Local Government Energy Audit Report

McKinley Elementary

October 25, 2024

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

Prepared by:
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Disclaimer

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

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

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

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

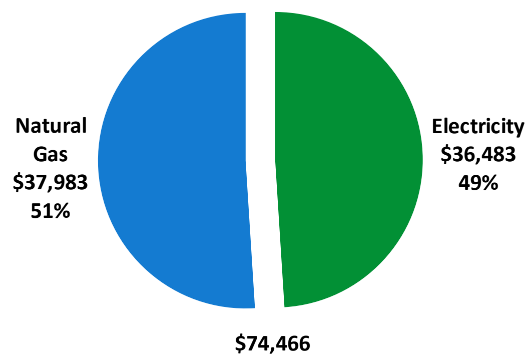
The customer and their respective contractor(s) are responsible to implement energy conservation measures in complete conformance with all applicable local, state, and federal requirements.

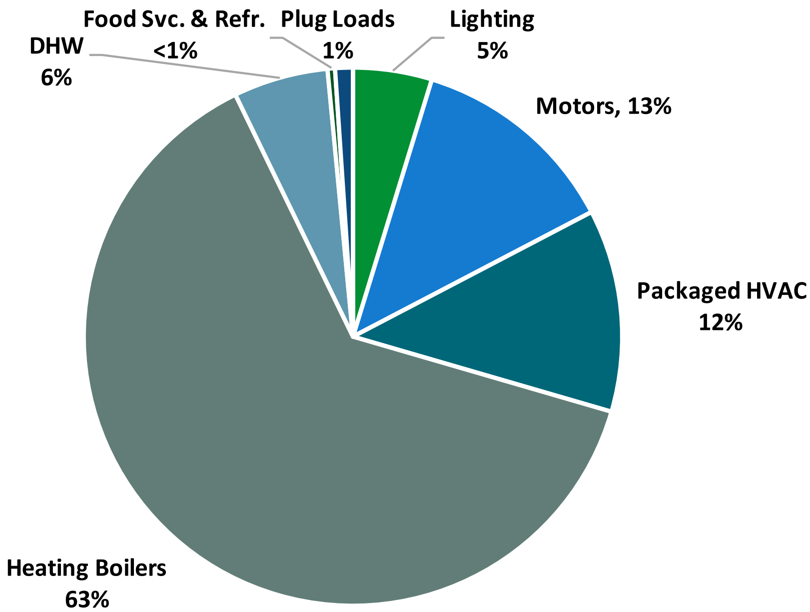
Table of Contents

1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for McKinley Elementary. 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: $74,466 Electricity: 228,508 kWh Natural Gas: 27,779 Therms	
ENERGY STAR® Benchmarking Score	51 *(1-100 scale)*	Congratulations, your building performs better than the national average. This report has suggestions about how to keep your building running efficiently, further improve performance, and lower your energy bills even more.



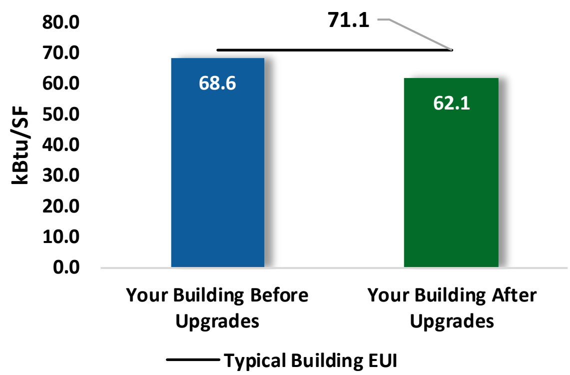
Energy Use by System

POTENTIAL IMPROVEMENTS

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

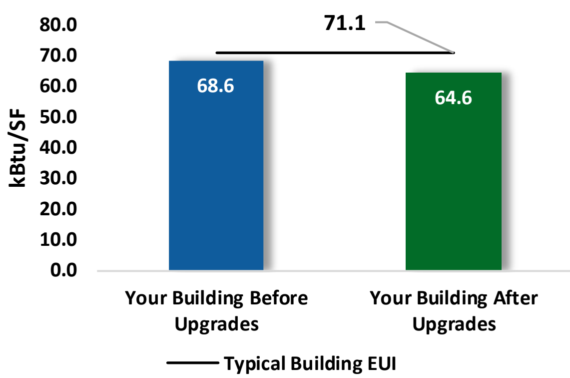
Scenario 1: Full Package (All Evaluated Measures)

Installation Cost	$99,300
Potential Rebates & Incentives[1]	$5,910
Annual Cost Savings	$8,009
Annual Energy Savings	Electricity: 30,336 kWh Natural Gas: 2,315 Therms
Greenhouse Gas Emission Savings	29 Tons
Simple Payback	11.7 Years
Site Energy Savings (All Utilities)	9%



Scenario 2: Cost Effective Package[2]

Installation Cost	$92,200
Potential Rebates & Incentives	$5,910
Annual Cost Savings	$7,922
Annual Energy Savings	Electricity: 45,379 kWh Natural Gas: 495 Therms
Greenhouse Gas Emission Savings	26 Tons
Simple Payback	10.9 Years
Site Energy Savings (all utilities)	6%



On-site Generation Potential

Photovoltaic	Medium
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			**8,161**	**2.9**	**-2**	**$1,280**	**$5,620**	**$1,050**	**$4,570**	**3.6**	**8,024**
ECM 1	Retrofit Fixtures with LED Lamps	Yes	7,756	2.8	-2	$1,217	$5,530	$1,050	$4,480	3.7	7,626
ECM 2	Install LED Exit Signs	Yes	405	0.0	0	$63	$90	$0	$90	1.4	398
Lighting Control Measures			**12,912**	**3.8**	**-3**	**$2,025**	**$18,340**	**$4,050**	**$14,290**	**7.1**	**12,686**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	9,923	3.3	-2	$1,556	$15,810	$2,470	$13,340	8.6	9,749
ECM 4	Install High/Low Lighting Controls	Yes	2,989	0.4	-1	$469	$2,530	$1,580	$950	2.0	2,936
Motor Upgrades			**8,854**	**0.9**	**0**	**$1,414**	**$11,200**	**$0**	**$11,200**	**7.9**	**8,916**
ECM 5	Premium Efficiency Motors	Yes	8,854	0.9	0	$1,414	$11,200	$0	$11,200	7.9	8,916
Variable Frequency Drive (VFD) Measures			**9,503**	**1.2**	**0**	**$1,517**	**$14,900**	**$500**	**$14,400**	**9.5**	**9,569**
ECM 6	Install VFDs on Constant Volume (CV) Fans	Yes	4,246	0.6	0	$678	$4,700	$100	$4,600	6.8	4,276
ECM 7	Install VFDs on Heating Water Pumps	Yes	5,257	0.7	0	$839	$10,200	$400	$9,800	11.7	5,294
Unitary HVAC Measures			**1,915**	**4.5**	**0**	**$306**	**$37,700**	**$0**	**$37,700**	**123.3**	**1,928**
ECM 8	Install High Efficiency Air Conditioning Units	No	1,915	4.5	0	$306	$37,700	$0	$37,700	123.3	1,928
HVAC System Improvements			**341**	**0.0**	**14**	**$249**	**$330**	**$40**	**$290**	**1.2**	**2,006**
ECM 9	Install Pipe Insulation	Yes	341	0.0	14	$249	$330	$40	$290	1.2	2,006
Domestic Water Heating Upgrade			**0**	**0.0**	**40**	**$542**	**$1,610**	**$270**	**$1,340**	**2.5**	**4,642**
ECM 10	Install High Efficiency Gas-Fired Water Heater	Yes	0	0.0	19	$263	$1,200	$100	$1,100	4.2	2,256
ECM 11	Install Low-Flow DHW Devices	Yes	0	0.0	20	$279	$410	$170	$240	0.9	2,386
Food Service & Refrigeration Measures			**2,026**	**0.2**	**0**	**$323**	**$4,600**	**$0**	**$4,600**	**14.2**	**2,040**
ECM 12	Replace Refrigeration Equipment	No	2,026	0.2	0	$323	$4,600	$0	$4,600	14.2	2,040
Custom Measures			**-13,376**	**0.0**	**182**	**$353**	**$5,000**	**$0**	**$5,000**	**14.2**	**7,840**
ECM 13	Replace Electric Water Heater with Heat Pump Water Heater	Yes	3,693	0.0	0	$590	$2,500	$0	$2,500	4.2	3,719
ECM 14	Replace Gas Fired Water Heater with Heat Pump Water Heater***	No	-17,069	0.0	182	-$237	$2,500	$0	$2,500	-10.5	4,122
TOTALS (COST EFFECTIVE MEASURES)			**43,464**	**8.8**	**49**	**$7,616**	**$54,500**	**$5,910**	**$48,590**	**6.4**	**49,562**
TOTALS (ALL MEASURES)			**30,336**	**13.6**	**231**	**$8,009**	**$99,300**	**$5,910**	**$93,390**	**11.7**	**57,652**

* - 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).

*** - Negative payback explained in section 4.9

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 McKinley Elementary. 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 February 28, 2024, TRC performed an energy audit at McKinley Elementary located in Westfield, New Jersey. TRC met with Sean McArthur to review the facility operations and help focus our investigation on specific energy-using systems.

McKinley Elementary is a three-story building with a basement. The building is 51,880 square feet and built in 1908. Spaces include classrooms, gymnasium, auditorium, offices, cafeteria, corridors, stairwells, library, storage rooms and basement mechanical space.

Most lighting has already been converted to LED.

2.2 Building Occupancy

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

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

Building Name	Weekday/Weekend	Operating Schedule
McKinley Elementary	Weekday	6:00 AM - 5:00 PM
	Weekend	Closed

Building Occupancy Schedule

2.3 Building Envelope

The walls are made of concrete masonry units (CMUs) with a brick veneer and gypsum drywall or painted CMU interior finish with drop ceilings.

The roof has multiple sections, most of which are slanted and covered in asphalt shingles. The roof is generally in good condition.

Most of the windows are double glazed and have aluminum frames. The glass-to-frame seals are in good condition. The operable window weather seals are in good condition, showing little evidence of excessive wear. Exterior doors are solid with small windows set in aluminum frames and are in good condition with undamaged door seals. Degraded window and door seals increase drafts and outside air infiltration.

Exterior

Exterior

2.4 Lighting Systems

The primary interior lighting system use 2-foot x 4-foot LED recessed panels or fixtures with 14.5-Watt linear LED T8 lamps. There are also several 32-Watt T8 linear and U-bend fluorescent fixtures. Fixture types include 2-lamp or 4-lamp, 4-foot long recessed, surface mounted, or pendant fixtures. Typically, T8 fluorescent lamps use electronic ballasts.

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

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

LED Linear Tube T8

LED Panel

Linear Fluorescent – Storage Room

Incandescent Bulb

Exterior fixtures include wall packs with CFLs or LED lamps and are controlled by a photocell.

CFL Wall Pack

LED Porch Light

2.5 Air Handling Systems

Unit Ventilators

Unit ventilators and fan coil units provide heating and ventilation to classrooms and corridors. They are equipped with supply fan motors, pneumatically controlled outside air dampers, and fan coil valves connected to the hot water distribution system. Most are older Nesbit units which appear to be in fair operating condition.

