Local Government Energy Audit Report

Alfred Vail Elementary School

August 8, 2024

Prepared for:
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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.

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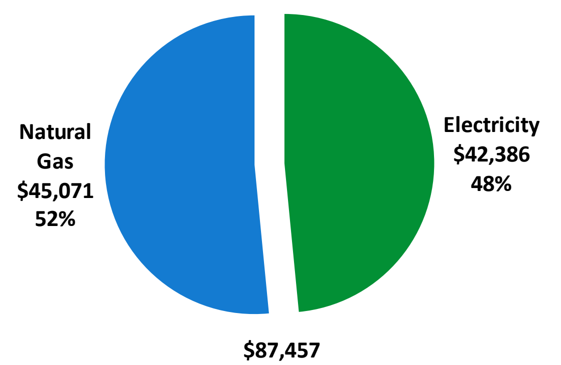
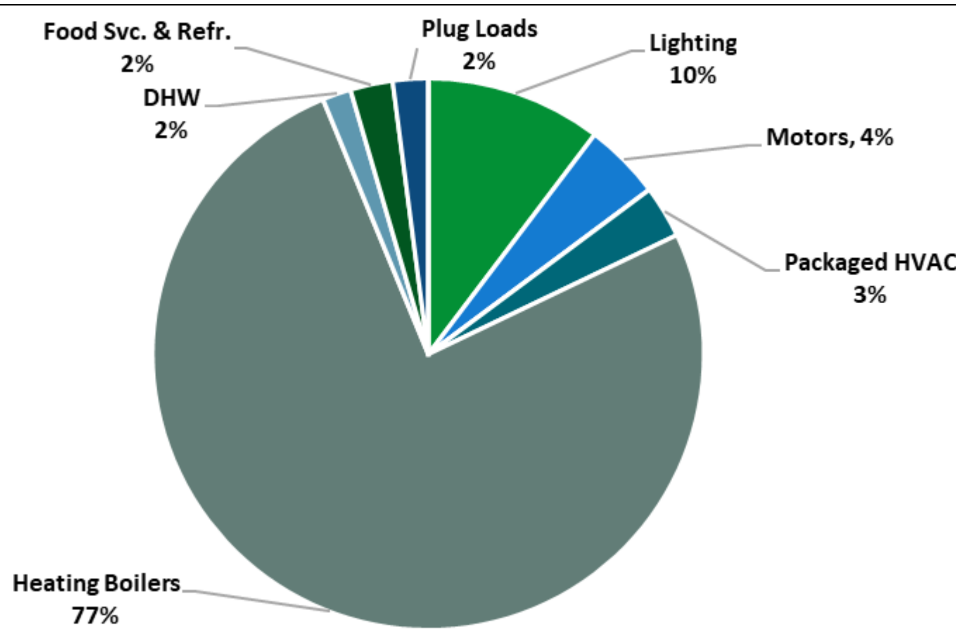
1 Executive Summary

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

BUILDING PERFORMANCE REPORT

Annual Energy Utilities	Costs: $87,457 Electricity: 304,258 kWh Natural Gas: 35,928 Therms Water: 762,711 Gallons	
ENERGY STAR® Benchmarking Score	37 *(1-100 scale)*	This building performs at or below the national average. This report contains suggestions about how to improve building performance and reduce energy costs.





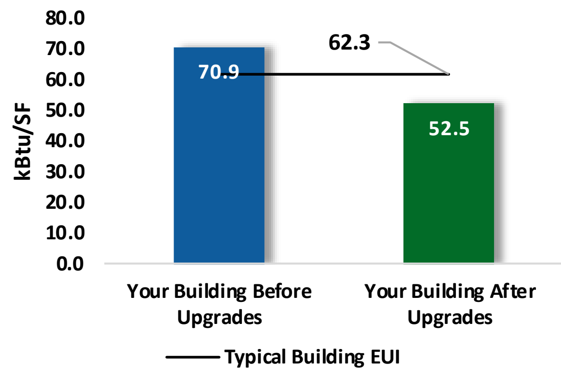
Energy Use by System

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.

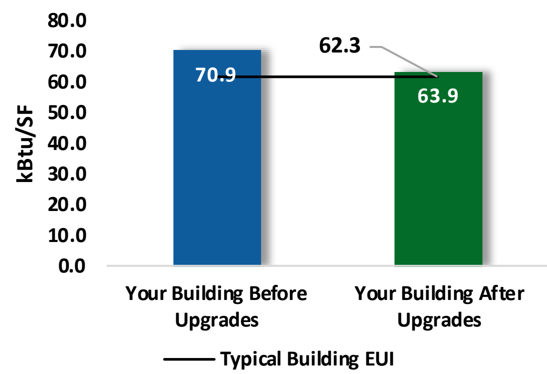
Scenario 1: Full Package (All Evaluated Measures)

Installation Cost	$410,850
Potential Rebates & Incentives[1]	$22,990
Annual Cost Savings	$26,318
Annual Energy Savings	Electricity: 116,251 kWh Natural Gas: 8,069 Therms
Greenhouse Gas Emission Savings	106 Tons
Simple Payback	14.7 Years
Site Energy Savings (All Utilities)	26%



Scenario 2: Cost Effective Package[2]

Installation Cost	$118,350
Potential Rebates & Incentives	$21,290
Annual Cost Savings	$15,840
Annual Energy Savings	Electricity: 104,951 kWh Natural Gas: 971 Therms
Greenhouse Gas Emission Savings	59 Tons
Simple Payback	6.1 Years
Site Energy Savings (all utilities)	10%



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			**72,269**	**16.7**	**-15**	**$9,878**	**$51,740**	**$10,490**	**$41,250**	**4.2**	**71,005**
ECM 1	Install LED Fixtures	Yes	6,539	0.0	0	$911	$4,430	$550	$3,880	4.3	6,585
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	221	0.1	0	$30	$380	$30	$350	11.6	217
ECM 3	Retrofit Fixtures with LED Lamps	Yes	65,509	16.6	-15	$8,937	$46,930	$9,910	$37,020	4.1	64,203
Lighting Control Measures			**19,007**	**4.8**	**-4**	**$2,593**	**$39,710**	**$9,330**	**$30,380**	**11.7**	**18,628**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	14,744	4.0	-3	$2,011	$30,690	$3,600	$27,090	13.5	14,450
ECM 5	Install High/Low Lighting Controls	Yes	4,263	0.8	-1	$582	$9,020	$5,730	$3,290	5.7	4,178
Motor Upgrades			**100**	**0.0**	**0**	**$14**	**$900**	**$0**	**$900**	**64.5**	**101**
ECM 6	Premium Efficiency Motors	No	100	0.0	0	$14	$900	$0	$900	64.5	101
Unitary HVAC Measures			**6,556**	**8.3**	**0**	**$913**	**$53,200**	**$1,700**	**$51,500**	**56.4**	**6,601**
ECM 7	Install High Efficiency Air Conditioning Units	No	6,556	8.3	0	$913	$53,200	$1,700	$51,500	56.4	6,601
HVAC System Improvements			**226**	**0.0**	**24**	**$329**	**$6,140**	**$50**	**$6,090**	**18.5**	**3,007**
ECM 8	Implement Demand Control Ventilation (DCV)	No	0	0.0	24	$298	$5,800	$0	$5,800	19.5	2,780
ECM 9	Install Pipe Insulation	Yes	226	0.0	0	$31	$340	$50	$290	9.2	227
Domestic Water Heating Upgrade			**278**	**0.0**	**12**	**$184**	**$460**	**$220**	**$240**	**1.3**	**1,635**
ECM 10	Install Low-Flow DHW Devices	Yes	278	0.0	12	$184	$460	$220	$240	1.3	1,635
Food Service & Refrigeration Measures			**10,101**	**1.2**	**0**	**$1,407**	**$17,000**	**$1,200**	**$15,800**	**11.2**	**10,172**
ECM 11	Replace Refrigeration Equipment	Yes	10,101	1.2	0	$1,407	$17,000	$1,200	$15,800	11.2	10,172
Custom Measures			**7,714**	**0.0**	**791**	**$10,999**	**$241,700**	**$0**	**$241,700**	**22.0**	**100,391**
ECM 12	Retro-Commissioning Study	Yes	3,070	0.0	105	$1,746	$9,100	$0	$9,100	5.2	15,392
ECM 13	Building Envelope Improvements	No	3,290	0.0	686	$9,064	$230,100	$0	$230,100	25.4	83,635
ECM 14	Replace Electric Water Heater with Heat Pump Water Heater	No	1,354	0.0	0	$189	$2,500	$0	$2,500	13.2	1,363
TOTALS (COST EFFECTIVE MEASURES)			**104,951**	**22.7**	**97**	**$15,840**	**$118,350**	**$21,290**	**$97,060**	**6.1**	**117,059**
TOTALS (ALL MEASURES)			**116,251**	**31.0**	**807**	**$26,318**	**$410,850**	**$22,990**	**$387,860**	**14.7**	**211,540**

* - 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 Alfred Vail Elementary School. This report provides information on how your facility uses energy, identifies energy conservation measures (ECMs) that can reduce your energy use, and provides information and assistance to help you implement the ECMs.

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 5, 2024, TRC performed an energy audit at Alfred Vail Elementary School located in Morristown, New Jersey. TRC met with Jeff Maegerlein to review the facility operations and help focus our investigation on specific energy-using systems.

The Alfred Vail Elementary School is a two-story, 65,339 square foot building built in 1930. Building spaces include classrooms, gymnasium, multipurpose room, offices, corridors, stairwells, kitchen, and mechanical space.

The facility mainly uses linear fluorescent T8 fixtures for lighting. In some offices and classrooms, window air conditioners are used for cooling, while two package units serve the media center, main office, and nurse's office. Heating is supplied by steam boilers. The site is considering upgrading the lighting and HVAC system for the facility. The facility's Standard Energy Performance (SEP) indicates that its gas and electric Energy Use Intensity (EUI) are notably higher compared to the national average.

2.2 Building Occupancy

The facility is occupied Monday through Friday during regular school hours. The facility is occupied intermittently on weekends, as needed for maintenance and operations.

The school is fully occupied from September through June. Typical weekday occupancy is 80 staff and 300 students. During the summer, occupancy primarily involves ongoing maintenance tasks and limited use of office space, with a few summer classes being held.

Building Name	Weekday/Weekend	Operating Schedule
Alfred Vail Elementary Staff	Weekday	6:30 AM - 10:00 PM
	Weekend	No
Alfred Vail Elementary Classes	Weekday	8:30 AM - 3:15 PM
	Weekend	No

Building Occupancy Schedule

2.3 Building Envelope

The walls are built with a brick structure and finished with painted CMU interiors. There are two parts to the roof. The flat roof is supported with steel trusses and a reinforced concrete deck, which is a built-up aggregate roof design with a covering of modified bitumen. Wood trusses support a pitched roof with a wood deck covered with asphalt shingles. The insulation in the attic area of the pitched roof is cellulose blown-in insulation, which is in depleting condition and is evaluated for improvement. The roof encloses a plenum area with conditioned space below a drop ceiling.

In the greenhouse section of the building, there is more infiltration compared to other sections due to single-pane glass walls and a corrugated PVC or polycarbonate roof supported by steel trusses. Gaps were observed in the glass walls, and the roof is in poor condition.

The facility has two types of windows. Newer ones installed around 1999 are double paned with aluminum frames and thermal breaks, with seals between the glass and frames in fair condition. Older windows are single-pane, and some located in stairs and restrooms have translucent panels with wood frames. Infiltration was observed through these older windows, which is a major concern. Window replacement has been evaluated based on audit data. Exterior doors are made from FRP composite material with aluminum frames and are in fair condition with intact door seals. Degraded window and door seals can lead to increased drafts and outside air infiltration.

Building Envelope

Typical Door

Building Envelope

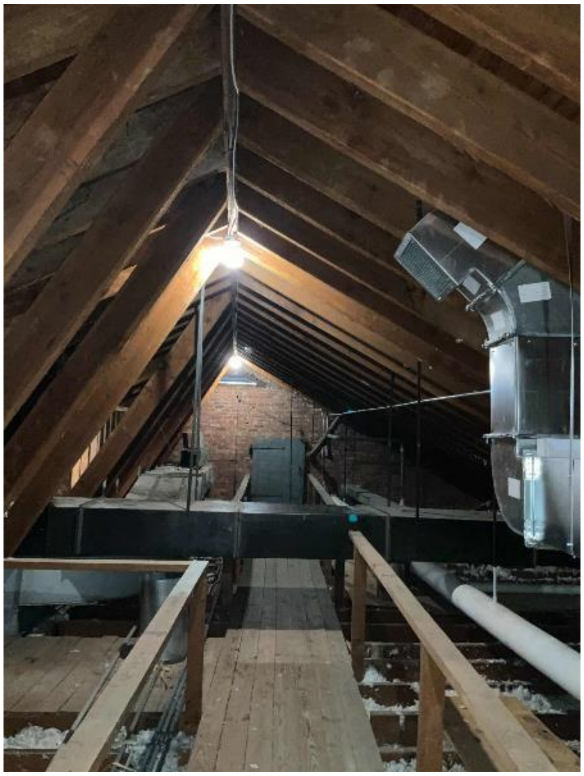
Building Envelope

Flat Roof Part

Pitched Roof Part

Translucent Window with Infiltration

Building Envelope – Mixed Windows



Attic Section

Greenhouse Envelope

Green House Envelope with Infiltration Gap

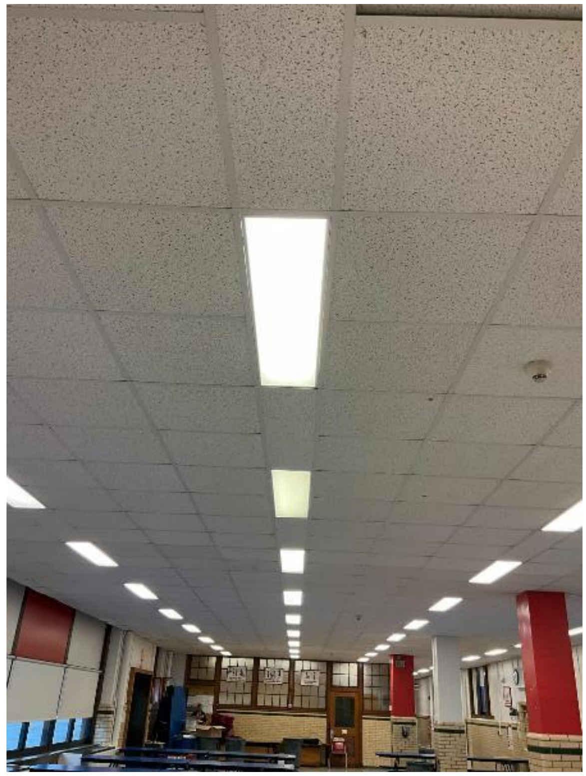
2.4 Lighting Systems

The primary interior lighting system utilizes 32-Watt linear fluorescent T8 lamps. Compact fluorescent lamps (CFL) and LED lamps are also installed in classrooms, attic areas, offices, and storage rooms. There are also a few 2-foot T12 fixtures. Fixture types include 1-lamp, 2-lamp, 3-lamp, and 4-lamp, 4-foot-long recessed troffer fixtures with U-bend and linear tube lamps. Typically, T8 fluorescent lamps use electronic ballasts, and T12 fluorescent lamps use magnetic ballasts.

