Local Government Energy Audit Report

Roosevelt Intermediate School

October 25, 2024

Prepared for:
Westfield Board of Education
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Westfield, New Jersey 07090

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Disclaimer

The goal of this audit report is to identify potential energy efficiency opportunities and help prioritize specific measures for implementation. 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 material and labor costs primarily on RS Means cost manuals as well as on our experience at similar facilities. This approach is based on standard cost estimating manuals and is vendor neutral. Cost estimates include material and labor pricing associated with one for one equipment replacements. Cost estimates do not include demolition or removal of hazardous waste. The actual implementation costs for energy savings projects are anticipated to be significantly higher based on the specific conditions at your site(s). We strongly recommend that you work with your design engineer or contractor to develop actual project costs for your specific scope of work for the installation of high efficiency equipment. We encourage you to obtain multiple estimates when considering measure installations. Actual installation costs can vary widely based on selected products and installers. TRC and NJBPU do not guarantee cost estimates and shall in no event be held liable should actual installed costs vary from these material and labor estimates.

Incentive values provided in this report are estimated based on previously run state efficiency programs. Incentive levels are not guaranteed. The NJBPU reserves the right to extend, modify, or terminate programs without prior notice. Please review all available utility program incentives and eligibility requirements prior to selecting and installing any energy conservation measures.

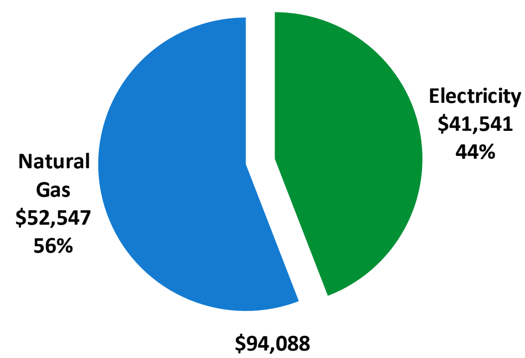
The customer and their respective contractor(s) are responsible to implement energy conservation measures in complete conformance with all applicable local, state, and federal requirements.

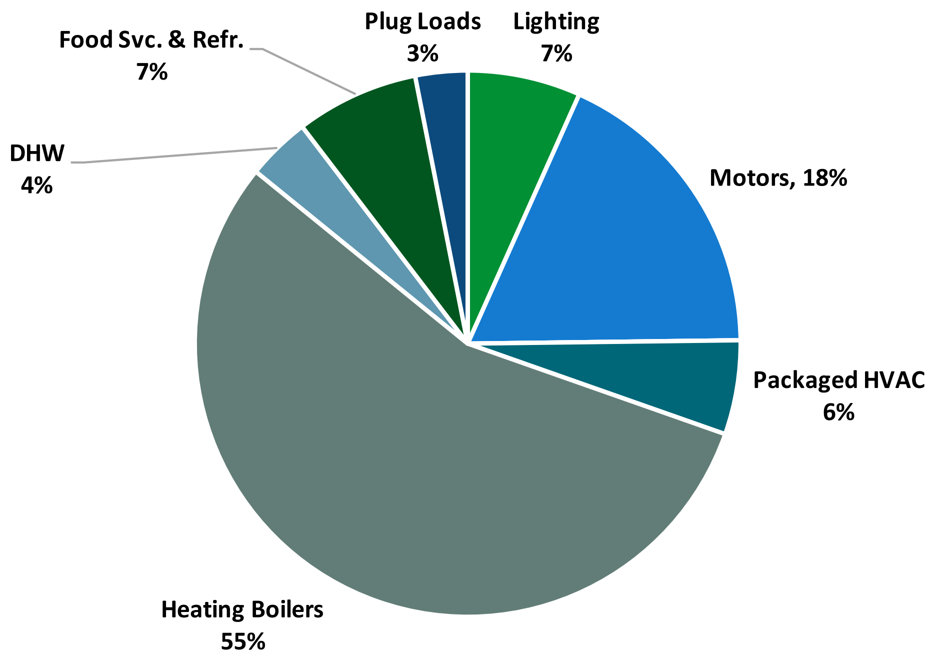
Table of Contents

1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Roosevelt Intermediate 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 Energy Utilities	Costs: $94,088 Electricity: 593,340 kWh Natural Gas: 38,013 Therms	
ENERGY STAR® Benchmarking Score	70 *(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.



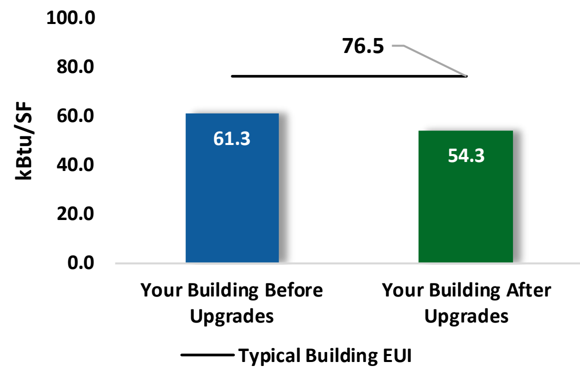
Energy Use by System

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.

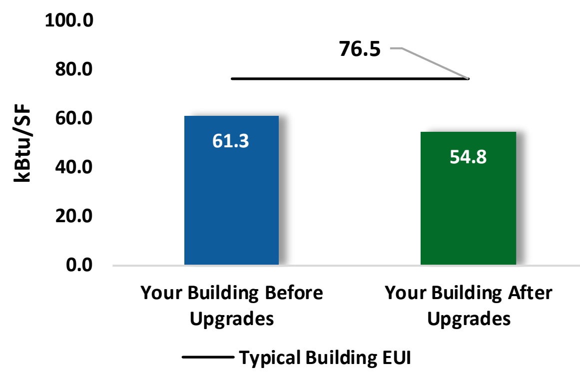
Scenario 1: Full Package (All Evaluated Measures)

Installation Cost	$134,390
Potential Rebates & Incentives[1]	$7,880
Annual Cost Savings	$11,618
Annual Energy Savings	Electricity: 102,744 kWh Natural Gas: 3,201 Therms
Greenhouse Gas Emission Savings	70 Tons
Simple Payback	10.9 Years
Site Energy Savings (All Utilities)	12%



Scenario 2: Cost Effective Package[2]

Installation Cost	$81,910
Potential Rebates & Incentives	$7,470
Annual Cost Savings	$10,589
Annual Energy Savings	Electricity: 88,035 kWh Natural Gas: 3,201 Therms
Greenhouse Gas Emission Savings	63 Tons
Simple Payback	7.0 Years
Site Energy Savings (all utilities)	11%



On-site Generation Potential

Photovoltaic	High
Combined Heat and Power	None

[1] Incentives are based on previously run state rebate programs. Contact your utility provider for current program incentives that 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 ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**15,316**	**2.9**	**-3**	**$1,030**	**$5,980**	**$160**	**$5,820**	**5.6**	**15,066**
ECM 1	Retrofit Fixtures with LED Lamps	Yes	8,840	2.5	-2	$595	$3,510	$160	$3,350	5.6	8,703
ECM 2	Install LED Exit Signs	Yes	6,475	0.5	-1	$435	$2,470	$0	$2,470	5.7	6,362
Lighting Control Measures			**7,390**	**2.0**	**-2**	**$496**	**$6,860**	**$1,030**	**$5,830**	**11.8**	**7,261**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	7,219	2.0	-2	$485	$6,300	$780	$5,520	11.4	7,093
ECM 4	Install High/Low Lighting Controls	No	171	0.0	0	$11	$560	$250	$310	27.1	168
Motor Upgrades			**11,072**	**1.4**	**0**	**$775**	**$23,900**	**$0**	**$23,900**	**30.8**	**11,150**
ECM 5	Premium Efficiency Motors	No	11,072	1.4	0	$775	$23,900	$0	$23,900	30.8	11,150
Variable Frequency Drive (VFD) Measures			**76,202**	**14.0**	**0**	**$5,335**	**$54,900**	**$5,100**	**$49,800**	**9.3**	**76,735**
ECM 6	Install VFDs on Constant Volume (CV) Fans	Yes	63,503	9.3	0	$4,446	$40,100	$3,100	$37,000	8.3	63,947
ECM 7	Install Boiler Draft Fan VFDs	Yes	12,699	4.7	0	$889	$14,800	$2,000	$12,800	14.4	12,788
Unitary HVAC Measures			**1,588**	**2.6**	**0**	**$111**	**$23,900**	**$0**	**$23,900**	**214.9**	**1,599**
ECM 8	Install High Efficiency Air Conditioning Units	No	1,588	2.6	0	$111	$23,900	$0	$23,900	214.9	1,599
HVAC System Improvements			**0**	**0.0**	**13**	**$177**	**$140**	**$20**	**$120**	**0.7**	**1,500**
ECM 9	Install Pipe Insulation	Yes	0	0.0	13	$177	$140	$20	$120	0.7	1,500
Domestic Water Heating Upgrade			**0**	**0.0**	**28**	**$391**	**$710**	**$280**	**$430**	**1.1**	**3,310**
ECM 10	Install Low-Flow DHW Devices	Yes	0	0.0	28	$391	$710	$280	$430	1.1	3,310
Food Service & Refrigeration Measures			**7,588**	**0.7**	**60**	**$1,355**	**$13,300**	**$1,290**	**$12,010**	**8.9**	**14,623**
ECM 11	Food Service Equipment Replacement	Yes	0	0.0	60	$824	$5,600	$1,000	$4,600	5.6	6,981
ECM 12	Refrigerator/Freezer Case Electrically Commutated Motors	Yes	1,133	0.1	0	$79	$740	$80	$660	8.3	1,141
ECM 13	Refrigeration Controls	No	1,878	0.0	0	$131	$4,120	$160	$3,960	30.1	1,891
ECM 14	Replace Refrigeration Equipment	Yes	3,026	0.3	0	$212	$2,300	$0	$2,300	10.9	3,047
ECM 15	Vending Machine Control	Yes	1,551	0.2	0	$109	$540	$50	$490	4.5	1,562
Custom Measures			**-16,413**	**0.0**	**224**	**$1,947**	**$4,700**	**$0**	**$4,700**	**2.4**	**9,700**
ECM 16	Replace Gas Fired Water Heater with Heat Pump Water Heater	Yes	-16,413	0.0	224	$1,947	$4,700	$0	$4,700	2.4	9,700
TOTALS (COST EFFECTIVE MEASURES)			**88,035**	**19.6**	**320**	**$10,589**	**$81,910**	**$7,470**	**$74,440**	**7.0**	**126,135**
TOTALS (ALL MEASURES)			**102,744**	**23.7**	**320**	**$11,618**	**$134,390**	**$7,880**	**$126,510**	**10.9**	**140,943**

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

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

All Evaluated Energy Improvements[3]

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

[3] TRC bases estimated material and labor costs primarily on RS Means cost manuals as well as on our experience at similar facilities. This approach is based on standard cost estimating manuals and is vendor neutral. Cost estimates include material and labor pricing associated with one for one equipment replacements. Cost estimates do not include demolition or removal of hazardous waste. The actual implementation costs for energy savings projects are anticipated to be significantly higher based on the specific conditions at your site(s). We strongly recommend that you work with your design engineer or contractor to develop actual project costs for your specific scope of work for the installation of high efficiency equipment. We encourage you to obtain multiple estimates when considering measure installations.

1.1 Planning Your Project

Careful planning makes for a successful energy project. When considering this scope of work, you will have some decision 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

Utility-run energy efficiency programs and 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.

Options from Your Utility Company

Prescriptive and Custom Rebates

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 Prescriptive and Custom Rebates 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 may be required for some incentives. Contact your utility company for more details prior to project installation.

Direct Install

The Direct Install program provides turnkey installation of multiple measures through an authorized contractor. This program can provide incentives up to 70% or 80% of the cost of selected measures. A Direct Install contractor will assess and verify individual measure eligibility and perform the installation work. The Direct Install program is available to sites with an average peak demand of less than 200 kW.

Engineered Solutions

The Engineered Solutions program provides tailored energy-efficiency assistance and turnkey engineering.
services to municipalities, universities, schools, hospitals, and healthcare facilities (MUSH), non-profit entities, and multifamily buildings. The program provides all professional services from audit, design, construction administration, to commissioning and measurement and verification for custom whole-building energy-efficiency projects. Engineered Solutions 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.

For more details on these programs please contact your utility provider.

Options from New Jersey's Clean Energy Program

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 and Power (CHP)

The CHP program provides incentives for combined heat and power (i.e., 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.

Successor Solar Incentive Program (SuSI)

New Jersey is committed to supporting solar energy. Solar projects help the state reach the renewable goals outlined in the state's Energy Master Plan. The SuSI program is used to register and certify solar projects in New Jersey. Rebates are not available, but certified solar projects are able to earn one SREC II (Solar Renewable Energy Certificates II) for each megawatt-hour of solar electricity produced from a qualifying solar facility.

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.

Large Energy User Program (LEUP)

LEUP is designed to promote self-investment in energy efficiency for the largest energy consumers in the state. Customers in this category spend about $5 million a year on energy bills. This program incentivizes owners/users of buildings to upgrade or install energy conserving measures in existing buildings to help offset the capital costs associated with the project. The efficiency upgrades are customized to meet the requirements of the customers' existing facilities, while advancing the State's energy efficiency, conservation, and greenhouse gas reduction goals.

For more details on these programs please visit New Jersey's Clean Energy Program website.

2 Existing Conditions

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Roosevelt Intermediate 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.

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 March 19, 2024, TRC performed an energy audit at Roosevelt Intermediate School located in Westfield, New Jersey. TRC met with Sean McArthur to review the facility operations and help focus our investigation on specific energy-using systems.

The Roosevelt Intermediate School is a three-story, 95,000 square foot building built in 1926. Spaces include classrooms, gymnasium, auditorium, offices, cafeteria, commercial kitchen, restrooms, locker rooms, corridors, stairwells, an elevator, storage spaces, and various mechanical spaces.

Most of the lighting has already been converted to LED.

2.2 Building Occupancy

The facility is occupied Monday through Friday during regular business hours. Janitorial services are performed after hours.

The school is fully occupied year-round, but there is lower occupancy in July and August for summer programs and maintenance. Typical weekday occupancy is 52 staff and 307 students during the school year. There are no weekend activities.

Building Name	Weekday/Weekend	Operating Schedule
Roosevelt Intermediate School	Weekday	7:00 AM - 6:00 PM
	Weekend	Closed

Building Occupancy Schedule

2.3 Building Envelope

The walls are made of concrete masonry units (CMUs) with a brick veneer and gypsum drywall or painted CMU interior finish with drop ceilings. During the audit, parts of the façade were currently under renovation.

The roof is flat and covered in modified bitumen roofing and is in fair condition with patches. The site has roof mounted solar panels.

Most of the windows are double glazed and have aluminum frames. 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 solid with small windows set in aluminum frames and are in good condition with undamaged door seals. Degraded window and door seals increase drafts and outside air infiltration.

Roof

Exterior Under Construction Roof

Exterior

Exterior Door

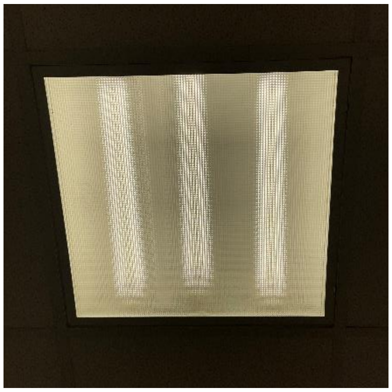
2.4 Lighting Systems

The primary interior lighting system uses 14.5-Watt linear LED T8 lamps. There are also several 32-Watt T8 linear and U-bend fluorescent fixtures. Fixture types include 2-lamp or 4-lamp, 4-foot long recessed, surface mounted, or pendant fixtures. Fixtures have a mix of prismatic and parabolic lens. Typically, T8 fluorescent lamps use electronic ballasts.

Most of the linear fixtures have been converted to operate LED tube lamps, with the majority of non-LED lighting being in less used spaces such as storage and mechanical rooms. Additionally, there are some compact fluorescent lamps (CFL) and LED general purpose A19 lamps. The high bay fixtures in the auditorium and gymnasium are manually controlled LED lamps. Exit signs are a mix of LED and incandescent units.

Most fixtures are in good condition. Interior lighting levels were generally sufficient.

Pendant Parabolic



2-foot x 2-foot Recessed Prismatic

Surface Mounted Troffers

CFL Grow Lights

CFL Pin Lamp Canopy Fixture

Ceiling Sconce

Interior lighting fixtures are primarily controlled by wall switches. Some corridors, stairwells, restrooms, and storage rooms have occupancy sensors.

Occupancy Sensor

Exterior fixtures include CFL and LED wall packs, LED canopy lights, and LED spots.

Exterior light fixtures are controlled by a time clock.

LED Canopy Fixture

LED Wall Pack

CFL Wall Pack

LED Spot

2.5 Air Handling Systems

Unit Ventilators

Unit ventilators and fan coil units provide heating and ventilation to classrooms and corridors. Units are equipped with supply fan motors, pneumatically controlled outside air dampers, and fan coil valves connected to the hot water or steam distribution system. A handful of units also have DX coils and provide cooling through a split system ACs. Most are older Nesbit units which appear to be in fair operating condition. A few of the units are relatively newer and have cooling coils as well.

Classroom Unit Ventilator

Ceiling Mounted Unit Ventilator

Unitary Electric HVAC Equipment

Classrooms and offices are generally cooled with window air conditioning (AC) units. These vary in capacity and efficiency. Most unit nameplates were not accessible at the time of the audit, so capacities, efficiencies and equipment ages were often estimated. The units are in good or fair condition. Some are ENERGY STAR labeled, while others are beyond what is typically considered useful life.

ENERGY STAR Window AC

Window AC

The auditorium is conditioned by a ductless mini-split heat pump. It has a cooling capacity of 3.79 tons and 18.60 SEER. The heating capacity is 52 MBh with an 8.5 HSPF. The unit was installed in 2017 and is in good condition though the DX line set insulation was in poor condition.

Mini-Split HP

Unitary Heating Equipment

The elevator mechanical room is heated by a suspended electric resistance heater. Capacity was estimated for the audit. The unit is in good condition. Equipment is controlled by a manual dial thermostat.

Electric Unit Heater

Packaged Units

The building is partially conditioned by three package units. These are controlled by the school district's central BAS. These units are equipped with economizers that are in good condition.

Two units are 15-ton, 15 SEER Daikon packaged units with natural gas heating sections rated at a nominal 80% thermal efficiency. Each have a constant speed 8 hp supply motors; 4 hp return fans; two, 1 hp condenser fans; and 0.17 hp energy recovery wheel motor. The units were installed in 2017 and are in good condition.

The third unit is a 3-ton 15 SEER Trane packaged unit with natural gas heating section rated at a nominal 80$ thermal efficiency. It has a constant speed 4 hp supply motor and 1 hp condenser fan. The unit was installed in 2021 and is in good condition.

Refer to Appendix A for detailed information about each unit.

Trane Packaged Unit

Trane Packaged Unit

Daikon Packaged Unit

Daikon Packaged Unit

Air Handling Units (AHUs)

The building has two air handling units (AHUs) which supply heating and ventilation to various spaces. Supply fan motors are constant speed. The motor nameplates were illegible at the time of the audit and estimated at 2 hp each. Motors are beyond what is typically considered useful life.

Steam pipe connected to the unit are partially uninsulated.

The building also has two lab fume hoods in science classrooms and a few pendant air filtration units in room 120.