Classroom Unit Ventilator

Ceiling-mounted Unit Ventilator

Unitary Electric HVAC Equipment

Classrooms and offices are generally cooled with window air conditioning (AC) units. These vary in capacity. Most unit nameplates were not accessible at audit, so capacities, efficiencies and equipment ages were often estimated. The units are in good condition. Most are ENERGY STAR labeled.

Window AC – ENERGY STAR

Various office areas are cooled and heated by two Variable Refrigerant Flow (VRF) ductless multi-split heat pumps. The units have 6-ton and 8-ton cooling capacities with 15 SEERand 16 SEER cooling efficiencies, respectively. Their heating capacities are 80 MBh and 108 MBh, respectively; each with a heating efficiency rating of 4.05 COP. The units are in good condition. Conditioned air is distributed by fractional hp supply fans located in the various zones.

VRF Ductless Mini-Split HPs

Heat Pump Alternative View

Packaged Units

The gym is served by a roof top packaged unit. It is a gas-fired unit equipped with an economizer and VFDs to control the 10 hp supply and exhaust fans. The unit also has a 0.25 hp energy recovery enthalpy wheel motor and four, 1 hp condenser fans. The cooling capacity is 30 tons with an energy efficiency ratio of 12.5, and the heating capacity is 400 MBh with an 80% nominal efficiency rating. The unit was installed in 2021 and is in good condition.

Gym Package Unit

Package Unit Ducting

Air Handling Units (AHUs)

The building has a number of air handling units (AHUs) which supply heating, cooling, and ventilation to various spaces.

AHU 1 and AHU 2 each have a constant speed 0.75 hp supply motor with electric heaters installed in units. These units were installed in 2020 and are generally in good condition. The faculty room has an AHU that was inaccessible at time of audit. Motor hp was estimated.

These systems include outdoor condensing units located on the roof, which were inaccessible during audit. Cooling capacities and efficiencies were estimated based on make and age of the units, which was the same as their indoor counterparts. This is a split air-conditioning (AC) system configuration.

Insulation on visible ductwork was in good condition.

AHUs are BAS controlled with local wall thermostats.

AHU 2

Ductwork

2.6 Heating Hot Water (HHW) and Steam Systems

The primary heating load for the building is split between steam and hot water boilers.

Two RBI 850 MBh non-condensing hot water boilers serve the hot water sections of the building. The burners are fully modulating with a nominal efficiency of 85%. The boilers are configured in an automated lead-lag control scheme. Both boilers are required under high load conditions. Installed in 2017, they are in good condition. The hydronic distribution system is a two-pipe, heating-only system. Boilers serve a primary only distribution system with two constant speed 2 hp heating hot water pumps operating in lead/lag fashion.

One EASCO 1,072 MBh steam boiler serves the steam sections of the building heating load. The burners are fully modulating with a nominal efficiency of 79.76%. Installed in 2012, it is in fair condition. The steam system is served by two constant speed 0.5 hp condensate pumps, which alternate automatically, and two constant speed 3 hp vacuum pumps.

Steam and heating hot water terminal units include unit ventilators, fan coil units, AHUs, and radiators.

HHW and steam pipes are generally well insulated, however, in the boiler room there was approximately eight feet of 2” HHW pipes and five feet of 2.5” diameter steam pipes that were uninsulated.

Boilers are controlled by facilities BAS. There is a service contract in place for all three boilers.

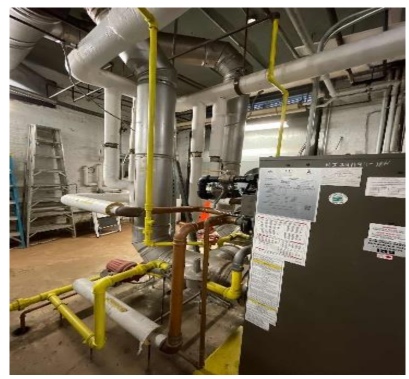
On the day of the audit, hot water supply temperature for boiler #1 was set to 172°F.

HHW Boilers – Boilers #1 and #2

HHW Circulation Pumps

Steam Boiler

Vacuum Pumps



HHW Pipes

Classroom Radiator

2.7 Building Automation System (BAS)

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

2.8 Domestic Hot Water

Hot water is primarily produced by a 40-gallon, 32 MBh, gas-fired storage water heater with an efficiency of 76%. It was installed in 1998 and is beyond useful life.

Two. 0.75 hp circulation pumps distribute water to end uses. The circulation pumps operate one at a time, manually switched through a control panel.

There is a secondary hot water heater, which is a 40-gallon, 4.50 kW electric storage water heater.

The domestic hot water pipes are partially uninsulated, but the existing insulation is in good condition. The natural gas hot water heater has approximately four feet of uninsulated DHW piping by unit and the electric has three feet.

Natural Gas DHW Heater

DHW Circulation Pumps and Controls

Electric DHW Heater

Uninsulated DHW Pipes – Natural Gas Unit

2.9 Refrigeration

The mechanical room has two commercial refrigerator chests. Equipment is not ENERGY STAR labeled but is in fair condition. Lunches for students are not prepared on site at this facility so this school does not have a commercial kitchen.

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

Refrigerator Chest

2.10 Plug Load and Vending Machines

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

There are 15 computer workstations throughout the facility. Plug loads include general cafe and office equipment. There are classroom typical loads such as printers, projectors, and fans.

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

The building has an elevator with a 25 hp motor and gets limited use.

Computer

Ceiling Fan

Coffee Maker

Elevator Motor

Copier/Printer

Residential-style Refrigerator

2.11 Water-Using Systems

Water is (mainly) provided by a municipal water supply company.

Potable water is used for drinking, cleaning, sanitary fixtures, building conditioning, and steam make up water.

Water leaks were not observed/reported.

EPA WaterSense® has set maximum flow rates for sanitary fixtures. They are: 1.28 gallons per flush (gpf) for toilets, 0.5 gpf for urinals, 1.5 gallons per minute (gpm) for lavatory faucets, and 2.0 gpm for showerheads. There are 16 restrooms with toilets, urinals, and sinks. Faucet flow rates are at 2.0 gpm or higher.

There are two utility facets used by maintenance staff, along with kitchen faucets in certain break areas. These tend to be higher flow than restroom faucets.

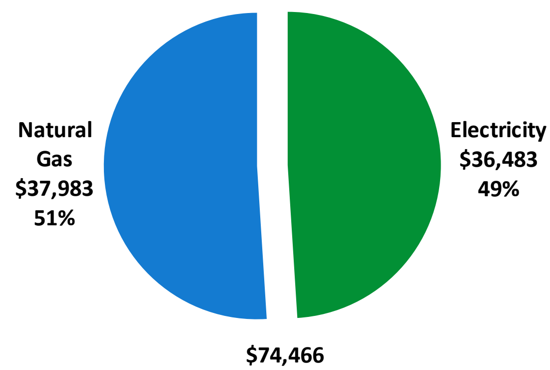
Restroom Faucet

Break Area Faucet

3 ENERGY USE AND COSTS

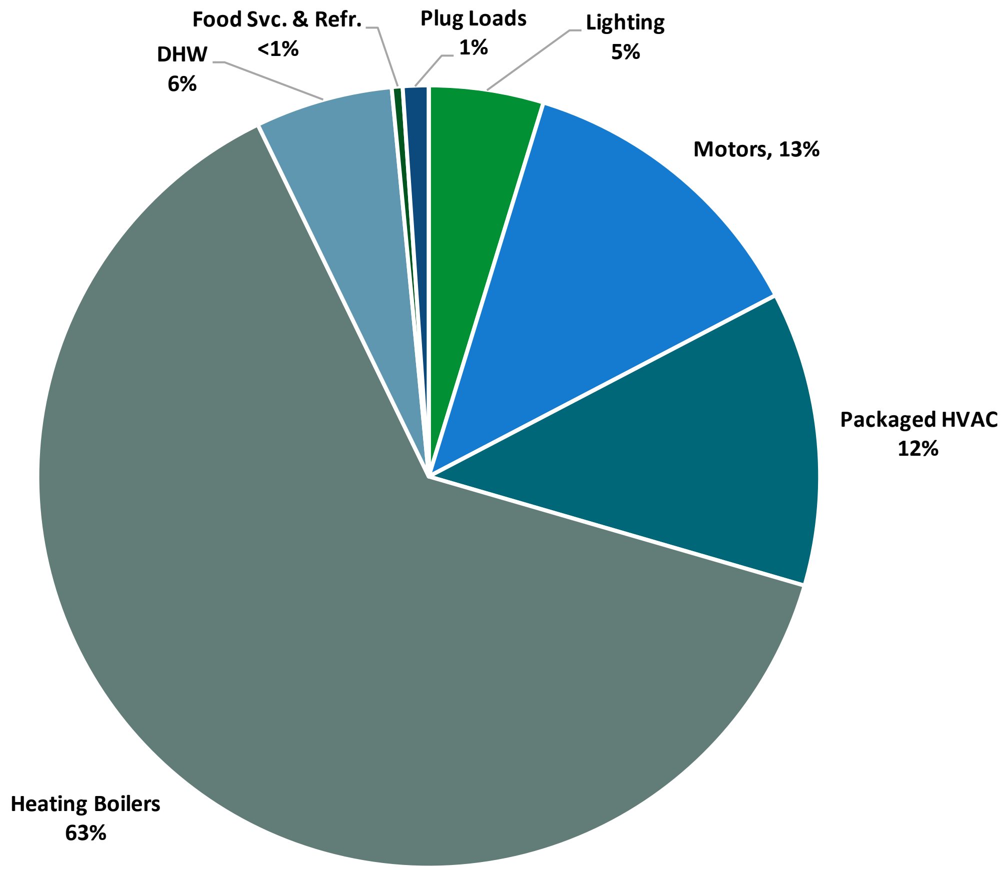
Twelve months of utility billing data are used to develop annual energy consumption and cost data. This information creates a profile of the annual energy consumption and energy costs.

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	228,508 kWh	$36,483
Natural Gas	27,779 Therms	$37,983
Total		**$74,466**



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

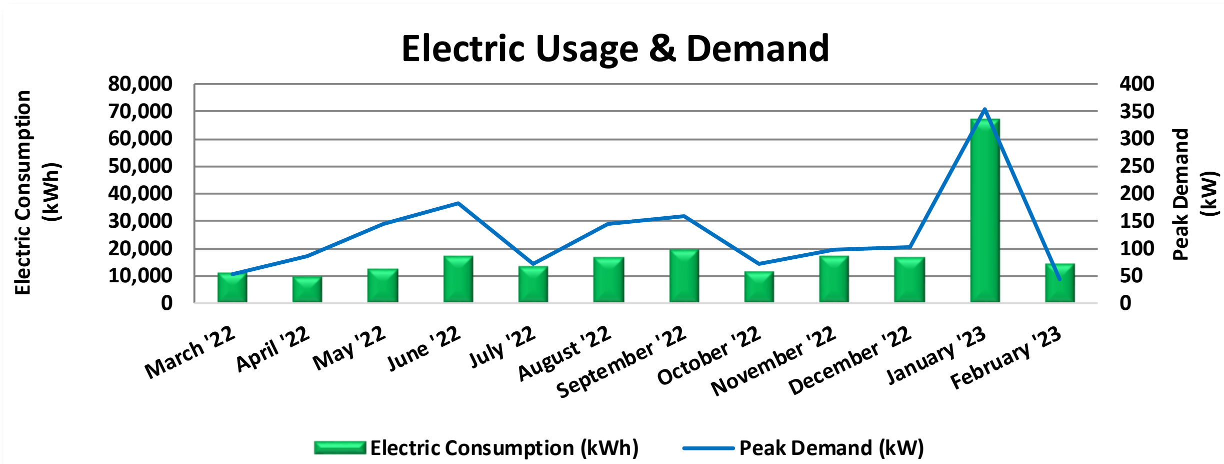
The energy auditor collects information regarding equipment operating hours, capacity, efficiency, and other operational parameters from facility staff, drawings, and on-site observations. This information is used as the inputs to calculate the existing conditions energy use for the site. The calculated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



Energy Balance by System

3.1 Electricity

PSE&G delivers electricity under rate class General Lighting & Power (GLP), with electric production provided by Constellation/PSE&G, a third-party supplier.



