Local Government Energy Audit Report

Brookdale Avenue Elementary

April 30, 2024

Prepared for:
Verona Board of Education
14 Brookdale Court
Verona, New Jersey 07044

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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.

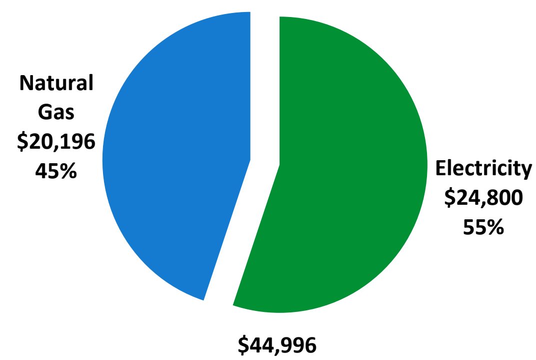
Table of Contents

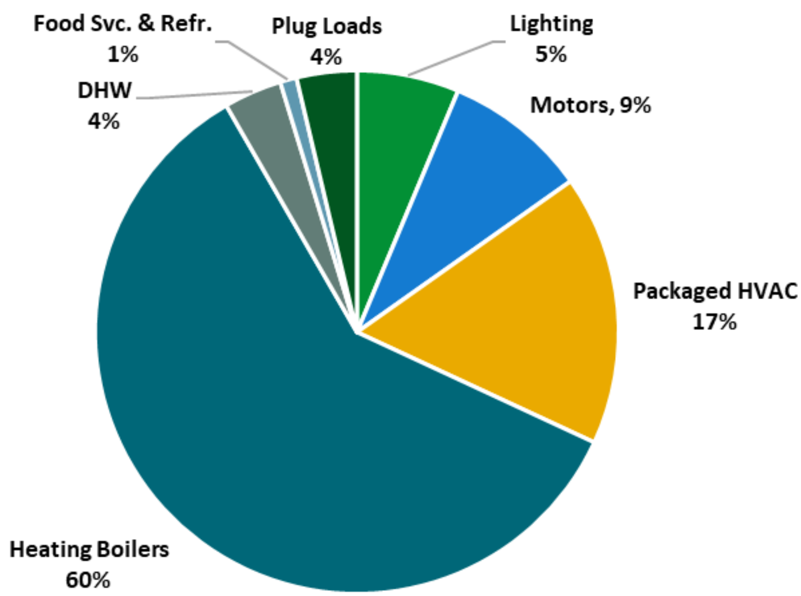
1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Brookdale Avenue 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: $44,996 Electricity: 160,080 kWh Natural Gas: 16,738 Therms	(see chart below)
ENERGY STAR® Benchmarking Score	57 *(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.





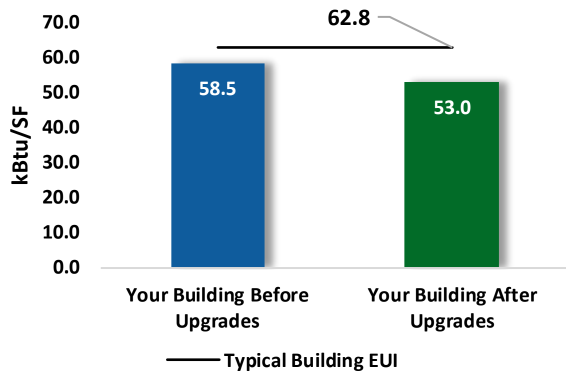
Energy Use by System

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.

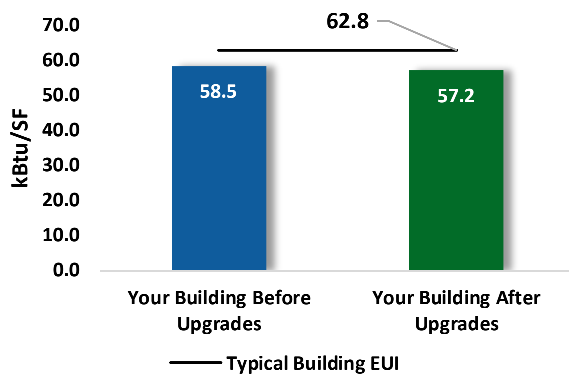
Scenario 1: Full Package (All Evaluated Measures)

Installation Cost	$249,220
Potential Rebates & Incentives[1]	$14,690
Annual Cost Savings	$3,480
Annual Energy Savings	Electricity: 8,417 kWh Natural Gas: 1,804 Therms
Greenhouse Gas Emission Savings	15 Tons
Simple Payback	67.4 Years
Site Energy Savings (All Utilities)	9%