Some of the linear fixtures in the classroom have been converted to operate LED tube lamps. There are a few incandescent lamps scattered in the various sections of the facility. Gymnasium fixtures have manually controlled high-bay LED lamps. All exit signs are LED.

Most fixtures are in fair condition. Interior lighting levels were generally sufficient. Interior lighting fixtures in most spaces are controlled by wall switches.

Linear T8 Fluorescent Fixtures



Linear T8 Fluorescent Fixtures

CFLs

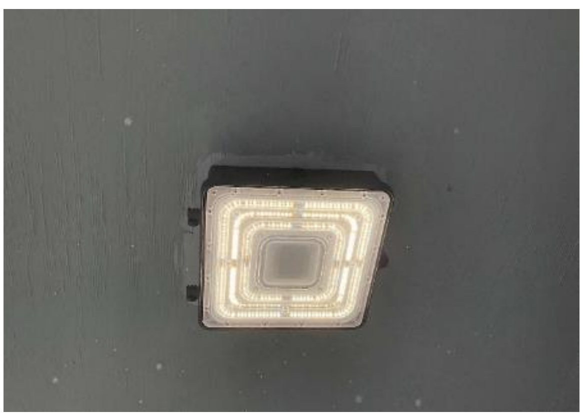
Linear T12 Fluorescent Fixtures

LED Lamp Fixture

Incandescent Lamps

Exterior fixtures include wall packs, canopy fixtures, and floodlights, which use a mix of high-intensity discharge (HID), fluorescent, and LED lamps, as well as HID flood lamps.

Fixtures are controlled by a photocell; however, several were observed to be operating during the day.



Exterior LED Fixture

Exterior HID Fixture

Exterior Canopy Fixture

Exterior HID Fixture

2.5 Air Handling Systems

Unit Ventilators

Unit ventilators have supply fan motors and pneumatically controlled outside air dampers, as well as a steam and hot water distribution system. The newer section of the building is connected to the hot water system, while the older section is connected to the steam system. Some classrooms also have split-system DX air conditioning units for cooling, which work alongside the unit ventilators. The condensing units are of standard efficiency, operating beyond their useful life and in fair condition. These systems provide heating, and in a few classrooms, cooling and ventilation. Overall, the system appears to be in fair operating condition and is original to the building.

Typical Unit Ventilator

Typical Unit Ventilator

Outdoor Condensing Unit *Outdoor Condensing Unit*

<u>Unitary Electric HVAC Equipment</u>

Some classrooms, gym office, speech room office, and office 304 are cooled by window AC units. These units have capacities ranging from 5,000 Btu to 24,000 Btu and are in good condition. Most units are beyond their useful life, in fair condition, and are of standard efficiency. The newer systems are operated using remote control units located within the space, while the older window air conditioners have mechanical control type with rotary knobs to control the temperature and fan speed of the air conditioner. In addition, there is a Fujitsu wall-mounted ductless mini-split heat pump in classroom 215, with a capacity of 2.75 tons. It was manufactured around 2017, is in fair condition, and operates at standard efficiency.

Wall Mounted Air Conditioner *Window AC*

Outdoor Unit- Heat Pump

Window AC

Unitary Heating Equipment

The greenhouse room is heated by suspended electric resistance heaters. The heater has an estimated capacity of 10 kW. The unit is fair condition. Equipment is controlled by a manual dial thermostat, which was set at 56°F at the time of the audit. There are also several radiant heaters present in the facility for heating.

Radiant Heaters

Radiant Heaters

Electric Resistance Heater

Electric Resistance Heater -Thermostat

Packaged Units

The media center, main office, and nurse's office are served by two Trane package units, with capacities of 10 tons and 6.25 tons. Specifically, the 10-ton unit serves the media center, while the 6.25-ton unit serves both the main office and nurse's office. These units are controlled by a Building Automation System (BAS). Heating is provided by boilers, as discussed in section 2.6. Manufactured around 1999, these units are beyond their expected life and are of standard efficiency. These units are evaluated for the replacement.

Refer to Appendix A for detailed information about each unit.

Package Unit

Package Unit

2.6 Heating Steam and Hot Water Systems

Two HB Smith 3,831 MBh steam boilers serve the building's heating load. The burners are fully modulating with a nominal efficiency of 83%. The boilers are configured in an automated lead-lag control scheme. Both boilers are required under high load conditions. Manufactured in 2018, they are in good condition. The facility regularly tests the air-fuel ratio with the combustion test and tunes the boiler for maximum efficiency.

The old section of the school has a heating system that operates through a steam distribution system, supplying unit ventilators and radiant heaters. In the newer addition, 25% of the building's steam is converted into hot water using a Hydronic Module's heat exchanger for heating purposes. This system uses a two-pipe hydronic distribution system for heating only. The hydronic system is configured for constant flow distribution with a 2 hp constant speed hot water pump. The system provides hot water and steam to various heating units, such as cast-iron radiators, unit ventilators, fan coil units, and package units throughout the building.

The mechanical room contains two, 1 hp boiler feed pumps and four condensate return pumps, two with 1.5 hp capacity and two with 2 hp capacity. Most of the insulation on the steam supply and condensate return is in good condition, and steam traps are replaced and repaired as necessary.

Energy for America is responsible for remotely managing the HVAC system, including controlling the boilers and setting the temperature for occupied and unoccupied times. Facility personnel manage boiler controls through a centralized BAS system, with limited options for making changes. During the audit, the BAS was set to maintain a supply temperature of 138°F for hot water and a steam pressure of 18 PSI.

Steam Boilers

Heat Exchanger- Steam to Hot Water

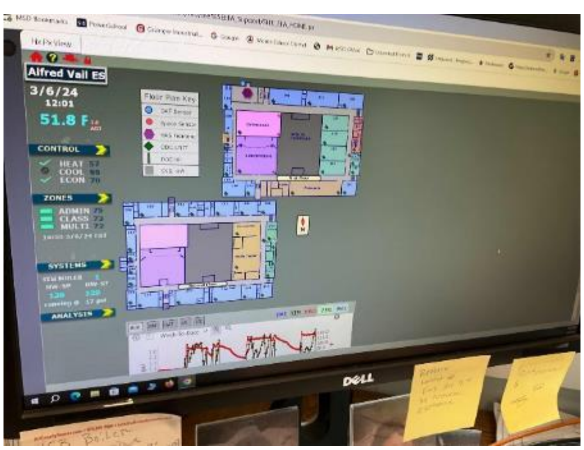
Condensate Return Pump

Steam Boiler

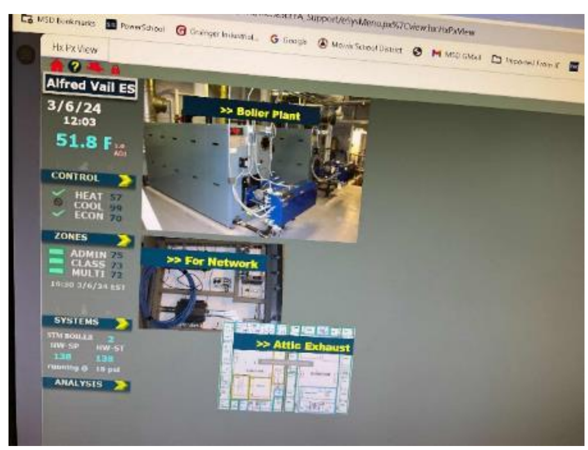
2.7 Building Automation System (BAS)

The HVAC system is remotely managed by a third party, Energy for America. Energy for America controls occupied and unoccupied temperature setpoints, as well as equipment operating times (including steam boilers and unit ventilators). Classrooms and similar spaces are scheduled based upon occupancy, while areas like the office, auditorium, and gymnasium are scheduled based upon both typical occupancy and events. According to staff, Energy for America's control functions are not accessible to local staff.

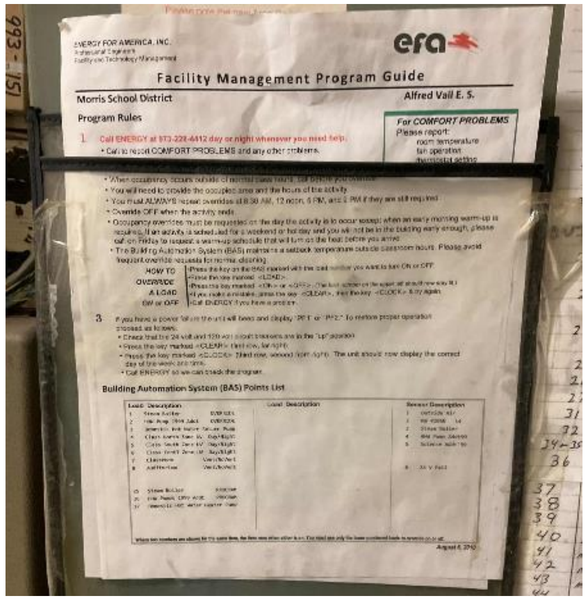
A local BAS controls some of the smaller localized HVAC equipment, including the unit ventilator, exhaust fans, and package units. The existing building automation system is frequently utilized to monitor the status of building rooftop package units, steam boilers, unit ventilators, and exhaust fans. Retro-commissioning of the BAS system has been evaluated and is recommended because the facility's EUI is higher than the national average. System upgrade planning and retro-commissioning activities should be coordinated among the various stakeholder parties.



BAS Interface



BAS Interface



BAS Program Guide-EFA

2.8 Domestic Hot Water

Hot water is generated by an ENERGY STAR qualified gas-fired AO Smith brand tankless condensing water heater with a capacity of 199 MBh and an efficiency of 96%. The water is then stored in one, 200-gallon tank. In the restroom, hot water is produced by a 40-gallon electric Rheem brand storage water heater with a capacity of 4.5 kW.

During the site visit, the domestic water heaters were set at 110°F.

Two fractional horsepower circulation pumps, operating continuously, circulate the water to the end uses from the mechanical room. Additionally, there is a 1/8 hp DHW circulation pump for the second-floor hot water heater. The domestic water pipes are insulated in the mechanical room section for the heater and storage water tank and are in fair condition. However, the pipes for the electric storage tank heater are not insulated.

Gas Fired Hot Water Heater

Electric Storage Tank Heater

Storage Tank Heater

DHW Circulation Pump

2.9 Food Service Equipment

The kitchen is equipped with a combination of gas and electric equipment used for preparing breakfast and lunch for students. Most of the cooking is done using a gas-fired cooktop and an electric oven. Electric holding cabinet of Metro brand are used for storing bulk prepared foods. The equipment's used is in fair condition and not high efficiency.

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

Cooktop/Oven

Convection Oven

Insulated Food Holding Cabinet (Full Size)

2.10 Refrigeration

The kitchen has several stand-up refrigerators and freezer with solid doors. There is a refrigerated milk cooler. Most of the equipment is of standard efficiency and in fair condition. This report makes additional suggestions for ECMs in this area as well as energy efficient best practices.

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

Refrigerated Milk Cooler

Stand-Up Refrigerator Solid Door

Stand-Up Freezer Solid Door

Stand-Up Refrigerator Solid Door

2.11 Plug Load

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 380 Chromebooks being used by both students and staff, plus a few computer workstations located throughout the facility. The plug loads consist of general cafe, office, and classroom equipment, including printer/copiers, microwaves, and projectors. All classrooms are equipped with Promethean smartboards and Medify brand air purifiers.

There are also a few residential-style refrigerators throughout the building that are used to store food. These vary in condition and efficiency. The art classroom also has a kiln.

Kiln

Air Purifier

Smartboard

Serving Table

Copier/Printer

Residential style Refrigerator

2.12 Water-Using Systems

Water is provided by the Southeast Morris County Municipal Utilities Authority. Water is mainly used for drinking, cleaning, cooking, landscaping, and sanitary fixtures. Water leaks were not observed.

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 few restrooms with toilets, urinals, and sinks. Faucet flow rates are 2.2 gpm or higher.

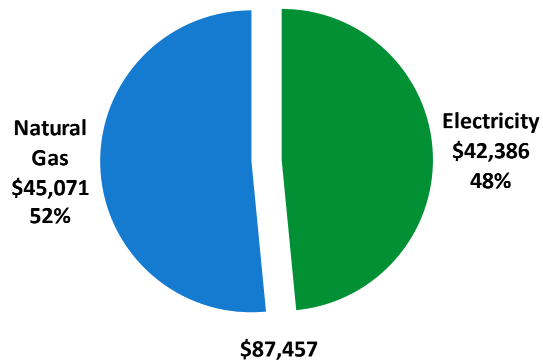
Typical Kitchen Faucets

Typical Restroom Faucets

3 Energy and Water Use and Costs

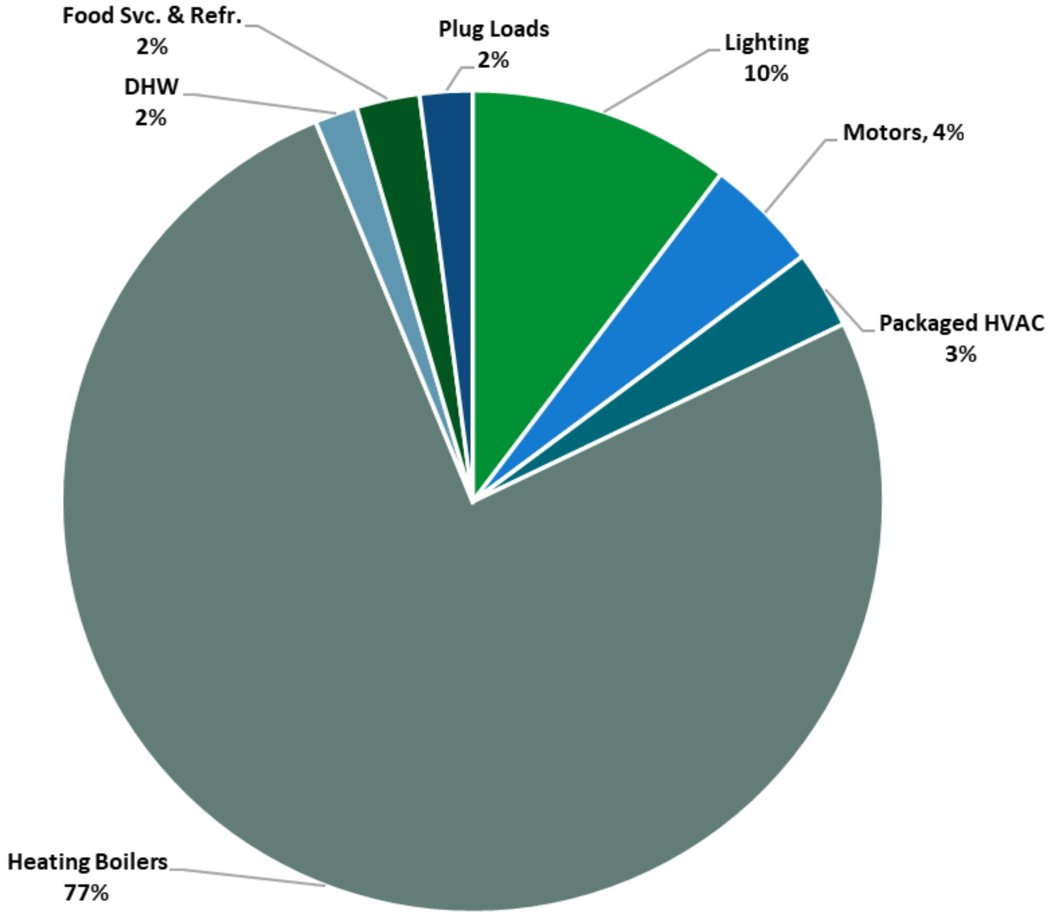
Twelve months of utility billing data are used to develop annual energy consumption and cost data. This information creates a profile of the annual energy consumption and energy costs.