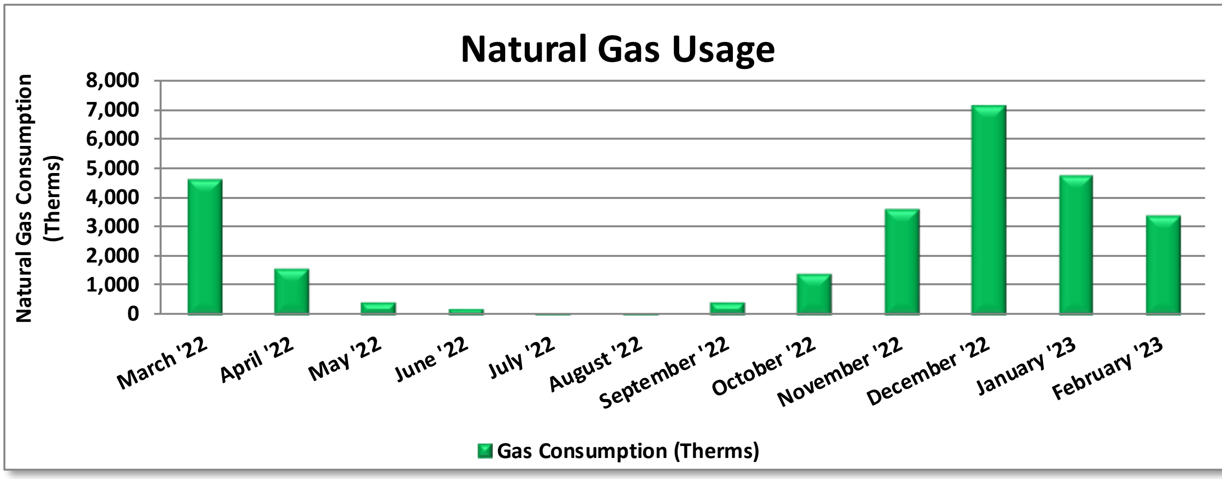
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
4/4/22	31	11,200	53	$209	$1,946
5/4/22	30	9,920	85	$335	$2,210
6/3/22	30	12,480	144	$285	$2,326
7/5/22	32	17,600	182	$1,314	$3,567
8/3/22	29	13,760	72	$1,054	$2,960
9/1/22	29	16,880	144	$1,054	$2,510
10/3/22	32	19,680	160	$1,171	$3,451
11/1/22	29	12,000	72	$335	$2,203
12/2/22	31	17,440	98	$455	$2,718
1/4/23	33	16,800	102	$239	$2,732
2/2/23	29	67,200	355	$552	$7,434
3/6/23	32	14,800	43	$201	$2,627
Totals	**367**	**229,760**	**355**	**$7,205**	**$36,683**
Annual	**365**	**228,508**	**355**	**$7,165**	**$36,483**

Notes:

- Peak demand of 355 kW occurred in January '23.
- Average demand over the past 12 months was 126 kW.
- The average electric cost over the past 12 months was $0.160/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.
- The billing period ending in February has an inconsistent spike in kWh and demand reading out of characteristic with the building's energy use. Since it is listed as an actual meter reading, this is likely a true up bill.

3.2 Natural Gas

Elizabethtown Gas delivers natural gas under rate class General Delivery Service - Transportation (GDSADD), 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
4/6/22	29	4,640	$5,264
5/5/22	29	1,598	$2,169
6/7/22	33	440	$966
7/7/22	30	221	$693
8/8/22	32	2	$419
9/7/22	30	11	$455
10/6/22	29	430	$1,110
11/4/22	29	1,434	$2,238
12/6/22	32	3,611	$4,586
1/6/23	31	7,159	$9,913
2/6/23	31	4,763	$5,934
3/7/23	29	3,392	$4,133
Totals	**364**	**27,703**	**$37,879**
Annual	**365**	**27,779**	**$37,983**

Notes:

- The average gas cost for the past 12 months is $1.367/therm, which is the blended rate used throughout the analysis.
- June and February therms usages are estimated due to missing data.
- Costs in June, November, and February have been partially estimated due to incomplete data.
- Gas use drops off significantly in summer months but not completely because natural gas is used by heating and domestic hot water systems.

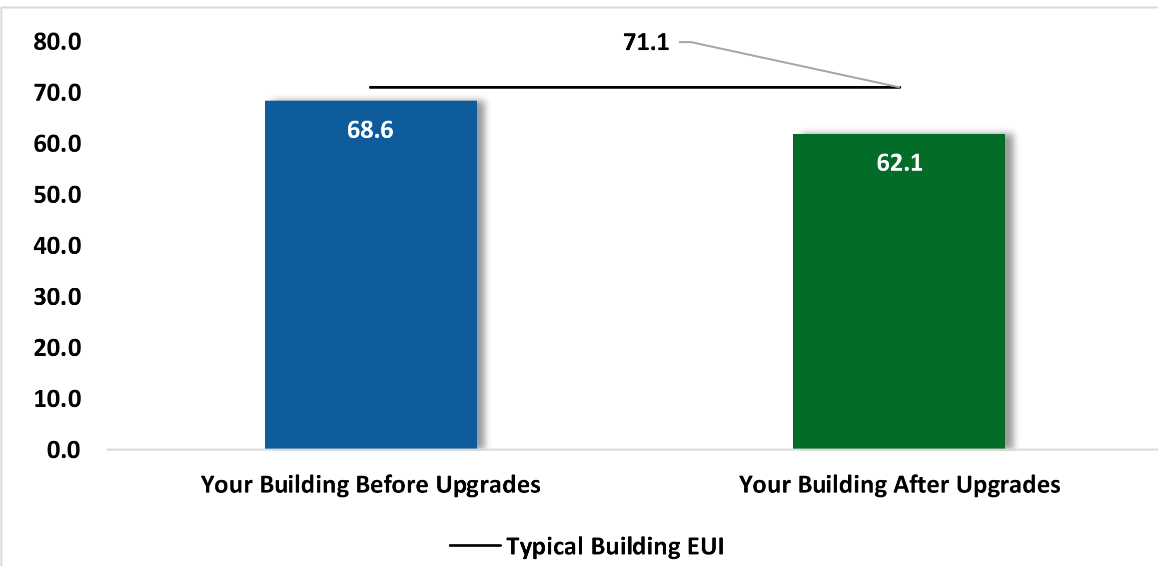
3.3 Benchmarking

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

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

Benchmarking Score	**51**

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



Energy Use Intensity Comparison[4]

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

[4] Based on all evaluated ECMs

Tracking your Energy Performance

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

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

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

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

3.4 Understanding Your Utility Bills

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

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

Why Utility Bills Vary

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

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

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

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

4 Energy Conservation Measures

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

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

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

Financial incentives in this report are based on the previously run state rebate program SmartStart, which has been retired. Now, all investor-owned gas and electric utility companies are offering complementary energy efficiency programs directly to their customers. Some measures and proposed upgrades may be eligible for higher incentives than those shown below. The incentives in the summary tables should be used for high-level planning purposes. To verify incentives, reach out to your utility provider or visit the NJCEP website for more information.

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

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**8,161**	**2.9**	**-2**	**$1,280**	**$5,620**	**$1,050**	**$4,570**	**3.6**	**8,024**
ECM 1	Retrofit Fixtures with LED Lamps	Yes	7,756	2.8	-2	$1,217	$5,530	$1,050	$4,480	3.7	7,626
ECM 2	Install LED Exit Signs	Yes	405	0.0	0	$63	$90	$0	$90	1.4	398
Lighting Control Measures			**12,912**	**3.8**	**-3**	**$2,025**	**$18,340**	**$4,050**	**$14,290**	**7.1**	**12,686**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	9,923	3.3	-2	$1,556	$15,810	$2,470	$13,340	8.6	9,749
ECM 4	Install High/Low Lighting Controls	Yes	2,989	0.4	-1	$469	$2,530	$1,580	$950	2.0	2,936
Motor Upgrades			**8,854**	**0.9**	**0**	**$1,414**	**$11,200**	**$0**	**$11,200**	**7.9**	**8,916**
ECM 5	Premium Efficiency Motors	Yes	8,854	0.9	0	$1,414	$11,200	$0	$11,200	7.9	8,916
Variable Frequency Drive (VFD) Measures			**9,503**	**1.2**	**0**	**$1,517**	**$14,900**	**$500**	**$14,400**	**9.5**	**9,569**
ECM 6	Install VFDs on Constant Volume (CV) Fans	Yes	4,246	0.6	0	$678	$4,700	$100	$4,600	6.8	4,276
ECM 7	Install VFDs on Heating Water Pumps	Yes	5,257	0.7	0	$839	$10,200	$400	$9,800	11.7	5,294
Unitary HVAC Measures			**1,915**	**4.5**	**0**	**$306**	**$37,700**	**$0**	**$37,700**	**123.3**	**1,928**
ECM 8	Install High Efficiency Air Conditioning Units	No	1,915	4.5	0	$306	$37,700	$0	$37,700	123.3	1,928
HVAC System Improvements			**341**	**0.0**	**14**	**$249**	**$330**	**$40**	**$290**	**1.2**	**2,006**
ECM 9	Install Pipe Insulation	Yes	341	0.0	14	$249	$330	$40	$290	1.2	2,006
Domestic Water Heating Upgrade			**0**	**0.0**	**40**	**$542**	**$1,610**	**$270**	**$1,340**	**2.5**	**4,642**
ECM 10	Install High Efficiency Gas-Fired Water Heater	Yes	0	0.0	19	$263	$1,200	$100	$1,100	4.2	2,256
ECM 11	Install Low-Flow DHW Devices	Yes	0	0.0	20	$279	$410	$170	$240	0.9	2,386
Food Service & Refrigeration Measures			**2,026**	**0.2**	**0**	**$323**	**$4,600**	**$0**	**$4,600**	**14.2**	**2,040**
ECM 12	Replace Refrigeration Equipment	No	2,026	0.2	0	$323	$4,600	$0	$4,600	14.2	2,040
Custom Measures			**-13,376**	**0.0**	**182**	**$353**	**$5,000**	**$0**	**$5,000**	**14.2**	**7,840**
ECM 13	Replace Electric Water Heater with Heat Pump Water Heater	Yes	3,693	0.0	0	$590	$2,500	$0	$2,500	4.2	3,719
ECM 14	Replace Gas Fired Water Heater with Heat Pump Water Heater***	No	-17,069	0.0	182	-$237	$2,500	$0	$2,500	-10.5	4,122
TOTALS			**30,336**	**13.6**	**231**	**$8,009**	**$99,300**	**$5,910**	**$93,390**	**11.7**	**57,652**

* - 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).