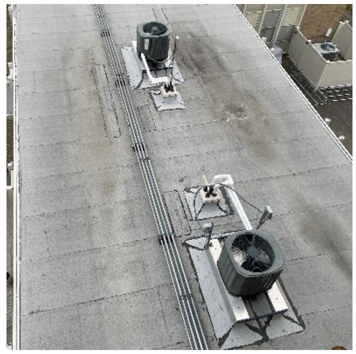
Various spaces have wall-mounted terminal units served by five outdoor split system DX condensing units. Condensing units vary in capacity from 3 tons to 10 tons. The two relatively newer Trane units were inaccessible at the time of the audit, so capacity and efficiencies were estimated. The older units are just beyond what is typically considered useful life but are in fair condition.

AHU

AHU Motor

Lab Fume Hood

Condensing Unit



Inaccessible Condensing Unit

Condensing Unit

Split Terminal Unit

Split Terminal Unit

Air Filtration–Room 120

2.6 Heating Hot Water and Steam Systems

The heating load for most of the building is served by two EASCO 5,021 MBh steam boilers. The burners are fully modulating with a nominal efficiency of 82%. The boilers are configured in an automated lead-lag control scheme. Only one boiler is required under high load conditions. Replaced in 2017, units are in fair condition. The steam system is served by two, 1 hp condensate pumps; which alternate automatically; three, 0.75 boiler feed water pumps; and two, 1.5 hp vacuum pumps. Motors are constant speed and operate lead/lag.

Steam and heating hot water terminal units include unit ventilators, fan coil units, AHUs, and radiators. Staff did not voice concerns about the state of the steam traps.

Two AERCO 1,410 MBh condensing hot water boilers serve the hot water sections of the building. The burners are fully modulating with a nominal efficiency of 94 percent. The boilers are configured in an automated lead-lag control scheme. Only one boiler is required under high load conditions. Boilers are in good condition. The hydronic distribution system is a two-pipe, heating only system. Boilers serve a primary-only distribution system with VFD controlled 3 hp heating hot water pumps operating in lead/lag fashion.

HHW and steam pipes are insulated, and insulations is in good to fair condition.

Boilers and HVAC systems are primarily controlled by facilities BAS, but still many systems have pneumatic controls operated by two sets of 2 hp air compressors with only two units operating in high load conditions. There is a service contract in place for all four boilers.

On the day of the audit, hot water supply temperature was set to 146°F.

Steam Boilers

Condensate Pumps

Condensing HHW Boiler

HHW Boilers and Pipe Insulation

HHW Circulation Pumps

HHW Pump VFDs

2.7 Building Automation System (BAS)

The facility-wide BAS controls the boilers, air handlers, and package unit. The BAS provides equipment scheduling control and monitors and controls space temperatures, supply air temperatures, humidity, and heating water loop temperatures.

2.8 Domestic Hot Water

Hot water is produced by a 100 gallon, 199 MBh condensing storage water heater with an efficiency of 97%. The unit was installed in 2017 and is in good condition.

At the time of the site visit, the domestic water heater tank temperature and operating setpoint were 140°F.

One, 0.04 hp circulation pump circulates water to end uses. The circulation pump operates continuously. Circulation pump is controlled by aquastat.

The domestic hot water pipes are insulated, and the insulation is in good condition.

Condensing Hot Water Heater

DHW Circulation Pump

2.9 Food Service Equipment

The kitchen has a mix of gas and electric equipment that is used to prepare lunch for students at this school as well as others in the town. Most cooking is done using a gas-fired oven. Bulk prepared foods are held in several electric holding cabinets. Most equipment is not high efficiency and is in good or fair condition. One of the holding cabinets is ENERY STAR certified.

The dishwasher is an ENERGY STAR high temperature, single tank conveyer type unit. It is equipped with a 15 kW and a 30-kW electric booster.

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

Rack Oven

Oven and Stove Top

ENERGY STAR Holding Cabinet

Dishwasher

2.10 Refrigeration

The kitchen has several stand-up refrigerators with either solid or glass doors. There are two freezer chests as well as many refrigerator chests. Equipment is standard efficiency except for one of the solid door refrigerators. Units are in good condition.

The walk-in refrigerator and freezer have split system condensing units, with poorly insulated piping. Capacities were estimated at 1 ton and 1.5 tons, respectively, each with one fan evaporator. No known evaporator fan or electric defrost controls.

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

Walk-in Freezer

Stand-up

Ice Maker

Walk-in Compressors

Freezer Chest

2.11 Plug Load and Vending Machines

The location is doing a great job managing the electrical plug loads. This report makes additional suggestions for ECMs in this area as well as energy efficient best practices.

There are 96 computer workstations throughout the facility. There are two computer labs. Plug loads include general cafe and office equipment. There are classroom typical loads such as televisions, projectors, and fans.

Some specialized classrooms have specialty equipment including two, 11 kW ceramic art kilns, multiple 3D printers, and one laser cutter.

The kitchen has a washer and dryer for laundry.

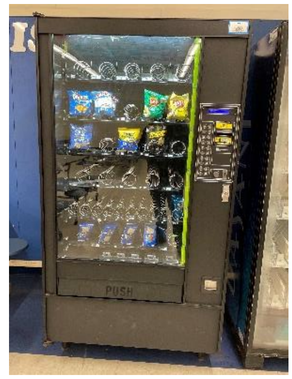
There are several residential-style refrigerators and many mini refrigerators throughout the building that are used to store student and staff snacks and lunch. These vary in condition and efficiency.

There is one refrigerated beverage vending machine and one non-refrigerated vending machine. Vending machines are not equipped with occupancy-based controls.

The building also has a number of other motors. There is an elevator motor, sump pumps, and four, 2 hp Quincy air compressors used for pneumatic HVAC controls.

Elevator Motor

Art Kiln



Vending Machine

Air Compressor

Sump Pumps

3D Printer

2.12 Water-Using Systems

Water is mainly provided by a municipal water supply company.

Potable water is used for drinking, cleaning, cooking, sanitary fixtures, make up water for the steam boiler heating system, and laundry.

Water leaks were not observed/reported.

EPA WaterSense® has set maximum flow rates for sanitary fixtures. They are: 1.28 gallons per flush (gpf) for toilets, 0.5 gpf for urinals, 1.5 gallons per minute (gpm) for lavatory faucets, and 2.0 gpm for showerheads. There are 25 restrooms with toilets, urinals, and sinks. Faucet flow rates are at 2.0 gpm or higher.

The locker rooms have 11 showerheads that are infrequently used.

The site has a commercial kitchen is equipped with pre-rinse sprayers, commercial ice maker, and ENERGY STAR dishwasher.

Classrooms and break areas have faucets estimated to have 2.0 gpm or 2.2 gpm flow rates.

Restroom Faucet

Showerhead

Residential Clothes Washer

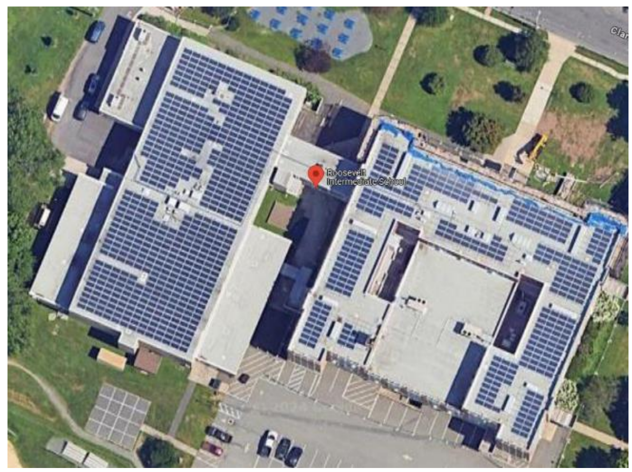
Pre-Rinse Sprayer

2.13 On-Site Generation

The Roosevelt Intermediate School has a 275-kW photovoltaic (PV) array with approximately 847 panels that was installed in 2017. This system provides approximately 34% of the electricity used.

Solar Array

Solar Array



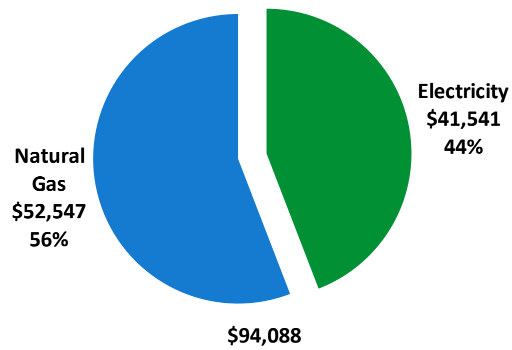
Inverter

Aerial View

3 Energy Use and Costs

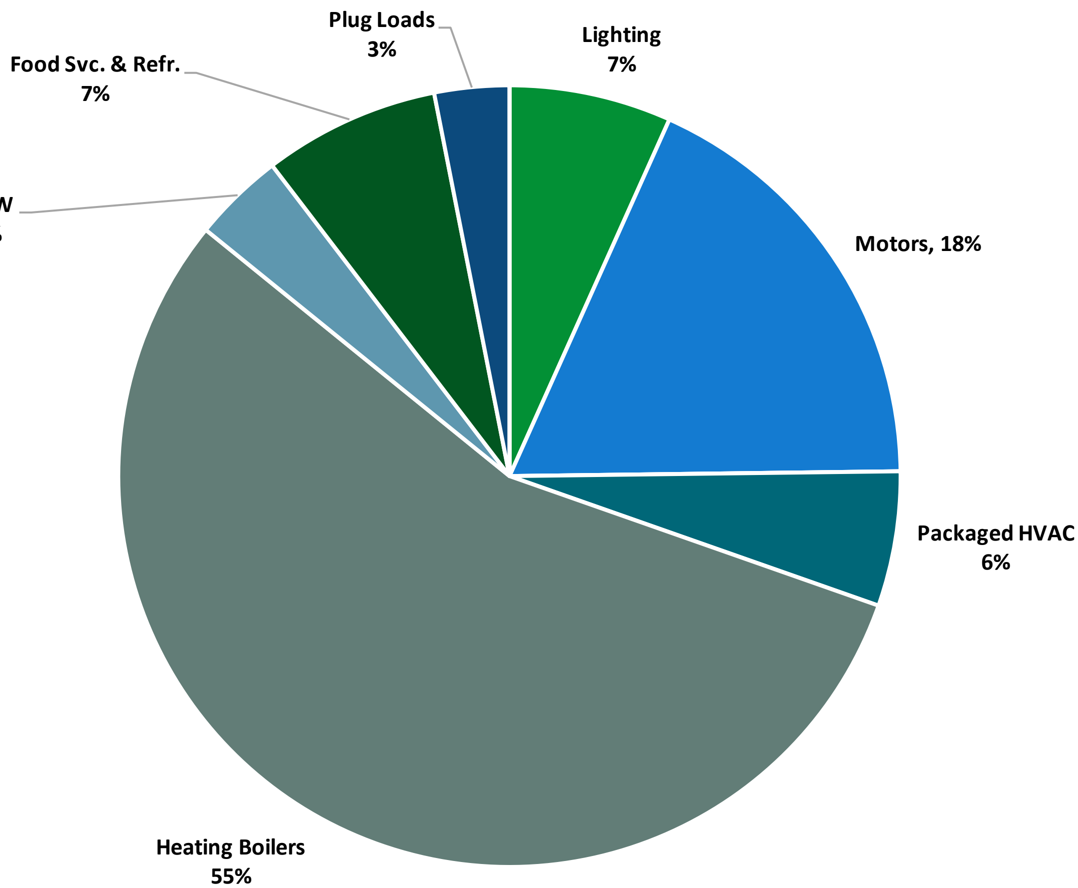
Twelve months of utility billing data are used to develop annual energy consumption and cost data. This information creates a profile of the annual energy consumption and energy costs.

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	593,340 kWh	$41,541
Natural Gas	38,013 Therms	$52,547
Total		**$94,088**



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.

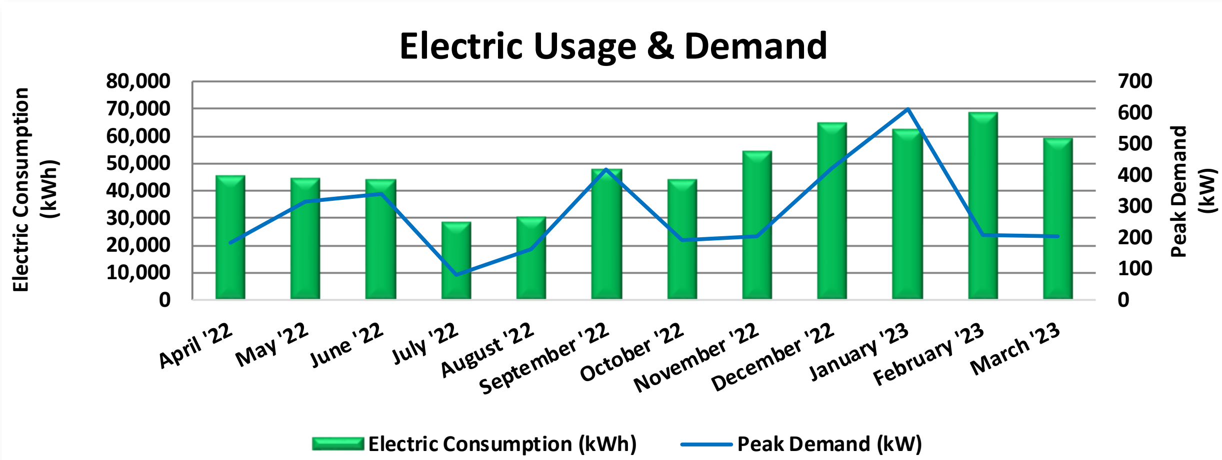
The energy auditor collects information regarding equipment operating hours, capacity, efficiency, and other operational parameters from facility staff, drawings, and on-site observations. This information is used as the inputs to calculate the existing conditions energy use for the site. The calculated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



Energy Balance by System

3.1 Electricity

PSE&G delivers electricity under rate class Large Power & Lighting Secondary (LPLS).



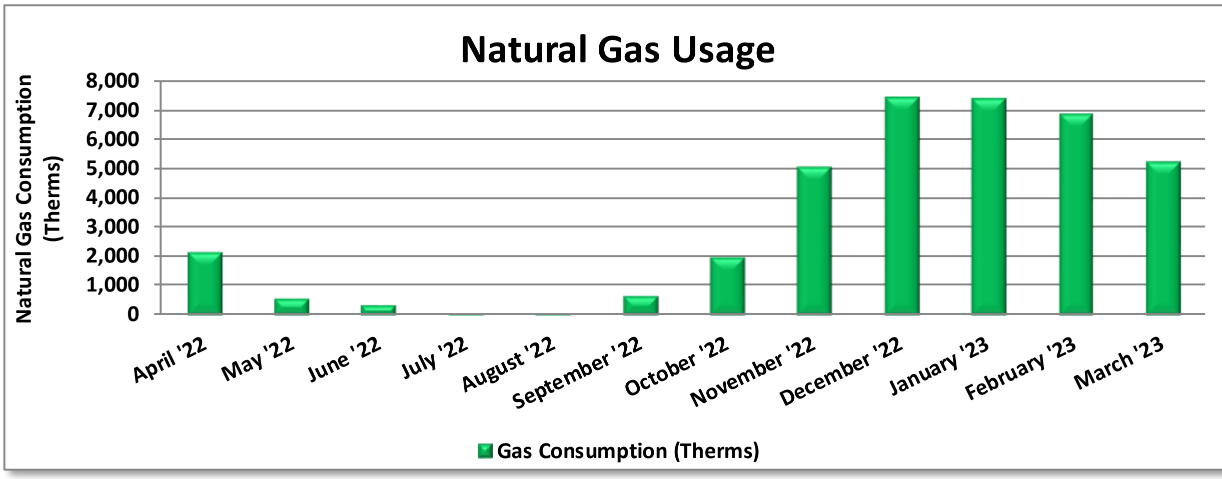
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
4/26/22	32	45,674	183	$691	$1,911
5/24/22	28	44,667	315	$597	$2,866
6/24/22	31	44,143	342	$2,278	$3,370
7/26/22	32	28,628	80	$1,078	$1,465
8/24/22	29	30,454	163	$1,007	$1,513
9/23/22	30	48,093	418	$2,834	$3,882
10/24/22	31	44,376	191	$854	$2,682
11/22/22	29	54,694	205	$914	$3,719
12/23/22	31	65,035	422	$943	$5,478
1/25/23	33	62,629	614	$915	$5,417
2/24/23	30	68,650	209	$933	$5,383
3/27/23	31	59,549	206	$920	$4,084
Totals	**367**	**596,592**	**614**	**$13,966**	**$41,769**
Annual	**365**	**593,340**	**614**	**$13,890**	**$41,541**

Notes:

- Peak demand of 614 kW occurred in January '23.
- Average demand over the past 12 months was 279 kW.
- The average electric cost over the past 12 months was $0.070/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.
- As the Auditorium is conditioned by a heat pump, winter months is partially electric heating. Heating season related pumps, and other HVAC equipment cause a spike in electric use in winter months greater than cooling season AC electric use.
- Electric is partially supplied by on-site solar.

3.2 Natural Gas

Elizabethtown Gas delivers natural gas under rate class General Delivery Service - Transportation (GDSADDQFT), with natural gas supply provided by Direct Energy, a third-party supplier.



Gas Billing Data			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
5/5/22	29	2,166	$3,110
6/7/22	33	587	$1,469
7/4/22	27	353	$883
8/8/22	35	29	$767
9/7/22	30	38	$825
10/6/22	29	686	$1,849
11/4/22	29	2,008	$3,314
12/6/22	32	5,089	$6,640
1/6/23	31	7,479	$10,158
2/6/23	31	7,423	$9,347
3/7/23	29	6,893	$8,251
4/6/23	30	5,263	$5,933
Totals	**365**	**38,013**	**$52,547**
Annual	**365**	**38,013**	**$52,547**

Notes:

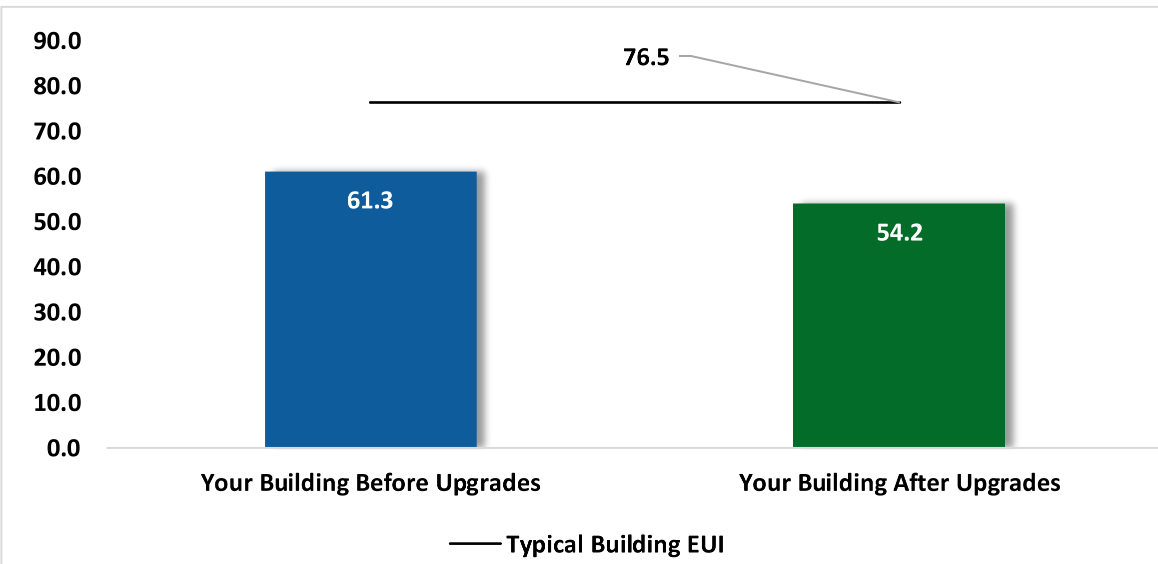
- The average gas cost for the past 12 months is $1.382/therm, which is the blended rate used throughout the analysis.
- Building heating is primarily natural gas. Natural gas is also used in domestic hot water for restrooms, cleaning, and commercial food service equipment, all of which drop off significantly in July and August when students are not present.