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	304,258 kWh	$42,386
Natural Gas	35,928 Therms	$45,071
Total		**$87,457**



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.

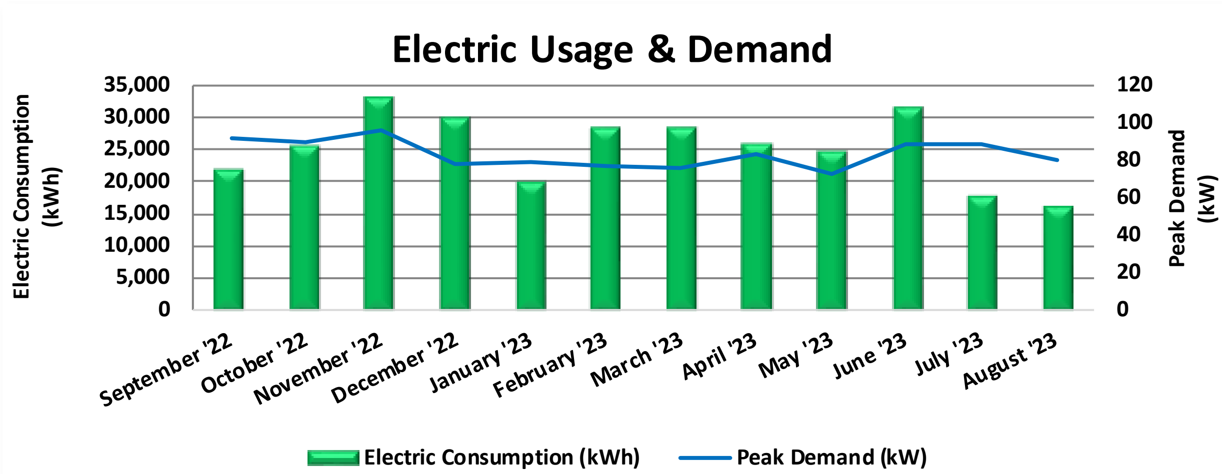
The energy auditor collects information regarding equipment operating hours, capacity, efficiency, and other operational parameters from facility staff, drawings, and on-site observations. This information is used as the inputs to calculate the existing conditions energy use for the site. The calculated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

JCP&L delivers electricity under rate class General Service Secondary 3 Phase JC_GS3_01D, with electric production provided by Direct Energy, a third-party supplier.



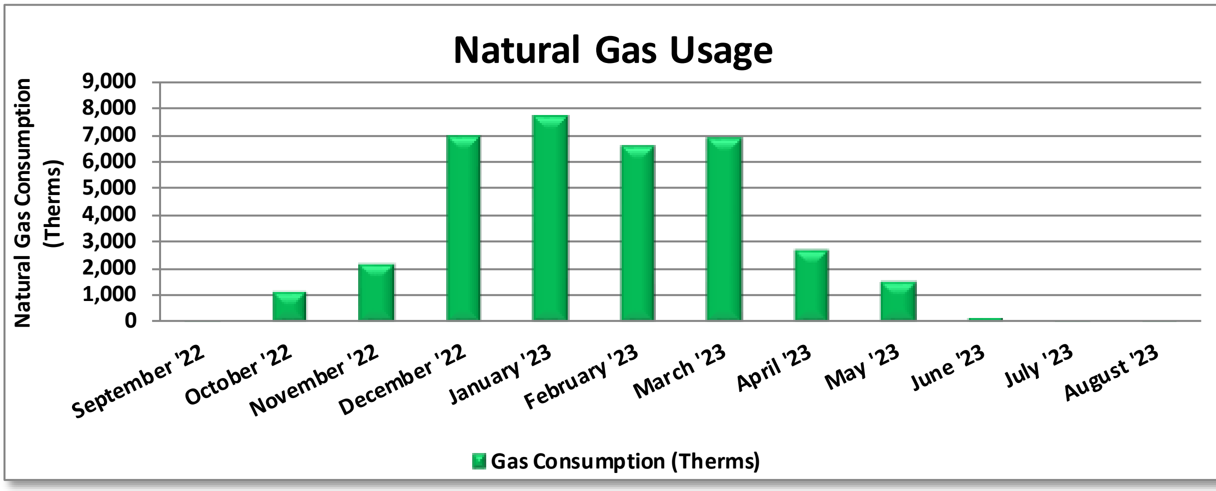
Electric Billing Data					
Period Ending	**Days in Period**	**Electric Usage (kWh)**	**Demand (kW)**	**Demand Cost**	**Total Electric Cost**
9/20/22	29	21,712	92	$730	$3,186
10/19/22	29	25,712	90	$661	$3,584
11/17/22	29	33,072	97	$714	$4,427
12/19/22	32	30,032	78	$578	$3,948
1/20/23	32	19,952	79	$585	$2,886
2/17/23	28	28,432	77	$571	$3,768
3/20/23	31	28,432	76	$558	$3,789
4/19/23	30	25,872	83	$615	$3,590
5/18/23	29	24,592	73	$536	$3,364
6/19/23	32	31,632	89	$704	$4,306
7/20/23	31	17,872	89	$704	$2,838
8/21/23	32	16,112	81	$638	$2,584
Totals	**364**	**303,424**	**97**	**$7,594**	**$42,270**
Annual	**365**	**304,258**	**97**	**$7,615**	**$42,386**

Notes:

- Peak demand of 97 kW occurred in November '22.
- Average demand over the past 12 months was 84 kW.
- The average electric cost over the past 12 months was $0.139/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.

3.2 Natural Gas

PSE&G delivers natural gas under rate class Large Volume Gas (LVG), with natural gas supply provided by Direct Energy, a third-party supplier.



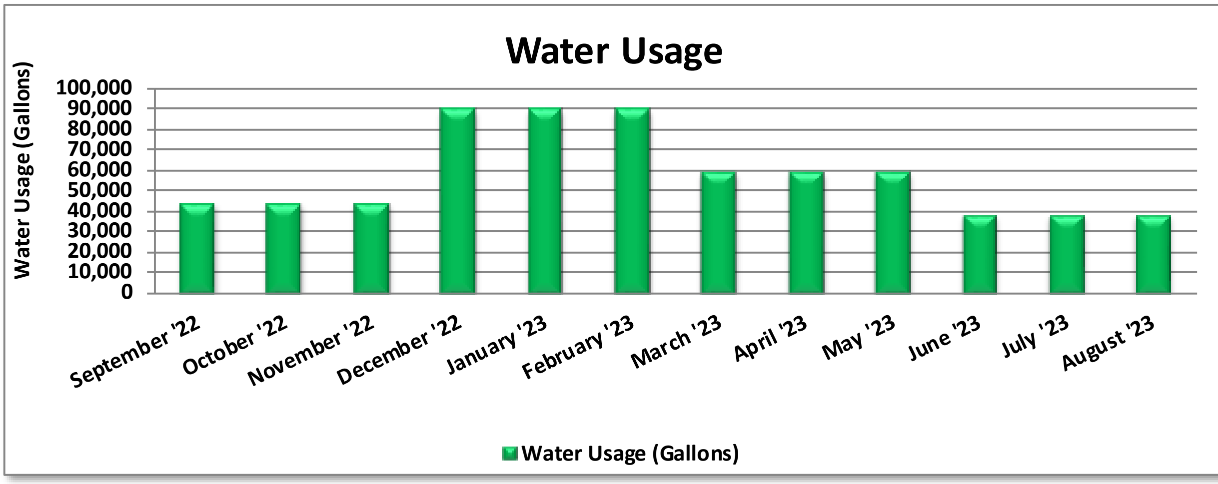
Gas Billing Data			
Period Ending	**Days in Period**	**Natural Gas Usage (Therms)**	**Natural Gas Cost**
9/19/22	32	88	$340
10/18/22	29	1,083	$1,478
11/16/22	29	2,186	$3,994
12/19/22	33	6,982	$9,245
1/20/23	32	7,718	$10,062
2/17/23	28	6,582	$7,754
3/21/23	32	6,874	$7,654
4/20/23	30	2,690	$2,398
5/19/23	29	1,480	$1,347
6/21/23	33	116	$293
7/20/23	29	66	$254
8/18/23	29	63	$252
Totals	**365**	**35,928**	**$45,071**
Annual	**365**	**35,928**	**$45,071**

Notes:

- The average gas cost for the past 12 months is $1.254/therm, which is the blended rate used throughout the analysis.

3.3 Water

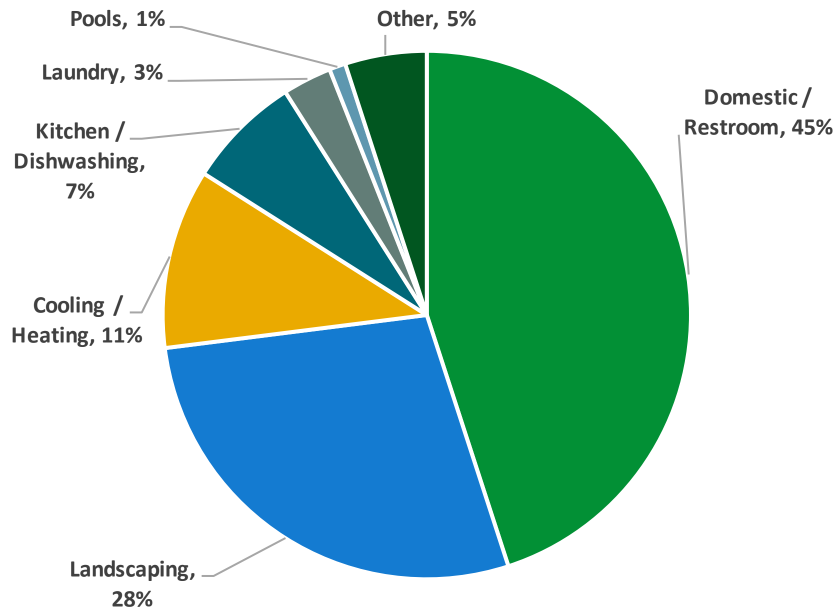
Southeast Morris County Municipal Utilities Authority delivers water to the project site.



Water Billing Data			
Period Ending	**Days in Period**	**Water Usage (gallons)**	**Water Cost**
8/22/22	30	44,135	$373
9/22/22	31	44,135	$373
10/22/22	30	44,135	$373
11/22/22	31	90,016	$789
12/22/22	30	90,016	$789
1/22/23	31	90,016	$789
2/22/23	31	59,844	$539
3/22/23	28	59,844	$539
4/22/23	31	59,844	$539
5/22/23	0	38,649	$332
6/22/23	31	38,649	$332
7/22/23	30	38,649	$332
Totals	**334**	**697,933**	**$6,101**
Annual	**365**	**762,711**	**$6,667**

Notes:

- The average cost of water for the past 12 months is $0.0087/gal.



Typical Education Water End Use[4]

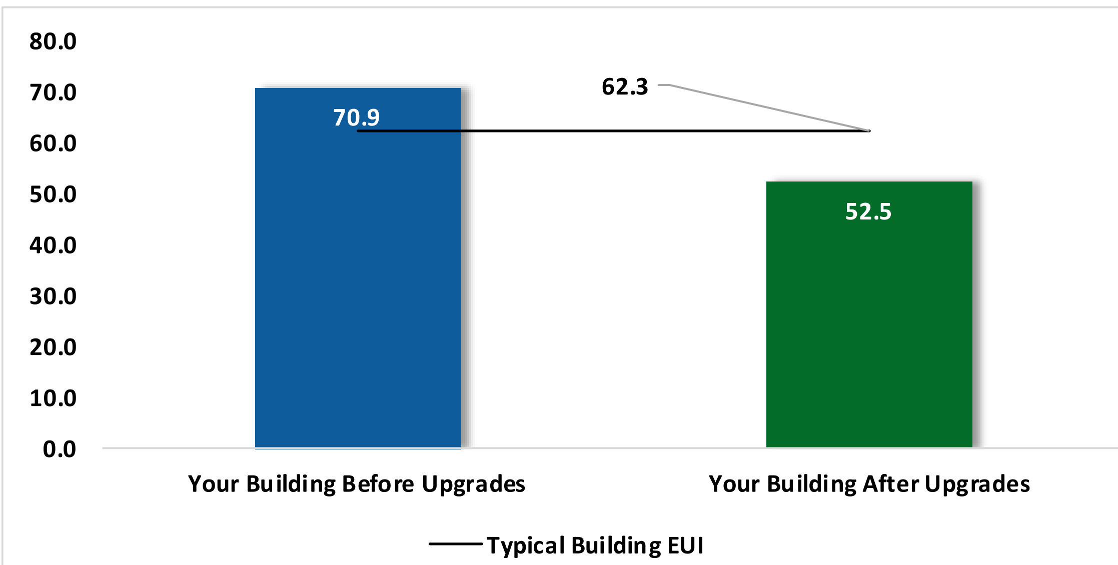
[4] Chart is of typical water end use and not specific to the facility

3.4 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	37



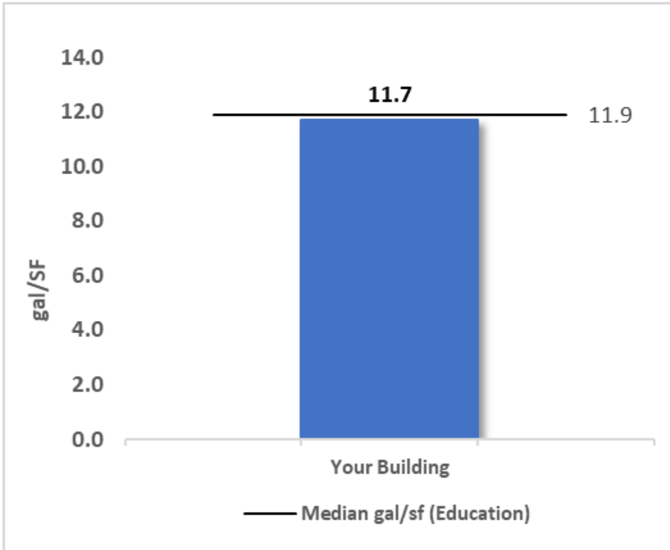
Energy Use Intensity Comparison[5]

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

Energy use intensity (EUI) measures energy consumption per square foot and is the standard metric for comparing buildings' energy performance. A lower EUI means better performance and less energy consumed. 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.