*** - Negative payback explained in section 4.9

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		**8,161**	**2.9**	**-2**	**$1,280**	**$5,620**	**$1,050**	**$4,570**	**3.6**	**8,024**
ECM 1	Retrofit Fixtures with LED Lamps	7,756	2.8	-2	$1,217	$5,530	$1,050	$4,480	3.7	7,626
ECM 2	Install LED Exit Signs	405	0.0	0	$63	$90	$0	$90	1.4	398
Lighting Control Measures		**12,912**	**3.8**	**-3**	**$2,025**	**$18,340**	**$4,050**	**$14,290**	**7.1**	**12,686**
ECM 3	Install Occupancy Sensor Lighting Controls	9,923	3.3	-2	$1,556	$15,810	$2,470	$13,340	8.6	9,749
ECM 4	Install High/Low Lighting Controls	2,989	0.4	-1	$469	$2,530	$1,580	$950	2.0	2,936
Motor Upgrades		**8,854**	**0.9**	**0**	**$1,414**	**$11,200**	**$0**	**$11,200**	**7.9**	**8,916**
ECM 5	Premium Efficiency Motors	8,854	0.9	0	$1,414	$11,200	$0	$11,200	7.9	8,916
Variable Frequency Drive (VFD) Measures		**9,503**	**1.2**	**0**	**$1,517**	**$14,900**	**$500**	**$14,400**	**9.5**	**9,569**
ECM 6	Install VFDs on Constant Volume (CV) Fans	4,246	0.6	0	$678	$4,700	$100	$4,600	6.8	4,276
ECM 7	Install VFDs on Heating Water Pumps	5,257	0.7	0	$839	$10,200	$400	$9,800	11.7	5,294
HVAC System Improvements		**341**	**0.0**	**14**	**$249**	**$330**	**$40**	**$290**	**1.2**	**2,006**
ECM 9	Install Pipe Insulation	341	0.0	14	$249	$330	$40	$290	1.2	2,006
Domestic Water Heating Upgrade		**0**	**0.0**	**40**	**$542**	**$1,610**	**$270**	**$1,340**	**2.5**	**4,642**
ECM 10	Install High Efficiency Gas-Fired Water Heater	0	0.0	19	$263	$1,200	$100	$1,100	4.2	2,256
ECM 11	Install Low-Flow DHW Devices	0	0.0	20	$279	$410	$170	$240	0.9	2,386
Custom Measures		**3,693**	**0.0**	**0**	**$590**	**$2,500**	**$0**	**$2,500**	**4.2**	**3,719**
ECM 13	Replace Electric Water Heater with Heat Pump Water Heater	3,693	0.0	0	$590	$2,500	$0	$2,500	4.2	3,719
TOTALS		**43,464**	**8.8**	**49**	**$7,616**	**$54,500**	**$5,910**	**$48,590**	**6.4**	**49,562**

* - 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		**8,161**	**2.9**	**-2**	**$1,280**	**$5,620**	**$1,050**	**$4,570**	**3.6**	**8,024**
ECM 1	Retrofit Fixtures with LED Lamps	7,756	2.8	-2	$1,217	$5,530	$1,050	$4,480	3.7	7,626
ECM 2	Install LED Exit Signs	405	0.0	0	$63	$90	$0	$90	1.4	398

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

ECM 1: Retrofit Fixtures with LED Lamps

Replace fluorescent and 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 and incandescent bulbs (storage rooms, mechanical spaces), and exterior wall packs with CFLs

ECM 2: Install LED Exit Signs

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

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		**12,912**	**3.8**	**-3**	**$2,025**	**$18,340**	**$4,050**	**$14,290**	**7.1**	**12,686**
ECM 3	Install Occupancy Sensor Lighting Controls	9,923	3.3	-2	$1,556	$15,810	$2,470	$13,340	8.6	9,749
ECM 4	Install High/Low Lighting Controls	2,989	0.4	-1	$469	$2,530	$1,580	$950	2.0	2,936

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

ECM 3: Install Occupancy Sensor Lighting Controls

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

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

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

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

Affected Building Areas: classrooms, offices, restrooms, library, and storage rooms

ECM 4: Install High/Low Lighting Controls

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

Lighting fixtures with these controls operate at default low levels when the area is unoccupied to provide minimal lighting to meet security or safety code requirements for egress. Sensors detect occupancy using ultrasonic and/or infrared sensors. When an occupant enters the space, the lighting fixtures switch to full lighting levels. Fixtures automatically switch back to low level after a predefined period of vacancy. In parking lots and parking garages with significant ambient lighting, this control can sometimes be combined with photocell controls to turn the lights off when there is sufficient daylight.

The controller lowers the light level by dimming the fixture output. Therefore, the controlled fixtures need to have a dimmable ballast or driver. This will need to be 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: hallways 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		**8,854**	**0.9**	**0**	**$1,414**	**$11,200**	**$0**	**$11,200**	**7.9**	**8,916**
ECM 5	Premium Efficiency Motors	8,854	0.9	0	$1,414	$11,200	$0	$11,200	7.9	8,916

ECM 5: Premium Efficiency Motors

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

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

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

EC motors are being recommended for the FCU and unit ventilator motors only, not the combustion air fan or the condensate pumps.

Affected Motors:

Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Additional Motor Description
Mechanical 1	Steam Boiler	1	Combustion Air Fan	0.5	
Mechanical 1	Steam heating system	2	Condensate Pump	0.5	
Classrooms	heating and ventilation	16	Fan Coil Unit	0.2	Unit Ventilator
Entrance	heating and ventilation	1	Fan Coil Unit	0.2	FCU
Large Office	heating and ventilation	2	Fan Coil Unit	0.2	FCU
Principal Office	heating and ventilation	1	Fan Coil Unit	0.2	FCU
Library 1	heating and ventilation	3	Fan Coil Unit	0.2	Unit Ventilator
B1	heating and ventilation	1	Fan Coil Unit	0.2	Unit Ventilator
B2	heating and ventilation	1	Fan Coil Unit	0.2	Unit Ventilator
B3	heating and ventilation	1	Fan Coil Unit	0.2	Unit Ventilator
B4	heating and ventilation	1	Fan Coil Unit	0.2	Unit Ventilator

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

4.4 Variable Frequency Drives (VFD)

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**9,503**	**1.2**	**0**	**$1,517**	**$14,900**	**$500**	**$14,400**	**9.5**	**9,569**
ECM 6	Install VFDs on Constant Volume (CV) Fans	4,246	0.6	0	$678	$4,700	$100	$4,600	6.8	4,276
ECM 7	Install VFDs on Heating Water Pumps	5,257	0.7	0	$839	$10,200	$400	$9,800	11.7	5,294

Variable frequency drives control motors for fans, pumps, and process equipment based on the actual output required of the driven equipment. Energy savings result from more efficient control of motor energy usage when equipment operates at partial load. The magnitude of energy savings depends on the estimated amount of time that the motor would operate at partial load. For equipment with proposed VFDs, we have included replacing the controlled motor with a new inverter duty rated motor to conservatively account for the cost of an inverter duty rated motor.

ECM 6: Install VFDs on Constant Volume (CV) Fans

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

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

For air handlers with direct expansion (DX) cooling systems, the minimum air flow across the cooling coil required to prevent the coil from freezing must be determined during the final project design. The control system programming should maintain the minimum air flow whenever the compressor is operating. Prior to implementation, verify minimum fan speed in cooling mode with the manufacturer. Note that savings will vary depending on the operating characteristics of each AHU.

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

Affected Air Handlers: faculty room AHU

ECM 7: Install VFDs on Heating Water Pumps

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

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

Affected Pumps: HHW pumps

4.5 Unitary HVAC

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Unitary HVAC Measures		**1,915**	**4.5**	**0**	**$306**	**$37,700**	**$0**	**$37,700**	**123.3**	**1,928**
ECM 8	Install High Efficiency Air Conditioning Units	1,915	4.5	0	$306	$37,700	$0	$37,700	123.3	1,928

ECM 8: Install High Efficiency Air Conditioning Units

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

Affected Units: window air conditioners.

4.6 HVAC Improvements

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
HVAC System Improvements		**341**	**0.0**	**14**	**$249**	**$330**	**$40**	**$290**	**1.2**	**2,006**
ECM 9	Install Pipe Insulation	341	0.0	14	$249	$330	$40	$290	1.2	2,006

ECM 9: Install Pipe Insulation

Install insulation on steam, heating water and 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: HHW, steam, and DHW

4.7 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**0**	**0.0**	**40**	**$542**	**$1,610**	**$270**	**$1,340**	**2.5**	**4,642**
ECM 10	Install High Efficiency Gas-Fired Water Heater	0	0.0	19	$263	$1,200	$100	$1,100	4.2	2,256
ECM 11	Install Low-Flow DHW Devices	0	0.0	20	$279	$410	$170	$240	0.9	2,386

ECM 10: Install High Efficiency Gas-Fired Water Heater

Replace the existing tank water heater with a high efficiency condensing tank water heater. Energy savings result from the increased efficiency of the unit, which uses less gas to heat water, and fewer operating hours to maintain the tank water temperature.

Affected Units: AO Smith HWH

ECM 11: Install Low-Flow DHW Devices

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

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

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

4.8 Food Service and Refrigeration Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Food Service & Refrigeration Measures		**2,026**	**0.2**	**0**	**$323**	**$4,600**	**$0**	**$4,600**	**14.2**	**2,040**
ECM 12	Replace Refrigeration Equipment	2,026	0.2	0	$323	$4,600	$0	$4,600	14.2	2,040

ECM 12: Replace Refrigeration Equipment

We evaluated replacing existing commercial refrigerators 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.

4.9 Custom Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Custom Measures		**-13,376**	**0.0**	**182**	**$353**	**$5,000**	**$0**	**$5,000**	**14.2**	**7,840**
ECM 13	Replace Electric Water Heater with Heat Pump Water Heater	3,693	0.0	0	$590	$2,500	$0	$2,500	4.2	3,719
ECM 14	Replace Gas Fired Water Heater with Heat Pump Water Heater***	-17,069	0.0	182	-$237	$2,500	$0	$2,500	**-10.5**	4,122

ECM 13: Replace Electric Water Heater with Heat Pump Water Heater

Replace 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.[5] 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: Bradford White electric HWH

ECM 14: Replace Gas Fired Water Heater with Heat Pump Water Heater

We evaluated replacing the existing gas water heater with a heat pump water heater (HPWH), rather than a one for one replacement described for the same unit in ECM-10.

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

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

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

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

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

** Note: Uniform Energy Factor (UEF): The newest measure of water heater overall efficiency. The higher the UEF value is, the more efficient the water heater. UEF is determined by the Department of Energy's test method outlined in 10 CFR Part 430, Subpart B, Appendix E.*[6]

HPWH reject cold air. As such, they need to be installed in an unconditioned space of about 750 cubic feet with good ventilation[7]. Ideal locations are garages, large enclosed, unconditioned storage areas, or areas with excess heat such as a furnace or boiler room. The HPWH will also produce condensate so accommodations for draining the condensate need to be provided.