Scenario 2: Cost Effective Package[2]

Installation Cost	$21,920
Potential Rebates & Incentives	$3,690
Annual Cost Savings	$1,863
Annual Energy Savings	Electricity: 11,162 kWh Natural Gas: 111 Therms
Greenhouse Gas Emission Savings	6 Tons
Simple Payback	9.8 Years
Site Energy Savings (all utilities)	2%



On-site Generation Potential

Photovoltaic	None
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			**3,202**	**0.5**	**0**	**$492**	**$1,840**	**$320**	**$1,520**	**3.1**	**3,183**
ECM 1	Install LED Fixtures	Yes	1,480	0.0	0	$229	$710	$100	$610	2.7	1,491
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	201	0.1	0	$31	$130	$10	$120	3.9	197
ECM 3	Retrofit Fixtures with LED Lamps	Yes	1,520	0.5	0	$232	$1,000	$210	$790	3.4	1,495
Lighting Control Measures			**5,157**	**1.2**	**-1**	**$786**	**$10,270**	**$3,090**	**$7,180**	**9.1**	**5,067**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	3,078	0.9	-1	$469	$7,440	$1,400	$6,040	12.9	3,024
ECM 5	Install High/Low Lighting Controls	Yes	2,079	0.3	0	$317	$2,830	$1,690	$1,140	3.6	2,043
Variable Frequency Drive (VFD) Measures			**6,068**	**1.7**	**0**	**$940**	**$18,800**	**$400**	**$18,400**	**19.6**	**6,111**
ECM 6	Install VFDs on Constant Volume (CV) Fans	No	2,803	1.2	0	$434	$9,400	$200	$9,200	21.2	2,822
ECM 7	Install VFDs on Heating Water Pumps	No	3,265	0.5	0	$506	$9,400	$200	$9,200	18.2	3,288
Unitary HVAC Measures			**1,474**	**4.9**	**6**	**$304**	**$91,200**	**$4,700**	**$86,500**	**284.7**	**2,216**
ECM 8	Install High Efficiency Air Conditioning Units	No	1,474	4.9	6	$304	$91,200	$4,700	$86,500	284.7	2,216
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**78**	**$945**	**$122,200**	**$6,000**	**$116,200**	**123.0**	**9,166**
ECM 9	Install High Efficiency Hot Water Boilers	No	0	0.0	78	$945	$122,200	$6,000	$116,200	123.0	9,166
HVAC System Improvements			**0**	**0.0**	**8**	**$96**	**$270**	**$40**	**$230**	**2.4**	**934**
ECM 10	Install Pipe Insulation	Yes	0	0.0	8	$96	$270	$40	$230	2.4	934
Domestic Water Heating Upgrade			**0**	**0.0**	**9**	**$112**	**$1,740**	**$140**	**$1,600**	**14.3**	**1,086**
ECM 11	Install High Efficiency Gas-Fired Water Heater	No	0	0.0	5	$57	$1,600	$100	$1,500	26.5	550
ECM 12	Install Low-Flow DHW Devices	Yes	0	0.0	5	$55	$140	$40	$100	1.8	536
Custom Measures			**-7,484**	**0.0**	**80**	**-$194**	**$2,900**	**$0**	**$2,900**	**-14.9**	**1,831**
ECM 13	Replace Gas Fired Water Heater with Heat Pump Water Heater***	No	-7,484	0.0	80	-$194	$2,900	$0	$2,900	-14.9	1,831
TOTALS (COST EFFECTIVE MEASURES)			**8,359**	**1.8**	**11**	**$1,429**	**$12,520**	**$3,490**	**$9,030**	**6.3**	**9,720**
TOTALS (ALL MEASURES)			**8,417**	**8.3**	**180**	**$3,480**	**$249,220**	**$14,690**	**$234,530**	**67.4**	**29,593**

* - 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 4.8

All Evaluated Energy Improvements

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

1.1 Planning Your Project

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

<u>Options from New Jersey's Clean Energy Program</u>

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 Brookdale Avenue 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 December 28, 2023, TRC performed an energy audit at Brookdale Avenue Elementary located in Verona, New Jersey. TRC met with Dennis James to review the facility operations and help focus our investigation on specific energy-using systems.

Brookdale Avenue Elementary is a 3-story, 37,972 square foot building built in 1927. Areas include classrooms, gymnasium, auditorium, offices, cafeteria, corridors, stairwells, offices, kitchen, and basement mechanical space.

Recent Improvements and Facility Concerns

Ove the last five years, the facility has replaced most lighting fixtures and bulbs with LED equivalents. Newer Trane unit ventilators with variable speed fans and variable refrigerant flow (VRF) cooling, controlled by BAS have also been installed across the schools in the district.