[5] Based on all evaluated ECMs

Water Benchmarking



A benchmark is provided for your building's water use based on the annual water use in gallons per square foot of building area (gal/sf-yr.). Your building is compared to other similar buildings based on average water usage as available from the 2012 Commercial Buildings Energy Consumption Survey (CBECS) and from the EPA ENERGY STAR DataTrends Water Use Tracking database. Steam boilers are significant water users. Kitchens and sanitary fixtures may use varying amounts of water.

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.

3.5 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			**72,269**	**16.7**	**-15**	**$9,878**	**$51,740**	**$10,490**	**$41,250**	**4.2**	**71,005**
ECM 1	Install LED Fixtures	Yes	6,539	0.0	0	$911	$4,430	$550	$3,880	4.3	6,585
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	221	0.1	0	$30	$380	$30	$350	11.6	217
ECM 3	Retrofit Fixtures with LED Lamps	Yes	65,509	16.6	-15	$8,937	$46,930	$9,910	$37,020	4.1	64,203
Lighting Control Measures			**19,007**	**4.8**	**-4**	**$2,593**	**$39,710**	**$9,330**	**$30,380**	**11.7**	**18,628**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	14,744	4.0	-3	$2,011	$30,690	$3,600	$27,090	13.5	14,450
ECM 5	Install High/Low Lighting Controls	Yes	4,263	0.8	-1	$582	$9,020	$5,730	$3,290	5.7	4,178
Motor Upgrades			**100**	**0.0**	**0**	**$14**	**$900**	**$0**	**$900**	**64.5**	**101**
ECM 6	Premium Efficiency Motors	No	100	0.0	0	$14	$900	$0	$900	64.5	101
Unitary HVAC Measures			**6,556**	**8.3**	**0**	**$913**	**$53,200**	**$1,700**	**$51,500**	**56.4**	**6,601**
ECM 7	Install High Efficiency Air Conditioning Units	No	6,556	8.3	0	$913	$53,200	$1,700	$51,500	56.4	6,601
HVAC System Improvements			**226**	**0.0**	**24**	**$329**	**$6,140**	**$50**	**$6,090**	**18.5**	**3,007**
ECM 8	Implement Demand Control Ventilation (DCV)	No	0	0.0	24	$298	$5,800	$0	$5,800	19.5	2,780
ECM 9	Install Pipe Insulation	Yes	226	0.0	0	$31	$340	$50	$290	9.2	227
Domestic Water Heating Upgrade			**278**	**0.0**	**12**	**$184**	**$460**	**$220**	**$240**	**1.3**	**1,635**
ECM 10	Install Low-Flow DHW Devices	Yes	278	0.0	12	$184	$460	$220	$240	1.3	1,635
Food Service & Refrigeration Measures			**10,101**	**1.2**	**0**	**$1,407**	**$17,000**	**$1,200**	**$15,800**	**11.2**	**10,172**
ECM 11	Replace Refrigeration Equipment	Yes	10,101	1.2	0	$1,407	$17,000	$1,200	$15,800	11.2	10,172
Custom Measures			**7,714**	**0.0**	**791**	**$10,999**	**$241,700**	**$0**	**$241,700**	**22.0**	**100,391**
ECM 12	Retro-Commissioning Study	Yes	3,070	0.0	105	$1,746	$9,100	$0	$9,100	5.2	15,392
ECM 13	Building Envelope Improvements	No	3,290	0.0	686	$9,064	$230,100	$0	$230,100	25.4	83,635
ECM 14	Replace Electric Water Heater with Heat Pump Water Heater	No	1,354	0.0	0	$189	$2,500	$0	$2,500	13.2	1,363
TOTALS			**116,251**	**31.0**	**807**	**$26,318**	**$410,850**	**$22,990**	**$387,860**	**14.7**	**211,540**

* - 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		**72,269**	**16.7**	**-15**	**$9,878**	**$51,740**	**$10,490**	**$41,250**	**4.2**	**71,005**
ECM 1	Install LED Fixtures	6,539	0.0	0	$911	$4,430	$550	$3,880	4.3	6,585
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	221	0.1	0	$30	$380	$30	$350	11.6	217
ECM 3	Retrofit Fixtures with LED Lamps	65,509	16.6	-15	$8,937	$46,930	$9,910	$37,020	4.1	64,203
Lighting Control Measures		**19,007**	**4.8**	**-4**	**$2,593**	**$39,710**	**$9,330**	**$30,380**	**11.7**	**18,628**
ECM 4	Install Occupancy Sensor Lighting Controls	14,744	4.0	-3	$2,011	$30,690	$3,600	$27,090	13.5	14,450
ECM 5	Install High/Low Lighting Controls	4,263	0.8	-1	$582	$9,020	$5,730	$3,290	5.7	4,178
HVAC System Improvements		**226**	**0.0**	**0**	**$31**	**$340**	**$50**	**$290**	**9.2**	**227**
ECM 9	Install Pipe Insulation	226	0.0	0	$31	$340	$50	$290	9.2	227
Domestic Water Heating Upgrade		**278**	**0.0**	**12**	**$184**	**$460**	**$220**	**$240**	**1.3**	**1,635**
ECM 10	Install Low-Flow DHW Devices	278	0.0	12	$184	$460	$220	$240	1.3	1,635
Food Service & Refrigeration Measures		**10,101**	**1.2**	**0**	**$1,407**	**$17,000**	**$1,200**	**$15,800**	**11.2**	**10,172**
ECM 11	Replace Refrigeration Equipment	10,101	1.2	0	$1,407	$17,000	$1,200	$15,800	11.2	10,172
Custom Measures		**3,070**	**0.0**	**105**	**$1,746**	**$9,100**	**$0**	**$9,100**	**5.2**	**15,392**
ECM 12	Retro-Commissioning Study	3,070	0.0	105	$1,746	$9,100	$0	$9,100	5.2	15,392
TOTALS		**104,951**	**22.7**	**97**	**$15,840**	**$118,350**	**$21,290**	**$97,060**	**6.1**	**117,059**

* - 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		**72,269**	**16.7**	**-15**	**$9,878**	**$51,740**	**$10,490**	**$41,250**	**4.2**	**71,005**
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ECM 3	Retrofit Fixtures with LED Lamps	65,509	16.6	-15	$8,937	$46,930	$9,910	$37,020	4.1	64,203

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: Install LED Fixtures

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

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

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

Affected Building Areas: exterior fixtures

ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

Retrofit fluorescent fixtures by removing the fluorescent tubes and ballasts and replacing them with LED tubes and LED drivers (if necessary), which are designed to be used in retrofitted fluorescent fixtures.

The measure uses the existing fixture housing but replaces the electric components with more efficient lighting technology, which use less power than other lighting technologies but provides equivalent lighting output. Maintenance savings may also be achieved since LED tubes last longer than fluorescent tubes and, therefore, do not need to be replaced as often.

Affected Building Areas: greenhouse room and storage art department with T12 fixture

ECM 3: 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: all areas with fluorescent fixtures with T8 tubes (linear and U-Bend), CFLs; various classrooms, dining area, exterior, storage, and theater; incandescent lamps: various classrooms, dining room, and theater

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		**19,007**	**4.8**	**-4**	**$2,593**	**$39,710**	**$9,330**	**$30,380**	**11.7**	**18,628**
ECM 4	Install Occupancy Sensor Lighting Controls	14,744	4.0	-3	$2,011	$30,690	$3,600	$27,090	13.5	14,450
ECM 5	Install High/Low Lighting Controls	4,263	0.8	-1	$582	$9,020	$5,730	$3,290	5.7	4,178

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 4: Install Occupancy Sensor Lighting Controls

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

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

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

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

Affected Building Areas: offices, conference rooms, classrooms, gymnasium, library, restrooms, mechanical room, theater, and storage rooms

ECM 5: Install High/Low Lighting Controls

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

Lighting fixtures with these controls operate at default low levels when the area is unoccupied to provide minimal lighting to meet security or safety 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: corridors and stairwells

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		**100**	**0.0**	**0**	**$14**	**$900**	**$0**	**$900**	**64.5**	**101**
ECM 6	Premium Efficiency Motors	100	0.0	0	$14	$900	$0	$900	64.5	101

ECM 6: Premium Efficiency Motors

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

Affected Motors:

Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Additional Motor Description
Attic Area	Kitchen Exhaust Fan	1	Kitchen Hood Exhaust Fan	1.3	

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 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		**6,556**	**8.3**	**0**	**$913**	**$53,200**	**$1,700**	**$51,500**	**56.4**	**6,601**
ECM 7	Install High Efficiency Air Conditioning Units	6,556	8.3	0	$913	$53,200	$1,700	$51,500	56.4	6,601

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 air conditioners are eventually replaced, consider purchasing equipment that exceeds the minimum efficiency required by building codes.

ECM 7: Install High Efficiency Air Conditioning Units

We evaluated replacing standard efficiency air conditioning units with high efficiency 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: package units: media center, main office, and nurse's office; window and split ACs: various classrooms

4.5 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		**226**	**0.0**	**24**	**$329**	**$6,140**	**$50**	**$6,090**	**18.5**	**3,007**
ECM 8	Implement Demand Control Ventilation (DCV)	0	0.0	24	$298	$5,800	$0	$5,800	19.5	2,780
ECM 9	Install Pipe Insulation	226	0.0	0	$31	$340	$50	$290	9.2	227

ECM 8: Implement Demand Control Ventilation (DCV)

Demand control ventilation (DCV) is a control strategy that monitors the indoor air's carbon dioxide (CO2) content to measure room occupancy. This data is used to regulate the amount of outdoor air provided to the space for ventilation.

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

Energy savings associated with DCV are based on hours of operation, space occupancy, outside air reduction, and other factors. Energy savings results from eliminating unnecessary ventilation and space conditioning. Implementation of this measure is dependent upon having a building automation system (BAS) or other smart building control system connected to the space conditioning equipment serving the noted areas.

Affected Building Areas: evaluated DCV for the gymnasium and auditorium

ECM 9: Install Pipe Insulation

Install insulation on domestic hot water 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: domestic hot water piping

4.6 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		**278**	**0.0**	**12**	**$184**	**$460**	**$220**	**$240**	**1.3**	**1,635**
ECM 10	Install Low-Flow DHW Devices	278	0.0	12	$184	$460	$220	$240	1.3	1,635

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.

4.7 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		**10,101**	**1.2**	**0**	**$1,407**	**$17,000**	**$1,200**	**$15,800**	**11.2**	**10,172**
ECM 11	Replace Refrigeration Equipment	10,101	1.2	0	$1,407	$17,000	$1,200	$15,800	11.2	10,172

ECM 11: Replace Refrigeration Equipment

Replace existing commercial refrigerators, and freezers 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.

4.8 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		**7,714**	**0.0**	**791**	**$10,999**	**$241,700**	**$0**	**$241,700**	**22.0**	**100,391**
ECM 12	Retro-Commissioning Study	3,070	0.0	105	$1,746	$9,100	$0	$9,100	5.2	15,392
ECM 13	Building Envelope Improvements	3,290	0.0	686	$9,064	$230,100	$0	$230,100	25.4	83,635
ECM 14	Replace Electric Water Heater with Heat Pump Water Heater	1,354	0.0	0	$189	$2,500	$0	$2,500	13.2	1,363

ECM 12: Retro-Commissioning Study

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

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

Note that this process may involve identifying additional control opportunities that require further investment, such as adding more control points to the BAS system. Retro-commissioning is especially important for your facility because it has a low energy benchmarking score. Adjustments to setpoints and schedules for air handling units, steam boilers, ventilation fans, and pumps will likely be necessary to optimize your building operations.

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

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

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

A high-level evaluation of potential savings and costs is provided for demonstration purposes only. It is a screening evaluation for the potential in HVAC control improvements. Based on industry standards and previous project experience, the potential energy savings may be up to 15% of existing HVAC energy use. We estimate the cost of retro-commissioning studies and control improvements of $0.30 per square foot.

Actual savings and costs will need to be outlined by the specific contractor engaged to perform the study. For the purposes of this report, we have conservatively estimated savings to be 3.0% of the HVAC energy consumption baseline.

ECM 13: Building Envelope Improvements

We evaluated improvements on the attic insulation and installed new windows throughout the facility based on the site condition and as per the data observed during the audit. Heat flows from warmer to cooler areas until there is no longer a temperature difference. In your building, this means that in winter, heat flows directly from all heated spaces to adjacent unheated attics, garages, basements, and to the outdoors. Heat flow can also move indirectly through interior ceilings, walls, and floors—wherever there is a difference in temperature. During the cooling season, heat flows from the exterior to the building interior.

To maintain comfort, the heat lost in the winter must be replaced by your heating system. Similarly, heat gained in the summer must be removed by your cooling system. Properly insulating your building will decrease this heat flow by providing an effective resistance to the flow of heat.

An insulating material's resistance to conductive heat flow is measured or rated in terms of its thermal resistance or R-value—the higher the R-value, the greater the insulating effectiveness. The R-value depends on the type of insulation, its thickness, and its density. Installing more (and thicker) insulation increases the R-value and the resistance to heat flow. In general, increased insulation thickness will proportionally increase the R-value.

Consider using a thermal camera to conduct a study of building heat loss to better understand where insulation will provide the greatest benefit.

For more information: https://www.energy.gov/energysaver/weatherize/insulation

Install Roof Insulation

We evaluated installing ceiling or roof insulation as a thermal barrier between the conditioned space and unconditioned attic will improve thermal comfort in the building and reduce the heating energy use. Commonly used insulation materials include fiberglass, cellulose, rigid foam, and polystyrene. Insulation can be blown in, applied as a layer, or sprayed on, depending on the type of material. Install insulation to levels that meet or exceed the current adopted building and energy code.

Sprayed foam insulation made from polyurethane or similar materials can be pressure sprayed to the underside of the roof decking. Install spray foam insulation (and additional loose-fill insulation if desired) in the roof cavity to levels that meet or exceed the current adopted building and energy code.

