Cost	$208,000	

Figure 9 - Photovoltaic Screening

Transition Incentive (TI) Program

The TI program is a bridge between the Legacy SREC Program and a to-be determined Successor Incentive Program. The program 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 TRECs (Transition Incentive Renewable Energy Certificates). The Transition Incentive is structured as a factorized renewable energy certificate. The factors allow the TI Program to provide differentiated financial incentives for different types of solar installation.

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:

- **Transition Incentive (TI) Program:** https://www.njcleanenergy.com/renewable-energy/programs/transition-incentive-program
- **Basic Info on Solar PV in NJ**: www.njcleanenergy.com/whysolar.
- **NJ Solar Market FAQs**: www.njcleanenergy.com/renewable-energy/program-updates-and-background-information/solar-transition/solar-market-faqs.
- **Approved Solar Installers in the NJ 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.

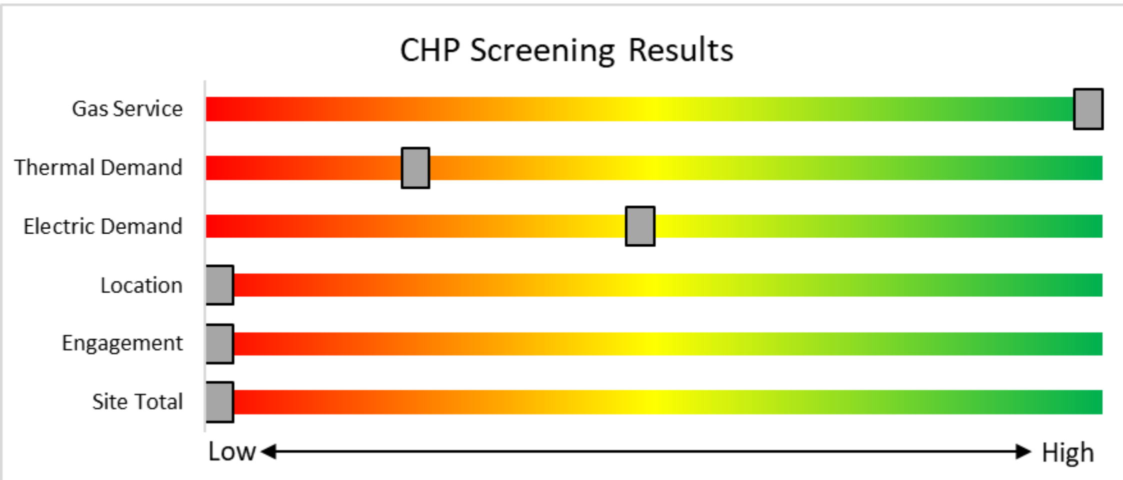


Figure 10 - Combined Heat and Power Screening

Find a qualified firm that specializes in commercial CHP cost assessment and installation: [http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/.](http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/)

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 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-efficient 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 Direct Install

Direct Install is a turnkey program available to existing small to medium-sized facilities with an average peak electric demand that does not exceed 200 kW over the recent 12-month period. You work directly with a pre-approved contractor who will perform a free energy assessment at your facility, identify specific eligible measures, and provide a clear scope of work for installation of selected measures. Energy efficiency measures may include lighting and lighting controls, refrigeration, HVAC, motors, variable speed drives, and controls.

Incentives

The program pays up to 70% of the total installed cost of eligible measures, up to $125,000 per project. Each entity is limited to incentives up to $250,000 per fiscal year.

How to Participate

To participate in Direct Install, you will need to contact the participating contractor assigned to the region of the state where your facility is located. A complete list of Direct Install program partners is provided on the Direct Install website linked below. The contractor will be paid the measure incentives directly by the program, which will pass on to you in the form of reduced material and implementation costs. This means up to 70% of eligible costs are covered by the program, subject to program caps and eligibility, while the remaining 30% of the cost is paid to the contractor by the customer.

Detailed program descriptions and applications can be found at: www.njcleanenergy.com/DI.

7.3 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.

Based on the site building and utility data provided, the facility does not meet the requirements of the current P4P 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.

7.4 Combined Heat and Power

The Combined Heat & Power (CHP) program provides incentives for eligible CHP or waste heat to power (WHP) projects. Eligible CHP or WHP projects must achieve an annual system efficiency of at least 65% (lower heating value, or LHV), based on total energy input and total utilized energy output. Mechanical energy may be included in the efficiency evaluation.

Incentives

Eligible Technologies	Size (Installed Rated Capacity)[1]	Incentive ($/kW)	% of Total Cost Cap per Project[3]	$ Cap per Project[3]
Powered by non-renewable or renewable fuel source[4]	≤500 kW	$2,000	30-40%[2]	$2 million
Gas Internal Combustion Engine	>500 kW - 1 MW	$1,000		
Gas Combustion Turbine	> 1 MW - 3 MW	$550	30%	$3 million
Microturbine	>3 MW	$350		
Fuel Cells with Heat Recovery				
Waste Heat to Power*	<1 MW	$1,000	30%	$2 million
	> 1MW	$500		$3 million

*Waste Heat to Power: Powered by non-renewable fuel source, heat recovery or other mechanical recovery from existing equipment utilizing new electric generation equipment (e.g. steam turbine).