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	70



Energy Use Intensity Comparison[4]

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.

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. Several factors can cause a building to vary from 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.

[4] Based on all evaluated ECMs

Tracking your Energy Performance

Keeping track of your energy and water use on a monthly basis is one of the best ways to keep utility costs in check and keep your facility operating efficiently. 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 have already entered the monthly utility data shown above for you. Account login information for your account will be sent via email.

Free online training is available to help you use ENERGY STAR Portfolio Manager to track your building's performance at: https://www.energystar.gov/buildings/training.

For more information on ENERGY STAR and Portfolio Manager, visit their website.

3.4 Understanding Your Utility Bills

The State of New Jersey Department of the Public Advocate provides detailed information on how to read natural gas and electric bills. Your bills contain important information including account numbers, meter numbers, rate schedules, meter readings, and the supply and delivery charges. Gas and electric bills both provide comparisons of current energy consumption with prior usage.

Sample bills, with annotation, may be viewed at:
https://www.nj.gov/rpa/docs/Understanding_Electric_Bill.pdf
https://www.nj.gov/rpa/docs/Understanding_Gas_Bill.pdf

Why Utility Bills Vary

Utility bills vary from one month to another for many reasons. For this reason, assessing the effects of your energy savings efforts can be difficult.

Billing periods vary, typically ranging between 28 and 33 days. Electric bills provide the kilowatt-hours (kWh) used per month while gas bills provide therms (or hundreds of cubic feet - CCF) per month consumption information. Monthly consumption information can be helpful as a tool to assess your efforts to reduce energy, particularly when compared to monthly usage from a similar calendar period in a prior year.

Bills typically vary seasonally, often with more gas consumed in the winter for heating, and more electricity used in the summer when air conditioning is used. Facilities with electric heating may experience higher electricity use in the winter. Seasonal variance will be impacted by the type of heating and cooling systems used. Normal seasonal fluctuations are further impacted by the weather. Extremely cold or hot weathers causes HVAC equipment to run longer, increasing usage. Other monthly fluctuations in usage can be caused by changes in building occupancy. Utility bills provide a comparison of usage between the current period and comparable billing month period of the prior year. Year-to-year monthly use comparisons can point to trends with energy savings for measures/projects that were implemented within the timeframe, but these comparisons do not account for changing weather of occupancy patterns.

The price of fuel and purchased power used to produce and delivery electricity and gas fluctuates. Any increase or decrease in these costs will be reflected in your monthly bill. Additionally, billing rates occasionally change after justification and approval of the NJBPU. For this reason, it is more useful to review energy use rather than cost when assessing energy use trends or the impact of energy conservation measures implemented.

4 Energy Conservation Measures

The goal of this audit report is to identify and evaluate potential energy efficiency improvements and provide information about the cost effectiveness of those improvements. Most energy conservation measures have received preliminary analysis of feasibility, which identifies expected ranges of savings. 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 in this report are based on the previously run state rebate program SmartStart, which has been retired. Now, all investor-owned gas and electric utility companies are offering complementary energy efficiency programs directly to their customers. Some measures and proposed upgrades may be eligible for higher incentives than those shown below. The incentives in the summary tables should be used for high-level planning purposes. To verify incentives, reach out to your utility provider or visit the NJCEP website for more information.

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 ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**15,316**	**2.9**	**-3**	**$1,030**	**$5,980**	**$160**	**$5,820**	**5.6**	**15,066**
ECM 1	Retrofit Fixtures with LED Lamps	Yes	8,840	2.5	-2	$595	$3,510	$160	$3,350	5.6	8,703
ECM 2	Install LED Exit Signs	Yes	6,475	0.5	-1	$435	$2,470	$0	$2,470	5.7	6,362
Lighting Control Measures			**7,390**	**2.0**	**-2**	**$496**	**$6,860**	**$1,030**	**$5,830**	**11.8**	**7,261**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	7,219	2.0	-2	$485	$6,300	$780	$5,520	11.4	7,093
ECM 4	Install High/Low Lighting Controls	No	171	0.0	0	$11	$560	$250	$310	27.1	168
Motor Upgrades			**11,072**	**1.4**	**0**	**$775**	**$23,900**	**$0**	**$23,900**	**30.8**	**11,150**
ECM 5	Premium Efficiency Motors	No	11,072	1.4	0	$775	$23,900	$0	$23,900	30.8	11,150
Variable Frequency Drive (VFD) Measures			**76,202**	**14.0**	**0**	**$5,335**	**$54,900**	**$5,100**	**$49,800**	**9.3**	**76,735**
ECM 6	Install VFDs on Constant Volume (CV) Fans	Yes	63,503	9.3	0	$4,446	$40,100	$3,100	$37,000	8.3	63,947
ECM 7	Install Boiler Draft Fan VFDs	Yes	12,699	4.7	0	$889	$14,800	$2,000	$12,800	14.4	12,788
Unitary HVAC Measures			**1,588**	**2.6**	**0**	**$111**	**$23,900**	**$0**	**$23,900**	**214.9**	**1,599**
ECM 8	Install High Efficiency Air Conditioning Units	No	1,588	2.6	0	$111	$23,900	$0	$23,900	214.9	1,599
HVAC System Improvements			**0**	**0.0**	**13**	**$177**	**$140**	**$20**	**$120**	**0.7**	**1,500**
ECM 9	Install Pipe Insulation	Yes	0	0.0	13	$177	$140	$20	$120	0.7	1,500
Domestic Water Heating Upgrade			**0**	**0.0**	**28**	**$391**	**$710**	**$280**	**$430**	**1.1**	**3,310**
ECM 10	Install Low-Flow DHW Devices	Yes	0	0.0	28	$391	$710	$280	$430	1.1	3,310
Food Service & Refrigeration Measures			**7,588**	**0.7**	**60**	**$1,355**	**$13,300**	**$1,290**	**$12,010**	**8.9**	**14,623**
ECM 11	Food Service Equipment Replacement	Yes	0	0.0	60	$824	$5,600	$1,000	$4,600	5.6	6,981
ECM 12	Refrigerator/Freezer Case Electrically Commutated Motors	Yes	1,133	0.1	0	$79	$740	$80	$660	8.3	1,141
ECM 13	Refrigeration Controls	No	1,878	0.0	0	$131	$4,120	$160	$3,960	30.1	1,891
ECM 14	Replace Refrigeration Equipment	Yes	3,026	0.3	0	$212	$2,300	$0	$2,300	10.9	3,047
ECM 15	Vending Machine Control	Yes	1,551	0.2	0	$109	$540	$50	$490	4.5	1,562
Custom Measures			**-16,413**	**0.0**	**224**	**$1,947**	**$4,700**	**$0**	**$4,700**	**2.4**	**9,700**
ECM 16	Replace Gas Fired Water Heater with Heat Pump Water Heater	Yes	-16,413	0.0	224	$1,947	$4,700	$0	$4,700	2.4	9,700
TOTALS			**102,744**	**23.7**	**320**	**$11,618**	**$134,390**	**$7,880**	**$126,510**	**10.9**	**140,943**

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

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

All Evaluated ECMs

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**15,316**	**2.9**	**-3**	**$1,030**	**$5,980**	**$160**	**$5,820**	**5.6**	**15,066**
ECM 1	Retrofit Fixtures with LED Lamps	8,840	2.5	-2	$595	$3,510	$160	$3,350	5.6	8,703
ECM 2	Install LED Exit Signs	6,475	0.5	-1	$435	$2,470	$0	$2,470	5.7	6,362
Lighting Control Measures		**7,219**	**2.0**	**-2**	**$485**	**$6,300**	**$780**	**$5,520**	**11.4**	**7,093**
ECM 3	Install Occupancy Sensor Lighting Controls	7,219	2.0	-2	$485	$6,300	$780	$5,520	11.4	7,093
Variable Frequency Drive (VFD) Measures		**76,202**	**14.0**	**0**	**$5,335**	**$54,900**	**$5,100**	**$49,800**	**9.3**	**76,735**
ECM 6	Install VFDs on Constant Volume (CV) Fans	63,503	9.3	0	$4,446	$40,100	$3,100	$37,000	8.3	63,947
ECM 7	Install Boiler Draft Fan VFDs	12,699	4.7	0	$889	$14,800	$2,000	$12,800	14.4	12,788
HVAC System Improvements		**0**	**0.0**	**13**	**$177**	**$140**	**$20**	**$120**	**0.7**	**1,500**
ECM 9	Install Pipe Insulation	0	0.0	13	$177	$140	$20	$120	0.7	1,500
Domestic Water Heating Upgrade		**0**	**0.0**	**28**	**$391**	**$710**	**$280**	**$430**	**1.1**	**3,310**
ECM 10	Install Low-Flow DHW Devices	0	0.0	28	$391	$710	$280	$430	1.1	3,310
Food Service & Refrigeration Measures		**5,710**	**0.7**	**60**	**$1,224**	**$9,180**	**$1,130**	**$8,050**	**6.6**	**12,731**
ECM 11	Food Service Equipment Replacement	0	0.0	60	$824	$5,600	$1,000	$4,600	5.6	6,981
ECM 12	Refrigerator/Freezer Case Electrically Commutated Motors	1,133	0.1	0	$79	$740	$80	$660	8.3	1,141
ECM 14	Replace Refrigeration Equipment	3,026	0.3	0	$212	$2,300	$0	$2,300	10.9	3,047
ECM 15	Vending Machine Control	1,551	0.2	0	$109	$540	$50	$490	4.5	1,562
Custom Measures		**-16,413**	**0.0**	**224**	**$1,947**	**$4,700**	**$0**	**$4,700**	**2.4**	**9,700**
ECM 16	Replace Gas Fired Water Heater with Heat Pump Water Heater	-16,413	0.0	224	$1,947	$4,700	$0	$4,700	2.4	9,700
TOTALS		**88,035**	**19.6**	**320**	**$10,589**	**$81,910**	**$7,470**	**$74,440**	**7.0**	**126,135**

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

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

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 ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**15,316**	**2.9**	**-3**	**$1,030**	**$5,980**	**$160**	**$5,820**	**5.6**	**15,066**
ECM 1	Retrofit Fixtures with LED Lamps	8,840	2.5	-2	$595	$3,510	$160	$3,350	5.6	8,703
ECM 2	Install LED Exit Signs	6,475	0.5	-1	$435	$2,470	$0	$2,470	5.7	6,362

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 is 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: Retrofit Fixtures with LED Lamps

Replace fluorescent 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. Be sure to specify replacement lamps that are compatible with existing dimming controls, where applicable. In some circumstances, you may need to upgrade your dimming system for optimum performance.

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: storage spaces, locker rooms, auditorium, cafeteria/kitchen, mechanical, restrooms, library, offices, and exterior CFL wall packs

ECM 2: Install LED Exit Signs

Replace incandescent or compact fluorescent exit signs with LED exit signs. LED exit signs require virtually no maintenance and have a life expectancy of at least 20 years. This measure saves energy by installing LED fixtures, which use less power than other technologies with an equivalent lighting output. Maintenance savings and improved reliability may also be achieved, as the longer-lasting LED lamps will not need to be replaced as often as the existing lamps. There are about 28 non-LED exit signs.

4.2 Lighting Controls

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**7,390**	**2.0**	**-2**	**$496**	**$6,860**	**$1,030**	**$5,830**	**11.8**	**7,261**
ECM 3	Install Occupancy Sensor Lighting Controls	7,219	2.0	-2	$485	$6,300	$780	$5,520	11.4	7,093
ECM 4	Install High/Low Lighting Controls	171	0.0	0	$11	$560	$250	$310	27.1	168

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.

More areas were originally considered but eliminated due to long payback.

Affected Building Areas: locker rooms, offices, library, cafeteria/kitchen, and room 120

ECM 4: Install High/Low Lighting Controls

High/Low lighting controls were evaluated.

We evaluated installing 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 considered when selecting retrofit lamps and bulbs for the areas proposed for high/low control.

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 occupants approach the area.

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

Affected Building Areas: corridor CFL and LED fixtures not currently on occupancy sensors

4.3 Motors

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Motor Upgrades		**11,072**	**1.4**	**0**	**$775**	**$23,900**	**$0**	**$23,900**	**30.8**	**11,150**
ECM 5	Premium Efficiency Motors	11,072	1.4	0	$775	$23,900	$0	$23,900	30.8	11,150

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.

The school district is considering replacing most of the old fan coil units at this site. The primary savings from replacing fan coil units will be from improved fan motor efficiency; however, those savings are unlikely to justify replacing the fan coils. The next potential savings would be from installing fan coils that provide for more optimal use of outside air than the existing fan coil units.

The potential savings from installing new fan coils with electronically commutated (EC) motors was evaluated. EC motors are generally more efficient than other fractional hp motors and have the capability of operating at variable speeds. In general, replacing the fan coils should be considered a capital improvement measure that has the potential to provide energy savings and improve occupant comfort.

Affected Motors:

Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Additional Motor Description
Corridor 1	Corridor 1	2	Fan Coil Unit	0.3	Fan Coil Unit
Dining Area/Kitchen	Dining Area/Kitchen	1	Fan Coil Unit	0.2	Unit Ventilator
Locker Rooms	Locker Rooms	3	Fan Coil Unit	0.2	Unit Ventilator
Offices 1	Offices 1	1	Fan Coil Unit	0.2	Unit Ventilator
Various Stairs	Various Stairs	10	Fan Coil Unit	0.3	Unit Ventilator
Storage 10	Storage 10	1	Fan Coil Unit	0.3	Unit Ventilator
Storage 11	Storage 11	1	Fan Coil Unit	0.3	Unit Ventilator
Corridor 2	Corridor 2	2	Fan Coil Unit	0.3	Fan Coil Unit
Storage 6	Storage 6	1	Fan Coil Unit	0.3	Fan Coil Unit
Storage 7	Storage 7	1	Fan Coil Unit	0.3	Fan Coil Unit
Teachers Lounge	Teachers Lounge	1	Fan Coil Unit	0.3	Fan Coil Unit
Corridor 3	Corridor 3	2	Fan Coil Unit	0.3	Fan Coil Unit
First Floor Classrooms	First Floor Classrooms	8	Fan Coil Unit	0.2	Unit Ventilator
Second Floor Classrooms	Second Floor Classrooms	22	Fan Coil Unit	0.2	Unit Ventilator
Third Floor Classrooms	Third Floor Classrooms	20	Fan Coil Unit	0.2	Unit Ventilator

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 ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**76,202**	**14.0**	**0**	**$5,335**	**$54,900**	**$5,100**	**$49,800**	**9.3**	**76,735**
ECM 6	Install VFDs on Constant Volume (CV) Fans	63,503	9.3	0	$4,446	$40,100	$3,100	$37,000	8.3	63,947
ECM 7	Install Boiler Draft Fan VFDs	12,699	4.7	0	$889	$14,800	$2,000	$12,800	14.4	12,788

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.

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

Affected Motors:

Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Additional Motor Description
Corridor 1	Corridor 1	2	Fan Coil Unit	0.3	Fan Coil Unit
Dining Area/Kitchen	Dining Area/Kitchen	1	Fan Coil Unit	0.2	Unit Ventilator
Locker Rooms	Locker Rooms	3	Fan Coil Unit	0.2	Unit Ventilator
Offices 1	Offices 1	1	Fan Coil Unit	0.2	Unit Ventilator
Various Stairs	Various Stairs	10	Fan Coil Unit	0.3	Unit Ventilator
Storage 10	Storage 10	1	Fan Coil Unit	0.3	Unit Ventilator
Storage 11	Storage 11	1	Fan Coil Unit	0.3	Unit Ventilator

Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Additional Motor Description
Corridor 2	Corridor 2	2	Fan Coil Unit	0.3	Fan Coil Unit
Storage 6	Storage 6	1	Fan Coil Unit	0.3	Fan Coil Unit
Storage 7	Storage 7	1	Fan Coil Unit	0.3	Fan Coil Unit
Teachers Lounge	Teachers Lounge	1	Fan Coil Unit	0.3	Fan Coil Unit
Corridor 3	Corridor 3	2	Fan Coil Unit	0.3	Fan Coil Unit
First Floor Classrooms	First Floor Classrooms	8	Fan Coil Unit	0.2	Unit Ventilator
Second Floor Classrooms	Second Floor Classrooms	22	Fan Coil Unit	0.2	Unit Ventilator
Third Floor Classrooms	Third Floor Classrooms	20	Fan Coil Unit	0.2	Unit Ventilator

ECM 7: Install Boiler Draft Fan VFDs

Replace existing volume control devices on boiler draft fans, such as inlet vanes or dampers, with VFDs. Inlet vanes or dampers are an inefficient means of controlling the air volume compared to VFDs. The existing volume control device will be removed or permanently disabled, and the control signal will be redirected to the VFD to determine proper fan motor speed.

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

Additional maintenance savings may result from this measure. VFDs are solid state electronic devices, which generally require less maintenance than mechanical air volume control devices.

Affected Units: steam boiler burners

4.5 Unitary HVAC

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Unitary HVAC Measures		**1,588**	**2.6**	**0**	**$111**	**$23,900**	**$0**	**$23,900**	**214.9**	**1,599**
ECM 8	Install High Efficiency Air Conditioning Units	1,588	2.6	0	$111	$23,900	$0	$23,900	214.9	1,599

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 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 older window ACs are eventually replaced, consider purchasing equipment that exceeds the minimum efficiency required by building codes.

ECM 8: Install High Efficiency Air Conditioning Units

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

Affected Units: older window air conditioners

4.6 HVAC Improvements

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
HVAC System Improvements		**0**	**0.0**	**13**	**$177**	**$140**	**$20**	**$120**	**0.7**	**1,500**
ECM 9	Install Pipe Insulation	0	0.0	13	$177	$140	$20	$120	0.7	1,500

ECM 9: Install Pipe Insulation

Install insulation on steam system piping. Distribution system thermal losses are dependent on system fluid temperature, the size of the distribution system, and the extent and condition of piping insulation. When the insulation has been damaged due to exposure to water, when the insulation has been removed from some areas of the pipe, or when valves have not been properly insulated, system thermal efficiency can be significantly reduced. This measure saves energy by reducing heat transfer in the distribution system.

Affected Systems: bare steam pipes in room with AHUs

4.7 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**0**	**0.0**	**28**	**$391**	**$710**	**$280**	**$430**	**1.1**	**3,310**
ECM 10	Install Low-Flow DHW Devices	0	0.0	28	$391	$710	$280	$430	1.1	3,310

ECM 10: 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
Faucet aerator (kitchen)	1.5 gpm
Showerhead	2.0 gpm
Pre-rinse spray valve (kitchen)	1.28 gpm

Low-flow devices reduce the overall water flow from the fixture, while still providing adequate pressure for washing.