We observed that the attic area that can be reached seems to have insulation, but it's deteriorating. There's existing blown-in insulation in and around the floorboards. It's important to inspect for gaps under the floorboards and utilize thermal imaging tools to determine the level of heat loss or gain through the roof. If there's a solid surface beneath the attic floorboards, blown-in insulation could be added underneath to maintain easy access. However, adding blown-in or batt insulation on top of the floorboards would make access to the attic more difficult.

Install Replacement Windows

We evaluated the installation of high-performance windows to replace the windows currently in the facility.

If your windows are in good condition, taking steps to improve their efficiency may be the most cost-effective option to increase comfort and save money on energy costs rather than replacing them. However, aging windows, particularly those that are single pane, contribute substantially to building heat loss and replacement may be warranted. Even if not cost effective on the basis of energy savings alone, new windows may improve comfort and building aesthetics.

New Jersey experiences a range of temperatures, so window replacement should consider both heating and cooling impacts. For colder weather, consider selecting gas-filled windows with low-e coatings to reduce heat loss. Choose a low U-factor for better thermal resistance; the U-factor is the rate at which a window conducts non-solar heat flow. For summer, select windows with coatings to reduce heat gain. Look for a low solar heat gain coefficient (SHGC). SHGC is a measure of solar radiation admitted through a window. Low SHGCs reduce heat gain. Select windows with both low U-factors and low SHGCs to maximize energy savings in temperate climates with both cold and hot seasons.

ECM 14: Replace Electric Water Heater with Heat Pump Water Heater

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

A typical electric water heater uses electric resistance coils to heat water at a coefficient of performance (COP) of 1. Air source heat pump water heaters use a refrigeration cycle to transfer heat from the surrounding air to the domestic water. The typical average COP for a HPWH is about 2.5, so they require significantly less electricity to produce the same amount of hot water as a traditional electric water heater. 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 following addresses integrated HPWH.

HPWH reject cold air. As such, they need to be installed in an unconditioned space of about 750 cubic feet with good ventilation. 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.

Affected Units: electric storage water heater–restroom

4.9 Measures for Future Consideration

There are additional opportunities for improvement that Morris School District BOE 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.

Morris School District BOE 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:

- 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.

Heating System Conversion from Steam to Hot Water

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 boilers have reached the end of their normal useful life. 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 resulted 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.

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

Weatherization

Caulk or weather strip leaky doors and windows to reduce drafts and loss of heated or cooled air. Sealing cracks and openings can reduce heating and cooling costs, improve building durability, and create a healthier indoor environment. Materials used may include caulk, polyurethane foam, and other weather-stripping materials. There is an energy savings opportunity by reducing the uncontrolled air exchange between the outside and inside of the building. Blower door assisted comprehensive building air sealing will reduce the amount of air exchange, which will in turn reduce the load on the buildings heating and cooling equipment, providing energy savings and increased occupant comfort.

Doors and Windows

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

Window Treatments/Coverings

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

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

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.

Motor Controls

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

Motor Maintenance

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

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.

AC System Evaporator/Condenser Coil Cleaning

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

HVAC Filter Cleaning and Replacement

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

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.

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.

Refrigeration Equipment Maintenance

Preventative maintenance keeps commercial refrigeration equipment running reliably and efficiently. Commercial refrigerators and freezers are mission-critical equipment that can cost a fortune when they go down. Even when they appear to be working properly, refrigeration units can be consuming too much energy. Have walk-in refrigeration and freezer and other commercial systems serviced at least annually. This practice will allow systems to perform to their highest capabilities and will help identify system issues if they exist.

Maintaining your commercial refrigeration equipment can save between five and ten percent on energy costs. When condenser coils are dirty, your commercial refrigerators and freezers work harder to maintain the temperature inside. Worn gaskets, hinges, door handles or faulty seals cause cold air to leak from the unit, forcing the unit to run longer and use more electricity.

Regular cleaning and maintenance also help your commercial refrigeration equipment to last longer.

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[7]. 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[8].

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[9] or download a copy of EPA's "WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities"[10] 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

[7] 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)

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

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

[10] 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.

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.

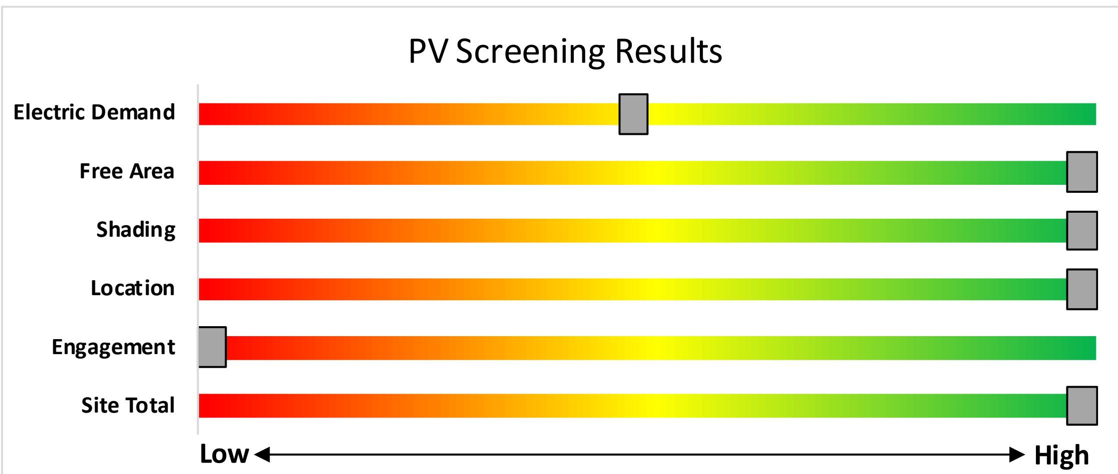
7.1 Solar Photovoltaic

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. A PV array located on the roof may be feasible. If you are interested in pursuing the installation of PV, we recommend conducting a full feasibility study.

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



Potential	High	
System Potential	83	kW DC STC
Electric Generation	98,884	kWh/yr
Displaced Cost	$13,780	/yr
Installed Cost	$215,800	

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.

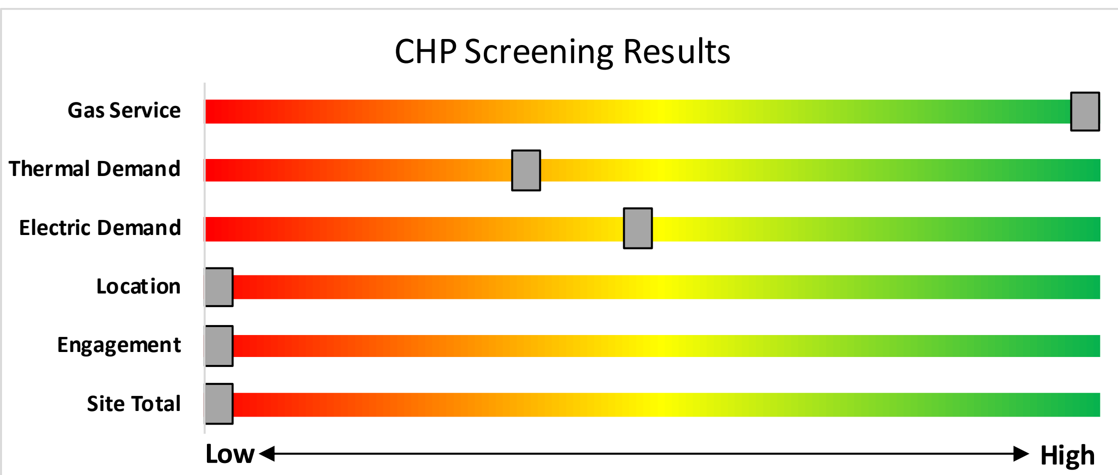
CHP systems typically produce a portion of the electric power used on-site, with the balance of electric power needs supplied by the local utility company. The heat is used to supplement (or replace) existing boilers and provide space heating and/or domestic hot water heating. Waste heat can also be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

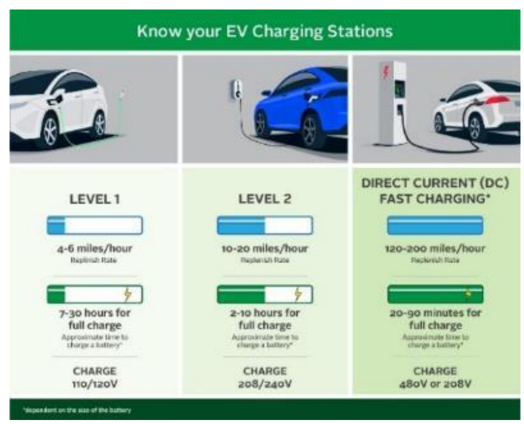
All electric vehicles (EVs) have an electric motor instead of an internal combustion engine. EVs function by plugging into a charge point, taking electricity from the grid, and then storing it in rechargeable batteries. Although electricity production may contribute to air pollution, the U.S. EPA categorizes 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 medium potential for adding EV chargers to the facility's parking, based on potential costs of installation and other site factors.

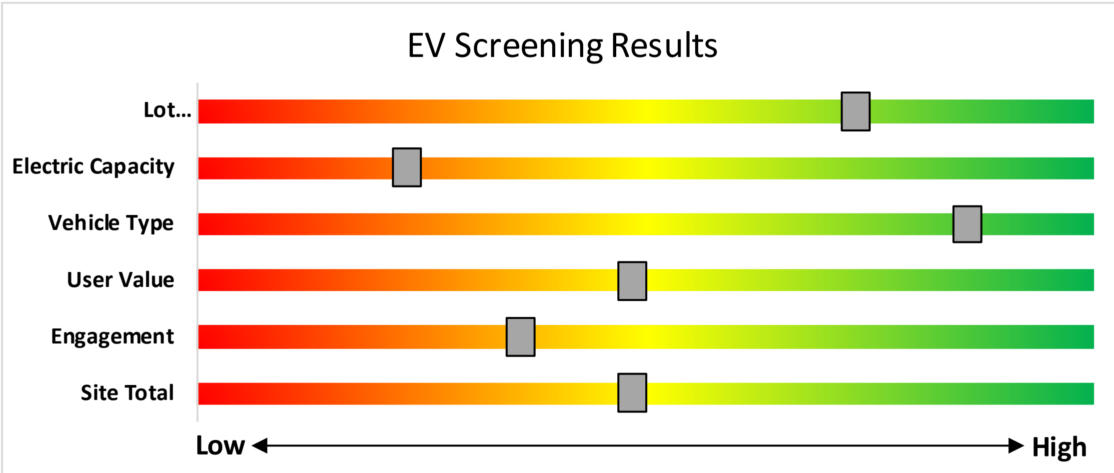
The primary costs associated with installing EV charging are the charger hardware and the cost to extend power from the facility to parking spaces. This may include upgrades to electric panels to serve increased loads.

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 Jersey's cleanenergy program

- 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

atlantic city electric (An Exelon Company) · Jersey Central Power & Light (A FirstEnergy Company) · PSE&G · Rockland Electric Company · Elizabethtown Gas · South Jersey Gas · New Jersey Natural Gas

- 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[11]

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

11

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[12]. 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[13].

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.

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

[13] 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.

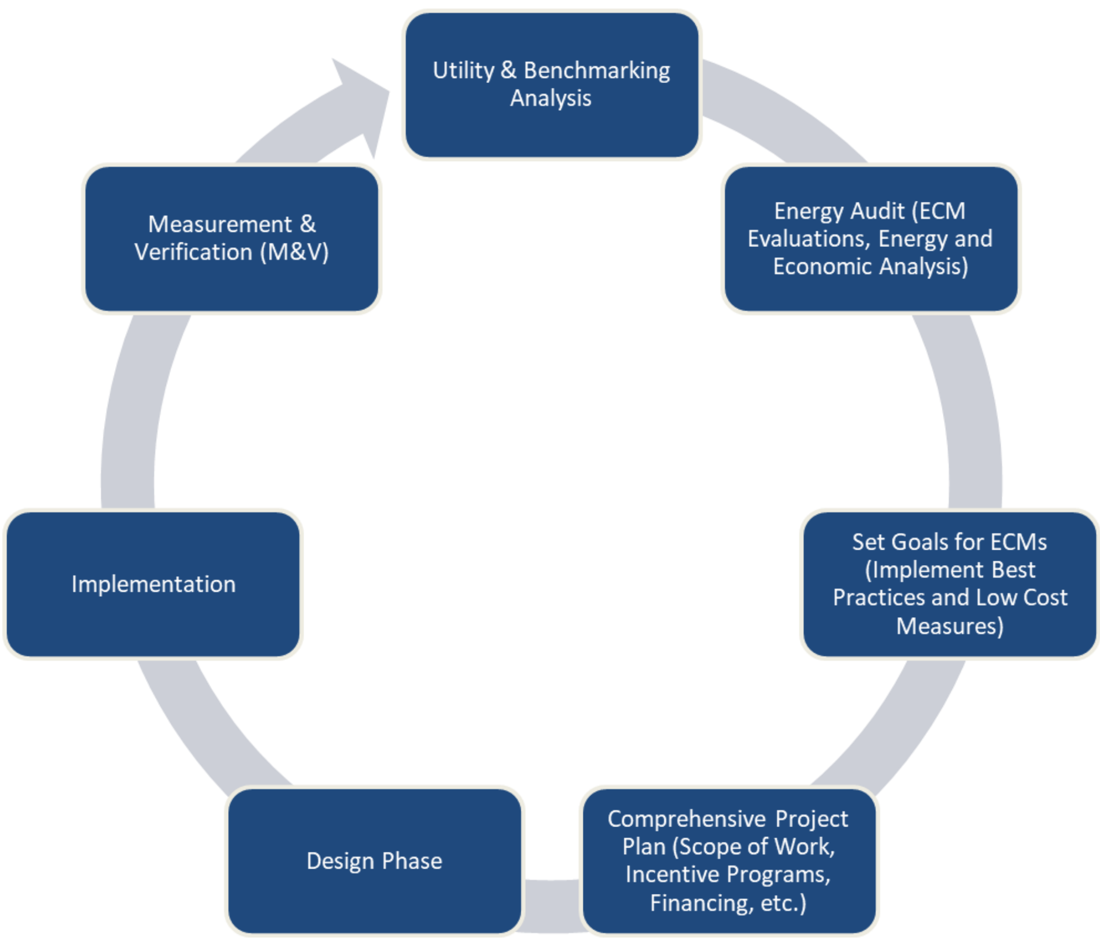
Engineered Solutions

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[14].

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[15].