Check the NJCEP website for details on program availability, current incentive levels, and requirements.

How to Participate

You work with a qualified developer or consulting firm to complete the CHP application. Once the application is approved the project can be installed. Information about the CHP program can be found at: www.njcleanenergy.com/CHP.

7.5 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 description 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.

7.6 Transition Incentive (TI) Program

The TI program is a bridge between the Legacy SREC Program and a to-be determined Successor Incentive Program. The program 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 TRECs (Transition Incentive Renewable Energy Certificates). The Transition Incentive is structured as a factorized renewable energy certificate. The factors allow the TI Program to provide differentiated financial incentives for different types of solar installations. NJBPU calculates the value of a Transition Renewable Energy Certificate (TREC) by multiplying the base compensation rate ($152/MWh) by the project's assigned factor (i.e. $152 x 0.85 = $129.20/MWh). The TREC factors are defined based on the chart below:

Project Type	Factor
Subsection (t): landfill, brownfield, areas of historic fill	1.00
Grid supply (Subsection (r)) rooftop	1.00
Net metered non-residential rooftop and carport	1.00
Community solar	0.85
Grid supply (Subsection (r)) ground mount	0.60
Net metered residential ground mount	0.60
Net metered residential rooftop and carport	0.60
Net metered non-residential ground mount	0.60

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 TRECs.

Eligible projects may generate TRECs for 15 years following the commencement of commercial operations (also referred to as the "Transition Incentive Qualification Life"). After 15 years, projects may be eligible for a NJ Class I REC.

TRECs will be used by the identified compliance entities to satisfy a compliance obligation tied to a new Transition Incentive Renewable Portfolio Standard ("Tl-RPS"), which will exist in parallel with, and completely separate from, the existing Solar RPS for Legacy SRECs. The Tl-RPS is a carve-out of the current Class I RPS requirement. The creation of TRECs is based upon metered generation supplied to PJM-EIS General Attribute Tracking System ("GATS") by the owners of eligible facilities or their agents. GATS would create one TREC for each MWh of energy produced from a qualified facility.

TRECs will be purchased monthly by a TREC Administrator who will allocate the TRECs to the Load Serving Entities (BGS Providers and Third-Party Suppliers) annually based on their market share of retail electricity sold during the relevant Energy Year.

Solar projects help the State of New Jersey reach renewable energy goals outlined in the state's Energy Master Plan. The Transition Incentive Program online portal is now open to new applications effective May 1, 2020. There are instructions on "How and When to Transfer my SRP Registration to the Transition Incentive Program". If you are considering installing solar photovoltaics on your building, visit the following link for more information:

https://www.njcleanenergy.com/renewable-energy/programs/transition-incentive-program

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[9].

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[10].

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

[10] 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
Atrium	4	Compact Fluorescent: (2) 13W Plug-In Lamps	Wall Switch	S	26	3,705	2, 4	Relamp	Yes	4	LED Lamps: (2) 9W Plug-In Lamps	High/Low Control	18	2,556	0.0	221	0	$32	$325	$241	2.6
Atrium	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Atrium	6	Halogen Incandescent: (1) 400W Lamp	Wall Switch	S	400	3,705	2, 4	Relamp	Yes	6	LED Lamps: (1) 60W Lamp	High/Low Control	60	2,556	1.5	8,769	-2	$1,271	$328	$237	0.1
Atrium	16	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,705	2, 4	Relamp	Yes	16	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	2,556	0.7	4,107	-1	$595	$1,551	$1,155	0.7
Atrium	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,705	2, 4	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	2,556	0.1	513	0	$74	$110	$60	0.7
Atrium	5	Metal Halide: (1) 175W Lamp	Wall Switch	S	215	3,705	1, 4	Fixture Replacement	Yes	5	LED - Fixtures: Decorative Pendant	High/Low Control	65	2,556	0.6	3,474	-1	$504	$1,881	$325	3.1
Classroom 100	3	Compact Fluorescent: (2) 13W Plug-In Lamps	Wall Switch	S	26	1,140	2	Relamp	No	3	LED Lamps: (2) 9W Plug-In Lamps	Wall Switch	18	1,140	0.0	30	0	$4	$75	$12	14.4
Classroom 100	19	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,140	2, 3	Relamp	Yes	19	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	787	0.9	1,501	0	$218	$1,581	$710	4.0
Classroom 101	3	Compact Fluorescent: (2) 13W Plug-In Lamps	Wall Switch	S	26	1,140	2	Relamp	No	3	LED Lamps: (2) 9W Plug-In Lamps	Wall Switch	18	1,140	0.0	30	0	$4	$75	$12	14.4
Classroom 101	19	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,140	2, 3	Relamp	Yes	19	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	787	0.9	1,501	0	$218	$1,581	$710	4.0
Classroom 102	3	Compact Fluorescent: (2) 13W Plug-In Lamps	Wall Switch	S	26	1,140	2	Relamp	No	3	LED Lamps: (2) 9W Plug-In Lamps	Wall Switch	18	1,140	0.0	30	0	$4	$75	$12	14.4
Classroom 102	19	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,140	2, 3	Relamp	Yes	19	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	787	0.9	1,501	0	$218	$1,581	$710	4.0
Classroom 103	3	Compact Fluorescent: (2) 13W Plug-In Lamps	Wall Switch	S	26	1,140	2	Relamp	No	3	LED Lamps: (2) 9W Plug-In Lamps	Wall Switch	18	1,140	0.0	30	0	$4	$75	$12	14.4
Classroom 103	19	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,140	2, 3	Relamp	Yes	19	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	787	0.9	1,501	0	$218	$1,581	$710	4.0
Classroom 104	16	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,140	2, 3	Relamp	Yes	16	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	787	0.7	1,264	0	$183	$1,146	$550	3.3
Classroom 105	16	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,140	2, 3	Relamp	Yes	16	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	787	0.7	1,264	0	$183	$1,146	$550	3.3
Classroom 108	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,140	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	787	0.2	316	0	$46	$489	$190	6.5
Classroom 117	1	Incandescent: (1) 200W A19 Screw-In Lamp	Wall Switch	S	200	1,140	2	Relamp	No	1	LED Lamps: (1) 30W Screw-In Lamp	Wall Switch	30	1,140	0.1	213	0	$31	$17	$2	0.5
Classroom 117	23	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,140	2, 3	Relamp	Yes	23	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	787	1.0	1,817	0	$263	$1,800	$830	3.7
Classroom 119	16	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,140	2, 3	Relamp	Yes	16	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	787	0.7	1,264	0	$183	$1,146	$550	3.3
Classroom 120	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,140	2, 3	Relamp	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	787	0.5	790	0	$115	$818	$370	3.9
Classroom 121	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,140	2, 3	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	787	0.3	474	0	$69	$599	$250	5.1
Classroom 121A	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,140	2, 3	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	787	0.2	263	0	$38	$453	$170	7.4
Classroom 122	2	Incandescent: (1) 100W A19 Screw-In Lamp	Wall Switch	S	100	1,140	2	Relamp	No	2	LED Lamps: (1) 15W Screw-In Lamp	Wall Switch	15	1,140	0.1	213	0	$31	$34	$4	1.0
Classroom 122	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,140	2, 3	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	787	0.5	948	0	$137	$1,197	$500	5.1