4.8 Food Service and Refrigeration Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Food Service & Refrigeration Measures		**7,588**	**0.7**	**60**	**$1,355**	**$13,300**	**$1,290**	**$12,010**	**8.9**	**14,623**
ECM 11	Food Service Equipment Replacement	0	0.0	60	$824	$5,600	$1,000	$4,600	5.6	6,981
ECM 12	Refrigerator/Freezer Case Electrically Commutated Motors	1,133	0.1	0	$79	$740	$80	$660	8.3	1,141
ECM 13	Refrigeration Controls	1,878	0.0	0	$131	$4,120	$160	$3,960	30.1	1,891
ECM 14	Replace Refrigeration Equipment	3,026	0.3	0	$212	$2,300	$0	$2,300	10.9	3,047
ECM 15	Vending Machine Control	1,551	0.2	0	$109	$540	$50	$490	4.5	1,562

ECM 11: Food Service Equipment Replacement

Buildings that use a lot of food service equipment are often among the most energy-intensive commercial buildings. Replace existing food service equipment with new, high-efficiency equipment. Consider replacing the following equipment with high efficiency or ENERGY STAR labeled versions:

Location	Quantity	Equipment Type	Manufacturer	Model
Kitchen	1	Gas Rack Oven (Single)	Cyclone	

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

ECM 12: Refrigerator/Freezer Case Electrically Commutated Motors

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

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

ECM 13: Refrigeration Controls

We evaluated installation of additional controls to optimize the operation of walk-in coolers and freezers.

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

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

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

ECM 14: Replace Refrigeration Equipment

Replace existing commercial freezer chests 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.

ECM 15: Vending Machine Control

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

4.9 Custom Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Custom Measures		**-16,413**	**0.0**	**224**	**$1,947**	**$4,700**	**$0**	**$4,700**	**2.4**	**9,700**
ECM 16	Replace Gas Fired Water Heater with Heat Pump Water Heater	-16,413	0.0	224	$1,947	$4,700	$0	$4,700	2.4	9,700

ECM 16: Replace Gas Fired Water Heater with Heat Pump Water Heater

We evaluated replacing existing gas water heater with a heat pump water heater (HPWH).

A gas fired water heater uses a burner to heat water. Air source heat pump water heaters use a refrigeration cycle to transfer heat from the surrounding air to the domestic water. Water heater efficiency is rated by the uniform energy factor (UEF). For a relative comparison of water heater UEFs, the criteria for certifying a water heater in the ENERGY STAR program are provided below. These values indicate that HPWH heaters are significantly more efficient than gas fired water heaters.

There are two types of HPWH: those integrated with the heat pump and storage tank in the same unit, and those that are split into two sections (with the storage tank separate from the heat pump). The measure considers an integrated HPWH.

ENERGY STAR Uniform Energy Factor (UEF) Criteria for Certified Water Heaters *

Water Heater Type	*Minimum UEF*	*Other*
Integrated HPWH	3.3	
Integrated HPWH	2.2	120 Volt, 15 Amp circuit
Split System HPWH	2.2	
Gas Fired Storage	0.64	≤ 55-gal, Medium Draw
Gas Fired Storage	0.68	≤ 55-gal, High Draw Pattern
Gas Fired Storage	0.78	> 55-gal, Medium Draw
Gas Fired Storage	0.80	> 55-gal, High Draw Pattern
Gas Fired Storage	0.80	Residential Duty
Gas Fired Instantaneous	0.87	

Note: Uniform Energy Factor (UEF): The newest measure of water heater overall efficiency. The higher the UEF value is, the more efficient the water heater. UEF is determined by the Department of Energy's test method outlined in 10 CFR Part 430, Subpart B, Appendix E.[5]

[5] https://www.energy.gov/sites/prod/files/2014/06/f17/rwh_tp_final_rule.pdf

HPWH reject cold air. As such, they need to be installed in an unconditioned space of about 750 cubic feet with good ventilation[6]. Ideal locations are garages, large enclosed, unconditioned storage areas, or areas with excess heat such as a furnace or boiler room. The HPWH will also produce condensate so accommodations for draining the condensate need to be provided.

Most HPWH operate effectively down to an air temperature of 40 °F. Below that temperature, an electric resistance booster heater is typically required to achieve full heating capacity. It is critical that the HPWH controls are set up so that the electric resistance heat only engages when the air temperature is too cold for the HPWH to extract heat from it. HPWHs have a slow recovery. During periods of high demand, the electric resistance heating element, if enabled, may be energized to maintain set point, thus reducing the overall efficiency of the unit. It is recommended that a careful analysis of the hot water demand be conducted to determine if the application makes economic sense, and the HPWH heating capacity and storage are properly sized.

HPWH operate most effectively when the temperature difference between the incoming and outgoing water is high. Generally, this means that cold make-up water should be piped to the bottom of the tank and return water should be piped to the top of the tank to maintain stratification within the storage tank. Water should be drawn from the bottom of the tank to be heated. If there is a DHW recirculation pump, it should only be operated during high hot water demand periods.

Switching from a gas fired water heater to a HPWH has the potential to reduce the sites overall greenhouse gas emissions. If the electricity for the HPWH is provided by an on-site photovoltaic (PV) system, then there are essentially no greenhouse gas (GHG) emissions. A 2016 study conducted at Cornell[7] calculated the kg of methane (CH_4) and carbon dioxide (CO_2) produced per GJ of water heated. The study compared HPWH to gas and electric fired, storage and tankless water heaters. The study also considered electricity produced from natural gas and coal fired electric plants. In all cases the study found that HPWHs produced less methane than all of the other water heaters. The study also found that HPWH produced less carbon dioxide than electric resistance water heaters but more carbon dioxide than tankless gas water heaters and about the same amount of carbon dioxide as storage gas water heaters. The summary tables provide the reduction in CO2 equivalent emissions based on the typical New Jersey electric utility.

4.10 Measures for Future Consideration

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

Westfield Board of Education may wish to consider the Energy Savings Improvement Program (ESIP) or other 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:

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[6] https://basc.pnnl.gov/code-compliance/heat-pump-water-heaters-code-compliance-brief#:~:text=HPWH%20must%20have%20unrestricted%20airflow,depending%20on%20size%20of%20system

[7] Greenhouse gas emissions from domestic hot water: Heat pumps compared to most commonly used systems. Bongghi Hong, Robert W. Howarth. Department of Ecology and Evolutionary Biology, Cornell University. Energy Science and Engineering 2016.

- 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.

Upgrade/Replace Building Automation System

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

The current generation BAS 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, and 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 BAS 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.

Heating System Conversion from Steam to Hot Water

Replacing the steam boilers with natural gas fired high-efficiency water boilers was of interest to facility personnel. This type of system upgrade/conversion has significant up-front capital costs. However, there are benefits with modular hot water boiler system designs with advanced control strategies. Advantages associated with configuring a boiler plant around several modular boilers include the better system performance at low load conditions, and the modular boilers will often take less space than multiple old large boilers.

Steam and condensate return piping will need to be capped off, removed, or replaced in most cases. If distribution systems are mainly hydronic, replacing a steam boiler will likely be more cost effective than for situations where steam is supplied to the end uses, for instance, where steam coils or fin tube radiators are used. In such cases, end use distribution points will need to be modified to accommodate the circulation of hot water.

As the existing boilers are approaching the end of their useful life, it is recommended that reconfiguring the boiler plant be further evaluated. We recommend that you work with your mechanical design team to select boilers that are sized appropriately for the heating load.

Replacing the boilers has a long payback, and it may not be justifiable based simply on energy considerations. However, the steam boilers were recently replaced but when they near the end of their useful life, since half the building has already been converted to hot water boilers, the facility may be interested in converting from steam to hot water. We also recommend working with your mechanical design team to determine whether a hot water heating system can operate with return water temperatures below 130°F, which would allow for operating condensing boilers at efficiencies above 90%. Energy savings results from improved combustion efficiency and reduced standby losses at low loads. Further analysis should be conducted for the feasibility of this measure. This measure is a capital improvement measure for future consideration.

Upgrade to a Heat Pump System

Electric resistance heating units work by passing an electric current through wires to heat them. The system is 100% efficient since for every unit of electricity consumed, one unit of heat is produced.

But there is a way to convert electricity to create heat at better than a 1:1 ratio. Heat pumps operate on a more efficient principle, the refrigeration cycle. Instead of directly converting electricity to heat, electricity does the work, via a compressor, of moving refrigerant through a system that transfers heat from a cooler place to a warmer place. That system can move three to five as much energy as is available using electric resistance heating methods. Heat pumps work in a similar manner to an air conditioner, except they reverse the cooling process to circulate warm air instead of cold air. Also, heat pumps are generally capable of dispensing refrigerated air as they can typically be operated in air conditioning mode.

Electric resistance heat, including electric furnaces and baseboard heaters, can be inexpensive to install but often expensive to run. Facilities with these systems can save substantial energy at a moderate cost by installing a heat pump when they replace a central air conditioner.

Even in buildings without central air-conditioning, there are opportunities to save energy when an existing electric furnace needs to be replaced, as well as opportunities to install ductless electric heat pumps in buildings with baseboard electric heaters and electric fan coils. Unit ventilators with built-in electric resistance heaters can be replaced with unit ventilators with integrated heat pumps.

Electric heat pumps have high coefficient of performance (COP) ratings and are substantially more efficient than traditional electric heating systems. Further investigation is required to determine whether installing a heat pump system is a cost-effective solution when replacing existing electrical heating systems.

Replace Smooth V-Belts with Notched or Synchronous Belts

This measure is for the replacement of smooth V-belts in non-residential package and split HVAC systems with notched V-belts or for the installation of new equipment with synchronous belts instead of smooth V-belts. Typically, there is a V-belt between the motor and the supply air fan and/or return air fan in larger package and split HVAC systems. In general, there are two styles of grooved V-belts: notched and synchronous. The U.S. Department of Energy (DOE) compares these two types as follows:[8]

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[8] https://www.nrel.gov/docs/fy13osti/56012.pdf US DOE Motor Systems Tip Sheet #5

Characteristic	Notched V-Belts	Synchronous Belts
Description	A notched belt has grooves or notches that run perpendicular to the belt's length, which reduces the bending resistance of the belt.	They are also called cogged, timing, positive-drive, or high-torque drive belts, and are "toothed".
Pulleys/Sprockets	Can use the same pulleys as cross-section standard V-belts	Require the installation of mating grooved sprockets.
Typical Efficiency	Run cooler, last longer, and are about 2% more efficient than standard V-belts.	Operate with a consistent efficiency of 98% and maintain their efficiency over a wide load range.
Constraints	Have a sharp reduction in efficiency at high torque due to increased slippage.	Noisier than V-belts, less suited for use on shock-loaded applications, and transfer more vibration due to their stiffness.
Other Benefits	Lower cost than synchronous belts, overall.	Require minimal maintenance and re-tensioning. Operate in wet and oily environments, and run slip-free

The DOE offers the following suggested actions with respect to investigating the applicability of notched or synchronous V belts:

- Conducted a survey of belt-driven equipment. Gather application and operating-hour data. Then determine the cost effectiveness of replacing existing V-belts with notched belts or synchronous belts and sprockets.
- Consider synchronous belts for all new installations; the price premium is minimal due to the avoidance of conventional pulley costs.
- Consider having a power transmission specialist determine the energy and cost savings potential from retrofitting all V-belt drives with synchronous belts. Synchronous belts rely on tooth grip instead of friction to efficiently transfer power and provide a constant speed ratio.
- Install notched belts where the retrofit of a synchronous belt is not cost effective.

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 5% –20% 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, and planned capital upgrades, and it 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 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 cannot manage what you do not 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[9]. Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

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.

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

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

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.

Thermostat Schedules and Temperature Resets

Use thermostat setback temperatures and schedules to reduce heating and cooling energy use during periods of low or no occupancy. Thermostats should be programmed for a setback of 5°F-10°F during low occupancy hours (reduce heating setpoints and increase cooling setpoints). Cooling load can be reduced by increasing the facility's occupied setpoint temperature. In general, during the cooling season, thermostats should be set as high as possible without sacrificing occupant comfort.

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 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.

Ductwork Maintenance

Duct maintenance has two primary goals: keep the ducts clean to avoid air quality problems and seal leaks to save energy. Check for cleanliness, obstructions that block airflow, water damage, and leaks. Ducts should be inspected at least every two years.

The biggest symptoms of clogged air ducts are differing temperatures throughout the building and areas with limited airflow from supply registers. If a particular air duct is clogged, then air flow will only be cut off to some rooms in the building—not all of them. The reduced airflow will make it more difficult for those areas to reach the temperature setpoint, which will cause the HVAC system to run longer to cool or heat that area properly. If you suspect clogged air ducts, ensure that all areas in front of supply registers are clear of items that may block or restrict air flow, and you should check for fire dampers or balancing dampers that have failed closed.

Duct leakage in commercial buildings can account for 5%–25% of the supply airflow. In the case of rooftop air handlers, duct leakage can occur to the outside of the building wasting conditioned air. Check ductwork for leakage. Eliminating duct leaks can improve ventilation system performance and reduce heating and cooling system operation.

Distribution system losses are dependent on-air system temperature, the size of the distribution system, and the level of insulation of the ductwork. Significant energy savings can be achieved when insulation has not been well maintained. When the insulation is missing or worn, the system efficiency can be significantly reduced. This measure saves energy by reducing heat transfer in the distribution system.

Steam Trap Repair and Replacement

Steam traps are a crucial part of delivering heat from the boiler to the space heating units. Steam traps are automatic valves that remove condensate from the system. If the traps fail closed, condensate can build up in the steam supply side of the trap, which reduces the flow in the steam lines and thermal capacity of the radiators. Or they may fail open, allowing steam into the condensate return lines resulting in wasted energy, water, and hammering. Losses can be significantly reduced by testing and replacing equipment as they start to fail. Repair or replace traps that are blocked or allowing steam to pass. Inspect steam traps as part of a regular steam system maintenance plan.

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 BAS 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 (BAS) typically provide advanced controls for building HVAC systems, including chillers, boilers, air handling units, rooftop units and exhaust fans. The BAS 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 BAS features, when in proper adjustment, can improve comfort for building occupants and save substantial energy.

Know your BAS scheduling capabilities. Regularly monitor HVAC equipment operating schedules and match them to building operating hours 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 BAS (if available) to optimize the building warmup sequence. Most BAS 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.
- Reduce pressure setting to minimum needed for air operated equipment.
- Turn off compressor if not routinely needed.
- Use low pressure blower air rather than high pressure compressed air.

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

Computer Monitor Replacement

ENERGY STAR labeled computer monitors can be up to 25% more efficient than standard monitors. ENERGY STAR rated monitors have power consumption requirements for different operating modes such as on, idle, and sleep.

Procurement Strategies

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

6 WATER BEST PRACTICES

Getting Started

The commercial and institutional sector is the second largest consumer of publicly supplied water in the United States, accounting for 17% of the withdrawals from public water supplies[10]. In New Jersey, excluding water used for power generation, approximately 80% of total water use was attributed to potable supply during the period of 2009 to 2018. Water withdrawals for potable supply have not changed noticeably during the period from 1990 to 2018[11].

Water management planning serves as the foundation for any successful water reduction effort. It is the first step a commercial or institutional facility owner or manager should take to achieve and sustain long-term water savings. Understanding how water is used within a facility is critical for the water management planning process. A water assessment provides a comprehensive account of all known water uses at the facility. It allows the water management team to establish a baseline from which progress and program success can be measured. It also enables the water management team to set achievable goals and identify and prioritize specific projects based on the relative savings opportunities and project cost-effectiveness.

Water conservation devices may significantly reduce your water and sewer usage costs. Any reduction in water use reduces grid-level electricity use since a significant amount of electricity is used to treat and deliver water from reservoirs to end users.

For more information regarding water conservation or additional details regarding the practices shown below go to the EPA's WaterSense website[12] or download a copy of EPA's "WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities"[13] to get ideas for creating a water management plan and best practices for a wide range of water using systems.

Leak Detection and Repair

Identifying and repairing leaks and other water use anomalies within a facility's water distribution system or from processes or equipment can keep a facility from wasting significant quantities of water. Examples of common leaks include leaking toilets and faucets, drip irrigation malfunctions, stuck float valves, and broken distribution lines. Reading meters, installing failure abatement technologies, and conducting visual and auditory inspections are important best practices to detect leaks. Train building occupants, employees, and visitors to report any leaks that they detect. To reduce unnecessary water loss, detected leaks should be repaired quickly. Repairing leaks in water distribution that is pressurized by on-site pumps or in heated or chilled water piping will also reduce energy use.

Toilets and Urinals

Toilets and urinals are considered sanitary fixtures and are found in most facilities. High efficiency fixtures are at least 20% more efficient than available standard products. Leaking or damaged equipment is a substantial source of water waste. Train users to report continuously flushing, leaking, or otherwise improperly operating equipment to the appropriate personnel. Depending on the age of the equipment

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[10] Estimated from analyzing data in: Solley, Wayne B. et al, "Estimated Use of Water in the United States in 1995", U.S Geological Survey Circular 1200, (1998)

[11] https://dep.nj.gov/wp-content/uploads/dsr/trends-water-supply.pdf

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

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

and the frequency of use, it may be cost effective to replace older inefficient fixtures with current generation WaterSense labeled equipment.

Commercial facilities typically use tank toilets or wall-mount flushometers. Educate and inform users with restroom signage and other means to avoid flushing inappropriate objects. For tank toilets, periodically check to ensure fill valves are working properly and that water level is set correctly. Annually test toilets to ensure the flappers are not worn or allowing water to seep from the tank into the bowl and down the sewer. Control stops and piston valves on flushometer toilets should be checked at least annually.

Most urinals use water to flush liquid. These standard single-user fixtures are present in most facilities. Non-water urinals use a specially designed trap that allows liquid waste to drain out of the fixture through a trap seal, and into the drainage system. Flushing urinals should be inspected at least annually for proper valve and sensor operation. For non-water urinals, follow maintenance practices as directed by the manufacturer to ensure products perform as expected. Non-water urinals can be considered during urinal replacement, however, review the condition and design of the existing plumbing system and the expected usage patterns to ensure that these products will provide the anticipated performance.

Faucets and Showerheads

Faucets and showerheads are sanitary fixtures that generally dispense heated water. Reducing water use by these fixtures translates into a reduction of site fuel or electric use depending on how water is heated. High efficiency fixtures are at least 20% more efficient than available standard products. Leaking or damaged equipment is a substantial source of water waste. Train users to report continuously dripping, leaking, or otherwise improperly operating equipment to the appropriate personnel. Depending on the age of the equipment and the frequency of use, it may be cost effective to replace older fixtures with current generation WaterSense labeled equipment.

Faucets are used for a variety of purposes, and standard flow rates are dictated by the intended use. Public use lavatory faucets and kitchen faucets are subject to maximum flow rates while service sinks are not. Periodically inspect faucet aerators for scale buildup to ensure flow is not being restricted. Clean or replace the aerator or other spout end device as needed. Check and adjust automatic sensors (where installed) to ensure they are operating properly to avoid faucets running longer than necessary. Post materials in restrooms and kitchens to ensure user awareness of the facility's water-efficiency goals. Remind users to turn off the tap when they are done and to consider turning the tap off during sanitation activities when it is not being used. Consider installing lavatory and kitchen faucet fixtures with reduced flow. Federal standards limit kitchen and restroom faucet flows to 2.2 gpm. To qualify for a WaterSense label a faucet cannot exceed 1.5 gpm.