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

[15] 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
Attic	19	LED Lamps: (1) 13W A19 Screw-In Lamp	Wall Switch		13	300		None	No	19	LED Lamps: (1) 13W A19 Screw-In Lamp	Wall Switch	13	300	0.0	0	0	$0	$0	$0	0.0
Classroom Green house room	4	Linear Fluorescent - T12: 2' T12 (20W) - 2L	Wall Switch	S	50	1,600	2, 4	Relamp & Reballast	Yes	4	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	1,104	0.1	245	0	$33	$630	$60	17.1
Classroom 101	2	Incandescent: (2) 60W A19 Screw-In Lamps	Wall Switch	S	120	1,800	3, 4	Relamp	Yes	2	LED Lamps: A19 Lamps	Occupancy Sensor	18	1,242	0.1	387	0	$53	$410	$40	7.0
Classroom 101	24	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	24	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.8	2,721	-1	$371	$2,180	$430	4.7
Classroom 102	1	Incandescent: (2) 60W A19 Screw-In Lamps	Wall Switch	S	120	1,800	3, 4	Relamp	Yes	1	LED Lamps: A19 Lamps	Occupancy Sensor	18	1,242	0.1	194	0	$26	$370	$40	12.5
Classroom 102	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	1,800	3, 4	Relamp	Yes	1	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,242	0.0	40	0	$5	$30	$10	3.7
Classroom 102	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,800	3, 4	Relamp	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,242	0.5	1,814	0	$247	$1,870	$310	6.3
Classroom 103	2	Incandescent: (2) 60W A19 Screw-In Lamps	Wall Switch	S	120	1,800	3, 4	Relamp	Yes	2	LED Lamps: A19 Lamps	Occupancy Sensor	18	1,242	0.1	387	0	$53	$410	$40	7.0
Classroom 103	23	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,800	3, 4	Relamp	Yes	23	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,242	0.5	1,738	0	$237	$1,820	$300	6.4
Classroom 104	1	Compact Fluorescent: (1) 15W Spiral Plug-In Lamp	Wall Switch	S	15	1,800	3, 4	Relamp	Yes	1	LED Lamps: (1) 10.5W Plug-In Lamp	Occupancy Sensor	11	1,242	0.0	14	0	$2	$360	$40	168.0
Classroom 104	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,800	3, 4	Relamp	Yes	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,242	0.3	1,209	0	$165	$1,470	$230	7.5
Classroom 105	6	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	1,800	4	None	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.0	146	0	$20	$330	$40	14.6
Classroom 107	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	1,800	4	None	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.0	49	0	$7	$330	$40	43.8
Classroom 108	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.5	1,701	0	$232	$1,280	$270	4.4
Classroom 109	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.2	680	0	$93	$710	$130	6.2
Classroom 110	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	1,800	3, 4	Relamp	Yes	1	LED Lamps: A19 Lamps	Occupancy Sensor	9	1,242	0.0	97	0	$13	$360	$40	24.2
Classroom 110	11	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	11	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.3	1,247	0	$170	$1,030	$210	4.8
Classroom 111	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.4	1,360	0	$186	$1,090	$220	4.7
Classroom 112	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.2	680	0	$93	$710	$130	6.2
Classroom 113	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.4	1,360	0	$186	$1,090	$220	4.7
Classroom 115	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.4	1,360	0	$186	$1,090	$220	4.7
Classroom 117	2	Incandescent: (2) 60W A19 Screw-In Lamps	Wall Switch	S	120	1,800	3, 4	Relamp	Yes	2	LED Lamps: A19 Lamps	Occupancy Sensor	18	1,242	0.1	387	0	$53	$410	$40	7.0
Classroom 117	11	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	11	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.3	1,247	0	$170	$1,030	$210	4.8
Classroom 201	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,800	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,242	0.0	76	0	$10	$50	$10	3.9
Classroom 201	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.4	1,360	0	$186	$1,090	$220	4.7

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantit y	Fixture Description	Control System	Light Level	Watts per Fixtur e	Annual Operatin g Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantit y	Fixture Description	Control System	Watts per Fixtur e	Annual Operatin g 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
Classroom 202	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,800	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupanc y Sensor	29	1,242	0.0	151	0	$21	$430	$60	17.9
Classroom 202	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupanc y Sensor	44	1,242	0.4	1,360	0	$186	$1,090	$220	4.7
Classroom 203	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,800	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,800	0.0	59	0	$8	$50	$10	4.9
Classroom 203	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupanc y Sensor	44	1,242	0.4	1,360	0	$186	$1,090	$220	4.7
Classroom 204	1	Compact Fluorescent: (1) 15W Spiral Plug-In Lamp	Wall Switch	S	15	1,800	3, 4	Relamp	Yes	1	LED Lamps: (1) 10.5W Plug-In Lamp	Occupanc y Sensor	11	1,242	0.0	14	0	$2	$360	$40	168.0
Classroom 204	9	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	9	LED - Linear Tubes: (3) 4' Lamps	Occupanc y Sensor	44	1,242	0.3	1,020	0	$139	$900	$180	5.2
Classroom 204 A	5	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	5	LED - Linear Tubes: (3) 4' Lamps	Occupanc y Sensor	44	1,242	0.2	567	0	$77	$650	$120	6.9
Classroom 205	1	Compact Fluorescent: (1) 15W Spiral Plug-In Lamp	Wall Switch	S	15	1,800	3, 4	Relamp	Yes	1	LED Lamps: (1) 10.5W Plug-In Lamp	Occupanc y Sensor	11	1,242	0.0	14	0	$2	$360	$40	168.0
Classroom 205	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupanc y Sensor	44	1,242	0.4	1,360	0	$186	$1,090	$220	4.7
Classroom 206	1	Compact Fluorescent: (1) 15W Spiral Plug-In Lamp	Wall Switch	S	15	1,800	3, 4	Relamp	Yes	1	LED Lamps: (1) 10.5W Plug-In Lamp	Occupanc y Sensor	11	1,242	0.0	14	0	$2	$360	$40	168.0
Classroom 206	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupanc y Sensor	44	1,242	0.4	1,360	0	$186	$1,090	$220	4.7
Classroom 207	1	Compact Fluorescent: (1) 15W Spiral Plug-In Lamp	Wall Switch	S	15	1,800	3, 4	Relamp	Yes	1	LED Lamps: (1) 10.5W Plug-In Lamp	Occupanc y Sensor	11	1,242	0.0	14	0	$2	$360	$40	168.0
Classroom 207	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupanc y Sensor	44	1,242	0.4	1,360	0	$186	$1,090	$220	4.7
Classroom 208	1	Compact Fluorescent: (1) 15W Spiral Plug-In Lamp	Wall Switch	S	15	1,800	3, 4	Relamp	Yes	1	LED Lamps: (1) 10.5W Plug-In Lamp	Occupanc y Sensor	11	1,242	0.0	14	0	$2	$360	$40	168.0
Classroom 208	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupanc y Sensor	44	1,242	0.4	1,360	0	$186	$1,090	$220	4.7
Classroom 209	1	Compact Fluorescent: (1) 15W Spiral Plug-In Lamp	Wall Switch	S	15	1,800	3, 4	Relamp	Yes	1	LED Lamps: (1) 10.5W Plug-In Lamp	Occupanc y Sensor	11	1,242	0.0	14	0	$2	$360	$40	168.0
Classroom 209	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupanc y Sensor	44	1,242	0.4	1,360	0	$186	$1,090	$220	4.7
Classroom 210	1	LED Lamps: (1) 13W A19 Screw-In Lamp	Wall Switch	S	13	1,800	4	None	Yes	1	LED Lamps: (1) 13W A19 Screw-In Lamp	Occupanc y Sensor	13	1,242	0.0	7	0	$1	$330	$40	293.0
Classroom 210	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupanc y Sensor	44	1,242	0.4	1,360	0	$186	$1,090	$220	4.7
Classroom 211	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	15	LED - Linear Tubes: (3) 4' Lamps	Occupanc y Sensor	44	1,242	0.5	1,701	0	$232	$1,280	$270	4.4
Classroom 211	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,800	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) U-Lamp	Occupanc y Sensor	33	1,242	0.0	71	0	$10	$420	$50	38.4
Classroom 212	1	Compact Fluorescent: (1) 15W Spiral Plug-In Lamp	Wall Switch	S	15	1,800	3, 4	Relamp	Yes	1	LED Lamps: (1) 10.5W Plug-In Lamp	Occupanc y Sensor	11	1,242	0.0	14	0	$2	$360	$40	168.0
Classroom 212	18	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	18	LED - Linear Tubes: (3) 4' Lamps	Occupanc y Sensor	44	1,242	0.6	2,041	0	$278	$1,800	$340	5.2
Classroom 212	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,800	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) U-Lamp	Occupanc y Sensor	33	1,242	0.0	71	0	$10	$420	$50	38.4
Classroom 213	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupanc y Sensor	44	1,242	0.2	680	0	$93	$710	$130	6.2

Location	Existing Conditions: Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	Proposed Conditions: ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	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
Classroom 214	1	Compact Fluorescent: (1) 15W Spiral Plug-In Lamp	Wall Switch	S	15	1,800	3, 4	Relamp	Yes	1	LED Lamps: (1) 10.5W Plug-In Lamp	Occupancy Sensor	11	1,242	0.0	14	0	$2	$360	$40	168.0
Classroom 214	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.4	1,360	0	$186	$1,090	$220	4.7
Classroom 215	19	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	19	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.6	2,154	0	$294	$1,860	$360	5.1
Classroom 217	19	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	19	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.6	2,154	0	$294	$1,860	$360	5.1
Classroom 218	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.4	1,360	0	$186	$1,090	$220	4.7
Classroom 240	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,800	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,242	0.0	76	0	$10	$50	$10	3.9
Classroom 240	5	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	5	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.2	567	0	$77	$650	$120	6.9
Conference 114	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.2	680	0	$93	$710	$130	6.2
Corridor A2	5	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	5	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor A2	61	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,520	3, 5	Relamp	Yes	61	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,739	1.3	6,455	-1	$881	$6,180	$2,750	3.9
Corridor A2	13	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,520	3, 5	Relamp	Yes	13	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	1,739	0.4	2,063	0	$281	$1,670	$660	3.6
Corridor first floor	55	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,520	3, 5	Relamp	Yes	55	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,739	1.2	5,820	-1	$794	$5,600	$2,480	3.9
Corridor first floor	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,520	3, 5	Relamp	Yes	15	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	1,739	0.5	2,381	-1	$325	$1,800	$760	3.2
Custodian office	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,000	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,000	0.0	99	0	$14	$50	$10	3.0
Dining Area	1	Compact Fluorescent: (1) 15W Spiral Plug-In Lamp	Wall Switch	S	15	1,980	3, 4	Relamp	Yes	1	LED Lamps: (1) 10.5W Plug-In Lamp	Occupancy Sensor	11	1,366	0.0	15	0	$2	$30	$0	14.3
Dining Area	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	1,980	3, 4	Relamp	Yes	1	LED Lamps: A19 Lamps	Occupancy Sensor	9	1,366	0.0	107	0	$15	$30	$0	2.1
Dining Area	3	LED Lamps: (1) 13W A19 Screw-In Lamp	Wall Switch	S	13	1,980	4	None	Yes	3	LED Lamps: (1) 13W A19 Screw-In Lamp	Occupancy Sensor	13	1,366	0.0	24	0	$3	$330	$40	88.8
Dining Area	46	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,980	3, 4	Relamp	Yes	46	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,366	0.9	3,573	-1	$487	$5,390	$600	9.8
Dining Area Teacher	9	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,980	3, 4	Relamp	Yes	9	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,366	0.3	1,122	0	$153	$900	$180	4.7
Exterior	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	300	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	300	0.0	10	0	$1	$50	$10	29.6
Exterior	1	Compact Fluorescent: (1) 18W Spiral Plug-In Lamp	Photocell		18	4,380	3	Relamp	No	1	LED Lamps: (1) 12W Plug-In Lamp	Photocell	12	4,380	0.0	26	0	$4	$30	$0	8.2
Exterior	3	LED - Fixtures: Architectural Flood/Spot Luminaire	Photocell		150	4,380		None	No	3	LED - Fixtures: Architectural Flood/Spot Luminaire	Photocell	150	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior	3	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell		35	4,380		None	No	3	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	35	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior	1	LED - Fixtures: Canopy Lights	Photocell		35	4,380		None	No	1	LED - Fixtures: Canopy Lights	Photocell	35	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior	1	LED Lamps: (1) 18W A19 Screw-In Lamp	Photocell		18	4,380		None	No	1	LED Lamps: (1) 18W A19 Screw-In Lamp	Photocell	18	4,380	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
Exterior	3	Metal Halide: (1) 150W Lamp	Photocell		190	4,380	1	Fixture Replacement	No	3	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	45	4,380	0.0	1,905	0	$265	$1,330	$150	4.4
Exterior	4	Metal Halide: (1) 70W Lamp	Photocell		95	4,380	1	Fixture Replacement	No	4	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	23	4,380	0.0	1,261	0	$176	$1,110	$200	5.2
Exterior	1	Mercury Vapor: (1) 400W Lamp	Photocell		455	4,380	1	Fixture Replacement	No	1	LED - Fixtures: Architectural Flood/Spot Luminaire	Photocell	120	4,380	0.0	1,467	0	$204	$660	$50	3.0
Exterior	3	Metal Halide: (1) 150W Lamp	Photocell		190	4,380	1	Fixture Replacement	No	3	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	45	4,380	0.0	1,905	0	$265	$1,330	$150	4.4
Gymnasium	4	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	4	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Gymnasium	8	LED - Fixtures: High-Bay	Wall Switch	S	105	1,980	4	None	Yes	8	LED - Fixtures: High-Bay	Occupancy Sensor	105	1,366	0.1	516	0	$70	$330	$40	4.1
Kitchen	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,980	3, 4	Relamp	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,366	0.4	1,746	0	$238	$1,720	$280	6.0
Library	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,980	3, 4	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,366	0.4	1,497	0	$204	$1,090	$220	4.3
Library	16	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	1,980	3, 4	Relamp	Yes	16	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,366	0.6	2,344	-1	$320	$2,080	$390	5.3
Mechanical room	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,000	3, 4	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,070	0.2	1,134	0	$155	$790	$130	4.3
Office - Speech room	1	LED Lamps: (1) 13W A19 Screw-In Lamp	Wall Switch	S	13	1,800		None	No	1	LED Lamps: (1) 13W A19 Screw-In Lamp	Wall Switch	13	1,800	0.0	0	0	$0	$0	$0	0.0
Office - Speech room	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,800	3, 4	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,242	0.1	378	0	$52	$580	$90	9.5
Office - Enclosed 304	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,800	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,800	0.0	59	0	$8	$50	$10	4.9
Office - Enclosed 311	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,800	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,800	0.0	59	0	$8	$50	$10	4.9
Office - Gym	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,800	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,800	0.0	59	0	$8	$50	$10	4.9
Office - Health education boys	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	1,800	3	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,800	0.0	101	0	$14	$90	$20	5.1
Office - Main	19	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	19	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.6	2,154	0	$294	$1,860	$360	5.1
Office - Nurse	7	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	7	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.2	794	0	$108	$770	$150	5.7
Restroom - Boys	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.1	227	0	$31	$460	$70	12.6
Restroom - Boys	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,800	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,242	0.0	141	0	$19	$510	$60	23.4
Restroom - Female	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,800	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,242	0.0	76	0	$10	$380	$50	32.0
Restroom - feMale 2nd floor	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,800	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,242	0.0	151	0	$21	$430	$60	17.9
Restroom - female first	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.0	113	0	$15	$390	$60	21.3
Restroom - Girls	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.1	227	0	$31	$460	$70	12.6
Restroom - Girls	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,800	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,242	0.0	71	0	$10	$420	$50	38.4