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

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

Switching from a gas fired water heater to a HPWH has the potential to reduce the sites overall greenhouse gas emissions. If the electricity for the HPWH is provided by an on-site photovoltaic (PV) system, then there are essentially no greenhouse gas (GHG) emissions. A 2016 study conducted at Cornell[8]

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

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

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

calculated the kg of methane (CH_4) and carbon dioxide (CO_2) produced per GJ of water heated. The study compared HPWH to gas and electric fired, storage and tankless water heaters. The study also considered electricity produced from natural gas and coal fired electric plants. In all cases the study found that HPWHs produced less methane than all of the other water heaters. The study also found that HPWH produced less carbon dioxide than electric resistance water heaters but more carbon dioxide than tankless gas water heaters and about the same amount of carbon dioxide as storage gas water heaters. The summary tables provide the reduction in CO2 equivalent emissions based on the typical New Jersey electric utility.

This measure has a negative simple payback due to the relative cost of electricity to natural gas. At this site the cost per Btu for natural gas is significantly lower than for electricity. Therefore, even though this measure will result in a net energy savings in terms of Btu at this site it will increase the overall cost for providing domestic hot water.

Affected Units: AO Smith HWH

4.10 Measures for Future Consideration

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

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

- Evaluate these measures further.
- Develop firm costs.
- Determine measure savings.
- Prepare detailed implementation plans.

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

Upgrade/Replace Building Automation System

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

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

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

It is recommended that an HVAC engineer or contractor who specializes in BAS be contacted for a detailed evaluation and implementation costs. A controls expert will be able to tell you to what extent an existing system can be refurbished or expanded, what sensors should be replaced, what additional HVAC systems could be controlled, and what monitoring and graphic capabilities can be added. For the purposes of this report, the potential energy savings and measure costs were estimated based on industry standards and previous project experience. Further analysis should be conducted for the feasibility of this measure. This is not an investment grade analysis, nor should be used as a basis for design and construction.

Heating System Conversion from Steam to Hot Water

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 building has already partially converted to hot water heating for most of the building. When the steam boiler nears the end of its useful life, a full conversion (expanding that capacity of existing hot water boilers) may be of interest. We also recommend working with your mechanical design team to determine whether a hot water heating system can operate with return water temperatures below 130°F, which would allow for operating condensing boilers at efficiencies above 90%. Energy savings results from improved combustion efficiency and reduced standby losses at low loads. Further analysis should be conducted for the feasibility of this measure. This measure is a capital improvement measure for future consideration.

Upgrade to a Heat Pump System

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

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

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

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

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

5 Energy Efficient Best Practices

A whole building maintenance plan will extend equipment life; improve occupant comfort, health, and safety; and reduce energy and maintenance costs.

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

You may already be doing some of these things—see our list below for potential additions to your maintenance plan. Be sure to consult with qualified equipment specialists for details on proper maintenance and system operation.

Energy Tracking with ENERGY STAR Portfolio Manager

You've heard it before—you cannot manage what you do not measure. ENERGY STAR Portfolio Manager is an online tool that you can use to measure and track energy and water consumption, as well as greenhouse gas emissions[9]. Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

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.

Fans to Reduce Cooling Load

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

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.

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

Ductwork Maintenance

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

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

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

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

Steam Trap Repair and Replacement

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

Thermostatic Radiator Valve Installations

We recommend investigating the installation of thermostatic control valves for existing radiators. Traditionally radiators have manual valves that are used to control the flow through the radiator. Replacing these manual valves with thermostatic control valves allows for automatic modulation of the steam or hot water flow to maintain the temperature setting. The valve will incrementally close as space temperature increases. This will allow a maximum temperature to be set per area/room. Using thermostatic control valves will result in energy savings by reducing the overheating of spaces throughout the facility.

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.

Procurement Strategies

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

6 Water Best Practices

Getting Started

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

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

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

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

Leak Detection and Repair

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

Toilets and Urinals

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

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

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

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

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

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

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

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

Faucets and Showerheads

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

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

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

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.

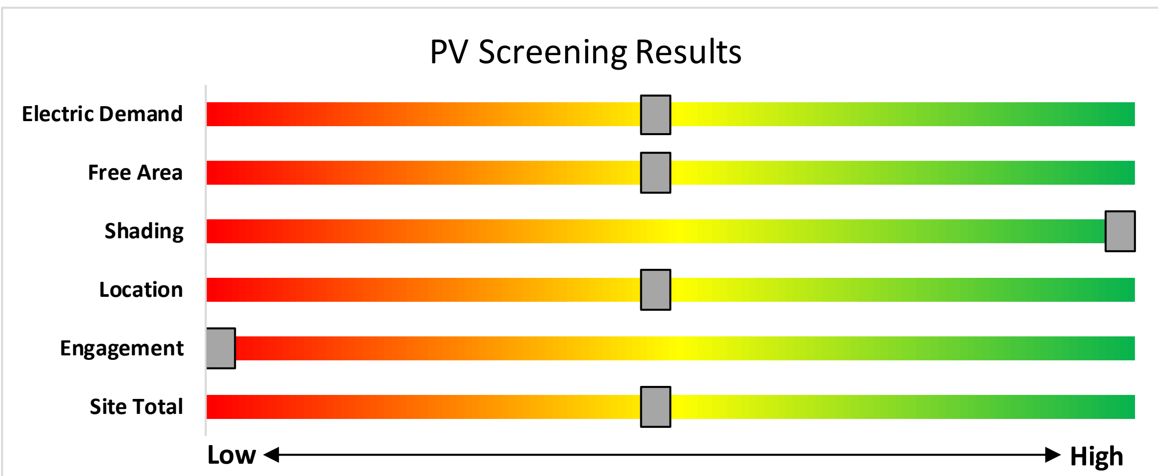
7.1 Solar Photovoltaic

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 medium potential for installing a PV array.

The amount of free area, ease of installation (location), and the lack of shading elements contribute to the medium potential. A PV array located on the roof may be difficult due to roof slope and orientation. 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	Medium	
System Potential	97	kW DC STC
Electric Generation	115,563	kWh/yr
Displaced Cost	$18,450	/yr
Installed Cost	$327,900	

Photovoltaic Screening

Successor Solar Incentive Program (SuSI)

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

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

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

7.2 Combined Heat and Power

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

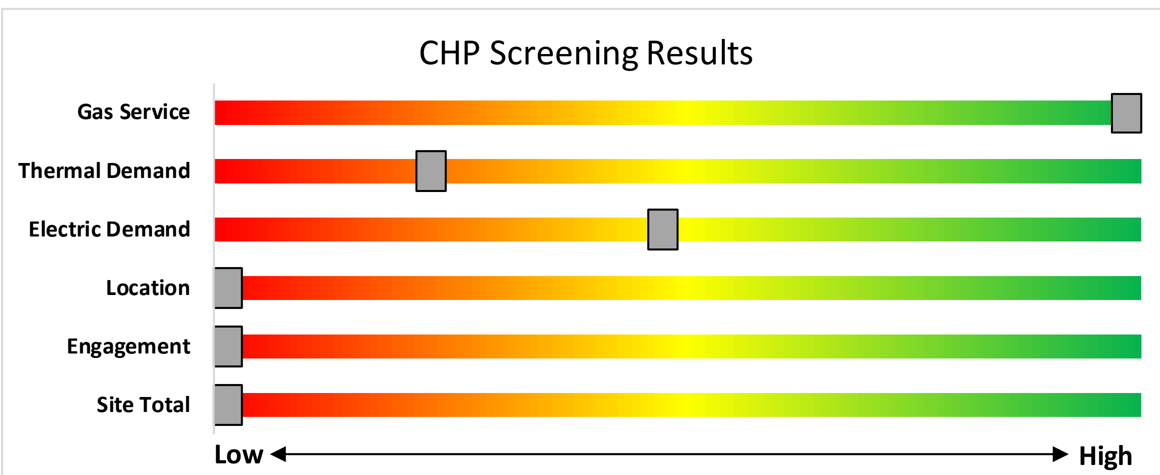
CHP systems typically produce a portion of the electric power used on-site, with the balance of electric power needs supplied by the local utility company. The heat is used to supplement (or replace) existing boilers and provide space heating and/or domestic hot water heating. Waste heat can also be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

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

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

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

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



Combined Heat and Power Screening

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

8 Electric Vehicles

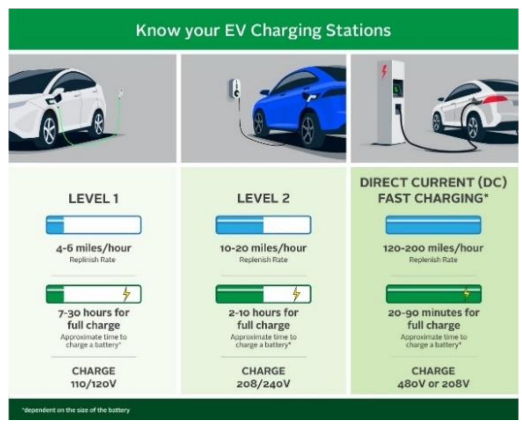
All electric vehicles (EVs) have an electric motor instead of an internal combustion engine. EVs function by plugging into a charge point, taking electricity from the grid, and then storing it in rechargeable batteries. Although electricity production may contribute to air pollution, the U.S. EPA categorizes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

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

8.1 EV Charging

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

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



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

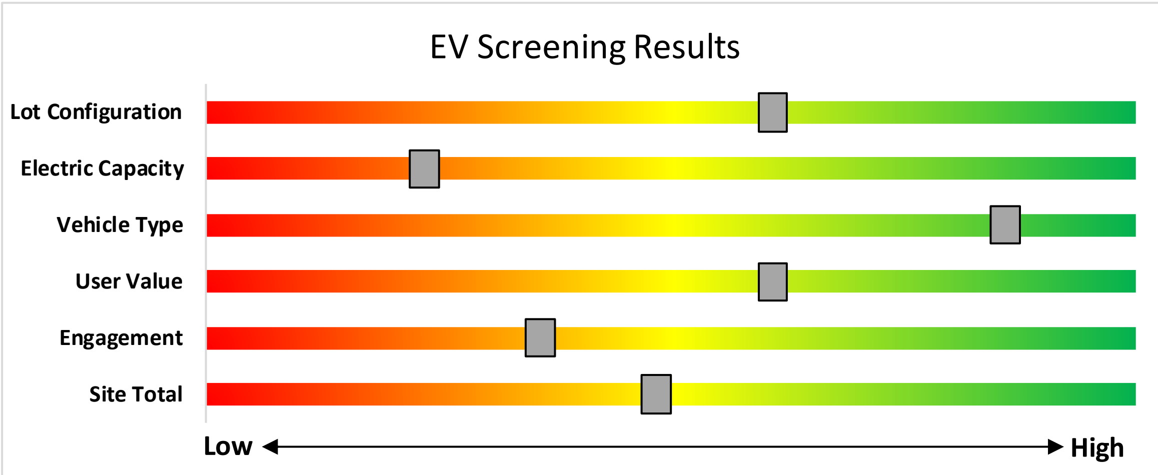
The primary costs associated with installing EV charging are the charger hardware and the cost to extend power from the facility to parking spaces. This may include upgrades to electric panels to serve increased loads.