Location	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
	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
Classroom 123	2	Incandescent: (1) 100W A19 Screw-In Lamp	Wall Switch	S	100	1,140	2	Relamp	No	2	LED Lamps: (1) 15W Screw-In Lamp	Wall Switch	15	1,140	0.1	213	0	$31	$34	$4	1.0
Classroom 123	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,140	2, 3	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	787	0.5	948	0	$137	$1,197	$500	5.1
Classroom 124	2	Incandescent: (1) 100W A19 Screw-In Lamp	Wall Switch	S	100	1,140	2	Relamp	No	2	LED Lamps: (1) 15W Screw-In Lamp	Wall Switch	15	1,140	0.1	213	0	$31	$34	$4	1.0
Classroom 124	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,140	2, 3	Relamp	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	787	0.7	1,264	0	$183	$1,416	$620	4.3
Classroom 125	12	LED - Fixtures: 60W 2x4 Panel LED Fixtures	Wall Switch	S	60	1,140	3	None	Yes	12	LED - Fixtures: 60W 2x4 Panel LED Fixtures	Occupancy Sensor	60	787	0.2	280	0	$41	$270	$70	4.9
Classroom 126	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,140	2, 3	Relamp	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	787	0.7	1,264	0	$183	$1,416	$620	4.3
Classroom 127	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,140	2, 3	Relamp	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	787	0.7	1,264	0	$183	$1,416	$620	4.3
Classroom 128	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,140	2, 3	Relamp	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	787	0.7	1,264	0	$183	$1,416	$620	4.3
Classroom 129	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,140	2, 3	Relamp	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	787	0.7	1,264	0	$183	$1,416	$620	4.3
Classroom 130	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,140	2, 3	Relamp	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	787	0.7	1,264	0	$183	$1,416	$620	4.3
Classroom 131	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	1,140	2	Relamp	No	1	LED Lamps: (1) 9W Screw-In Lamp	Wall Switch	9	1,140	0.0	64	0	$9	$17	$2	1.6
Classroom 131	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,140	2, 3	Relamp	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	787	0.7	1,264	0	$183	$1,416	$620	4.3
Classroom 132	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	1,140	2	Relamp	No	1	LED Lamps: (1) 9W Screw-In Lamp	Wall Switch	9	1,140	0.0	64	0	$9	$17	$2	1.6
Classroom 132	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,140	2, 3	Relamp	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	787	0.7	1,264	0	$183	$1,416	$620	4.3
Classroom 133	1	Incandescent: (1) 100W A19 Screw-In Lamp	Wall Switch	S	100	1,140	2	Relamp	No	1	LED Lamps: (1) 15W Screw-In Lamp	Wall Switch	15	1,140	0.1	107	0	$15	$17	$2	1.0
Classroom 133	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,140	2, 3	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	787	0.5	948	0	$137	$1,197	$500	5.1
Classroom 134	1	Incandescent: (1) 100W A19 Screw-In Lamp	Wall Switch	S	100	1,140	2	Relamp	No	1	LED Lamps: (1) 15W Screw-In Lamp	Wall Switch	15	1,140	0.1	107	0	$15	$17	$2	1.0
Classroom 134	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,140	2, 3	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	787	0.5	948	0	$137	$1,197	$500	5.1
Classroom 135	11	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	1,140	2, 3	Relamp	Yes	11	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	787	0.6	1,020	0	$148	$1,073	$510	3.8
Classroom 136	11	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	1,140	2, 3	Relamp	Yes	11	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	787	0.6	1,020	0	$148	$1,073	$510	3.8
Classroom 137	11	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	1,140	2, 3	Relamp	Yes	11	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	787	0.6	1,020	0	$148	$1,073	$510	3.8
Corridor 3	4	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	4	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor 3	13	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,705	2, 4	Relamp	Yes	13	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	2,556	0.6	3,337	-1	$484	$1,387	$1,065	0.7
Corridor 4	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor 4	20	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,705	2, 4	Relamp	Yes	20	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	2,556	0.9	5,134	-1	$744	$1,995	$1,500	0.7