Effective in 1992, the maximum allowable flow rate for all showerheads sold in the United States is 2.5 gpm. Since this standard was enacted, many showerheads have been designed to use even less water. WaterSense labeled equipment is designed to use 2.0 gpm, or less. For optimum showerhead efficiency, the system pressure should be tested to make sure that it is between 20 and 80 pounds per square inch (psi). Verify that plumbing lines are routed through a shower valve to prevent water pressure fluctuations. Periodically inspect showerheads for scale buildup to ensure flow is not being restricted. In general, replace showerheads with 2.5 gpm flow rates or higher with WaterSense labeled models. Note: Use of poor performing replacement reduced flow showerheads may result in increased use if the duration of use is increased to compensate for reduced performance. WaterSense labeled showerheads are independently certified to meet or exceed minimum performance requirements for spray coverage and force.

Commercial Kitchen Equipment

Commercial and institutional sectors, including hospitals, offices, and schools, have substantial kitchen water use. Water in food service is used for steam cooking, spray/flow cleaning, dish washing, and ice making. In most commercial kitchens, the commercial dishwasher and pre-rinse spray valve account for over two-thirds of the water use. Newer technologies and better practices are available that can significantly reduce commercial kitchen equipment water and energy use. For example, ENERGY STAR qualified dishwashers and steam cookers are at least 10% more water-efficient and 15% more energy-efficient than standard models. With some models saving significantly more.

Cooking equipment includes combination ovens, steam cookers, and steam kettles. For efficient steam cooking operation, fill vessels to capacity when possible, set temperatures optimally for the process, and keep doors and lids closed while cooking. Replace gaskets to ensure proper sealing and repair leaks. When replacing combination ovens, select connectionless equipment; replace steam cookers with ENERGY STAR rated steam cookers.

Spray/flow cleaning equipment includes dipper wells, pre-rinse spray valves, food disposals, and wash down sprayers. Turn off water when service periods are slow and keep flow rates to minimum level. Train users to scrape food rather than rely on water pressure. Inspect for leaks and scaling. Test system pressure to ensure it is between 20 and 80 pounds per square inch (psi) for optimum flow and performance of spray equipment. For dipper wells, consider installing in-line flow restrictors to reduce flow. Pre-rinse spray valves can be replaced with new assemblies which use 1.3 gpm or less. Washdown sprayers can be equipped with self-closing nozzles or consider mopping/sweeping as an alternative.

Dishwashers range in type and include undercounter, stationary/hood, conveyor, and flight-type models. Only run dishwashers when they are full and fill racks to maximum capacity. Be sure to replace damaged dishwasher racks. Educate staff to scrape dishes prior to loading. Ensure that final rinse pressure and water temperature are within the manufacturer's recommendations. Operate the dishwasher close to or at the minimum flow rate and set rinse cycle time to the manufacturer's minimum recommended settings. Make sure that manual fill valves close completely after the wash tank is filled. Find and repair any leaks. Inspect valves and rinse nozzles for proper operation and repair worn nozzles. Look for ENERGY STAR qualified models when purchasing or leasing a new commercial dishwasher or replacing an existing unit. Consider your kitchen throughput to select an appropriately sized commercial dishwasher since an oversized dishwasher will waste water if the machine is not loaded to capacity.

Ice Machines

Commercial ice machines use refrigeration units to freeze water into ice. Ice machines typically use water for two purposes: cooling the refrigeration unit and making ice. Because the ice-making process generates a significant amount of heat, either water or air is used to remove this waste heat from the ice machine's refrigeration unit.

Water-cooled ice machines generally pass water through the machine once to cool it and then dispose of the single-pass water down the drain. Water-cooled systems can use less water by recirculating the cooling water through a chiller or a cooling tower to lower the temperature, returning the water to the machine for reuse. To eliminate using water to cool the refrigeration unit altogether, air can be used to cool the unit. Air-cooled ice machines use motor-driven fans or centrifugal blowers to move air through the refrigeration unit to remove heat. In general, water-cooled units are more energy efficient than air-cooled units but use more water. Commercial ice machines that are ENERGY STAR qualified are, on average, 15% more energy-efficient and 10% more water-efficient than standard air-cooled models.

For optimal ice machine efficiency, consider the following:

- Clean the ice machine to remove lime and scale buildup; sanitize it to kill bacteria and fungi. Run the self-cleaning sequence if available. For machines without a self-cleaning mode, shut down the machine, empty the bin of ice, add cleaning or sanitizing solution to the machine, switch it to cleaning mode, and then switch it to ice production mode. For health and safety purposes, create and discard several batches of ice to remove residual cleaning solution.
- Keep the ice machine's coils clean to ensure the heat exchange process is running efficiently.
- Keep the lid closed to preserve cool air and maintain the appropriate temperature.
- Install a timer to shift ice production to off-peak hours to decrease peak energy demand.
- Work with the manufacturer to ensure that the ice machine's rinse cycle is set to the lowest possible frequency that still provides sufficient ice quality and meets local water quality and site requirements.
- Follow the manufacturer's use and care instructions for the specific ice machine model.
- Train users to report leaking or otherwise improperly operating ice machines to the appropriate personnel.

If the machine is cooled using single-pass water, modify the machine to operate on a closed loop that recirculates the cooling water through a cooling tower or heat exchanger, if possible.

When replacing an ice machine or installing a new one, ensure that the new model is sized appropriately to fit the facility's need. Choose an ice machine that is appropriate for the quality of ice needed. Producing ice of higher quality than required will use water unnecessarily. Look for ENERGY STAR qualified models, all of which are air-cooled. Also consider air- or water-cooled ice machines that meet the efficiency specifications outlined by the Consortium for Energy Efficiency. If feasible, consider selecting air-cooled flake or nugget ice machines, which use less water and energy than cubed ice machines.

Steam Boiler System

Typically, boilers that produce hot water are closed loop systems and do not have significant water losses as long as there are no leaks in the boiler or distribution piping. Therefore, this section focuses on boilers that produce steam. Steam is typically used for space heating, indirectly to heat domestic water and for process heating.

As steam is distributed, its heat is transferred to the process or the ambient environment and, as a result, the steam condenses to water. This condensate is then either discharged to the sewer or captured and returned to the boiler for reuse.

As water is converted to steam within the boiler, dissolved solids, such as calcium, magnesium, chloride, and silica, are left behind. With evaporation, the total dissolved solids (TDS) concentration increases. If the concentration gets too high, the TDS can cause scale to form within the system or can lead to corrosion. The concentration of TDS is controlled by removing (i.e., blowing down) a portion of the water that has a high concentration of TDS and replacing that water with make-up water, which has a lower concentration of TDS. Some boiler operators practice continuous blowdown by leaving the blowdown valve partially open, requiring a continuous feed of make-up water.

Proper control of boiler blowdown water is critical to ensure efficient boiler operation and minimize make-up water use. Insufficient blowdown can lead to scaling and corrosion, while excessive blowdown wastes water, energy, and chemicals. The optimum blowdown rate is influenced by several factors, including boiler type, operating pressure, water treatment, and quality of make-up water. Generally, blowdown rates range from 4% to 8% of the make-up water flow rate, although they can be as high as 10% if the make-up water is poor quality with high concentrations of solids.

Blowdown is typically assessed and controlled by measuring the conductivity of the boiler make-up water compared to that in the boiler blowdown water. Conductivity provides an indication of the overall TDS concentration in the boiler. The blowdown percentage can be calculated as indicated below. The boiler water quality is often expressed in terms of cycles of concentration, which is the inverse of the blowdown percentage. See figure below.

Blowdown Percentage = Make-up Water Conductivity / Blowdown Conductivity

Blowdown Percentage

Controlling the blowdown percentage and maximizing the cycles of concentration will reduce make-up water use; however, this can only be done within the constraints of the make-up and boiler water chemistry. As the TDS concentration in the blowdown water increases, scaling and corrosion problems can occur, unless carefully controlled.

For optimum steam boiler water efficiency, there are several operations, maintenance, and user education strategies to consider.

- Check steam, hot water, and condensate lines for leaks regularly and make repairs promptly.
- Regularly clean and inspect boiler water and fire tubes.
- Develop and implement an annual boiler tune-up program.
- Provide proper insulation on piping and the central storage tank to conserve heat.
- Implement a steam trap inspection program for boiler systems with condensate recovery. Repair leaking traps as soon as possible.
- Choose a water treatment vendor that will work with you to minimize water use, chemical use, and cost, while maintaining appropriate water chemistry for efficient scale and corrosion control.
- Have the water treatment vendor produce a report every time they evaluate the water chemistry in the boiler. Review the reports to ensure that characteristics, such as conductivity and cycles of concentration, are within the target range.
- To minimize blowdown, calculate and understand the boiler's cycles of concentration.
- Consider pre-treating boiler make-up water to remove impurities, which can increase the cycles of concentration the boiler can achieve.

There are also retrofits to consider if the steam system is not already equipped with these items.

- Install and maintain a condensate recovery system to return condensate to the boiler for reuse. If there already is a condensate recovery system inspect and maintain it regularly to maintain the maximum level of condensate return possible. Maximizing condensate return to the boiler is the most effective way to reduce water use. Recovering condensate:
  - Reduces the amount of make-up water required,
  - Reduces the frequency of blowdown,
  - Reduces boiler fuel use since the temperature of the condensate is considerably higher than the temperature of the make-up water.
- Where condensate cannot be returned to the boiler and must be discharged to the sanitary sewer, consider one of the following options:
  - Installing a heat exchanger to recover heat from the condensate to preheat the make-up water,
  - Install an expansion tank to temper hot condensate rather than adding water to cool it.

- Install an automatic blowdown control system, particularly on boilers that are more than 200 horsepower (6,700 kBtu/hr.), to control the amount and frequency of blowdown rather than relying on continuous blowdown. Control systems with a conductivity controller will initiate blowdown only when the TDS concentrations in the boiler have built up to a specified concentration.
- Install flow meters on the make-up water line and the condensate return line to monitor the amount of make-up water added to the boiler.
- Install automated chemical feed systems to monitor conductivity, control blowdown, and add chemicals based on make-up water flow. These systems minimize water and chemical use while protecting against scale buildup and corrosion.

7 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.

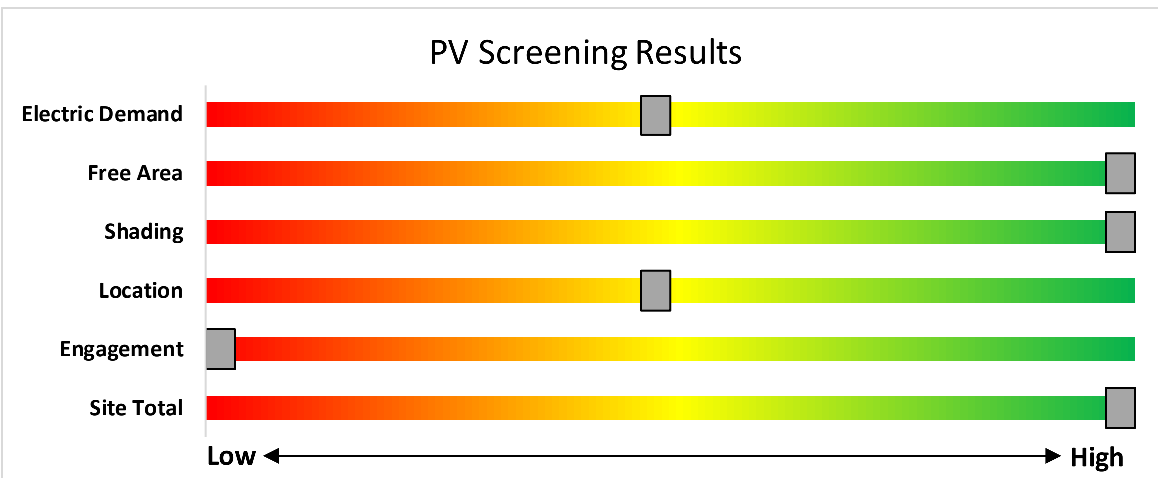
7.1 Solar Photovoltaic

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 for additional installation. PV array expansion located on the roof and ground 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	172	kW DC STC
Electric Generation	204,916	kWh/yr
Displaced Cost	$14,350	/yr
Installed Cost	$581,400	

Photovoltaic Screening

Successor Solar Incentive Program (SuSI)

The SuSI program replaces the SREC Registration Program (SRP) and the Transition Incentive (TI) program. The SuSI program is used to register and certify solar projects in New Jersey. Rebates are not available for solar projects. Solar projects may qualify to earn SREC- IIs (Solar Renewable Energy Certificates-II), however, the project owners must register their solar projects prior to the start of construction to establish the project's eligibility.

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:

- **Successor Solar Incentive Program (SuSI):** https://www.njcleanenergy.com/renewable-energy/programs/susi-program
- **Basic Info on Solar PV in NJ**: http://www.njcleanenergy.com/whysolar
- **NJ Solar Market FAQs**: ww.njcleanenergy.com/renewable-energy/program-updates-and-background-information/solar-transition/solar-market-faqs
- **Approved Solar Installers in the NJ Market**: http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/?id=60&start=1

7.2 Combined Heat and Power

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

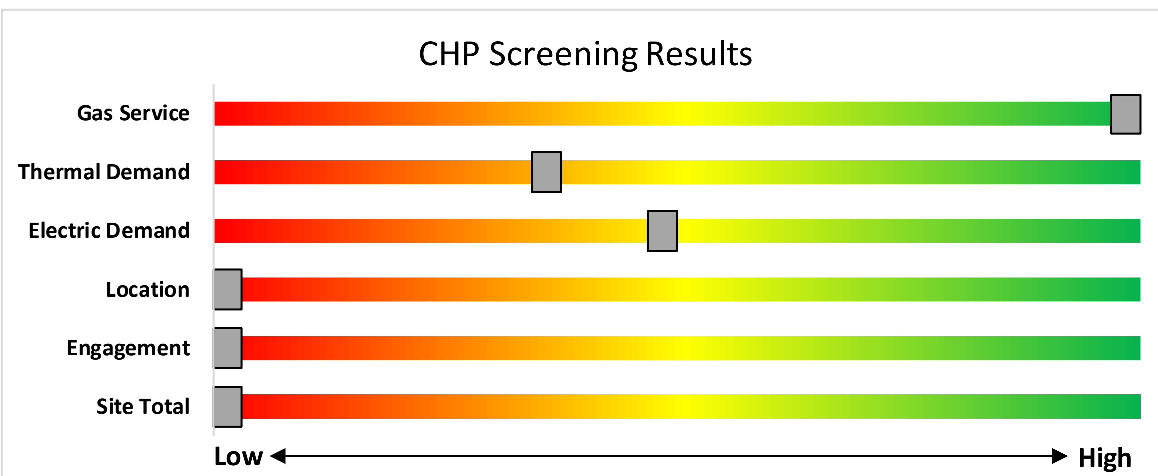
CHP systems typically produce a portion of the electric power used on-site, with the balance of electric power needs supplied by the local utility company. The heat is used to supplement (or replace) existing boilers and provide space heating and/or domestic hot water heating. Waste heat can also be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

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

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

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

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



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/

8 ELECTRIC VEHICLES

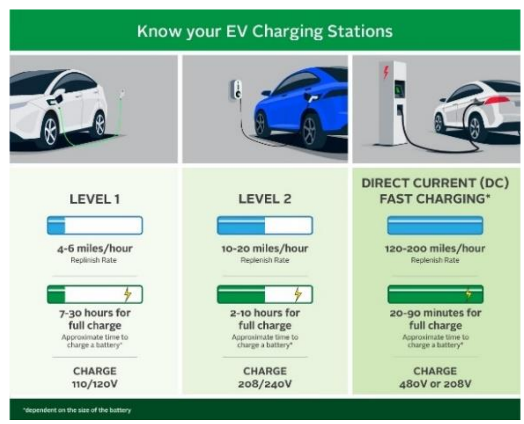
All electric vehicles (EVs) have an electric motor instead of an internal combustion engine. EVs function by plugging into a charge point, taking electricity from the grid, and then storing it in rechargeable batteries. Although electricity production may contribute to air pollution, the U.S. EPA categorizes all-electric vehicles as zero-emission vehicles because they produce no direct exhaust or tailpipe emissions.

EVs are typically more expensive than similar conventional and hybrid vehicles, although some cost can be recovered through fuel savings, federal tax credit, or state incentives.

8.1 EV Charging

EV charging stations provide a means for electric vehicle operators to recharge their batteries at a facility. While many EV drivers charge at home, others do not have access to regular home charging, and the ability to charge at work or in public locations is critical to making EVs practical for more drivers. Charging can also be used for electric fleet vehicles, which can reduce fuel and maintenance costs for fleets that replace gas or diesel vehicles with EVs.

EV charging comes in three main types. For this assessment, the screening considers addition of Level 2 charging, which is most common at workplaces and other public locations. Depending on the site type and usage, other levels of charging power may be more appropriate.



The preliminary assessment of EV charging at the facility shows that there is high potential for adding EV chargers to the facility's parking, based on potential costs of installation and other site factors.

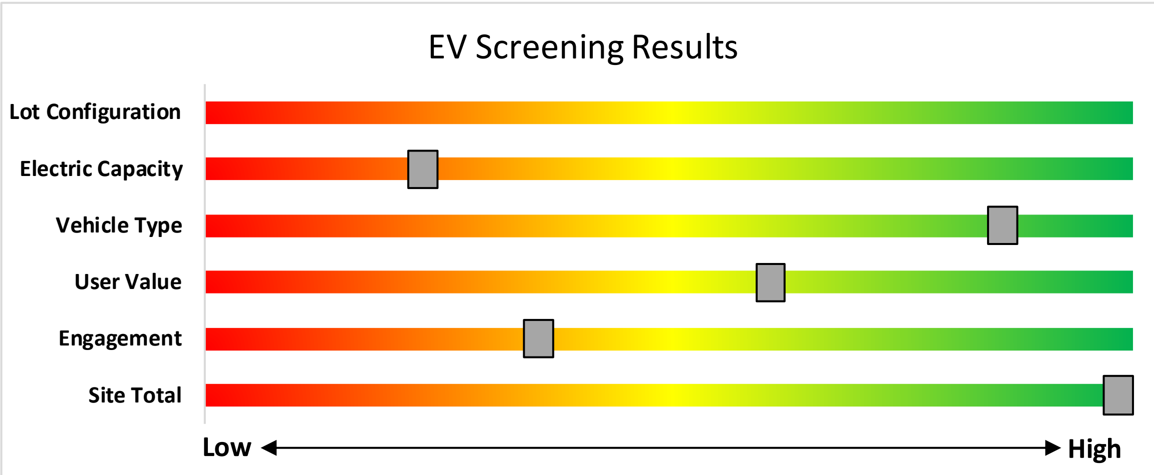
The primary costs associated with installing EV charging are the charger hardware and the cost to extend power from the facility to parking spaces. This may include upgrades to electric panels to serve increased loads.

The type and size of the parking area impact the costs and feasibility of adding EV charging. Parking structure installations can be less costly than surface lot installations as power may be readily available, and equipment and wiring can be surface mounted. Parking lot installations often require trenching through concrete or asphalt surface. Large parking areas provide greater flexibility in charger siting than smaller lots.