	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
Restroom - Male	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,800	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,242	0.0	76	0	$10	$380	$50	32.0
Restroom - Male 2nd floor	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,800	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,242	0.1	227	0	$31	$480	$70	13.3
Restroom - Male first	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.0	113	0	$15	$390	$60	21.3
Restroom - Male first	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,800	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,242	0.0	71	0	$10	$420	$50	38.4
Restroom - staff men	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,800	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,242	0.0	71	0	$10	$420	$50	38.4
Restroom - staff women	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,800	3, 4	Relamp	Yes	1	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,242	0.0	71	0	$10	$420	$50	38.4
Restroom - Unisex	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,800	3, 4	Relamp	Yes	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.0	113	0	$15	$390	$60	21.3
Stairs A1	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	4,000	3, 5	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	2,760	0.1	504	0	$69	$430	$140	4.2
Stairs B2	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	4,000	3, 5	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	2,760	0.1	672	0	$92	$480	$180	3.3
Stairs C2	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	4,000	3, 5	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	2,760	0.1	672	0	$92	$480	$180	3.3
Stairs D2	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	4,000	3, 5	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	2,760	0.1	672	0	$92	$480	$180	3.3
Stairs E2	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	4,000	3, 5	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	2,760	0.1	672	0	$92	$480	$180	3.3
Storage art department	1	Linear Fluorescent - T12: 2' T12 (20W) - 2L	Wall Switch	S	50	300	2	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	300	0.0	10	0	$1	$80	$10	51.8
Storage cafe	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	300	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	300	0.0	10	0	$1	$50	$10	29.6
Storage Closet	1	LED Lamps: (1) 13W A19 Screw-In Lamp	Wall Switch	S	13	300		None	No	1	LED Lamps: (1) 13W A19 Screw-In Lamp	Wall Switch	13	300	0.0	0	0	$0	$0	$0	0.0
Storage custodian	1	LED Lamps: (1) 13W A19 Screw-In Lamp	Wall Switch	S	13	300		None	No	1	LED Lamps: (1) 13W A19 Screw-In Lamp	Wall Switch	13	300	0.0	0	0	$0	$0	$0	0.0
Storage first floor	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	300	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	300	0.0	10	0	$1	$50	$10	29.6
Storage mechanical	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,000	3	Relamp	No	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	3,000	0.0	297	0	$41	$130	$30	2.5
Storage Projection	1	Compact Fluorescent: (1) 18W Spiral Plug-In Lamp	Wall Switch	S	18	450	3	Relamp	No	1	LED Lamps: (1) 12W Plug-In Lamp	Wall Switch	12	450	0.0	3	0	$0	$30	$0	81.4
Theater Auditorium	6	LED Lamps: (12) 13W A19 Screw-In Lamps	Wall Switch	S	156	1,980	4	None	Yes	6	LED Lamps: (12) 13W A19 Screw-In Lamps	Occupancy Sensor	156	1,366	0.1	575	0	$78	$330	$40	3.7
Theater Auditorium	2	LED Lamps: (1) 13W A19 Screw-In Lamp	Wall Switch	S	13	1,980	4	None	Yes	2	LED Lamps: (1) 13W A19 Screw-In Lamp	Occupancy Sensor	13	1,366	0.0	16	0	$2	$330	$40	133.2
Theater Auditorium	6	Halogen Incandescent: High-Bay (Prismatic Reflector)	Wall Switch	S	90	300	3	Relamp	No	6	LED Lamps: (1) 18.5W Plug-In Lamp	Wall Switch	19	300	0.2	129	0	$18	$150	$10	8.0

Motor Inventory & Recommendations

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	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
Mechanical Room	DHW water circulation	2	DHW Circulation Pump	0.17	65.0%	No	Bell & Gossett	NBF-33	W	8,760		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	Boiler Combustion fan	2	Combustion Air Fan	3.00	85.0%	No	Marathon	5K48TN2182	W	1,784		No	85.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 107	Unit Ventilator	1	Supply Fan	0.25	65.0%	No			W	2,196		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Classroom 215	Wall Mounted AC	1	Supply Fan	0.20	65.0%	No	Fujitsu	ASU36RLXB	W	2,196		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Conference 114	Unit Ventilator	1	Supply Fan	0.25	65.0%	No			W	2,196		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Various Classrooms	Unit Ventilator	31	Supply Fan	0.25	65.0%	No			W	2,196		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Elevator room	Elevator Motor	1	Other	15.00	85.0%	No			W	100		No	85.0%	No		0.0	0	0	$0	$0	$0	0.0
Attic Area	Kitchen Exhaust Fan	1	Kitchen Hood Exhaust Fan	1.25	80.0%	No	Universal Blower		B	3,150	6	Yes	82.5%	No		0.0	100	0	$14	$900	$0	64.5
Mechanical Room	Feed Water Pump-Boiler	1	Boiler Feed Water Pump	1.00	76.0%	No	AO Smith		W	2,745		No	76.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	Feed Water Pump-Boiler	1	Boiler Feed Water Pump	1.00	76.0%	No	US Motors	P63GEL-4517	W	2,745		No	76.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	Condensate Return Pump	2	Condensate Pump	1.50	82.0%	No	Century		W	2,745		No	82.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	Condensate Return Pump	2	Condensate Pump	2.00	85.0%	No	Century		W	2,745		No	85.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room	Hot Water Pump	1	Heating Hot Water Pump	2.00	85.0%	No			W	2,745		No	85.0%	No		0.0	0	0	$0	$0	$0	0.0
Attic Area	Exhaust System Attic Area	5	Exhaust Fan	0.17	75.0%	No	Greenheck	SQ-80-VG-X	W	2,745		No	75.0%	No		0.0	0	0	$0	$0	$0	0.0
Attic Area	Exhaust System Attic Area	1	Exhaust Fan	0.25	65.0%	No	Greenheck	SQ-70-VG-X	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Attic Area	Exhaust System-Bathrooms	3	Exhaust Fan	0.05	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Attic Area	Exhaust System	1	Exhaust Fan	0.25	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Rooftop	Exhaust Fan-3	1	Exhaust Fan	0.33	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Rooftop	Exhaust Fan-1	1	Exhaust Fan	0.33	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Rooftop	Exhaust Fan-7	1	Exhaust Fan	0.33	65.0%	No			W	2,745		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
Exterior Rooftop	Exhaust Fan-4	1	Exhaust Fan	0.33	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Rooftop	Exhaust Fan-2 DownStairs Bathrooms	1	Exhaust Fan	0.33	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Rooftop	Exhaust Fan-9 Old Nurse Room	2	Exhaust Fan	0.33	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Rooftop	Exhaust Fan- Gym Area	1	Exhaust Fan	0.33	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Restroom Boys second floor	Domestic Hot Water System	1	DHW Circulation Pump	0.13	65.0%	No			W	8,760		No	65.0%	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
Classroom 101	Window Air Conditioner	1	Window AC	2.00		10.40		Friedrich		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 102	Window Air Conditioner	1	Window AC	2.00		10.40		Friedrich		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 104	Window Air Conditioner	1	Window AC	1.50		11.80		Friedrich		W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 108	Window Air Conditioner	1	Window AC	1.58		11.80		Friedrich	CP18G30B	W		No							0.0	0	0	$0	$0	$0	0.0
Classroom 109	Window Air Conditioner	1	Window AC	1.50		9.65		Friedrich		B	7	Yes	1	Window AC	1.50		12.00		0.2	144	0	$20	$1,200	$0	59.7
Classroom 110	Window Air Conditioner	1	Window AC	2.00		9.65		Friedrich		B	7	Yes	1	Window AC	2.00		12.00		0.2	192	0	$27	$1,700	$0	63.5
Classroom 111	Window Air Conditioner	1	Window AC	2.00		8.81		Friedrich		B	7	Yes	1	Window AC	2.00		12.00		0.4	285	0	$40	$1,700	$0	42.8
Classroom 113	Window Air Conditioner	1	Window AC	2.00		8.81		Friedrich		B	7	Yes	1	Window AC	2.00		12.00		0.4	285	0	$40	$1,700	$0	42.8
Classroom 115	Window Air Conditioner	1	Window AC	2.00		8.81		Friedrich		B	7	Yes	1	Window AC	2.00		12.00		0.4	285	0	$40	$1,700	$0	42.8
Classroom 117	Window Air Conditioner	1	Window AC	2.00		8.81		Friedrich	SL24J30A-A	B	7	Yes	1	Window AC	2.00		12.00		0.4	285	0	$40	$1,700	$0	42.8
Classroom 205	Window Air Conditioner	1	Window AC	2.00		8.81		Friedrich		B	7	Yes	1	Window AC	2.00		12.00		0.4	285	0	$40	$1,700	$0	42.8
Classroom 206	Window Air Conditioner	1	Window AC	2.00		8.81		Friedrich		B	7	Yes	1	Window AC	2.00		12.00		0.4	285	0	$40	$1,700	$0	42.8
Classroom 207	Window Air Conditioner	1	Window AC	2.00		8.81		Friedrich		B	7	Yes	1	Window AC	2.00		12.00		0.4	285	0	$40	$1,700	$0	42.8
Classroom 208	Window Air Conditioner	1	Window AC	2.00		8.81		Friedrich		B	7	Yes	1	Window AC	2.00		12.00		0.4	285	0	$40	$1,700	$0	42.8
Classroom 209	Window Air Conditioner	1	Window AC	2.00		8.81		Friedrich	SL24J30A-A	B	7	Yes	1	Window AC	2.00		12.00		0.4	285	0	$40	$1,700	$0	42.8
Classroom 240	Window Air Conditioner	1	Window AC	0.67		9.28		Friedrich		B	7	Yes	1	Window AC	0.67		12.00		0.1	77	0	$11	$900	$0	83.7
Classroom 240	Window Air Conditioner	1	Window AC	0.83		11.30		Friedrich	CP10G10A	W		No							0.0	0	0	$0	$0	$0	0.0
Office - Speech room	Window Air Conditioner	1	Window AC	0.67		9.28		White Westinghouse		B	7	Yes	1	Window AC	0.67		12.00		0.1	77	0	$11	$900	$0	83.7
Office - Enclosed 304	Window Air Conditioner	1	Window AC	0.42		12.10		Heat Controller	RADS-51Q	W		No							0.0	0	0	$0	$0	$0	0.0
Classroom Green house room	Unit Heater-Electric	1	Unit Heater		34.12		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0

Location	Area(s)/System(s) Served	Existing Conditions: System Quantity	Existing Conditions: System Type	Existing Conditions: Cooling Capacity per Unit (Tons)	Existing Conditions: Heating Capacity per Unit (MBh)	Existing Conditions: Cooling Mode Efficiency (SEER/IEER/EER)	Existing Conditions: Heating Mode Efficiency	Existing Conditions: Manufacturer	Existing Conditions: Model	Existing Conditions: Remaining Useful Life	Proposed Conditions: ECM #	Proposed Conditions: Install High Efficiency System?	Proposed Conditions: System Quantity	Proposed Conditions: System Type	Proposed Conditions: Cooling Capacity per Unit (Tons)	Proposed Conditions: Heating Capacity per Unit (kBtu/hr)	Proposed Conditions: Cooling Mode Efficiency (SEER/EER)	Proposed Conditions: Heating Mode Efficiency	Energy Impact & Financial Analysis: Total Peak kW Savings	Energy Impact & Financial Analysis: Total Annual kWh Savings	Energy Impact & Financial Analysis: Total Annual MMBtu Savings	Energy Impact & Financial Analysis: Total Annual Energy Cost Savings	Energy Impact & Financial Analysis: Estimated M&L Cost ($)	Energy Impact & Financial Analysis: Total Incentives	Energy Impact & Financial Analysis: Simple Payback w/ Incentives in Years
Exterior Rooftop	Media Center- New Building	1	Package Unit	10.00		9.28		Trane	TFD120	B	7	Yes	1	Package Unit	10.00		14.00		2.2	1,720	0	$240	$14,800	$800	58.4
Exterior Rooftop	Main Office and Nurse Office	1	Package Unit	6.25		9.28		Trane	TFD075C30ABC	B	7	Yes	1	Package Unit	6.25		14.00		1.4	1,075	0	$150	$9,600	$500	60.8
Exterior Rooftop	Classroom 215 Wall Mounted AC	1	Split-System Air-Source HP	2.75	34.00	8.50	9 HSPF	Fujitsu	AOU36RLXB	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior Rooftop	Classroom Unit ventilator	1	Split-System	2.00		10.55		Goodman	GSC130241DA	B	7	Yes	1	Split-System	2.00		16.00		0.4	305	0	$43	$4,400	$200	98.8
Exterior Rooftop	Classroom Unit ventilator	1	Split-System	2.00		9.55		Comfortmaker	AG024GB3	B	7	Yes	1	Split-System	2.00		16.00		0.5	399	0	$56	$4,400	$200	75.6
Classroom 103	Classroom 103	1	Window AC	1.00		8.89		LG	LP1217GSR	W		No							0.0	0	0	$0	$0	$0	0.0
Office Gym	Office Gym	1	Window AC	0.67		8.16		LG	LP0817WSR	W		No							0.0	0	0	$0	$0	$0	0.0

Space Heating Boiler Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions: System Quantity	Existing Conditions: System Type	Existing Conditions: Output Capacity per Unit (MBh)	Existing Conditions: Manufacturer	Existing Conditions: Model	Existing Conditions: Remaining Useful Life	Proposed Conditions: ECM #	Proposed Conditions: Install High Efficiency System?	Proposed Conditions: System Quantity	Proposed Conditions: System Type	Proposed Conditions: Output Capacity per Unit (MBh)	Proposed Conditions: Heating Efficiency	Proposed Conditions: Heating Efficiency Units	Energy Impact & Financial Analysis: Total Peak kW Savings	Energy Impact & Financial Analysis: Total Annual kWh Savings	Energy Impact & Financial Analysis: Total Annual MMBtu Savings	Energy Impact & Financial Analysis: Total Annual Energy Cost Savings	Energy Impact & Financial Analysis: Estimated M&L Cost ($)	Energy Impact & Financial Analysis: Total Incentives	Energy Impact & Financial Analysis: Simple Payback w/ Incentives in Years
Mechanical Room	Building Heating Load	2	Forced Draft Steam Boiler	3,831	H.B. Smith	28HE-15	W		No						0.0	0	0	$0	$0	$0	0.0