	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
Corridor 5	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,705	2, 4	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	2,556	0.2	1,027	0	$149	$444	$345	0.7
Corridor 6	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,705	2, 4	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	2,556	0.2	1,027	0	$149	$444	$345	0.7
Corridor 7	1	Compact Fluorescent: (2) 13W Plug-In Lamps	Wall Switch	S	26	3,705	2, 4	Relamp	Yes	1	LED Lamps: (2) 9W Plug-In Lamps	High/Low Control	18	2,556	0.0	55	0	$8	$25	$4	2.6
Corridor 7	1	Linear Fluorescent - T8: 2' T8 (17W) - 3L	Wall Switch	S	53	3,705	2, 4	Relamp	Yes	1	LED - Linear Tubes: (3) 2' Lamps	High/Low Control	26	2,556	0.0	144	0	$21	$49	$18	1.5
Corridor 7	10	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,705	2, 4	Relamp	Yes	10	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	2,556	0.5	2,567	-1	$372	$998	$750	0.7
Corridor 7	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	3,705	2, 4	Relamp	Yes	1	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	2,556	0.1	302	0	$44	$73	$40	0.8
Display case	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,600	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,600	0.0	189	0	$27	$73	$40	1.2
Electrical Room 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	260	2	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	260	0.0	14	0	$2	$55	$30	12.1
Exterior Ground	1	Compact Fluorescent: (1) 13W Plug-In Lamp	Timeclock		13	4,380	2	Relamp	No	1	LED Lamps: (1) 9W Plug-In Lamps	Timeclock	9	4,380	0.0	18	0	$3	$13	$2	4.1
Exterior Ground	1	Compact Fluorescent: (2) 13W Plug-In Lamps	Timeclock		26	4,380	2	Relamp	No	1	LED Lamps: (2) 9W Plug-In Lamps	Timeclock	18	4,380	0.0	35	0	$5	$25	$4	4.1
Exterior Ground	7	Compact Fluorescent: (2) 26W Plug-In Lamps	Photocell		52	4,380	2	Relamp	No	7	LED Lamps: (2) 18W Plug-In Lamps	Photocell	36	4,380	0.0	491	0	$72	$189	$28	2.2
Exterior Ground	1	LED - Fixtures: 15W Wall Pack LED Fixture	Wall Switch		15	4,940		None	No	1	LED - Fixtures: 15W Wall Pack LED Fixture	Wall Switch	15	4,940	0.0	0	0	$0	$0	$0	0.0
Exterior Ground	3	LED - Fixtures: 20W Wall Pack LED Fixtures	Timeclock		20	4,380		None	No	3	LED - Fixtures: 20W Wall Pack LED Fixtures	Timeclock	20	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior Ground	1	Metal Halide: (1) 100W Lamp	Wall Switch		128	4,940	1	Fixture Replacement	No	1	LED - Fixtures: Ceiling Mount	Wall Switch	38	4,940	0.0	443	0	$65	$297	$20	4.3
Exterior Ground	2	Metal Halide: (1) 100W Lamp	Wall Switch		128	4,940	1	Fixture Replacement	No	2	LED - Fixtures: Ceiling Mount	Wall Switch	38	4,940	0.0	885	0	$130	$594	$40	4.3
Exterior Ground	5	Metal Halide: (1) 175W Lamp	Timeclock		215	4,380	1	Fixture Replacement	No	5	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	65	4,380	0.0	3,296	0	$484	$1,610	$1,000	1.3
Exterior Ground	15	Metal Halide: (1) 175W Lamp	Photocell		215	4,380	1	Fixture Replacement	No	15	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	65	4,380	0.0	9,888	0	$1,452	$4,830	$3,000	1.3
Exterior Parking Lot	6	Metal Halide: (1) 175W Lamp	Photocell	S	215	4,380	1	Fixture Replacement	No	6	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Photocell	65	4,380	0.0	3,955	0	$581	$5,583	$1,200	7.5
Faculty Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,080	2, 3	Relamp	Yes	1	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,435	0.0	50	0	$7	$18	$10	1.1
Faculty Room	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 3	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.2	769	0	$111	$562	$230	3.0
Garage	12	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,560		None	No	12	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,560	0.0	0	0	$0	$0	$0	0.0
Garage	1	Metal Halide: (1) 400W Lamp	Wall Switch		458	2,470	1	Fixture Replacement	No	1	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Wall Switch	137	2,470	0.0	792	0	$116	$310	$200	0.9
Group Reading Room	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,140	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	787	0.2	316	0	$46	$489	$190	6.5
Gym Hallway	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Gym Hallway	7	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,705	2, 4	Relamp	Yes	7	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	2,556	0.3	1,797	0	$260	$833	$660	0.7