The location and capacity of facility electric panels also impact charger installation costs. A Level 2 charger generally requires a dedicated 208-240V, 40 Amp circuit. The electric panel nearest the planned installation may not have available capacity and may need to be upgraded to serve new EV charging loads. Alternatively, chargers could be powered from a more distant panel. The distance from the panel to the location of charging stations ties directly to costs, as conduits, cables, and potential trenching costs all increase on a per-foot basis. The more charging stations planned, the more likely it is that additional electrical capacity will be needed.

Other factors to consider when planning for EV charging at a facility include who the intended users are, how long they park vehicles at the site, and whether they will need to pay for the electricity they use.

The graphic below displays the results of the EV charging assessment conducted as part of this audit. The position of each slider indicates the impact each factor has on the feasibility of installing EV charging at the site.



EV Charger Screening

Electric Vehicle Programs Available

New Jersey is leading the way on electric vehicle (EV) adoption on the East Coast. There are several programs designed to encourage EV adoption in New Jersey, which is crucial to reaching a 100% clean energy future.

NJCEP offers a variety of EV programs for vehicles, charging stations, and fleets. Certain EV charging stations that receive electric utility service from Atlantic City Electric Company (ACE), Public Service Electric and Gas Company (PSE&G) or Jersey Central Power and Light (JCP&L), may be eligible for additional electric vehicle charging incentives directly from the utility. Projects may be eligible for both the incentives offered by this BPU program and incentives offered by ACE, PSE&G or JCP&L, up to 90% of the combined charger purchase and installation costs. Please check ACE, PSE&G or JCP&L program eligibility requirements before purchasing EV charging equipment, as additional conditions on types of eligible chargers may apply for utility incentives.

EV Charging incentive information is available from Atlantic City Electric, PSE&G and JCP&L. For more information and to keep up to date on all EV programs please visit https://www.njcleanenergy.com/commercial-industrial/programs/electric-vehicle-programs

9 Project Funding and Incentives

Ready to improve your building's performance? New Jersey's Clean Energy Programs and Utility Energy Efficiency Programs can help. Pick the program that works best for you. This section provides an overview of currently available incentive programs in New Jersey.

NJBPU and NJCEP Administered Programs

- New Construction (residential, commercial, industrial, government)
- Large Energy Users
- Energy Savings Improvement Program (financing)
- State Facilities Initiative*
- Local Government Energy Audits
- Combined Heat & Power & Fuel Cells

*State facilities are also eligible for utility programs

Utility Administered Programs

- Existing buildings (residential, commercial, industrial, government)
- Efficient Products
  - Lighting & Marketplace
  - HVAC
  - Appliance Rebates
  - Appliance Recycling

9.1 New Jersey's Clean Energy Program

Save money while saving the planet! New Jersey's Clean Energy Program is a statewide program that offers incentives, programs, and services that benefit New Jersey residents, businesses, educational, non-profit, and government entities to help them save energy, money, and the environment.

Large Energy Users

The Large Energy Users Program (LEUP) is designed to foster self-directed investment in energy projects. This program is offered to New Jersey's largest energy customers. To qualify entities must have incurred at least $5 million in total energy costs in the prior fiscal year.

Incentives

Incentives are based on the specifications below. The maximum incentive per entity is the lesser of:

- $4 million
- 75% of the total project(s) cost
- 90% of total NJCEP fund contribution in previous year
- $0.33 per projected kWh saved; $3.75 per projected Therm saved annually.

How to Participate

To participate in LEUP, you will first need submit an enrollment application. This program requires all qualified and approved applicants to submit an energy plan that outlines the proposed energy efficiency work for review and approval. Applicants may submit a Draft Energy Efficiency Plan (DEEP), or a Final Energy Efficiency Plan (FEEP). Once the FEEP is approved, the proposed work can begin.

Detailed program descriptions, instructions for applying, and applications can be found at http://www.njcleanenergy.com/LEUP.

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[14]

Eligible Technology	Size (Installed Rated Capacity)	Incentive ($/Watt)[5]	% of Total Cost Cap per Project	$ Cap per Project
CHPs powered by non-renewable or renewable fuel source, or a combination:[4] - Gas Internal Combustion Engine - Gas Combustion Turbine - Microturbine Fuel Cells ≥60%	≤500 kW[1]	$2.00	30-40%[2]	$2 million
	>500 kW - 1 MW[1]	$1.00		
	> 1 MW - 3 MW[1]	$0.55	30%	$3 million
	>3 MW[1]	$0.35		
Fuel Cells ≥40%	Same as above[1]	Applicable amount above	30%	$1 million
Waste Heat to Power (WHP)[3] Powered by non-renewable fuel source. Heat recovery or other mechanical recovery from existing equipment utilizing new electric generation equipment (e.g. steam turbine)	≤1MW[1]	$1.00	30%	$2 million
	> 1MW[1]	$.50	30%	$3 million

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1 Incentives are tiered, which means the incentive levels vary based upon the installed rated capacity, as listed in the chart above. For example, a 4 MW CHP system would receive $2.00/watt for the first 500 kW, $1.00/watt for the second 500 kW, $0.55/watt for the next 2 MW and $0.35/watt for the last 1 MW (up to the caps listed).

2 The maximum incentive will be limited to 30% of total project. For CHP projects up to 1 MW, this cap will be increased to 40% where a cooling application is used or included with the CHP system (e.g. absorption chiller).

3 Projects will be eligible for incentives shown above, not to exceed the lesser of % of total project cost per project cap or maximum $ per project cap. Projects installing CHP or FC with WHP will be eligible for incentive shown above, not to exceed the lesser caps of the CHP or FC incentive. Minimum efficiency will be calculated based on annual total electricity generated, utilized waste heat at the host site (i.e. not lost/rejected), and energy input.

4 Systems fueled by a Class 1 Renewable Fuel Source, as defined by N.J.A.C. 14:8-2.5, are eligible for a 30% incentive bonus. If the fuel is mixed, the bonus will be prorated accordingly. For example, if the mix is 60/40 (60% being a Class 1 renewable), the bonus will be 18%. This bonus will be included in the final performance incentive payment, based on system performance and fuel mix consumption data. Total incentive, inclusive of bonus, shall not exceed above stipulated caps.

5 CHP-FC systems located at Critical Facility and incorporating blackstart and islanding technology are eligible for a 25% incentive bonus. This bonus incentive will be paid with the second/Installation incentive payment. Total incentive, inclusive of bonus, shall not exceed above stipulated caps.

How to Participate

You will 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 http://www.njcleanenergy.com/CHP.

Successor Solar Incentive Program (SuSI)

The SuSI program replaces the SREC Registration Program (SRP) and the Transition Incentive (TI) program. The program is used to register and certify 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 SREC-IIs (Solar Renewable Energy Certificates-II). SuSI consists of two sub-programs. The Administratively Determined Incentive (ADI) Program and the Competitive Solar Incentive (CSI) Program.

Administratively Determined Incentive (ADI) Program

The ADI Program provides administratively set incentives for net metered residential projects, net metered non-residential projects 5 MW or less, and all community solar projects.

After the registration is accepted, construction is complete, and a complete final as-built packet has been submitted, the project is issued a New Jersey certification number, which enables it to generate New Jersey SREC- IIs.

Market Segments	Size MW dc	Incentive Value ($/SREC II)	Public Entities Incentive Value - $20 Adder ($/SRECII)
Net Metered Residential	All types and sizes	$90	N/A
Small Net Metered Non-Residential located on Rooftop, Carport, Canopy and Floating Solar	Projects smaller than 1 MW	$100	$120
Large Net Metered Non-Residential located on Rooftop, Carport, Canopy and Floating Solar	Projects 1 MW to 5 MW	$90	$110
Small Net Metered Non-Residential Ground Mount	Projects smaller than 1 MW	$85	$105
Large Net Metered Non-Residential Ground Mount	Projects 1 MW to 5 MW	$80	$100
LMI Community Solar	Up to 5 MW	$90	N/A
Non-LMI Community Solar	Up to 5 MW	$70	N/A
Interim Subsection (t)	All types and sizes	$100	N/A

Eligible projects may generate SREC-IIs for 15 years following the commencement of commercial operations which is defined as permission to operate (PTO) from the Electric Distribution Company. After 15 years, projects may be eligible for a NJ Class I REC.

SREC-IIs will be purchased monthly by the SREC-II Program Administrator who will allocate the SREC-IIs 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.

The ADI Program online portal is now open to new registrations.

Competitive Solar Incentive (CSI) Program

The CSI Program opened on April 15, 2023, and will serve as the permanent program within the SuSI Program providing incentives to larger solar facilities. The CSI Program is open to qualifying grid supply solar facilities, non-residential net metered solar installations with a capacity greater than five (5) megawatts ("MW"), and to eligible grid supply solar facilities installed in combination with energy storage.

CSI eligible facilities will only be allowed to register in the CSI program upon award of a bid pursuant to N.J.A.C. 14:8-11.10.

The CSI program structure has separate categories, or tranches, to ensure that a range of solar project types, including those on preferred sites, are able to participate despite potentially different project cost profiles. The Board has approved four tranches for grid supply and large net metered solar and an additional fifth tranche for storage in combination with grid supply solar. The following table lists procurement targets for the first solicitation:

Tranche	Project Type	MW (dc) Targets
Tranche 1.	Basic Grid Supply	140
Tranche 2.	Grid Supply on the Built Environment	80
Tranche 3.	Grid Supply on Contaminated Sites and Landfills	40
Tranche 4.	Net Metered Non- Residential	40
Tranche 5.	*Storage Paired with Grid	160 MWh

*The storage tranche of 160 MWh corresponds to a 4-hour storage pairing of 40 MW of solar

Solar projects help the State of New Jersey reach renewable energy goals outlined in the state's Energy Master Plan.

If you are considering installing solar on your building, visit the following link for more information: https://njcleanenergy.com/renewable-energy/programs/susi-program

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 contracts to help finance building energy upgrades. Annual payments are lower than the savings projected from the energy conservation measures (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 can begin. The ESP demonstrates that the total project costs of the ECMs are offset by the energy savings over the financing term, not to exceed 15 years. The verified savings will then be used to pay for the financing.

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

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

Demand Response (DR) Energy Aggregator

Demand Response Energy Aggregator is a program designed to reduce the electric load when electric wholesale prices are high or when the reliability of the electric grid is threatened due to peak demand. Grid operators call upon curtailment service providers and commercial facilities to reduce electric usage during times of peak demand, making the grid more reliable and reducing transmission costs for all ratepayers. Curtailment service providers provide regular payments to medium and large consumers of electric power for their participation in DR programs. Program participation is voluntary, and participants receive payments whether or not their facility is called upon to curtail its electric usage.

Typically, an electric customer must be capable of reducing their electric demand, within minutes, by at least 100 kW or more in order to participate in a DR program. Customers with greater capability to quickly curtail their demand during peak hours receive higher payments. Customers with back-up generators on site may also receive additional DR payments for their generating capacity if they agree to run the generators for grid support when called upon. Eligible customers who have chosen to participate in DR programs often find it to be a valuable source of revenue for their facility, because the payments can significantly offset annual electric costs.

Participating customers can often quickly reduce their peak load through simple measures, such as temporarily raising temperature setpoints on thermostats (so that air conditioning units run less frequently) or agreeing to dim or shut off less critical lighting. This usually requires some level of building automation and controls capability to ensure rapid load reduction during a DR curtailment event. DR program participants may need to install smart meters or may need to also sub-meter larger energy-using equipment, such as chillers, to demonstrate compliance with DR program requirements.

DR does not include the reduction of electricity consumption based on normal operating practice or behavior. For example, if a company's normal schedule is to close for a holiday, the reduction of electricity due to this closure or scaled-back operation is not considered a DR activity in most situations.

The first step toward participation in a DR program is to contact a curtailment service provider. A list of these providers is available on the website of the independent system operator, PJM, and it includes contact information for each company, as well as the states where they have active business[15]. PJM also posts training materials for program members interested in specific rules and requirements regarding DR activity along with a variety of other DR program information[16].

Curtailment service providers typically offer free assessments to determine a facility's eligibility to participate in a DR program. They will provide details regarding program rules and requirements for metering and controls, assess a facility's ability to temporarily reduce electric load, and provide details on payments to be expected for participation in the program. Providers usually offer multiple options for DR to larger facilities, and they may also install controls or remote monitoring equipment of their own to help ensure compliance with all terms and conditions of a DR contract.

[15] http://www.pjm.com/markets-and-operations/demand-response.aspx.

[16] http://www.pjm.com/training/training-events.aspx.

9.2 Utility Energy Efficiency Programs

The Clean Energy Act, signed into law by Governor Murphy in 2018, requires New Jersey's investor-owned gas and electric utilities to reduce their customers' use by set percentages over time. To help reach these targets the New Jersey Board of Public Utilities approved a comprehensive suite of energy efficiency programs to be run by the utility companies.

Prescriptive and Custom

The Prescriptive and Custom rebate program through your utility provider 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.

Equipment Examples

Lighting
Lighting Controls
HVAC Equipment
Refrigeration
Gas Heating
Gas Cooling
Commercial Kitchen Equipment
Food Service Equipment
Variable Frequency Drives
Electronically Commutate Motors
Variable Frequency Drives
Plug Loads Controls
Washers and Dryers
Agricultural
Water Heating

The Prescriptive program provides fixed incentives for specific energy efficiency measures. Prescriptive incentives vary by equipment type. The Custom program provides incentives for more unique or specialized technologies or systems that are not addressed through prescriptive incentives.

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 or less 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.

How to Participate

To participate in Direct Install, you will work with a participating contractor. 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 Direct Install program, subject to program rules and eligibility, while the remaining percent of the cost is paid to the contractor by the customer.

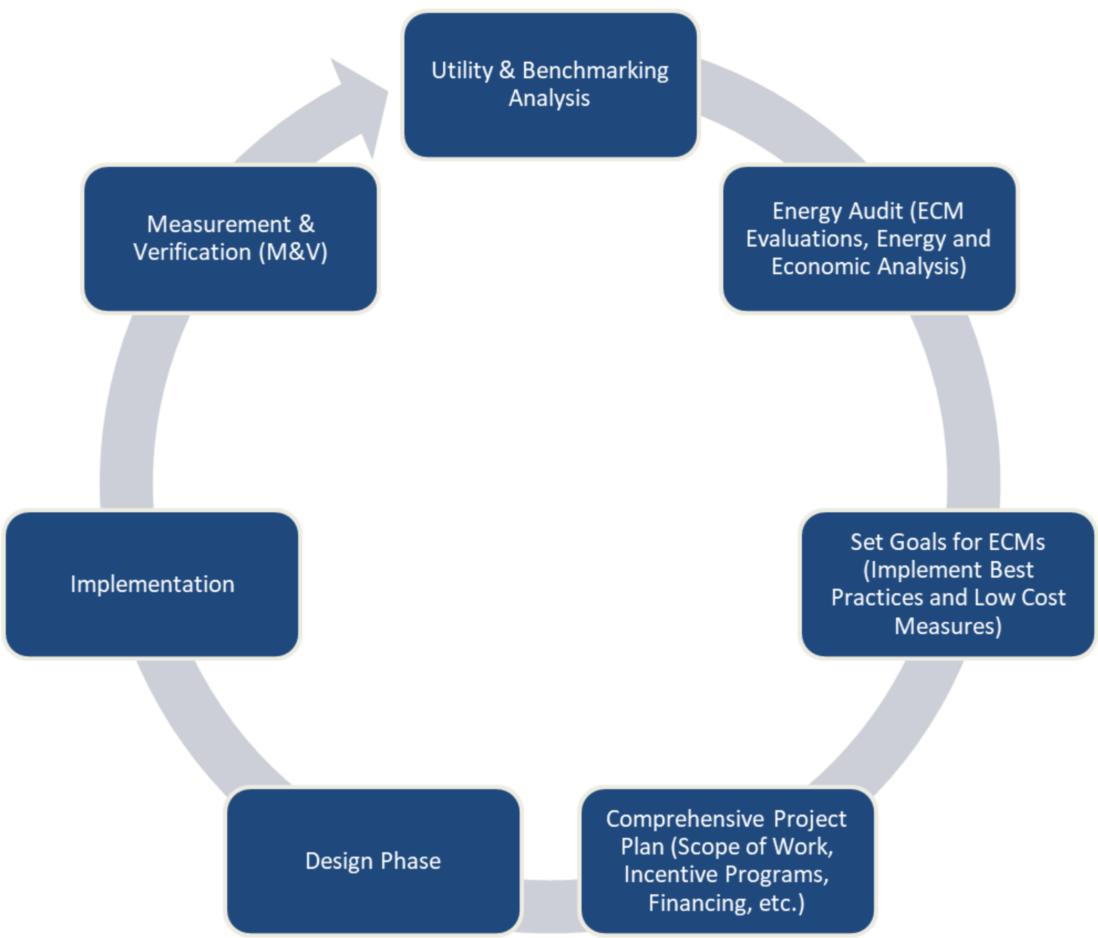
Engineered Solutions

The Engineered Solutions Program provides tailored energy-efficiency assistance and services to municipalities, universities, schools, hospitals, and healthcare facilities (MUSH), non-profit entities, and multifamily buildings. Customers receive expert guided services, including investment-grade energy auditing, engineering design, installation assistance, construction administration, commissioning, and measurement and verification (M&V) services to support the implementation of cost-effective and comprehensive efficiency projects. Engineered Solutions is generally a good option for medium to large sized facilities with a peak demand over 200 kW looking to implement as many measures as possible under a single project to achieve deep energy savings. Engineered Solutions has an added benefit of addressing measures that may not qualify for other programs. Many facilities pursuing an Energy Savings Improvement Program loan also use this program. Incentives for this program are based on project scope and energy savings achieved.

For more information on any of these programs, contact your local utility provider or visit https://www.njcleanenergy.com/transition.

10 Project Development

Energy conservation measures (ECMs) have been identified for your site, and their energy and economic analyses are provided within this LGEA report. Note that some of the identified projects may be mutually exclusive, such as replacing equipment versus upgrading motors or controls. The next steps with project development are to set goals and create a comprehensive project plan. The graphic below provides an overview of the process flow for a typical energy efficiency or renewable energy project. We recommend implementing as many ECMs as possible prior to undertaking a feasibility study for a renewable project. The cyclical nature of this process flow demonstrates the ongoing work required to continually improve building energy efficiency over time. If your building(s) scope of work is relatively simple to implement or small in scope, the measurement and verification (M&V) step may not be required. It should be noted through a typical project cycle, there will be changes in costs based on specific scopes of work, contractor selections, design considerations, construction, etc. The estimated costs provided throughout this LGEA report demonstrate the unburdened turn-key material and labor cost only. There will be contingencies and additional costs at the time of implementation. We recommend comprehensive project planning that includes the review of multiple bids for project work, incorporates potential operations and maintenance (O&M) cost savings, and maximizes your incentive potential.



Project Development Cycle

11 Energy Purchasing and Procurement Strategies

11.1 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. 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[17].

11.2 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 fluctuate monthly. The utility provides basic gas supply service 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[18].