Demand Control Ventilation Recommendations

Location	Area(s)/System(s) Affected	Recommendation Inputs: ECM #	Recommendation Inputs: Number of Zones	Recommendation Inputs: Cooling Capacity of Controlled System (Tons)	Recommendation Inputs: Electric Heating Capacity of Controlled System (kBtu/hr)	Recommendation Inputs: Output Heating Capacity of Controlled System (MBh)	Energy Impact & Financial Analysis: Total Peak kW Savings	Energy Impact & Financial Analysis: Total Annual kWh Savings	Energy Impact & Financial Analysis: Total Annual MMBtu Savings	Energy Impact & Financial Analysis: Total Annual Energy Cost Savings	Energy Impact & Financial Analysis: Estimated M&L Cost ($)	Energy Impact & Financial Analysis: Total Incentives	Energy Impact & Financial Analysis: Simple Payback w/ Incentives in Years
Gymnasium	Gymnasium HVAC	8	2.00	0.00	0.00	545.00	0.0	0	12	$156	$2,900	$0	18.6
Auditorium	Auditorium HVAC	8	2.00	0.00	0.00	494.00	0.0	0	11	$142	$2,900	$0	20.5

Pipe Insulation Recommendations

Location	Area(s)/System(s) Affected	Recommendation Inputs: ECM #	Recommendation Inputs: Length of Uninsulated Pipe (ft)	Recommendation Inputs: Pipe Diameter (in)	Energy Impact & Financial Analysis: Total Peak kW Savings	Energy Impact & Financial Analysis: Total Annual kWh Savings	Energy Impact & Financial Analysis: Total Annual MMBtu Savings	Energy Impact & Financial Analysis: Total Annual Energy Cost Savings	Energy Impact & Financial Analysis: Estimated M&L Cost ($)	Energy Impact & Financial Analysis: Total Incentives	Energy Impact & Financial Analysis: Simple Payback w/ Incentives in Years
Restroom Boys	Domestic hotwater system	9	25	1.00	0.0	226	0	$31	$340	$50	9.2

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 room	Domestic Hot Water System	1	Boiler	Ao Smith	XWH200NP	W		No						0.0	0	0	$0	$0	$0	0.0
Restroom Boys second floor	Domestic Hot Water System	1	Storage Tank Water Heater (≤ 50 Gal)	Rheem	ELD40-C	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
Kitchen	10	3	Faucet Aerator (Kitchen)	2.50	1.50	0.0	0	0	$5	$30	$10	3.8
Various Classrooms and Restrooms	10	47	Faucet Aerator (Lavatory)	2.20	0.50	0.0	0	11	$140	$400	$190	1.5
Various Classrooms and Restrooms	10	4	Faucet Aerator (Lavatory)	2.20	0.50	0.0	278	0	$39	$30	$20	0.3

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	Refrigerator Chest	Powers		No	11	Yes	0.1	1,006	0	$140	$2,700	$0	19.3
Kitchen	1	Stand-Up Freezer, Solid Door (>50 cu. ft.)	Continental	3F	No	11	Yes	0.5	4,375	0	$610	$4,600	$600	6.6
Kitchen	1	Stand-Up Freezer, Solid Door (31 - 50 cu. ft.)	TRUE	T-49F	No	11	Yes	0.3	2,507	0	$349	$3,400	$300	8.9
Kitchen	1	Stand-Up Refrigerator, Solid Door (31 - 50 cu. ft.)	Beverage Air	HR2HC-1S	Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Stand-Up Refrigerator, Solid Door (>50 cu. ft.)	TRUE	T-72	No	11	Yes	0.1	1,279	0	$178	$3,600	$200	19.1
Kitchen	1	Stand-Up Refrigerator, Solid Door (31 - 50 cu. ft.)	Beverage Air	HR2-1S	No	11	Yes	0.1	935	0	$130	$2,700	$100	20.0

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	Oven / Cooktop			No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Electric Convection Oven (Full Size)	Southbend		No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Insulated Food Holding Cabinet (Full Size)	Metro	C539-HDS-U	No		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 Teacher	1	Coffee Machine	800	No		
Classroom 105	1	Dehumidifier	710	No	Heat Controller	BHD-651-G
Classroom 107	1	Dehumidifier	710	No	Heat Controller	BHD-651-G
Classroom 240	1	Desktop	150	No		
Office - Main	2	Desktop	150	No		
Office - Nurse	1	Desktop	150	No		
Classroom 215	1	Kiln	15,000	No	Amaco	
Dining Area	1	Microwave	1,000	No		
Dining Area Teacher	1	Microwave	1,000	No		
Office - Main	1	Microwave	1,000	No		
Office - Nurse	1	Paper Shredder	150	No		
Classroom 105	1	Printer (Medium/Small)	200	No		
Classroom 107	1	Printer (Medium/Small)	200	No		
Classroom 218	1	Printer (Medium/Small)	200	No		
Classroom 240	1	Printer (Medium/Small)	200	No		
Dining Area Teacher	1	Printer (Medium/Small)	200	No		
Office - Speach room	1	Printer (Medium/Small)	200	No		
Office - Enclosed 311	1	Printer (Medium/Small)	200	No		
Classroom 218	1	Printer/Copier (Large)	600	No		
Dining Area Teacher	1	Printer/Copier (Large)	600	No		
Office - Main	1	Printer/Copier (Large)	600	No		
Office - Main	1	Printer/Copier (Large)	600	No		
Classroom 204 A	1	Projector	200	No		
Classroom 212	1	Projector	200	No		
Theater Auditorium	1	Projector	200	No		
Office - Main	1	Refrigerator (Mini)	153	No		
Dining Area	1	Refrigerator (Residential)	218	No		
Dining Area Teacher	1	Refrigerator (Residential)	218	No		
Office - Nurse	1	Refrigerator (Residential)	218	No		
Kitchen	2	Serving Table (Chilled/Heated)	1,920	No		
Classroom 101	1	Smart Board	235	No	Promethean	
Classroom 102	1	Smart Board	235	No	Promethean	
Classroom 103	1	Smart Board	235	No	Promethean	
Classroom 108	1	Smart Board	235	No	Promethean	
Classroom 110	1	Smart Board	235	No	Promethean	

	Existing Conditions					
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Classroom 111	1	Smart Board	235	No	Promethean	
Classroom 112	1	Smart Board	235	No	Promethean	
Classroom 113	1	Smart Board	235	No	Promethean	
Classroom 115	1	Smart Board	235	No	Promethean	
Classroom 117	1	Smart Board	235	No	Promethean	
Classroom 201	1	Smart Board	235	No	Promethean	
Classroom 202	1	Smart Board	235	No	Promethean	
Classroom 203	1	Smart Board	235	No	Promethean	
Classroom 205	1	Smart Board	235	No	Promethean	
Classroom 206	1	Smart Board	235	No	Promethean	
Classroom 208	1	Smart Board	235	No	Promethean	
Classroom 209	1	Smart Board	235	No	Promethean	
Classroom 210	1	Smart Board	235	No	Promethean	
Classroom 211	1	Smart Board	235	No	Promethean	
Classroom 212	1	Smart Board	235	No	Promethean	
Classroom 214	1	Smart Board	235	No	Promethean	
Classroom 215	1	Smart Board	235	No	Promethean	
Classroom 217	1	Smart Board	235	No	Promethean	
Classroom 218	1	Smart Board	235	No	Promethean	
Classroom 103	1	Air purifier	95	No	Medify Air	MA-112
Classroom 107	1	Air purifier	95	No	Medify Air	MA-112
Classroom 108	1	Air purifier	95	No	Medify Air	MA-112
Classroom 110	1	Air purifier	95	No	Medify Air	MA-112
Classroom 206	1	Air purifier	95	No	Medify Air	MA-112
Classroom 214	1	Air purifier	95	No	Medify Air	MA-112
Classroom 218	1	Air purifier	95	No	Medify Air	MA-112
Classroom 240	2	Air purifier	95	No	Medify Air	MA-112
Conference 114	1	Air purifier	95	No	Medify Air	MA-112
Dining Area Teacher	1	Air purifier	95	No	Medify Air	MA-112
Kitchen	1	Air purifier	95	No	Medify Air	MA-112
Library	2	Air purifier	95	No	Medify Air	MA-112
Office - Speach room	1	Air purifier	95	No	Medify Air	MA-112
Office - Enclosed 311	1	Air purifier	95	No	Medify Air	MA-112
Office - Nurse	1	Air purifier	95	No	Medify Air	MA-112
Theater Auditorium	3	Air purifier	95	No	Medify Air	MA-112

	Existing Conditions					
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Classroom 101	1	Air purifier	95	No	Medify Air	MA-112
Classroom 102	1	Air purifier	95	No	Medify Air	MA-112
Classroom 104	1	Air purifier	95	No	Medify Air	MA-112
Classroom 105	1	Air purifier	95	No	Medify Air	MA-112
Classroom 111	1	Air purifier	95	No	Medify Air	MA-112
Classroom 112	1	Air purifier	95	No	Medify Air	MA-112
Classroom 113	1	Air purifier	95	No	Medify Air	MA-112
Classroom 115	1	Air purifier	95	No	Medify Air	MA-112
Classroom 117	1	Air purifier	95	No	Medify Air	MA-112
Classroom 201	1	Air purifier	95	No	Medify Air	MA-112
Classroom 202	1	Air purifier	95	No	Medify Air	MA-112
Classroom 203	1	Air purifier	95	No	Medify Air	MA-112
Classroom 204	1	Air purifier	95	No	Medify Air	MA-112
Classroom 204 A	1	Air purifier	95	No	Medify Air	MA-112
Classroom 205	1	Air purifier	95	No	Medify Air	MA-112
Classroom 208	1	Air purifier	95	No	Medify Air	MA-112
Classroom 209	1	Air purifier	95	No	Medify Air	MA-112
Classroom 210	1	Air purifier	95	No	Medify Air	MA-112
Classroom 211	1	Air purifier	95	No	Medify Air	MA-112
Classroom 213	1	Air purifier	95	No	Medify Air	MA-112
Classroom 215	1	Air purifier	95	No	Medify Air	MA-112
Classroom 217	1	Air purifier	95	No	Medify Air	MA-112
Various	380	Chromebooks	45	No		

Custom (High Level) Measure Analysis

Retro-Commissioning Study

Building Square Footage	65,339	Fuel Utility Rate	$12.545 MMBtu
Percent of Conditioned Area Impacted	40%	Blended Electric Utility Rate	$0.139 kWh

Existing Conditions						Proposed Conditions					Energy Impact & Financial Analysis										
Description	Area(s)/System(s) Served	Remaining Useful Life	Total HVAC Motor Usage kWh	Total HVAC Electric Usage kWh	Total HVAC Fuel Usage MMBtu	Description	% Savings HVAC Motor Usage kWh	% Savings HVAC Electric Usage kWh	% Savings HVAC Fuel Usage MMBtu	Estimated Cost per Sqft	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Base Incentives	Enhanced Incentives	Total Incentives	Total Net Cost	Payback w/o Incentives in Years	Simple Payback w/ Incentives in Years
HVAC Controls Not Currently Optimized	HVAC Equipment & Systems	3	60,829	41,488	3,502	Retro-Commissioning Study	3%	3%	3%	$0.30	0.00	3,070	105	$1,746	$9,100	$0	$0	$0	$9,100	5.21	5.21

Building Envelope Improvements

Existing Conditions			Proposed Conditions			Energy Impact & Financial Analysis										
Description	Conduction Loss (kBtu/yr)	Infiltration Loss (kBtu/yr)	Description	Conduction Loss (kBtu/yr)	Infiltration Loss (kBtu/yr)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Base Incentives	Enhanced Incentives	Total Incentives	Total Net Cost	Payback w/o Incentives in Years	Payback w/ Incentives in Years
Existing Building Envelope with Opportunities for Improvement	294,051	784,208	Install Roof Insulation and Replace Windows	84,189	392,104	0.00	3,290	686	$9,064	$230,100	$0	$0	$0	$230,100	25.39	25.39

Electric Tank Water Heater to HPWH

NOTE: HPWH calculation should not be used for existing water heaters with a storage capacity greater than 120 gal or less than 30 gal.

Existing Conditions						Proposed Conditions				Energy Impact & Financial Analysis										
Description	Area(s)/System(s) Served	SF of Area Served	Fuel Type	Input Capacity per Unit (kW)	Tank Capacity per Unit (Gal)	Description	COP	Tank Capacity per Unit (Gal)	Estimated Unit Cost	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Base Incentives	Enhanced Incentives	Total Incentives	Total Net Cost	Payback w/o Incentives in Years	Payback w/ Incentives in Years
Storage Tank Water Heater (≤50 Gal)	Domestic Hot Water System	1,100	Electric	4.5	40.0	Heat Pump Water Heater	2.5	40	$2,091.00	0.00	1,354	0	$189	$2,500	$0	$0	$0	$2,500	13.23	13.23
			Electric																	
			Electric																	

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. NJCEP uses the EPA's ENERGY STAR Portfolio Manager system to generate baseline energy usage results and comparable building EUIs. Portfolio Manager is specifically designed for benchmarking energy consumption within a building.

LEARN MORE AT energystar.gov

ENERGY STAR® Statement of Energy Performance

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ENERGY STAR® Score[1]

Alfred Vail Elementary

Primary Property Type: K-12 School
Gross Floor Area (ft²): 65,339
Built: 1930

For Year Ending: July 31, 2023
Date Generated: March 13, 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
Alfred Vail Elementary 125 Speedwell Avenue Morris Plains, New Jersey 07950	Morris School District 31 Hazel Street Morristown, NJ 07960 (973) 292-2300	Anthony Lo Franco 31 Hazel Street Morristown, NJ 07960 (973) 292-2300 x2021 Anthony.LoFranco@msdk12.net

Property ID: 32587375

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
70.4 kBtu/ft²

Annual Energy by Fuel

Electric - Grid (kBtu)	1,004,567 (22%)
Natural Gas (kBtu)	3,592,693 (78%)

Source EUI
100.8 kBtu/ft²

National Median Comparison

National Median Site EUI (kBtu/ft²)	62.3
National Median Source EUI (kBtu/ft²)	89.3
% Diff from National Median Source EUI	13%

Annual Emissions

Total (Location-Based) GHG Emissions (Metric Tons CO2e/year)	281

Signature & Stamp of Verifying Professional

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

LP Signature: ______________________Date: ___________

Licensed Professional

____ ________
,
(____)____-______
____

Professional Engineer or Registered Architect Stamp (if applicable)

Appendix C: Glossary

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

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

SEER	*Seasonal energy efficiency ratio:* a measure of efficiency in terms of annual cooling energy provided divided by total electric input.
SEP	*Statement of energy performance:* a summary document from the ENERGY STAR Portfolio Manager.
Simple Payback	The amount of time needed to recoup the funds expended in an investment or to reach the break-even point between investment and savings.
SREC (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 $1/8^{th}$ 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.