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

*State facilities are also eligible for utility programs

Utility Administered Programs

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

9.1 New Jersey's Clean Energy Program

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

Large Energy Users

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

Incentives

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

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

How to Participate

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

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

Combined Heat and Power

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

Incentives[14]

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

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

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

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

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

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

How to Participate

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

Successor Solar Incentive Program (SuSI)

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

Administratively Determined Incentive (ADI) Program

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

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

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

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

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

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

Competitive Solar Incentive (CSI) Program

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

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

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

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

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

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

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

Energy Savings Improvement Program

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

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

How to Participate

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

(1) Use an energy services company or "ESCO."
(2) Use independent engineers and other specialists, or your own qualified staff, to provide and manage the requirements of the program through bonds or lease obligations.
(3) Use a hybrid approach of the two options described above where the ESCO is used for some services and independent engineers, or other specialists or qualified staff, are used to deliver other requirements of the program.

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

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

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

Demand Response (DR) Energy Aggregator

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

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

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

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

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

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

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

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

9.2 Utility Energy Efficiency Programs

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

Prescriptive and Custom

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

Equipment Examples

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

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

Direct Install

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

Incentives

The program pays up to 70% of the total installed cost of eligible measures.

How to Participate

To participate in Direct Install, you will work with a participating contractor. The contractor will be paid the measure incentives directly by the program, which will pass on to you in the form of reduced material and implementation costs. This means up to 70% of eligible costs are covered by the Direct Install program, subject to program rules and eligibility, while the remaining percent of the cost is paid to the contractor by the customer.

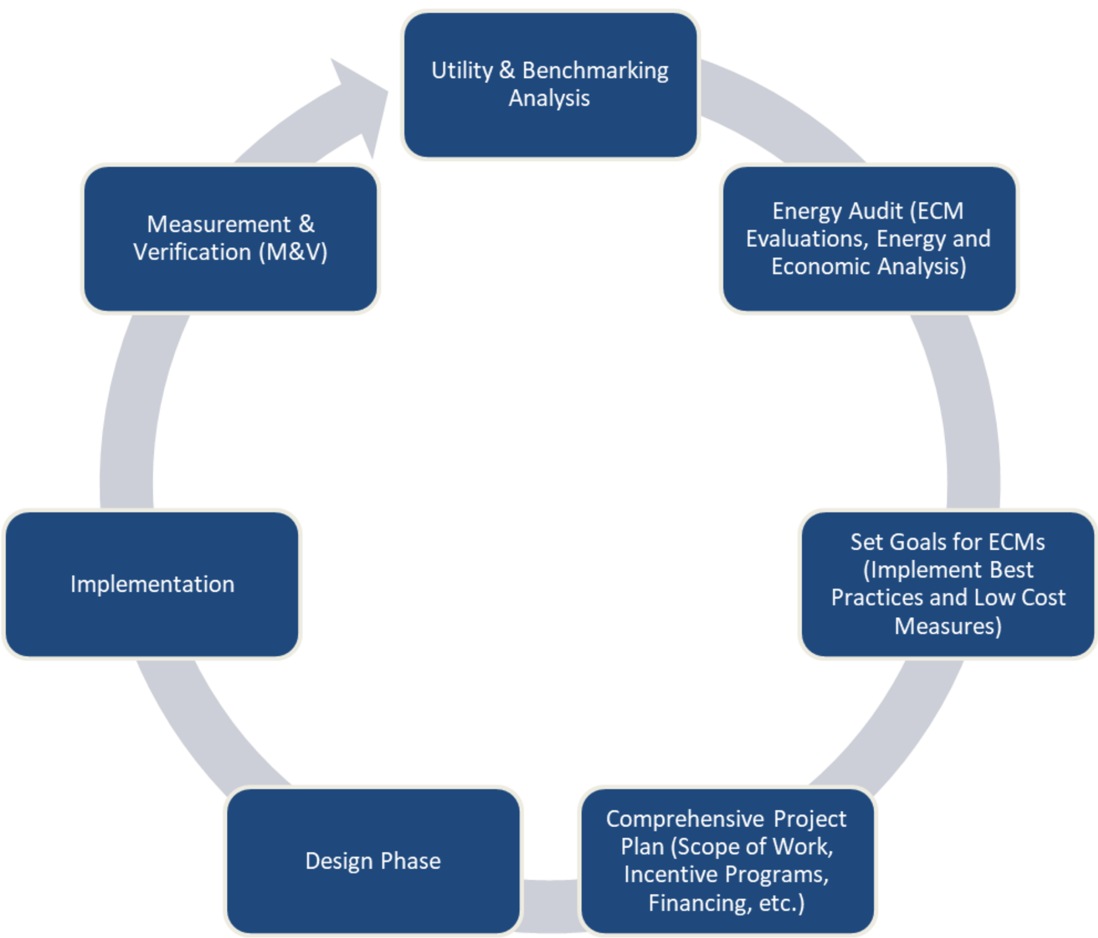
Engineered Solutions

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

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

10 Project Development

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



Project Development Cycle

11 Energy Purchasing and Procurement Strategies

11.1 Retail Electric Supply Options

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

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

A list of licensed third-party electric suppliers is available at the NJBPU website[17].

11.2 Retail Natural Gas Supply Options

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

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

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

A list of licensed third-party natural gas suppliers is available at the NJBPU website[18].

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

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

Appendix A: Equipment Inventory & Recommendations

Lighting Inventory & Recommendations

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
101	1	Compact Fluorescent: (1) 32W Plug-In Lamp	Wall Switch	S	32	1,000	1	Relamp	No	1	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	18	1,000	0.0	15	0	$2	$10	$0	4.1
101	6	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	45	2,200	3	None	Yes	6	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	45	1,518	0.1	203	0	$32	$150	$20	4.1
102	1	Compact Fluorescent: (1) 32W Plug-In Lamp	Wall Switch	S	32	1,000	1	Relamp	No	1	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	18	1,000	0.0	15	0	$2	$10	$0	4.1
102	10	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	45	2,200	3	None	Yes	10	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	45	1,518	0.1	338	0	$53	$330	$40	5.5
103	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,200	3	None	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,518	0.0	65	0	$10	$150	$20	12.7
104	9	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,200	3	None	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,518	0.1	196	0	$31	$330	$40	9.4
105	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	1,000	1	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	9	1,000	0.0	56	0	$9	$30	$0	3.4
105	9	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,200	3	None	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,518	0.1	196	0	$31	$330	$40	9.4
106	1	Compact Fluorescent: (1) 32W Plug-In Lamp	Wall Switch	S	32	1,000	1	Relamp	No	1	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	18	1,000	0.0	15	0	$2	$10	$0	4.1
106	10	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	45	2,200	3	None	Yes	10	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	45	1,518	0.1	338	0	$53	$330	$40	5.5
107	12	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	2,200	3	None	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,518	0.1	392	0	$61	$330	$40	4.7
108	12	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	2,200	3	None	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,518	0.1	392	0	$61	$330	$40	4.7
215	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,200	1	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,200	0.0	42	0	$7	$30	$10	3.0
Corridor 2	6	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	6	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor 2	4	LED - Linear Tubes: (2) 4' Lamps	None		29	4,380	4	None	Yes	4	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,022	0.0	173	0	$27	$280	$140	5.2
Corridor 2	16	LED - Linear Tubes: (4) 4' Lamps	Wall Switch		58	4,380	4	None	Yes	16	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	3,022	0.2	1,386	0	$217	$850	$560	1.3
Entrance	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch		58	4,380		None	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior 1	3	Compact Fluorescent: (2) 26W Plug-In Lamps	Photocell		52	4,380	1	Relamp	No	3	LED Lamps: GX23 (Plug-In) Lamps	Photocell	35	4,380	0.0	223	0	$36	$110	$10	2.8
Exterior 1	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	None		20	8,760		None	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	None	20	8,760	0.0	0	0	$0	$0	$0	0.0
Exterior 1	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell		50	4,380		None	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	50	4,380	0.0	0	0	$0	$0	$0	0.0
Guidance Councilor Office	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,500		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,500	0.0	0	0	$0	$0	$0	0.0
Guidance Councilor Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	1,500	1	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,500	0.0	29	0	$5	$30	$10	4.4
Gymnasium 1	7	Exit Signs: LED - 2 W Lamp	None	S	6	8,760		None	No	7	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Gymnasium 1	9	LED - Fixtures: Ambient 1x4 Fixture	Wall Switch	S	18	2,400	3	None	Yes	9	LED - Fixtures: Ambient 1x4 Fixture	Occupancy Sensor	18	1,656	0.0	133	0	$21	$330	$40	13.9
Gymnasium 1	12	LED - Fixtures: High-Bay	Wall Switch	S	75	2,400	3	None	Yes	12	LED - Fixtures: High-Bay	Occupancy Sensor	75	1,656	0.2	737	0	$115	$540	$70	4.1

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Large Office	3	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	1,000	1, 3	Relamp	Yes	3	LED Lamps: A19 Lamps	Occupancy Sensor	9	690	0.1	178	0	$28	$230	$20	7.5
Large Office	10	LED - Fixtures: Ambient 2x2 Fixture	Wall Switch	S	35	2,400	3	None	Yes	10	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	35	1,656	0.1	286	0	$45	$330	$40	6.5
Large Office	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,400	1	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	2,400	0.0	77	0	$12	$90	$10	6.7
Principal Office	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,800	3	None	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,242	0.0	53	0	$8	$150	$20	15.5
Restroom - Female 3	3	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	2,500	3	None	Yes	3	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,725	0.0	148	0	$23	$330	$40	12.5
Restroom - Female 4	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,500	1, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,725	0.1	346	0	$54	$480	$70	7.5
Restroom - Male 3	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,500	3	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,725	0.0	49	0	$8	$330	$40	37.4
Restroom - Male 4	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,500	1, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,725	0.1	346	0	$54	$480	$70	7.5
Restroom - Unisex 1	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,000		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,000	0.0	0	0	$0	$0	$0	0.0
Stairs 1	1	Exit Signs: Fluorescent	None		20	8,760	2	Fixture Replacement	No	1	LED Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	135	0	$21	$30	$0	1.4
Stairs 1	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	4,380	1, 3	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,022	0.2	1,618	0	$254	$1,250	$360	3.5
Stairs 2	1	Exit Signs: Fluorescent	None		20	8,760	2	Fixture Replacement	No	1	LED Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	135	0	$21	$30	$0	1.4
Stairs 2	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	4,380	1, 3	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,022	0.2	1,618	0	$254	$1,250	$360	3.5
Stairs 3	1	Exit Signs: Fluorescent	None		20	8,760	2	Fixture Replacement	No	1	LED Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	135	0	$21	$30	$0	1.4
Stairs 3	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	4,380	1, 3	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,022	0.2	1,618	0	$254	$1,250	$360	3.5
Storage 4	4	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	600	3	None	Yes	4	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	414	0.0	12	0	$2	$150	$20	69.9
Storage 5	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	600		None	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	600	0.0	0	0	$0	$0	$0	0.0
Storage 6	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	60	1, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	41	0.2	17	0	$3	$450	$80	141.9
201	1	Compact Fluorescent: (1) 32W Plug-In Lamp	Wall Switch	S	32	1,000	1	Relamp	No	1	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	18	1,000	0.0	15	0	$2	$10	$0	4.1
201	6	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	45	2,200	3	None	Yes	6	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	45	1,518	0.1	203	0	$32	$150	$20	4.1
202	1	Compact Fluorescent: (1) 32W Plug-In Lamp	Wall Switch	S	32	1,000	1	Relamp	No	1	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	18	1,000	0.0	15	0	$2	$10	$0	4.1
202	6	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	45	2,200	3	None	Yes	6	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	45	1,518	0.1	203	0	$32	$150	$20	4.1
203	1	Compact Fluorescent: (1) 32W Plug-In Lamp	Wall Switch	S	32	1,000	1	Relamp	No	1	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	18	1,000	0.0	15	0	$2	$10	$0	4.1
203	7	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	45	2,200	3	None	Yes	7	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	45	1,518	0.1	236	0	$37	$150	$20	3.5
204	1	Compact Fluorescent: (1) 32W Plug-In Lamp	Wall Switch	S	32	1,000	1	Relamp	No	1	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	18	1,000	0.0	15	0	$2	$10	$0	4.1