Facility concerns include the site's older rooftop mounted units (RTU's).

2.2 Building Occupancy

The facility is occupied Monday through Friday during regular business hours. Typical occupancy is 15 staff and 150 students. Summer occupancy includes a summer recreation program and continuing maintenance activities. There are no regular weekend activities.

The facility is occupied intermittently, as needed for maintenance and operations. Hours on select days may go to 10:00 PM.

Building Name	Weekday/Weekend	Operating Schedule
Brookdale Avenue Elementary School	Weekday	7:00 AM- 6:00 PM
	Weekend	As needed

Building Occupancy Schedule

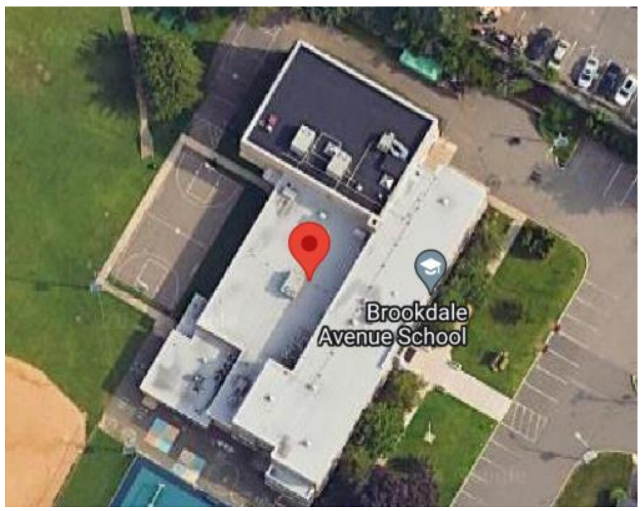
2.3 Building Envelope

Building walls are made of brick. The roof is flat with some areas covered in black and white membrane, and it is in fair condition.

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

Windows

Doors



Bird's eye view of campus

2.4 Lighting Systems

The primary interior lighting system uses linear lamps. There are also several 40-Watt T12 fixtures and 32-Watt T8 fixtures. Fixture types include 2- 3- or lamp, 4-foot-long fixtures. Typically, T8 fluorescent lamps use electronic ballasts and T12 fluorescent lamps use magnetic ballasts. Most of the linear fixtures have been converted to operate LED tube lamps.

Additionally, there are some compact fluorescent lamps (CFL) and LED general purpose lamps. Gymnasium fixtures have various switch settings including occupancy hi-low controls high bay LED lamps.

All exit signs are LED.

Most fixtures are in fair condition. Interior lighting levels are sufficient.

LED Gym fixtures

T12 Linear Tubes

Classroom T8 linear fixtures

CFL fixtures

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

Exterior fixtures include wall packs with LED lamps and a CFL can fixture. The pole mounted flood fixture use HID lamp. Exterior light fixtures are controlled by a time clock, or photocell, depending on the fixture.

Metal Halide Pole Arm fixture

Exterior CFL fixture

LED wall pack

LED wall pack

2.5 Air Handling Systems

Unit Ventilators

Most classrooms have unit ventilators equipped with variable speed supply fan motors. Heating and cooling are provided through two variable refrigerant flow heat pump units (VRFs). The VRFs are each 10 tons in capacity and have efficiency ratings of 11.40 SEER and heating outputs of 135 MBh. The carry a heating efficiency rating of 11 HSPF. The units are controlled by the Trane Synchrony BAS.

There are a few older fan coil units (FCU) that provide heating via hot water coils. Most are ceiling mounted in corridors and bathrooms. These are controlled by thermostats that are not directly linked into the BAS.

Unit Ventilator

VRFs

Unitary Heating Equipment

The corridors, stairwells and gym are heated by electric resistance heaters, each estimated to have a 3 kW (10.24 MBh) heating capacity. The units are in fair condition.

Electric resistance heater

Electric resistance heater

Packaged Units

The school is served by multiple packaged roof top units (RTUs). There are gas-fired burner units ranging in size from 75 MBh to 350 MBh. Some units are equipped with economizers that are in fair condition. The newer units are controlled by the Trane BAS and the older units by the older Summit Tracer BAS.

Unit	Area Served	Size (tons)	Efficiency (SEER)	Heating (MBh)
RTU-BR-2	Library	15.0	12.10	350
RTU-BR-3	Cafeteria	15.0	12.10	350
RTU (York)	Various	4.0	13.0	75
RTU (York)	Various	12.33	10.0	240
RTU-BR-1	Gym	25.0	10.0	N/A
RTU (York)	Various	5.0	13.0	125

Refer to Appendix A for detailed information about each unit.