	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
Gymnasium 1	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Gymnasium 1	20	LED Lamps: (1) 80W Corn Bulb Screw-In Lamp	Wall Switch	S	80	4,940	3	None	Yes	20	LED Lamps: (1) 80W Corn Bulb Screw-In Lamp	Occupancy Sensor	80	3,409	0.4	2,695	-1	$391	$4,400	$1,400	7.7
Gymnasium Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,080	2, 3	Relamp	Yes	1	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,435	0.0	50	0	$7	$18	$10	1.1
Gymnasium Office	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.1	288	0	$42	$380	$130	6.0
Gymnasium Storage	2	LED Lamps: (1) 15W A19 Screw-In Lamp	Wall Switch	S	15	520		None	No	2	LED Lamps: (1) 15W A19 Screw-In Lamp	Wall Switch	15	520	0.0	0	0	$0	$0	$0	0.0
Hallway 2	4	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	4	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Hallway 2	18	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,705	2, 4	Relamp	Yes	18	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	2,556	0.8	4,621	-1	$670	$1,661	$1,215	0.7
Janitorial 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	780	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	780	0.0	28	0	$4	$37	$20	4.0
Janitorial 2	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	780	2	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	780	0.0	42	0	$6	$55	$30	4.0
Kitchen 1	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,760	2	Relamp	No	15	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,760	0.4	958	0	$139	$548	$300	1.8
Kitchen 1	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	1,760	2, 3	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,214	0.1	286	0	$42	$146	$80	1.6
Library 1	40	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 3	Relamp	Yes	40	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	1.2	3,843	-1	$557	$2,271	$1,010	2.3
Lobby Front Entrance	1	Exit Signs: LED - 2 W Lamp	None		6	3,705		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	3,705	0.0	0	0	$0	$0	$0	0.0
Lobby Front Entrance	8	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,705	2, 4	Relamp	Yes	8	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	2,556	0.4	2,054	0	$298	$888	$240	2.2
Mechanical Boiler	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Mechanical Boiler	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	780	2	Relamp	No	7	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	780	0.2	198	0	$29	$256	$140	4.0
Mechanical Shop	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,140	2	Relamp	No	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,140	0.1	207	0	$30	$183	$100	2.8
Office Kitchen	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,760	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,760	0.0	128	0	$19	$73	$40	1.8
Office Library	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,435	0.1	384	0	$56	$416	$150	4.8
Main Office	9	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,600	2, 3	Relamp	Yes	9	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,794	0.4	1,621	0	$235	$763	$340	1.8
Office Nurse	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,600	2, 3	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,794	0.3	1,081	0	$157	$599	$250	2.2
Office Principal	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,600	2	Relamp	No	1	LED Lamps: (1) 9W Screw-In Lamp	Wall Switch	9	2,600	0.0	146	0	$21	$17	$2	0.7
Office Principal	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,600	2, 3	Relamp	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,794	0.3	1,081	0	$157	$599	$250	2.2
Restroom - Female 1	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,080	2, 3	Relamp	Yes	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,435	0.0	101	0	$15	$37	$20	1.1
Restroom - Female 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,080	2, 3	Relamp	Yes	1	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,435	0.1	169	0	$25	$343	$110	9.5

	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
Restroom - Female 2	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,080	2, 3	Relamp	Yes	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,435	0.0	101	0	$15	$37	$20	1.1
Restroom - Female 2	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,080	2, 3	Relamp	Yes	1	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,435	0.1	169	0	$25	$343	$110	9.5
Restroom - Male 1	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,080	2, 3	Relamp	Yes	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,435	0.0	101	0	$15	$37	$20	1.1
Restroom - Male 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,080	2, 3	Relamp	Yes	1	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,435	0.1	169	0	$25	$343	$110	9.5
Restroom - Male 1	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,080	2, 3	Relamp	Yes	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,435	0.0	101	0	$15	$37	$20	1.1
Restroom - Male 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,080	2, 3	Relamp	Yes	1	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,435	0.1	169	0	$25	$343	$110	9.5
Restroom - Unisex 3	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.0	76	0	$11	$37	$20	1.5
Restroom 100	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,080	2	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,080	0.0	113	0	$16	$55	$30	1.5
Restroom 101	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,080	2	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,080	0.0	113	0	$16	$55	$30	1.5
Restroom 102	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,080	2	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,080	0.0	113	0	$16	$55	$30	1.5
Restroom 103	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	2,080	2	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,080	0.0	113	0	$16	$55	$30	1.5
Restroom 104	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	2,080	2	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,080	0.0	113	0	$16	$55	$30	1.5
Restroom 105	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	S	93	2,080	2	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,080	0.0	113	0	$16	$55	$30	1.5
Restroom 117	1	Incandescent: (1) 100W A19 Screw-In Lamp	Wall Switch	S	100	2,080	2	Relamp	No	1	LED Lamps: (1) 15W Screw-In Lamp	Wall Switch	15	2,080	0.1	194	0	$28	$17	$2	0.5
Restroom 119	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,080	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	2,080	0.0	66	0	$10	$72	$20	5.5
Restroom 121A	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,080	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,080	0.0	128	0	$19	$73	$40	1.8
Restroom 135	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.0	76	0	$11	$37	$20	1.5
Restroom 136	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.0	76	0	$11	$37	$20	1.5
Restroom 137	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,080	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.0	76	0	$11	$37	$20	1.5
Restroom Kitchen	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,760	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,214	0.1	163	0	$24	$343	$40	12.9
Restroom Mechanical	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	2,080	2	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,080	0.0	37	0	$5	$33	$12	3.9
Restroom Nurse	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	2,600	2	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,600	0.0	46	0	$7	$33	$12	3.1
Server Room 1	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	520	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	520	0.0	38	0	$5	$73	$40	6.0
Storage 10	2	LED Lamps: (1) 15W A19 Screw-In Lamp	Wall Switch	S	15	260		None	No	2	LED Lamps: (1) 15W A19 Screw-In Lamp	Wall Switch	15	260	0.0	0	0	$0	$0	$0	0.0
Storage 11	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	260	2	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	260	0.0	14	0	$2	$55	$30	12.1