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
204	7	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	45	2,200	3	None	Yes	7	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	45	1,518	0.1	236	0	$37	$150	$20	3.5
205	1	Compact Fluorescent: (1) 32W Plug-In Lamp	Wall Switch	S	32	1,000	1	Relamp	No	1	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	18	1,000	0.0	15	0	$2	$10	$0	4.1
205	7	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	45	2,200	3	None	Yes	7	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	45	1,518	0.1	236	0	$37	$150	$20	3.5
206	1	Compact Fluorescent: (1) 32W Plug-In Lamp	Wall Switch	S	32	1,000	1	Relamp	No	1	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	18	1,000	0.0	15	0	$2	$10	$0	4.1
206	8	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	45	2,200	3	None	Yes	8	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	45	1,518	0.1	270	0	$42	$330	$40	6.8
207	12	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	2,200	3	None	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,518	0.1	392	0	$61	$330	$40	4.7
208	12	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	2,200	3	None	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,518	0.1	392	0	$61	$330	$40	4.7
Corridor 3	4	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	4	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor 3	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch		29	4,380	4	None	Yes	5	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,022	0.0	217	0	$34	$280	$180	2.9
Corridor 3	8	LED - Linear Tubes: (4) 4' Lamps	Wall Switch		58	4,380	4	None	Yes	8	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	3,022	0.1	693	0	$109	$560	$280	2.6
Faculty Room	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,500	1, 3	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,035	0.2	346	0	$54	$400	$70	6.1
Restroom - Female 5	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,500	1, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,725	0.1	346	0	$54	$480	$70	7.5
Restroom - Male 5	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,500	1, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,725	0.1	346	0	$54	$480	$70	7.5
Restroom - Unisex 2	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,000		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,000	0.0	0	0	$0	$0	$0	0.0
Storage 7	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	400		None	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	400	0.0	0	0	$0	$0	$0	0.0
Storage 8	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	400	1, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	276	0.1	37	0	$6	$250	$40	36.2
Library 1	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Library 1	29	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	2,200	3	None	Yes	29	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,518	0.4	1,262	0	$198	$660	$70	3.0
Library 1	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,200	1, 3	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,518	0.2	508	0	$80	$400	$70	4.1
Storage 10	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	400	1, 3	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	276	0.2	92	0	$14	$400	$70	22.8
Storage 9	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Storage 9	20	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	800	1, 3	Relamp	Yes	20	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	552	0.6	739	0	$116	$1,670	$270	12.1
B1	3	Compact Fluorescent: (1) 32W Plug-In Lamp	Wall Switch	S	32	800	1, 3	Relamp	Yes	3	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	18	552	0.0	52	0	$8	$190	$20	21.0
B1	10	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	800	3	None	Yes	10	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	552	0.1	158	0	$25	$330	$40	11.7
B2	3	Compact Fluorescent: (1) 32W Plug-In Lamp	Wall Switch	S	32	800	1, 3	Relamp	Yes	3	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	18	552	0.0	52	0	$8	$190	$20	21.0

	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
B2	11	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	800	3	None	Yes	11	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	552	0.1	174	0	$27	$330	$40	10.6
B3	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	800		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	800	0.0	0	0	$0	$0	$0	0.0
B3	13	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	800	1, 3	Relamp	Yes	13	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	552	0.6	721	0	$113	$1,150	$240	8.1
B4	13	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	800	3	None	Yes	13	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	552	0.2	206	0	$32	$330	$40	9.0
Corridor 1	4	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	4	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor 1	12	LED - Linear Tubes: (2) 4' Lamps	Wall Switch		29	4,380	4	None	Yes	12	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,022	0.1	520	0	$81	$560	$420	1.7
Elevator Room	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	200		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	200	0.0	0	0	$0	$0	$0	0.0
Mechanical 1	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Mechanical 1	11	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,000		None	No	11	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.0	0	0	$0	$0	$0	0.0
Restroom - Female 1	3	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	2,500	3	None	Yes	3	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,725	0.0	148	0	$23	$330	$40	12.5
Restroom - Female 2	2	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	2,500	3	None	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,725	0.0	99	0	$16	$330	$40	18.7
Restroom - Male 1	3	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	2,500	3	None	Yes	3	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,725	0.0	148	0	$23	$330	$40	12.5
Restroom - Male 2	2	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	2,500	3	None	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,725	0.0	99	0	$16	$330	$40	18.7
Storage 1	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Storage 1	3	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch	S	60	400	1, 3	Relamp	Yes	3	LED Lamps: A19 Lamps	Occupancy Sensor	9	276	0.1	71	0	$11	$230	$20	18.9
Storage 1	5	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	400	3	None	Yes	5	LED Lamps: (1) 10W A19 Screw-In Lamp	Occupancy Sensor	10	276	0.0	7	0	$1	$150	$20	121.6
Storage 1	1	LED - Fixtures: Ambient 1x4 Fixture	Wall Switch	S	35	8,760		None	No	1	LED - Fixtures: Ambient 1x4 Fixture	Wall Switch	35	8,760	0.0	0	0	$0	$0	$0	0.0
Storage 1	2	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	600	1, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	414	0.0	28	0	$4	$230	$30	45.4
Storage 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	600	1	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	600	0.0	22	0	$3	$50	$10	11.7
Storage 2	3	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	400	3	None	Yes	3	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	276	0.0	6	0	$1	$150	$20	139.7
Storage 3	1	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	45	8,760		None	No	1	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	45	8,760	0.0	0	0	$0	$0	$0	0.0

Motor Inventory & Recommendations

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	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 1	HHW Boilers	2	Combustion Air Fan	0.25	69.5%	No	FASCO	M3817	W	3,066		No	69.5%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Steam Boiler	1	Combustion Air Fan	0.50	75.0%	No	Marathon	K216	W	5,110	5	Yes	78.2%	No		0.0	78	0	$12	$900	$0	72.3
Mechanical 1	Steam heating system	2	Condensate Pump	0.50	57.0%	No	Baldor	56588-50	B	1,278	5	Yes	78.2%	No		0.2	340	0	$54	$1,800	$0	33.2
Roof	Ventilation	6	Exhaust Fan	0.50	75.0%	No			W	8,760		No	75.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	HHW system	2	Heating Hot Water Pump	3.00	86.5%	No	Baldor	M3211T	B	2,555	7	No	89.5%	Yes	2	0.7	5,257	0	$839	$10,200	$400	11.7
Mechanical 1	DHW system	2	DHW Circulation Pump	0.75	80.0%	No	Grunfos	96404960	W	5,200		No	80.0%	No		0.0	0	0	$0	$0	$0	0.0
Elevator Room	Elevator	1	Other	25.00	75.5%	No	Allweiler AG	SUB 210-46	W	60		No	75.5%	No		0.0	0	0	$0	$0	$0	0.0
Storage 1	Other	2	Other	2.00	85.0%	No			W	250		No	85.0%	No		0.0	0	0	$0	$0	$0	0.0
Storage 1	heating system	2	Process Pump	3.00	85.0%	No	Baldor		W	800		No	85.0%	No		0.0	0	0	$0	$0	$0	0.0
Classrooms	heating and ventilation	16	Fan Coil Unit	0.24	65.0%	No			B	8,760	5	Yes	80.0%	No		0.5	5,429	0	$867	$5,100	$0	5.9
Entrance	heating and ventilation	1	Fan Coil Unit	0.17	65.0%	No			B	8,760	5	Yes	80.0%	No		0.0	236	0	$38	$300	$0	8.0
Large Office	heating and ventilation	2	Fan Coil Unit	0.17	65.0%	No			B	8,760	5	Yes	80.0%	No		0.0	471	0	$75	$600	$0	8.0
Principal Office	heating and ventilation	1	Fan Coil Unit	0.17	65.0%	No			B	8,760	5	Yes	80.0%	No		0.0	236	0	$38	$300	$0	8.0
Library 1	heating and ventilation	3	Fan Coil Unit	0.17	65.0%	No			B	8,760	5	Yes	80.0%	No		0.1	707	0	$113	$1,000	$0	8.9
B1	heating and ventilation	1	Fan Coil Unit	0.24	65.0%	No			B	8,760	5	Yes	80.0%	No		0.0	339	0	$54	$300	$0	5.5
B2	heating and ventilation	1	Fan Coil Unit	0.24	65.0%	No			B	8,760	5	Yes	80.0%	No		0.0	339	0	$54	$300	$0	5.5
B3	heating and ventilation	1	Fan Coil Unit	0.24	65.0%	No			B	8,760	5	Yes	80.0%	No		0.0	339	0	$54	$300	$0	5.5
B4	heating and ventilation	1	Fan Coil Unit	0.24	65.0%	No			B	8,760	5	Yes	80.0%	No		0.0	339	0	$54	$300	$0	5.5
Faculty Room	heating, cooling, ventilation	1	Supply Fan	2.00	85.0%	No			W	8,760	6	No	86.5%	Yes	1	0.6	4,246	0	$678	$4,700	$100	6.8
Storage 10	heating, cooling, ventilation	1	Supply Fan	0.75	81.1%	No			W	2,800		No	81.1%	No		0.0	0	0	$0	$0	$0	0.0

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Storage 9	heating, cooling, ventilation	1	Supply Fan	0.75	81.1%	No			W	2,800		No	81.1%	No		0.0	0	0	$0	$0	$0	0.0
Exterior 1 - RTU	Gym - heating and cooling	1	Supply Fan	10.00	93.0%	Yes			W	2,800		No	93.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior 1 - RTU	Gym - heating and cooling	1	Return Fan	10.00	91.7%	Yes			W	2,800		No	91.7%	No		0.0	0	0	$0	$0	$0	0.0
Exterior 1 - RTU	Gym - heating and cooling	1	Other	0.25	70.0%	No			W	800		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior	cooling	3	Supply Fan	0.17	65.0%	No			W	50		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior 1 - RTU	Gym - heating and cooling	4	Other	1.00	85.5%	No			W	320		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0