Packaged unit

Gym Packaged unit

Air Handling Units (AHUs)

The gym and auditorium are conditioned by two air handling units located above the wings of the stage. These units are each equipped with a supply fan motor and a hot water heating coil. The supply fan motors are 2 hp, constant speed, and standard efficiency. The AHUs are controlled by the Tracer Summit BAS.

Some classrooms and offices are cooled by outdoor condensing units that have cooling capacities ranging from 1.6 tons to 10 tons and has energy efficiency ratios ranging from 11.40 to 17 SEER. The condition of the cooling units varies from fair to good condition. This is a split air-conditioning (AC) system configuration. These units are controlled locally and not tied into the BAS.

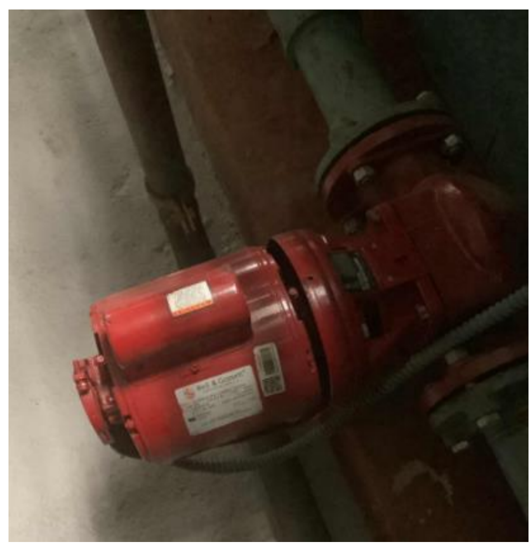
Auditorium AHU

Split systems

2.6 Heating Hot Water Systems

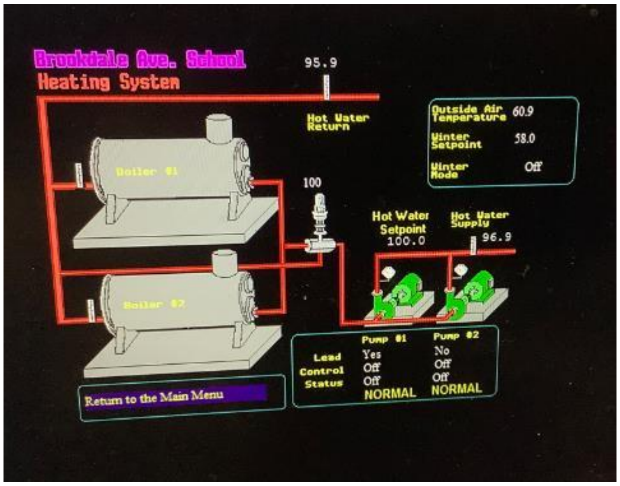
Two Cleaver Brooks 2,008.8 MBh forced draft hot water boilers serve most of the building fan coil units and radiators. The burners are non- modulating with a nominal efficiency of 80 percent. The boilers are configured in a lead-lag control scheme. Installed in 1998, they are in fair condition.

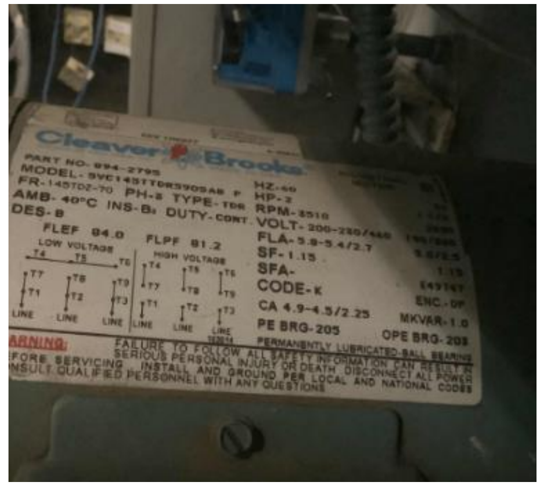
The boilers serve a primary/secondary distribution system with two constant speed 0.25 hp pumps circulating the primary loop and two constant speed 2.0 hp heating hot water pumps operating in lead/lag fashion on the secondary loop.