	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
Storage 7	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	260		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	260	0.0	0	0	$0	$0	$0	0.0
Storage 8	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	260	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	260	0.0	9	0	$1	$37	$20	12.1
Storage 9	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	260	2	Relamp	No	8	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	260	0.2	76	0	$11	$292	$160	12.1
Storage Kitchen	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	260	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	260	0.0	9	0	$1	$37	$20	12.1
Storage Main Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	260	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	260	0.0	19	0	$3	$73	$40	12.1
Storage Mechanical	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	260	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	260	0.0	9	0	$1	$37	$20	12.1
Storage Nurse	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	260		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	260	0.0	0	0	$0	$0	$0	0.0
Storage Volt	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	260	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	260	0.0	9	0	$1	$37	$20	12.1
Theater 1	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,760	2	Relamp	No	10	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,760	0.2	639	0	$93	$365	$200	1.8

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
Maintenance Shop	Maintenance Shop	1	Supply Fan	0.3	65.0%	No	W	1,040		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Maintenance Shop	Maintenance Shop	1	Supply Fan	0.3	65.0%	No	W	20		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 108	Classroom 108	1	Supply Fan	0.1	65.0%	No	B	1,820		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Hallway	Hallway	5	Supply Fan	0.1	65.0%	No	B	1,820		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Storage Room	Storage Room	1	Supply Fan	0.3	65.0%	No	W	1,820		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classrooms 100-105	Classrooms 100-105	6	Supply Fan	1.0	85.5%	No	B	4,940		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Kitchen	Kitchen	1	Supply Fan	0.3	65.0%	No	B	1,820		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Atrium & Hallway	1	Supply Fan	2.0	86.5%	No	B	4,940	6	No	86.5%	Yes	1	0.6	3,195	0	$469	$3,261	$200	6.5
Roof	Atrium & Hallway	1	Exhaust Fan	0.3	65.0%	No	B	4,940	6	No	73.4%	Yes	1	0.1	742	0	$109	$2,728	$100	24.1
Classrooms & Offices	Classrooms & Offices	25	Supply Fan	0.1	65.0%	No	B	1,820		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Maintenance Shop	Cleaning & Tools & Filling Tires	1	Air Compressor	0.5	70.0%	No	W	20		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room	Pnuematic Controls	1	Air Compressor	0.5	69.9%	No	B	400		No	69.9%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room	Heating Hot Water System	1	Combustion Air Fan	3.0	85.5%	No	B	1,373		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room	Heating Hot Water System	1	Combustion Air Fan	1.0	75.5%	No	B	1,373		No	75.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Classrooms	1	Exhaust Fan	0.3	65.0%	No	B	3,000		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Dishwasher	1	Exhaust Fan	1.0	82.5%	No	B	3,000	5	Yes	85.5%	No		0.0	71	0	$10	$474	$0	45.2
Roof	Hallway	1	Exhaust Fan	2.0	84.0%	No	B	3,000	5	Yes	86.5%	No		0.0	116	0	$17	$532	$0	31.4
Roof	Classrooms	1	Exhaust Fan	0.2	65.0%	No	B	3,000		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	New Wing Hallway	1	Exhaust Fan	0.5	70.0%	No	W	3,000		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Gym	1	Exhaust Fan	1.0	82.5%	No	B	3,000	5	Yes	85.5%	No		0.0	71	0	$10	$474	$0	45.2