Packaged HVAC Inventory & Recommendations

		Existing Conditions									Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/IEER/EER)	Heating Mode Efficiency	Manufacturer	Model	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/IEER/EER)	Heating Mode Efficiency	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Exterior 1	Various	1	Ductless Mini-Split HP	6.00	80.00	15.00	4.05 COP	Mitsubishi Trane	TUHYE0723AN40AN	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior 1	Various	1	Ductless Mini-Split HP	8.00	108.00	16.00	4.04 COP	Mitsubishi Trane	TUHYE0963AN40AN	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior 1 / Storage 10	AHU 1	1	Split-System	2.00	32.00	12.00	1 COP	Trane	TEM4A0C60	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior 1 / Storage 9	AHU 2	1	Split-System	2.00	32.00	12.00	1 COP	Trane	TEM4A0C60	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior 1	Gym	1	Package Unit	30.00	400.00	12.50	0.8 AFUE	Trane	OAND360D3-D1B400JT	W		No							0.0	0	0	$0	$0	$0	0.0
101	101	1	Window AC	1.50		10.00				W	8	Yes	1	Window AC	1.50		12.00		0.2	66	0	$11	$1,200	$0	113.9
102	102	1	Window AC	2.04		9.80				W	8	Yes	1	Window AC	2.04		12.00		0.2	101	0	$16	$1,800	$0	111.8
103	103	1	Window AC	1.00		10.00				W	8	Yes	1	Window AC	1.00		12.00		0.1	44	0	$7	$1,000	$0	142.3
104	104	1	Window AC	2.04		9.80				W	8	Yes	1	Window AC	2.04		12.00		0.2	101	0	$16	$1,800	$0	111.8
105	105	1	Window AC	2.04		9.80				W	8	Yes	1	Window AC	2.04		12.00		0.2	101	0	$16	$1,800	$0	111.8
106	106	1	Window AC	2.04		9.80				W	8	Yes	1	Window AC	2.04		12.00		0.2	101	0	$16	$1,800	$0	111.8
107	107	1	Window AC	2.04		9.80				W	8	Yes	1	Window AC	2.04		12.00		0.2	101	0	$16	$1,800	$0	111.8
108	108	1	Window AC	2.04		9.80		LG	LW2514ER	W	8	Yes	1	Window AC	2.04		12.00		0.2	101	0	$16	$1,800	$0	111.8
Large Office	Large Office	2	Window AC	1.00		11.00				W	8	Yes	2	Window AC	1.00		12.00		0.1	73	0	$12	$2,100	$0	180.9
Principal Office	Principal Office	1	Window AC	1.00		11.00				W	8	Yes	1	Window AC	1.00		12.00		0.0	27	0	$4	$1,000	$0	229.7
201	201	1	Window AC	2.04		9.80				W	8	Yes	1	Window AC	2.04		12.00		0.2	92	0	$15	$1,800	$0	123.0
202	202	1	Window AC	2.04		9.80				W	8	Yes	1	Window AC	2.04		12.00		0.2	92	0	$15	$1,800	$0	123.0
203	203	1	Window AC	2.04		9.80				W	8	Yes	1	Window AC	2.04		12.00		0.2	92	0	$15	$1,800	$0	123.0
204	204	1	Window AC	2.04		9.80				W	8	Yes	1	Window AC	2.04		12.00		0.2	92	0	$15	$1,800	$0	123.0
205	205	1	Window AC	2.04		9.80				W	8	Yes	1	Window AC	2.04		12.00		0.2	92	0	$15	$1,800	$0	123.0

		Existing Conditions									Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (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 (kBtu/hr)	Cooling Mode Efficiency (SEER/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
206	206	1	Window AC	2.04		9.80				W	8	Yes	1	Window AC	2.04		12.00		0.2	92	0	$15	$1,800	$0	123.0
207	207	1	Window AC	2.04		9.80				W	8	Yes	1	Window AC	2.04		12.00		0.2	92	0	$15	$1,800	$0	123.0
208	208	1	Window AC	2.04		9.80				W	8	Yes	1	Window AC	2.04		12.00		0.2	92	0	$15	$1,800	$0	123.0
B1	B1	1	Window AC	2.04		9.80		LG		W	8	Yes	1	Window AC	2.04		12.00		0.2	92	0	$15	$1,800	$0	123.0
B2	B2	1	Window AC	2.04		9.80				W	8	Yes	1	Window AC	2.04		12.00		0.2	92	0	$15	$1,800	$0	123.0
B3	B3	1	Window AC	2.04		9.80				W	8	Yes	1	Window AC	2.04		12.00		0.2	92	0	$15	$1,800	$0	123.0
B4	B4	1	Window AC	2.04		9.80				W	8	Yes	1	Window AC	2.04		12.00		0.2	92	0	$15	$1,800	$0	123.0

Space Heating Boiler Inventory & Recommendations

		Existing Conditions						Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Manufacturer	Model	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical 1	HHW system - Boiler #1,2	2	Non-Condensing Hot Water Boiler	850	RBI	FB1000	W		No						0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Steam Heat systems	1	Natural Draft Steam Boiler	1,072	EASCO	FST-32	W		No						0.0	0	0	$0	$0	$0	0.0

Pipe Insulation Recommendations

		Recommendation Inputs			Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	ECM #	Length of Uninsulated Pipe (ft)	Pipe Diameter (in)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical 1	HHW boilers	9	8	2.00	0.0	0	7	$90	$150	$20	1.5
Mechanical 1	Steam boiler	9	5	2.50	0.0	0	6	$86	$90	$10	0.9
Mechanical 1	DHW heater	9	4	0.75	0.0	0	1	$19	$50	$10	2.1
Storage 4	DHW heater	9	1	0.75	0.0	83	0	$13	$10	$0	0.8
Storage 4	DHW heater	9	2	1.25	0.0	259	0	$41	$30	$0	0.7

DHW Inventory & Recommendations

		Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Manufacturer	Model	Remaining Useful Life	ECM #	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Storage 4	DWH	1	Storage Tank Water Heater (≤ 50 Gal)	Bradford White	M140L6DS	W		No						0.0	0	0	$0	$0	$0	0.0
Mechanical 1	DWH	1	Storage Tank Water Heater (≤ 50 Gal)	AO Smith	FSG 40 242	B	10	Yes	1	Storage Tank Water Heater (≤ 50 Gal)	Natural Gas	85.00%	UEF	0.0	0	19	$263	$1,200	$100	4.2

Low-Flow Device Recommendations

	Recommedation Inputs					Energy Impact & Financial Analysis						
Location	ECM #	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Restrooms	11	24	Faucet Aerator (Lavatory)	2.20	0.50	0.0	0	11	$156	$200	$100	0.6
Classrooms	11	18	Faucet Aerator (Lavatory)	2.00	0.50	0.0	0	8	$103	$150	$70	0.8
Faculty Rooms	11	2	Faucet Aerator (Kitchen)	2.20	1.50	0.0	0	0	$5	$20	$0	3.7
Guidance Councilor Office	11	1	Faucet Aerator (Kitchen)	2.20	1.50	0.0	0	0	$3	$10	$0	3.7
Gymnasium 1	11	1	Faucet Aerator (Kitchen)	2.20	1.50	0.0	0	0	$3	$10	$0	3.7
Large Office	11	1	Faucet Aerator (Kitchen)	2.20	1.50	0.0	0	0	$3	$10	$0	3.7
Corridor 1	11	1	Faucet Aerator (Lavatory)	2.20	0.50	0.0	0	0	$6	$10	$0	1.5

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
Mechanical 1	2	Refrigerator Chest	Powers		No	12	Yes	0.2	2,026	0	$323	$4,600	$0	14.2

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
Faculty Room	1	Gas Convection Oven (Half Size)			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
Faculty Room	1	Coffee Machine	900			
Guidance Councilor Office	2	Desktop	280			
Large Office	4	Desktop	280			
Principal Office	2	Desktop	280			
Library 1	4	Desktop	280			
Storage 10	1	Desktop	280			
Storage 9	1	Desktop	280			
Mechanical 1	1	Desktop	280			
Library 1	2	Fan (Ceiling)	55			
Gymnasium 1	1	Microwave	1,500			
Large Office	1	Microwave	1,500			
Faculty Room	1	Microwave	1,500			
Mechanical 1	1	Microwave	1,500			
Library 1	4	Printer (Medium/Small)	240			
B4	1	Printer (Medium/Small)	240			
Corridor 1	1	Printer (Medium/Small)	240			
Corridor 2	1	Printer/Copier (Large)	1,200			
Large Office	1	Printer/Copier (Large)	1,200			
Corridor 3	1	Printer/Copier (Large)	1,200			
101	1	Projector	240			
102	1	Projector	240			
103	1	Projector	240			
104	1	Projector	240			
105	1	Projector	240			
106	1	Projector	240			
107	1	Projector	240			
108	1	Projector	240			
201	1	Projector	240			
202	1	Projector	240			
203	1	Projector	240			
204	1	Projector	240			
205	1	Projector	240			
206	1	Projector	240			
207	1	Projector	240			
208	1	Projector	240			

	Existing Conditions					
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Library 1	1	Projector	240			
B1	1	Projector	240			
B2	1	Projector	240			
B3	2	Projector	240			
B4	1	Projector	240			
Large Office	1	Refrigerator (Mini)	220			
Gymnasium 1	1	Refrigerator (Residential)	380			
Faculty Room	1	Refrigerator (Residential)	380			
Mechanical 1	1	Refrigerator (Residential)	280			
Large Office	1	Television	400			
Gymnasium 1	1	Toaster Oven	1,500			
Building	1	Server Equipment	800			
Building	1	Other	2,000			

Custom (High Level) Measure Analysis

Electric Tank Water Heater to HPWH

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)	DWH	3,000	Electric	4.5	40	Heat Pump Water Heater	2.5	40	$2,091.00	0.00	3,693	0	$590	$2,500	$0	$0	$0	$2,500	4.24	4.24

Gas Tank Water Heater to HPWH

Existing Conditions						Proposed Conditions				Energy Impact & Financial Analysis										
Description	Area(s)/System(s) Served	SF of Area Served	Fuel Type	Input Capacity per Unit (MBH)	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)	DWH	26,000	Natural Gas	32.0	40	Heat Pump Water Heater	2.5	40	$2,091.00	0.00	-17,069	182	-$237	$2,500	$0	$0	$0	$2,500	-10.55	-10.55

APPENDIX B: ENERGY STAR STATEMENT OF ENERGY PERFORMANCE

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

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ENERGY STAR® Statement of Energy Performance

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ENERGY STAR® Score[1]

McKinley Elementary School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 51,880
Built: 1908

For Year Ending: February 28, 2023
Date Generated: May 27, 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
McKinley Elementary School 500 First Street Westfield, New Jersey 07090	Westfield Board of Education 302 Elm Street Westfield, NJ 07090 (908) 789-4400	Sean McArthur 302 Elm Street Westfield, NJ 07090 (908) 789-4460 smcarthur@westfieldnjk12.org

Property ID: 4163455

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
69.7 kBtu/ft²

Source EUI
99.5 kBtu/ft²

Annual Energy by Fuel

Electric - Grid (kBtu)	780,145 (22%)
Natural Gas (kBtu)	2,835,059 (78%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	71.1
National Median Source EUI (kBtu/ft²)	101.5
% Diff from National Median Source EUI	-2%

Annual Emissions

Total (Location-Based) GHG Emissions (Metric Tons CO2e/year)	221

Signature & Stamp of Verifying Professional

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

LP Signature: ______________________Date: ___________

Licensed Professional

____ ________
,
(____)____-______
____

Professional Engineer or Registered Architect Stamp
(if applicable)

Appendix C: Glossary

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

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

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