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17 www.state.nj.us/bpu/commercial/shopping.html

18 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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
102	18	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	18	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
103	25	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	25	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
106	25	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	25	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
118	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	800	1	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	9	800	0.0	45	0	$3	$30	$0	10.0
118	40	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	40	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
120	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	800	1	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	9	800	0.0	45	0	$3	$30	$0	10.0
120	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,200	1, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,518	0.1	203	0	$14	$250	$40	15.4
120	64	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	64	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
123	22	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	22	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
126	24	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	24	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
129	5	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	2,200		None	No	5	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	2,200	0.0	0	0	$0	$0	$0	0.0
129	32	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	32	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
Auditorium	3	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	800	1	Relamp	No	3	LED Lamps: A19 Lamps	Wall Switch	9	800	0.1	135	0	$9	$80	$0	8.9
Auditorium	30	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	2,200		None	No	30	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	2,200	0.0	0	0	$0	$0	$0	0.0
Auditorium	1	Compact Fluorescent: (2) 26W Biaxial Plug-In Lamps	Wall Switch	S	52	800	1	Relamp	No	1	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	37	800	0.0	13	0	$1	$40	$0	45.1
Auditorium	10	LED - Fixtures: Ceiling Mount	Wall Switch	S	25	2,200		None	No	10	LED - Fixtures: Ceiling Mount	Wall Switch	25	2,200	0.0	0	0	$0	$0	$0	0.0
Auditorium	20	LED - Fixtures: High-Bay	Wall Switch	S	75	2,200	3	None	Yes	20	LED - Fixtures: High-Bay	Occupancy Sensor	75	1,518	0.3	1,125	0	$76	$1,350	$180	15.5
Auditorium	8	Exit Signs: Incandescent	None		30	8,760	2	Fixture Replacement	No	8	LED Exit Signs: 2 W Lamp	None	6	8,760	0.1	1,850	0	$124	$710	$0	5.7
Auditorium	21	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	21	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
Corridor 1	5	Compact Fluorescent: (1) 26W Biaxial Plug-In Lamp	Wall Switch		26	4,000	1, 4	Relamp	Yes	5	LED Lamps: GX23 (Plug-In) Lamps	High/Low Control	19	2,760	0.0	284	0	$19	$340	$190	7.9
Corridor 1	1	Compact Fluorescent: (3) 26W Biaxial Plug-In Lamps	Wall Switch		78	4,000	1	Relamp	No	1	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	55	4,000	0.0	101	0	$7	$50	$0	7.4
Corridor 1	2	LED - Fixtures: Ceiling Mount	Wall Switch		15	4,000	4	None	Yes	2	LED - Fixtures: Ceiling Mount	High/Low Control	15	2,760	0.0	41	0	$3	$280	$70	76.5
Corridor 1	20	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	20	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor 1	66	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor		29	3,200		None	No	66	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,200	0.0	0	0	$0	$0	$0	0.0
Corridor 1	9	LED - Linear Tubes: (1) 8' Lamp	Occupancy Sensor		36	3,200		None	No	9	LED - Linear Tubes: (1) 8' Lamp	Occupancy Sensor	36	3,200	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Dining Area/Kitchen	12	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,000	1, 3	Relamp	Yes	12	LED Lamps: A19 Lamps	Occupancy Sensor	9	1,380	0.5	1,420	0	$95	$630	$50	6.1
Dining Area/Kitchen	3	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	2,000		None	No	3	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	2,000	0.0	0	0	$0	$0	$0	0.0
Dining Area/Kitchen	4	Exit Signs: Incandescent	None		30	8,760	2	Fixture Replacement	No	4	LED Exit Signs: 2 W Lamp	None	6	8,760	0.1	925	0	$62	$350	$0	5.6
Dining Area/Kitchen	103	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,000		None	No	103	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,000	0.0	0	0	$0	$0	$0	0.0
Dining Area/Kitchen	24	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,000		None	No	24	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,000	0.0	0	0	$0	$0	$0	0.0
Elevator Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	800	1	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	800	0.0	29	0	$2	$50	$10	20.5
Exterior 1	11	Compact Fluorescent: (2) 26W Biaxial Plug-In Lamps	Timeclock		52	4,380	1	Relamp	No	11	LED Lamps: GX23 (Plug-In) Lamps	Timeclock	37	4,380	0.0	723	0	$51	$420	$20	7.9
Exterior 1	2	LED - Fixtures: Ceiling Mount	Timeclock		25	4,380		None	No	2	LED - Fixtures: Ceiling Mount	Timeclock	25	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior 1	8	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock		15	4,380		None	No	8	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	15	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior 1	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock		25	4,380		None	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	25	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior 1	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock		50	4,380		None	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	50	4,380	0.0	0	0	$0	$0	$0	0.0
Gymnasium 1	30	LED - Fixtures: High-Bay	Wall Switch	S	150	2,475	3	None	Yes	30	LED - Fixtures: High-Bay	Occupancy Sensor	150	1,708	1.0	3,798	-1	$255	$1,350	$180	4.6
Library 1	5	Compact Fluorescent: (1) 26W Biaxial Plug-In Lamp	Wall Switch	S	26	2,475	1, 3	Relamp	Yes	5	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	19	1,708	0.0	175	0	$12	$390	$50	28.9
Library 1	6	Exit Signs: Incandescent	None		30	8,760	2	Fixture Replacement	No	6	LED Exit Signs: 2 W Lamp	None	6	8,760	0.1	1,388	0	$93	$530	$0	5.7
Library 1	17	LED - Linear Tubes: (3) 2' Lamps	Wall Switch	S	26	2,475		None	No	17	LED - Linear Tubes: (3) 2' Lamps	Wall Switch	26	2,475	0.0	0	0	$0	$0	$0	0.0
Library 1	71	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,475	3	None	Yes	71	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,708	0.5	1,738	0	$117	$1,650	$180	12.6
Locker Rooms	17	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	1,500	1	Relamp	No	17	LED Lamps: A19 Lamps	Wall Switch	9	1,500	0.6	1,431	0	$96	$430	$20	4.3
Locker Rooms	10	Exit Signs: Incandescent	None		30	8,760	2	Fixture Replacement	No	10	LED Exit Signs: 2 W Lamp	None	6	8,760	0.2	2,313	0	$155	$880	$0	5.7
Locker Rooms	4	Compact Fluorescent: (3) 26W Plug-in Lamps	Wall Switch	S	78	1,500	1, 3	Relamp	Yes	4	LED Lamps: A19 Lamps	Occupancy Sensor	55	1,035	0.1	264	0	$18	$580	$50	29.9
Locker Rooms	10	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	1,500		None	No	10	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	1,500	0.0	0	0	$0	$0	$0	0.0
Locker Rooms	36	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,500		None	No	36	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,500	0.0	0	0	$0	$0	$0	0.0
Locker Rooms	3	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,500	1, 3	Relamp	Yes	3	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,035	0.1	194	0	$13	$600	$70	40.7
Mechanical 1	3	Incandescent: (1) 75W A19 Screw-In Lamp	Wall Switch	S	75	1,000	1, 3	Relamp	Yes	3	LED Lamps: A19 Lamps	Occupancy Sensor	12	690	0.1	220	0	$15	$410	$40	25.0
Mechanical 1	12	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,000		None	No	12	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.0	0	0	$0	$0	$0	0.0
Nurse	5	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	1,500		None	No	5	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	1,500	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	**Fixture Quantity**	**Fixture Description**	**Control System**	**Light Level**	**Watts per Fixture**	**Annual Operating Hours**	**ECM #**	**Fixture Recommendation**	**Add Controls?**	**Fixture Quantity**	**Fixture Description**	**Control System**	**Watts per Fixture**	**Annual Operating Hours**	**Total Peak kW Savings**	**Total Annual kWh Savings**	**Total Annual MMBtu Savings**	**Total Annual Energy Cost Savings**	**Estimated M&L Cost ($)**	**Total Incentives**	**Simple Payback w/ Incentives in Years**
Nurse	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,500		None	No	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,500	0.0	0	0	$0	$0	$0	0.0
Offices 1	4	Compact Fluorescent: (1) 26W Biaxial Plug-In Lamp	Wall Switch	S	26	1,500	1, 3	Relamp	Yes	4	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	19	1,035	0.0	85	0	$6	$200	$20	31.5
Offices 1	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	1,500		None	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	1,500	0.0	0	0	$0	$0	$0	0.0
Offices 1	36	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	1,500		None	No	36	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,500	0.0	0	0	$0	$0	$0	0.0
Offices 2	1	Compact Fluorescent: (1) 26W Biaxial Plug-In Lamp	Wall Switch	S	26	1,500	1	Relamp	No	1	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	19	1,500	0.0	12	0	$1	$10	$0	12.9
Offices 2	12	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	1,500		None	No	12	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,500	0.0	0	0	$0	$0	$0	0.0
Restroom - Female 1	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,475	1	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	9	2,475	0.0	139	0	$9	$30	$0	3.2
Restroom - Female 1	3	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	S	45	1,708		None	No	3	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	45	1,708	0.0	0	0	$0	$0	$0	0.0
Restroom - Female 3	2	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,475	1	Relamp	No	2	LED Lamps: A19 Lamps	Wall Switch	9	2,475	0.1	278	0	$19	$50	$0	2.7
Restroom - Female 3	3	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,475	3	None	Yes	3	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,708	0.0	37	0	$2	$0	$0	0.0
Restroom - Female 3	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,475		None	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,475	0.0	0	0	$0	$0	$0	0.0
Restroom - Male 1	3	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	S	45	1,708		None	No	3	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	45	1,708	0.0	0	0	$0	$0	$0	0.0
Restroom - Male 3	2	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,475	1	Relamp	No	2	LED Lamps: A19 Lamps	Wall Switch	9	2,475	0.1	278	0	$19	$50	$0	2.7
Restroom - Male 3	3	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,475	3	None	Yes	3	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,708	0.0	37	0	$2	$0	$0	0.0
Restroom - Male 3	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,475		None	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,475	0.0	0	0	$0	$0	$0	0.0
Stairs 1	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Stairs 1	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor		29	3,200		None	No	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,200	0.0	0	0	$0	$0	$0	0.0
Stairs 2	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Stairs 2	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor		29	3,200		None	No	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,200	0.0	0	0	$0	$0	$0	0.0
Stairs 3	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Stairs 3	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor		29	3,200		None	No	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,200	0.0	0	0	$0	$0	$0	0.0
Stairs 4	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Stairs 4	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor		29	3,200		None	No	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,200	0.0	0	0	$0	$0	$0	0.0
Stairs 5	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Stairs 5	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor		29	3,200		None	No	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,200	0.0	0	0	$0	$0	$0	0.0

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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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Storage 1	1	Compact Fluorescent: (1) 26W Spiral Plug-In Lamp	Wall Switch	S	26	800	1	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	19	800	0.0	6	0	$0	$30	$0	72.6
Storage 10	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	800		None	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	800	0.0	0	0	$0	$0	$0	0.0
Storage 11	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	800		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	800	0.0	0	0	$0	$0	$0	0.0
Storage 11	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	800		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	800	0.0	0	0	$0	$0	$0	0.0
Storage 12	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	800		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	800	0.0	0	0	$0	$0	$0	0.0
Storage 12	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	800		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	800	0.0	0	0	$0	$0	$0	0.0
Storage 8	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	800		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	800	0.0	0	0	$0	$0	$0	0.0
Storage 9	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	800		None	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	800	0.0	0	0	$0	$0	$0	0.0
Teachers Lounge 2	6	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	1,500		None	No	6	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,500	0.0	0	0	$0	$0	$0	0.0
200	2	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,200	1	Relamp	No	2	LED Lamps: A19 Lamps	Wall Switch	9	2,200	0.1	247	0	$17	$50	$0	3.0
200	12	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	12	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
202	28	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	28	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
204	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
205	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
206	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
207	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
208	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
210	22	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	22	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
214	22	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	22	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
216	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
218	20	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	20	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
219	12	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	12	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
220	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
221	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
223	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0

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225	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
501	29	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	29	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
502	24	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	24	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
503	29	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	29	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
506	24	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	24	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
515	24	Compact Fluorescent: (1) 26W Spiral Plug-In Lamp	Wall Switch	S	26	8,760	1, 3	Relamp	Yes	24	LED Lamps: A19 Lamps	Occupancy Sensor	19	6,044	0.2	2,981	-1	$200	$1,270	$90	5.9
515	27	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	27	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
Corridor 2	18	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	18	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor 2	74	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor		29	4,380		None	No	74	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,380	0.0	0	0	$0	$0	$0	0.0
Restroom - Female 2	3	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	S	45	1,708		None	No	3	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	45	1,708	0.0	0	0	$0	$0	$0	0.0
Restroom - Female 4	2	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,475	1	Relamp	No	2	LED Lamps: A19 Lamps	Wall Switch	9	2,475	0.1	278	0	$19	$50	$0	2.7
Restroom - Female 4	3	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,475	3	None	Yes	3	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,708	0.0	37	0	$2	$0	$0	0.0
Restroom - Female 4	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,475		None	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,475	0.0	0	0	$0	$0	$0	0.0
Restroom - Male 2	3	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	S	45	1,708		None	No	3	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	45	1,708	0.0	0	0	$0	$0	$0	0.0
Restroom - Male 4	2	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,475	1	Relamp	No	2	LED Lamps: A19 Lamps	Wall Switch	9	2,475	0.1	278	0	$19	$50	$0	2.7
Restroom - Male 4	3	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,475	3	None	Yes	3	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,708	0.0	37	0	$2	$0	$0	0.0
Restroom - Male 4	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,475		None	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,475	0.0	0	0	$0	$0	$0	0.0
Restroom - Unisex 1	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,475	1	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	9	2,475	0.0	139	0	$9	$30	$0	3.2
Restroom - Unisex 1	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	2,475		None	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,475	0.0	0	0	$0	$0	$0	0.0
Restroom - Unisex 2	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,475	1	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	9	2,475	0.0	139	0	$9	$30	$0	3.2
Restroom - Unisex 2	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	2,475		None	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,475	0.0	0	0	$0	$0	$0	0.0
Storage 13	2	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	45	800		None	No	2	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	45	800	0.0	0	0	$0	$0	$0	0.0
Storage 14	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	800		None	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	800	0.0	0	0	$0	$0	$0	0.0
Storage 15	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	800		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	800	0.0	0	0	$0	$0	$0	0.0
Storage 2	1	Compact Fluorescent: (1) 26W Spiral Plug-In Lamp	Wall Switch	S	26	800	1	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	19	800	0.0	6	0	$0	$30	$0	72.6

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Storage 3	1	Compact Fluorescent: (1) 26W Spiral Plug-In Lamp	Wall Switch	S	26	800	1	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	19	800	0.0	6	0	$0	$30	$0	72.6
Storage 4	8	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	800		None	No	8	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	800	0.0	0	0	$0	$0	$0	0.0
Storage 5	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	800		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	800	0.0	0	0	$0	$0	$0	0.0
Storage 6	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	35	800		None	No	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	35	800	0.0	0	0	$0	$0	$0	0.0
Storage 7	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	35	800		None	No	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	35	800	0.0	0	0	$0	$0	$0	0.0
Teachers Lounge	9	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	1,500		None	No	9	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,500	0.0	0	0	$0	$0	$0	0.0
300	1	Compact Fluorescent: (1) 26W Spiral Plug-In Lamp	Wall Switch	S	26	2,200	1	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	19	2,200	0.0	17	0	$1	$30	$0	26.4
300	12	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	12	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
302	18	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	18	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
304	20	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	20	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
305	20	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	20	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
306	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
307	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
308	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
310	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
311	16	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	16	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
312	10	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	10	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
313	8	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	8	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
314	18	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	18	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
315	16	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	16	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
316	18	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	18	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
318	18	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	18	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
319	18	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	18	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
320	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
321	18	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	18	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
323	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	15	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
325	11	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,200		None	No	11	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	0	0	$0	$0	$0	0.0
Corridor 3	11	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	11	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor 3	41	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor		29	3,200		None	No	41	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,200	0.0	0	0	$0	$0	$0	0.0
Restroom - Female 5	2	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,475	1	Relamp	No	2	LED Lamps: A19 Lamps	Wall Switch	9	2,475	0.1	278	0	$19	$50	$0	2.7
Restroom - Female 5	3	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,475		None	No	3	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,475	0.0	0	0	$0	$0	$0	0.0
Restroom - Female 5	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,475		None	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,475	0.0	0	0	$0	$0	$0	0.0
Restroom - Male 5	2	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	2,475	1	Relamp	No	2	LED Lamps: A19 Lamps	Wall Switch	9	2,475	0.1	278	0	$19	$50	$0	2.7
Restroom - Male 5	3	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,475		None	No	3	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,475	0.0	0	0	$0	$0	$0	0.0
Restroom - Male 5	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,475		None	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,475	0.0	0	0	$0	$0	$0	0.0
Storage 16	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	800		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	800	0.0	0	0	$0	$0	$0	0.0
Storage 17	1	Compact Fluorescent: (1) 26W Spiral Plug-In Lamp	Wall Switch	S	26	2,475	1	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	19	2,475	0.0	19	0	$1	$30	$0	23.5
Storage 18	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,475		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,475	0.0	0	0	$0	$0	$0	0.0
Storage 19	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,475		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,475	0.0	0	0	$0	$0	$0	0.0

Motor Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions: Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model	Remaining Useful Life	Annual Operating Hours	Proposed Conditions: ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Energy Impact & Financial Analysis: Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Exterior 1	Trane Packaged Unit	1	Supply Fan	4.00	89.5%	No			W	6,600	6	No	89.5%	Yes	1	1.1	8,132	0	$569	$5,400	$300	9.0
Exterior 1	Daikin Packaged Units	2	Supply Fan	8.00	91.0%	No			W	6,600	6	No	91.0%	Yes	2	4.6	32,463	0	$2,273	$13,700	$2,000	5.1
Exterior 1	Daikin Packaged Units	2	Return Fan	4.00	89.5%	No			W	6,600	6	No	89.5%	Yes	2	2.4	14,304	0	$1,001	$10,800	$600	10.2
Exterior 1	Daikin Packaged Units	2	Other	0.17	65.0%	No			W	3,000		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior 1	Daikin Packaged Units	2	Combustion Air Fan	0.25	69.5%	No			W	200		No	69.5%	No		0.0	0	0	$0	$0	$0	0.0
Storage 4	Heating and Ventilation	2	Supply Fan	2.00	85.5%	No	US Electrical Motors		B	8,760	6	No	87.5%	Yes	2	1.2	8,604	0	$602	$10,200	$200	16.6
Elevator Room	Pendant Unit Heat	1	Fan Coil Unit	0.25	69.5%	No			W	200		No	69.5%	No		0.0	0	0	$0	$0	$0	0.0
Corridor 1	Corridor 1	2	Fan Coil Unit	0.25	65.0%	No			W	5,840	5	Yes	74.0%	No		0.0	306	0	$21	$600	$0	28.0
Dining Area/Kitchen	Dining Area/Kitchen	1	Fan Coil Unit	0.20	62.0%	No			W	5,840	5	Yes	74.0%	No		0.0	171	0	$12	$300	$0	25.1
Locker Rooms	Locker Rooms	3	Fan Coil Unit	0.17	62.0%	No			W	5,840	5	Yes	74.0%	No		0.1	427	0	$30	$1,000	$0	33.4
Offices 1	Offices 1	1	Fan Coil Unit	0.17	62.0%	No			W	5,840	5	Yes	74.0%	No		0.0	142	0	$10	$300	$0	30.1
Various Stairs	Various Stairs	10	Fan Coil Unit	0.25	65.0%	No			W	5,840	5	Yes	74.0%	No		0.2	1,528	0	$107	$3,200	$0	29.9
Storage 10	Storage 10	1	Fan Coil Unit	0.25	65.0%	No			W	5,840	5	Yes	74.0%	No		0.0	153	0	$11	$300	$0	28.0
Storage 11	Storage 11	1	Fan Coil Unit	0.25	65.0%	No			W	5,840	5	Yes	74.0%	No		0.0	153	0	$11	$300	$0	28.0
Corridor 2	Corridor 2	2	Fan Coil Unit	0.25	65.0%	No			W	5,840	5	Yes	74.0%	No		0.0	306	0	$21	$600	$0	28.0
Storage 6	Storage 6	1	Fan Coil Unit	0.25	65.0%	No			W	5,840	5	Yes	74.0%	No		0.0	153	0	$11	$300	$0	28.0
Storage 7	Storage 7	1	Fan Coil Unit	0.25	65.0%	No			W	5,840	5	Yes	74.0%	No		0.0	153	0	$11	$300	$0	28.0
Teachers Lounge	Teachers Lounge	1	Fan Coil Unit	0.25	65.0%	No			W	5,840	5	Yes	74.0%	No		0.0	153	0	$11	$300	$0	28.0
Corridor 3	Corridor 3	2	Fan Coil Unit	0.25	65.0%	No			W	5,840	5	Yes	74.0%	No		0.0	306	0	$21	$600	$0	28.0
First Floor Classrooms	First Floor Classrooms	8	Fan Coil Unit	0.17	62.0%	No			W	5,840	5	Yes	74.0%	No		0.1	1,139	0	$80	$2,500	$0	31.3