		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	Hallway	1	Exhaust Fan	1.0	82.5%	No	B	3,000	5	Yes	85.5%	No		0.0	71	0	$10	$474	$0	45.2
Roof	Hallway	1	Exhaust Fan	0.5	70.0%	No	B	3,000	5	Yes	78.2%	No		0.0	126	0	$18	$352	$0	19.1
Roof	Hallway	1	Exhaust Fan	1.0	82.5%	No	B	3,000	5	Yes	85.5%	No		0.0	71	0	$10	$474	$0	45.2
Roof	Classroom Rest Room	1	Exhaust Fan	0.3	65.0%	No	B	3,000		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Rest Room	1	Exhaust Fan	0.5	70.0%	No	B	3,000	5	Yes	78.2%	No		0.0	126	0	$18	$352	$0	19.1
Roof	Rest Room	1	Exhaust Fan	0.1	65.0%	No	B	3,000		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Hallway	1	Exhaust Fan	1.0	82.5%	No	B	3,000	5	Yes	85.5%	No		0.0	71	0	$10	$474	$0	45.2
Roof	Hallway	1	Exhaust Fan	1.0	82.5%	No	B	3,000	5	Yes	85.5%	No		0.0	71	0	$10	$474	$0	45.2
Boiler Room	Heating Hot Water System	1	Heating Hot Water Pump	3.0	86.5%	Yes	B	2,745	5	Yes	89.5%	No		0.0	179	0	$26	$876	$0	33.4
Boiler Room	Heating Hot Water System	1	Heating Hot Water Pump	3.0	86.5%	Yes	B	2,745	5	Yes	89.5%	No		0.0	179	0	$26	$876	$0	33.4
Boiler Room	Heating Hot Water System	1	Heating Hot Water Pump	1.5	84.0%	No	B	2,745	7	No	86.5%	Yes	1	0.2	1,443	0	$212	$13,920	$150	65.0
Boiler Room	Heating Hot Water System	1	Heating Hot Water Pump	0.5	70.0%	No	B	2,745	5	Yes	78.2%	No		0.0	115	0	$17	$352	$0	20.9
Boiler Room	Heating Hot Water System	1	Heating Hot Water Pump	0.5	70.0%	No	B	2,745	5	Yes	78.2%	No		0.0	115	0	$17	$352	$0	20.9
Roof	Kitchen Hood	1	Kitchen Hood Exhaust Fan	2.0	84.0%	No	B	660	8	No	86.5%	Yes	1	0.0	1,184	23	$375	$3,261	$200	8.2
Boiler Room	Ground Water	2	Other	1.0	85.5%	No	W	728		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room	Domestic Hot Water System	2	DHW Circulation Pump	0.1	70.0%	No	W	8,760		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Classrooms 100-105	Classrooms 100-105	6	Exhaust Fan	0.2	65.0%	No	B	4,940		No	65.0%	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	Server Room	1	Ductless Mini-Split AC	1.00		W		No							0.0	0	0	$0	$0	$0	0.0
Roof	Room 121A (CAC-1)	1	Ductless Mini-Split AC	2.00		B		No							0.0	0	0	$0	$0	$0	0.0
Roof	Classroom 108	1	Ductless Mini-Split AC	1.00		B		No							0.0	0	0	$0	$0	$0	0.0
Maintenance Shop	Maintenance Shop	1	Electric Resistance Heat		34.12	W		No							0.0	0	0	$0	$0	$0	0.0
Maintenance Shop	Maintenance Shop	1	Electric Resistance Heat		34.12	W		No							0.0	0	0	$0	$0	$0	0.0
Storage Room	Storage Room	1	Electric Resistance Heat		11.26	W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 100	Classroom 100 (UV-1)	1	Packaged Terminal AC	4.00		B		No							0.0	0	0	$0	$0	$0	0.0
Classroom 101	Classroom 101 (UV-2)	1	Packaged Terminal AC	4.00		B		No							0.0	0	0	$0	$0	$0	0.0
Classroom 102	Classroom 102 (UV-4)	1	Packaged Terminal AC	4.00		B		No							0.0	0	0	$0	$0	$0	0.0
Classroom 103	Classroom 103 (UV-3)	1	Packaged Terminal AC	4.00		B		No							0.0	0	0	$0	$0	$0	0.0
Classroom 104	Classroom 104 (UV-5)	1	Packaged Terminal AC	4.00		B		No							0.0	0	0	$0	$0	$0	0.0
Classroom 105	Classroom 105 (UV-6)	1	Packaged Terminal AC	4.00		B		No							0.0	0	0	$0	$0	$0	0.0
Roof	Atrium & Hallway	1	Packaged AC	10.00		B	9	Yes	1	Packaged AC	10.00		11.50		1.3	4,120	0	$605	$17,821	$1,460	27.0
Classroom 117	Classroom 117	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 119	Classroom 119	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 120	Classroom 120	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 121	Classroom 121	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 121A	Classroom 121A	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 122	Classroom 122	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 123	Classroom 123	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0

		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 (kBtu/hr)	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	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
Classroom 124	Classroom 124	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 125	Classroom 125	1	Window AC	2.02		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 126	Classroom 126	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 127	Classroom 127	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 128	Classroom 128	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 129	Classroom 129	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 130	Classroom 130	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 131	Classroom 131	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 132	Classroom 132	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 133	Classroom 133	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 134	Classroom 134	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 135	Classroom 135	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 136	Classroom 136	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 137	Classroom 137	1	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Faculty Room	Faculty Room	1	Window AC	1.00		B		No							0.0	0	0	$0	$0	$0	0.0
Library	Library	2	Window AC	2.00		W		No							0.0	0	0	$0	$0	$0	0.0
Library Office	Library Office	1	Window AC	0.83		B		No							0.0	0	0	$0	$0	$0	0.0
Main Office	Main Office	1	Window AC	2.00		B		No							0.0	0	0	$0	$0	$0	0.0
Nurse's Office	Nurse's Office	1	Window AC	1.00		W		No							0.0	0	0	$0	$0	$0	0.0
Principal's Office	Principal's Office	1	Window AC	1.00		W		No							0.0	0	0	$0	$0	$0	0.0