		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?	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Second Floor Classrooms	Second Floor Classrooms	22	Fan Coil Unit	0.17	62.0%	No			W	5,840	5	Yes	74.0%	No		0.4	3,134	0	$219	$7,000	$0	31.9
Third Floor Classrooms	Third Floor Classrooms	20	Fan Coil Unit	0.17	62.0%	No			W	5,840	5	Yes	74.0%	No		0.4	2,849	0	$199	$6,300	$0	31.6
Mechanical 1	Pneumatic Controls	2	Air Compressor	2.00	78.0%	No	Baldor	M8157T	W	800		No	78.0%	No		0.0	0	0	$0	$0	$0	0.0
Storage 4	Pneumatic Controls	2	Air Compressor	2.00	78.0%	No	Baldor	M8157T	W	800		No	78.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Steam Heating System	2	Combustion Air Fan	7.50	88.5%	No	Marathon Electric	SVF184TTDW	W	2,520	7	No	91.7%	Yes	2	4.7	12,699	0	$889	$14,800	$2,000	14.4
Mechanical 1	Steam Heating System	3	Boiler Feed Water Pump	0.75	81.1%	No	Marathon Electric	5K37MN3543	W	1,500		No	81.1%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Steam Heating System	2	Condensate Pump	1.00	89.0%	No	Marathon Electric	5K38PN48	W	800		No	89.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Ventilation	6	Exhaust Fan	0.25	69.5%	No			W	8,760		No	69.5%	No		0.0	0	0	$0	$0	$0	0.0
Nurse	Ventilation	1	Exhaust Fan	0.17	65.0%	No			W	8,760		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Storage 10	Ventilation	1	Exhaust Fan	0.17	65.0%	No			W	8,760		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Storage 11	Ventilation	1	Exhaust Fan	0.17	65.0%	No			W	8,760		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Storage 12	Ventilation	1	Exhaust Fan	0.25	69.5%	No			W	8,760		No	69.5%	No		0.0	0	0	$0	$0	$0	0.0
Storage 8	Ventilation	1	Exhaust Fan	0.25	69.5%	No			W	8,760		No	69.5%	No		0.0	0	0	$0	$0	$0	0.0
Storage 9	Ventilation	1	Exhaust Fan	0.17	69.5%	No			W	8,760		No	69.5%	No		0.0	0	0	$0	$0	$0	0.0
Teachers Lounge 2	Ventilation	1	Exhaust Fan	0.25	69.5%	No			W	8,760		No	69.5%	No		0.0	0	0	$0	$0	$0	0.0
502	Ventilation	1	Exhaust Fan	1.00	82.0%	No			W	4,000		No	82.0%	No		0.0	0	0	$0	$0	$0	0.0
506	Ventilation	1	Exhaust Fan	1.00	82.0%	No			W	4,000		No	82.0%	No		0.0	0	0	$0	$0	$0	0.0
Storage 13	Ventilation	1	Exhaust Fan	0.17	65.0%	No			W	8,760		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Storage 14	Ventilation	1	Exhaust Fan	0.17	65.0%	No			W	8,760		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Storage 4	Ventilation	6	Exhaust Fan	0.25	65.0%	No			W	8,760		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0

		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?	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Storage 5	Ventilation	1	Ventilation Fan	1.00	82.0%	No	US Electrical Motors		B	8,760		No	82.0%	No		0.0	0	0	$0	$0	$0	0.0
Teachers Lounge	Ventilation	1	Ventilation Fan	1.00	82.0%	No	US Electrical Motors		B	8,760		No	82.0%	No		0.0	0	0	$0	$0	$0	0.0
Storage 18	Ventilation	1	Exhaust Fan	0.25	65.0%	No			W	8,760		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Hot Water Heating System	2	Heating Hot Water Pump	3.00	89.5%	Yes	WEG	003180T3V182	W	2,400		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
120	Air filtration system	3	Ventilation Fan	0.75	81.0%	No			W	2,000		No	81.0%	No		0.0	0	0	$0	$0	$0	0.0
Elevator Room	Elevator Motor	1	Other	30.00	76.0%	No			W	50		No	76.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Sump pumps	2	Other	2.00	85.5%	No	Bluffton	1313381107	W	240		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Vacuum pump	2	Other	1.50	84.0%	No	Marathon Electric	SVC 56T34D5369D	W	1,200		No	84.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	DHW sytem	1	DHW Circulation Pump	0.04	60.0%	No	Taco	007-SF5	W	8,760		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior 1	Daikin Packaged Units	4	Other	1.00	85.5%	No			W	200		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Various	ventilation and cooling	12	Other	0.25	69.0%	No			W	200		No	69.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior 1	Trane Packaged Unit	1	Other	1.00	89.5%	No			W	400		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0

Packaged 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)	Cooling Mode Efficiency (SEER/IEER/EER)	Heating Mode Efficiency	Manufacturer	Model	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/IEER/EER)	Heating Mode Efficiency	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Roof	Heating, Cooling, Ventilation	1	Package Unit	3.00	80.00	15.00	0.8 AFUE	Trane	0ABD036E3	W		No							0.0	0	0	$0	$0	$0	0.0
Roof	Heating, Cooling, Ventilation	2	Package Unit	15.00	240.00	15.00	0.8 AFUE	Daikin	DPS015AHMG2	W		No							0.0	0	0	$0	$0	$0	0.0
Elevator Room	Elevator Room	1	Unit Heater		15.00		1 COP					No							0.0	0	0	$0	$0	$0	0.0
Exterior 1	Cooling	1	Split-System	10.00		12.20		Trane	TTA120B30UEA	B		No							0.0	0	0	$0	$0	$0	0.0
Exterior 1	Cooling	2	Split-System	3.00		12.50		Mitsubishi Electric	OHA36A2A	B		No							0.0	0	0	$0	$0	$0	0.0
Exterior 1 - Lower Roof	Cooling	2	Split-System	4.00		14.00		Trane		W		No							0.0	0	0	$0	$0	$0	0.0
Exterior 1	Auditorium	2	Ductless Mini-Split HP	3.79	52.50	18.60	8.5 HSPF	Daikin	RXTQ48TAVJU	W		No							0.0	0	0	$0	$0	$0	0.0
Dining Area/Kitchen	Dining Area/Kitchen	1	Window AC	2.00		11.20		Frigidaire		W		No							0.0	0	0	$0	$0	$0	0.0
Locker Rooms	Locker Rooms	3	Window AC	2.00		11.20		Frigidaire		W		No							0.0	0	0	$0	$0	$0	0.0
Offices 1	Offices 1	4	Window AC	1.00		15.00		Frigidaire		W		No							0.0	0	0	$0	$0	$0	0.0
Offices 2	Offices 2	2	Window AC	1.00		15.00		Frigidaire		W		No							0.0	0	0	$0	$0	$0	0.0
Teachers Lounge 2	Teachers Lounge 2	1	Window AC	1.50		11.80		Frigidaire		W		No							0.0	0	0	$0	$0	$0	0.0
Teachers Lounge	Teachers Lounge	1	Window AC	1.50		11.80		Frigidaire		W		No							0.0	0	0	$0	$0	$0	0.0
Various Classrooms	Various Classrooms	22	Window AC	1.50		11.80		Frigidaire		W		No							0.0	0	0	$0	$0	$0	0.0
Various Classrooms	Various Classrooms	20	Window AC	1.50		10.20		Various		B	8	Yes	20	Window AC	1.50		12.00		2.6	1,588	0	$111	$23,900	$0	214.9

Space Heating Boiler 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)	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical 1	Primary Building Heating	2	Forced Draft Steam Boiler	5,021	Easco	FPS-150-S015	W		No						0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Secondary Building Heating	2	Condensing Hot Water Boiler	1,410	Aerco	BMK 1500	W		No						0.0	0	0	$0	$0	$0	0.0

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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Storage 4	AHU	9	8	3.00	0.0	0	13	$177	$140	$20	0.7

DHW Inventory & Recommendations

		Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical 1	Building DHW	1	Storage Tank Water Heater (> 50 Gal)	AO Smith	BTH-199 300	W		No						0.0	0	0	$0	$0	$0	0.0

Low-Flow Device Recommendations

	Recommendation 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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Classrooms	10	21	Faucet Aerator (Kitchen)	2.20	1.50	0.0	0	4	$57	$180	$40	2.5
Offices	10	1	Faucet Aerator (Kitchen)	2.00	1.50	0.0	0	0	$2	$10	$0	5.2
Kitchen	10	3	Faucet Aerator (Kitchen)	2.00	1.50	0.0	0	0	$6	$30	$10	3.5
Restrooms	10	38	Faucet Aerator (Lavatory)	2.20	0.50	0.0	0	18	$249	$320	$150	0.7
Restrooms	10	20	Faucet Aerator (Lavatory)	1.50	0.50	0.0	0	6	$77	$170	$80	1.2

Walk-In Cooler/Freezer Inventory & Recommendations

	Existing Conditions				Proposed Conditions				Energy Impact & Financial Analysis						
Location	Cooler/ Freezer Quantity	Case Type/Temperature	Manufacturer	Model	ECM #	Install EC Evaporator Fan Motors?	Install Electric Defrost Control?	Install Evaporator Fan Control?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Cooler	Bally		12, 13	Yes	No	Yes	0.1	1,344	0	$94	$2,430	$120	24.6
Kitchen	1	Low Temp Freezer (-35 F to -5 F)	Bally		12, 13	Yes	No	Yes	0.1	1,668	0	$117	$2,430	$120	19.8

Commercial Refrigerator/Freezer Inventory & Recommendations

	Existing Conditions					Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Refrigerator/ Freezer Type	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Freezer Chest			No	14	Yes	0.3	3,026	0	$212	$2,300	$0	10.9
Kitchen	2	Stand-Up Refrigerator, Glass Door (16 - 30 cu. ft.)	Beverage-Air	VM-12	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Stand-Up Refrigerator, Solid Door (31 - 50 cu. ft.)	Traulsen		No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Stand-Up Refrigerator, Solid Door (31 - 50 cu. ft.)	AdvantEDGE		Yes		No	0.0	0	0	$0	$0	$0	0.0

Commercial Ice Maker Inventory & Recommendations

	Existing Conditions					Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Ice Maker Type	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Self-Contained Unit (≥175 lbs/day), Batch	Hoshizaki	KML-325MAJ	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	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Gas Convection Oven (Full Size)	Universal Chef		No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Electric Fryer	Lincoln		No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Insulated Food Holding Cabinet (Full Size)	Cres Cor		Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Insulated Food Holding Cabinet (Full Size)	Metro	C5 3 Series	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Electric Griddle (≤2 Feet Width)	Universal Chef		No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Gas Rack Oven (Single)	Cyclone		No	11	Yes	0.0	0	60	$824	$5,600	$1,000	5.6

Dishwasher Inventory & Recommendations

	Existing Conditions							Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Dishwasher Type	Manufacturer	Model	Water Heater Fuel Type	Booster Heater Fuel Type	ENERGY STAR Qualified?	ECM #	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Payback w/ Incentives in Years
Kitchen	1	Single Tank Conveyor (High Temp)	Hobart	CL44EN	Electric	None	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?**	**Manufacturer**	**Model**
Dining Area/Kitchen	1	Clothes Dryer	2,000	No		
Dining Area/Kitchen	1	Clothes Washer	2,000	No		
Library 1	1	Coffee Machine	900	No		
Locker Rooms	1	Coffee Machine	900	No		
Offices 2	1	Coffee Machine	900	No		
Storage 10	1	Coffee Machine	900	No		
Storage 11	1	Coffee Machine	900	No		
Storage 12	1	Coffee Machine	900	No		
Storage 8	1	Coffee Machine	900	No		
Storage 9	1	Coffee Machine	900	No		
Teachers Lounge 2	1	Coffee Machine	900	No		
515	1	Coffee Machine	900	No		
Teachers Lounge	1	Coffee Machine	900	No		
323	1	Coffee Machine	900	No		
106	27	Desktop	280	No		
123	28	Desktop	280	No		
Auditorium	1	Desktop	280	No		
Dining Area/Kitchen	2	Desktop	280	No		
Library 1	12	Desktop	280	No		
Nurse	1	Desktop	280	No		
Offices 1	8	Desktop	280	No		
Offices 2	2	Desktop	280	No		
Teachers Lounge 2	1	Desktop	280	No		
Various Classrooms	10	Desktop	280	No		
Storage 13	1	Desktop	280	No		
Storage 14	2	Desktop	280	No		
Teachers Lounge	1	Desktop	280	No		
Dining Area/Kitchen	4	Fan (Large)	80	No		
Dining Area/Kitchen	2	Microwave	1,500	No		
Locker Rooms	2	Microwave	1,500	No		
Nurse	1	Microwave	1,500	No		
Offices 2	1	Microwave	1,500	No		
501	1	Microwave	1,500	No		
502	1	Microwave	1,500	No		
Storage 13	1	Microwave	1,500	No		

	Existing Conditions					
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Teachers Lounge	1	Microwave	1,500	No		
300	1	Microwave	1,500	No		
323	1	Microwave	1,500	No		
325	1	Microwave	1,200	No		
103	4	3D printer	1,800	No	Lulbot Taz	
103	1	Laser cutter	1,100	No	Glowforge	
118	1	Kiln	11,000	No		
Dining Area/Kitchen	1	Portable Air Conditioner	400	No	Amana	
210	1	Kiln	11,000	No		
214	1	Other	500	No		
Teachers Lounge	1	Electric stove	1,500	No		
Offices 1	1	Paper Shredder	400	No		
Offices 2	1	Paper Shredder	400	No		
106	1	Printer (Medium/Small)	200	No		
123	1	Printer (Medium/Small)	200	No		
Dining Area/Kitchen	1	Printer (Medium/Small)	200	No		
Library 1	2	Printer (Medium/Small)	200	No		
Nurse	1	Printer (Medium/Small)	200	No		
Offices 1	1	Printer (Medium/Small)	200	No		
Offices 1	2	Printer (Medium/Small)	200	No		
Offices 2	2	Printer (Medium/Small)	200	No		
503	1	Printer (Medium/Small)	200	No		
Storage 13	1	Printer (Medium/Small)	200	No		
313	1	Printer (Medium/Small)	200	No		
Offices 1	1	Printer/Copier (Large)	1,200	No		
Teachers Lounge 2	1	Printer/Copier (Large)	1,200	No		
Teachers Lounge	1	Printer/Copier (Large)	1,200	No		
Various Classrooms	44	Projector	240	No		
Auditorium	1	Projector	240	No		
Dining Area/Kitchen	1	Projector	240	No		
Library 1	2	Projector	240	No		
Locker Rooms	2	Refrigerator (Mini)	200	No		
Nurse	1	Refrigerator (Mini)	200	No		
Offices 2	1	Refrigerator (Mini)	200	No		
Storage 10	1	Refrigerator (Mini)	200	No		

	Existing Conditions					
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Storage 11	1	Refrigerator (Mini)	200	No		
Storage 12	1	Refrigerator (Mini)	200	No		
Storage 8	1	Refrigerator (Mini)	200	No		
Storage 9	1	Refrigerator (Mini)	200	No		
Teachers Lounge 2	1	Refrigerator (Mini)	200	No		
220	1	Refrigerator (Mini)	200	No		
223	1	Refrigerator (Mini)	200	No		
Storage 13	1	Refrigerator (Mini)	200	No		
319	1	Refrigerator (Mini)	200	No		
323	1	Refrigerator (Mini)	200	No		
325	1	Refrigerator (Mini)	200	No		
Offices 1	1	Refrigerator (Residential)	380	No		
Teachers Lounge	1	Refrigerator (Residential)	380	No		
118	1	Television	200	No		
Dining Area/Kitchen	1	Television	200	No		
Locker Rooms	2	Television	300	No		
Offices 1	2	Television	300	No		
210	1	Television	300	No		
214	1	Television	300	No		
Offices 2	1	Toaster	1,000	No		
Library 1	1	Toaster Oven	1,500	No		
Nurse	1	Water Cooler	500	No		
Building	1	Server Equipment	1,500	No		
Various	40	Laptops	180	No		

Vending Machine Inventory & Recommendations

	Existing Conditions		Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Vending Machine Type	ECM #	Install Controls?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Dining Area/Kitchen	1	Non-Refrigerated	15	Yes	0.0	343	0	$24	$270	$0	11.3
Dining Area/Kitchen	1	Glass Fronted Refrigerated	15	Yes	0.1	1,209	0	$85	$270	$50	2.6

APPENDIX B: ENERGY STAR STATEMENT OF ENERGY PERFORMANCE

Energy use intensity (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

70

ENERGY STAR® Score[1]

Roosevelt Intermediate School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 95,000
Built: 1926

For Year Ending: March 31, 2023
Date Generated: June 03, 2024

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
Roosevelt Intermediate School 301 Clark Street Westfield, New Jersey 07090	Westfield Board of Education 302 Elm Street Westfield, NJ 07090 (908) 789-4400	Sean McArthur 302 Elm Street Westfield, NJ 07090 (908) 789-4460 smcarthur@westfieldnjk12.org

Property ID: 4163463

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
61.6 kBtu/ft²

Source EUI
89.1 kBtu/ft²

Annual Energy by Fuel

Electric - Solar (kBtu)	695,677 (12%)
Natural Gas (kBtu)	3,812,707 (65%)
Electric - Grid (kBtu)	1,345,400 (23%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	76.5
National Median Source EUI (kBtu/ft²)	110.6
% Diff from National Median Source EUI	-19%

Annual Emissions

Total (Location-Based) GHG Emissions (Metric Tons CO2e/year)	323

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, which 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 (II)	*Solar renewable energy credit*: a credit you can earn from the state for energy produced from a photovoltaic array.
T5, T8, T12	A reference to a linear lamp diameter. The number represents increments of 1/8th of an inch.
Temperature Setpoint	The temperature at which a temperature regulating device (thermostat, for example) has been set.
therm	100,000 Btu. Typically used as a measure of natural gas consumption.
tons	A unit of cooling capacity equal to 12,000 Btu/hr.
Turnkey	Provision of a complete product or service that is ready for immediate use.
VAV	*Variable air volume*
VFD	*Variable frequency drive*: a controller used to vary the speed of an electric motor.
WaterSense®	The symbol for water efficiency. The WaterSense® program is managed by the EPA.
Watt (W)	Unit of power commonly used to measure electricity use.