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 Hot Water System	1	Non-Condensing Hot Water Boiler	4,184	B	10	Yes	1	Non-Condensing Hot Water Boiler	4,184	85.00%	Ec	0.0	0	94	$825	$71,694	$0	86.9
Boiler Room	Heating Hot Water System	1	Non-Condensing Hot Water Boiler	2,532	W		No						0.0	0	0	$0	$0	$0	0.0

Occupancy Controlled Thermostat Recommendations

		Recommendation Inputs							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	ECM #	Thermostat Quantity	Cooling Capacity of Controlled System (Tons)	Electric Heating Capacity of Controlled System (MBh)	Output Heating Capacity of Controlled System (MBh)	Cooling Setpoint Temp (deg F)	Heating Setpoint Temp (deg F)	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
Maintenance Shop	Maintenance Shop	11	1.00	0.00	34.12		0	70	0.0	490	0	$72	$239	$150	1.2
Maintenance Shop	Maintenance Shop	11	1.00	0.00	34.12		0	70	0.0	12	0	$2	$239	$150	49.7

Pipe Insulation Recommendations

		Recommendation Inputs			Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	ECM #	Length of Uninsulated Pipe (ft)	Pipe Diameter (in)	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	Doemstic Hot Water System	12	5	0.75	0.0	0	2	$15	$29	$20	0.6
Boiler Room	Heating Hot Water System	12	4	3.00	0.0	0	5	$44	$35	$16	0.4
Boiler Room	Heating Hot Water System	12	7	2.50	0.0	0	7	$61	$62	$28	0.6
Boiler Room	Heating Hot Water System	12	5	1.50	0.0	0	3	$29	$44	$20	0.8

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
Boiler Room	Domestic Hot Water System	1	Storage Tank Water Heater (> 50 Gal)	W		No						0.0	0	0	$0	$0	$0	0.0

Low-Flow Device Recommendations

	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
Rest Room	13	36	Faucet Aerator (Lavatory)	2.20	0.50	0.0	0	17	$150	$258	$258	0.0

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	1	Freezer Chest	No	14	Yes	0.4	3,551	0	$521	$2,050	$0	3.9
Kitchen	1	Refrigerator Chest	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Stand-Up Freezer, Solid Door (31 - 50 cu. ft.)	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Stand-Up Freezer, Solid Door (31 - 50 cu. ft.)	No	14	Yes	0.3	2,420	0	$355	$2,742	$600	6.0
Kitchen	1	Stand-Up Refrigerator, Solid Door (>50 cu. ft.)	No		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 Rack Oven (Single)	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Gas Convection Oven (Full Size)	No		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

Plug Load Inventory

	Existing Conditions			
Location	**Quantity**	**Equipment Description**	**Energy Rate (W)**	**ENERGY STAR Qualified?**
Building	2	Coffee Machine	800	
Building	36	Computer	125	
Building	1	Electric Space Heater	1,500	
Building	16	Ceiling Fan	75	
Building	2	Large Fan	150	
Building	2	Portable Fan	100	
Building	261	Laptop	40	
Building	4	Microwave	800	
Maintenance Shop	1	Drill Press	186	
Maintenance Shop	1	Grinder	249	
Maintenance Shop	1	Saw	5,593	
Maintenance Shop	1	Dust Collector	750	
Kitchen	1	Refrigerated Table	650	
Kitchen	1	Steam Table	1,200	
Main Office	1	Laminator	1,400	
Building	1	Paper Shredder	150	
Building	14	Small/Medium Printer	150	
Main Office	2	Large Printer	300	
Building	30	Projector	175	
Building	4	Mini Fridge	260	
Building	2	Residential Refrigerator	800	
Building	21	TV	175	
Kitchen	1	Toaster Oven	1,300	

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.

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ENERGY STAR® Statement of Energy Performance

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ENERGY STAR® Score[1]

Meadowbrook School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 46,683
Built: 1963

For Year Ending: February 29, 2020
Date Generated: September 02, 2020

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
Meadowbrook School 50 Piermont Avenue Hillsdale, New Jersey 07642	Hillsdale School District 32 Ruckman Road Hillsddale, NJ 07642 (201) 664-4512	Sacha Pouliot 32 Ruckman Road Hillsdale, NJ 07642 (201) 664-4512 spouliot@hillsdaleschools.com

Property ID: 3255748

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
85.1 kBtu/ft²

Annual Energy by Fuel

Natural Gas (kBtu)	2,795,174 (70%)	
Electric - Grid (kBtu)	1,178,016 (30%)	

Source EUI
133.5 kBtu/ft²

National Median Comparison

National Median Site EUI (kBtu/ft²)	89.9
National Median Source EUI (kBtu/ft²)	141
% Diff from National Median Source EUI	-5%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	261

Signature & Stamp of Verifying Professional

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

LP Signature: ______________________ Date: ___________

Licensed Professional

____ ________
,
(____)____-______
____

Professional Engineer or Registered Architect 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.
TREC	*Transition Incentive Renewable Energy Certificate:* a factorized renewable energy certificate 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.