Hydronic Boilers

Primary Pump





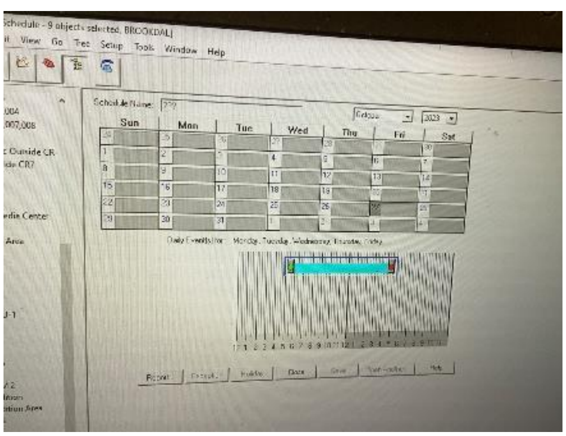
Boiler configuration

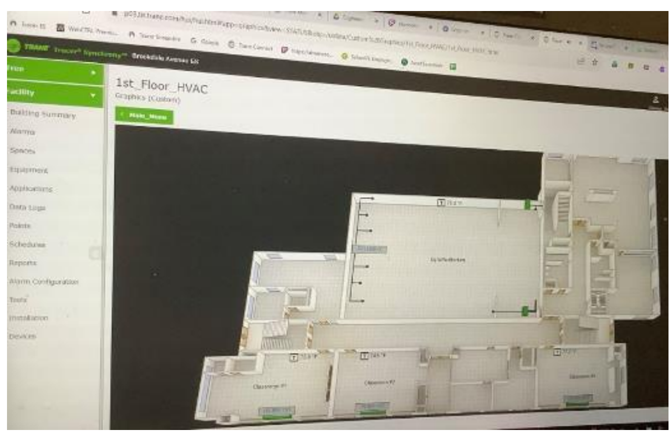
Secondary Pump nameplate

2.7 Building Automation System (BAS)

The Verona school district has three BAS controls systems that control and monitor the HVAC equipment, the boilers, the air handlers, the package units, and unit ventilators, and exhaust fans across the schools. Unit ventilators and newer packaged units are operated from new Trane Tracer Synchrony system. Boilers, AHUs and other older pieces of equipment are operated by the older Tracer Summit system. The new BAS provides equipment scheduling control and monitors and controls space temperatures, supply air temperatures, humidity, heating water loop temperatures, and fan speeds. The old Tracer Summit system has less control capability.

The site staff expressed an interest in transitioning all equipment to a single BAS.





Tracer Summit Controls

Trane Tracer Synchrony Controls

2.8 Domestic Hot Water

Hot water is produced by a 50 gallon 40 MBh gas-fired storage water heater with an efficiency rating of 80%. One fractional hp circulation pump distributes water to end uses. The circulation pump operates continuously. There was a secondary unit that is no longer in operation.

The domestic hot water pipes are uninsulated.

DHW heater

Hot Water circulation pump

Uninsulated pipes

Hot water heater nameplate

2.9 Food Service Equipment

The kitchen has all electric equipment that is used to serve meals for students and staff. Food is prepared at a different school and transported to the site each day. Bulk prepared foods are held in several electric holding cabinets. Equipment is not high efficiency and is in fair condition.

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

Food Cabinet

2.10 Refrigeration

The kitchen has a freezer chest. This equipment is standard efficiency and in fair condition. Additionally, there were some residential style refrigerators in the kitchen.

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

Freezer

2.11 Plug Load and Vending Machines

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

There are approximately 17 computer workstations throughout the facility and a number of laptop charging carts enough for all students and faculty. Plug loads include general cafe and office equipment. There are classroom typical loads such as smart boards, projectors, and fans.

There are several residential style refrigerators throughout the building that are used to store perishables. These vary in condition and efficiency.

Classroom fan

Refrigerator

Break Room – various cafe equipment

Projector

2.12 Water-Using Systems

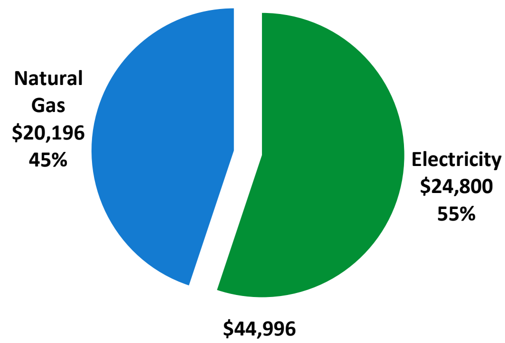
Water is provided by a municipal water supply company.

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 6 restrooms with toilets, urinals, and sinks as well as kitchen sinks. Some classrooms also have faucets. Most faucet flow rates are at 1.0 gallons per minute (gpm) or higher, but most restroom faucets were 0.5 gpm low flow devices.

3 Energy Use and Costs

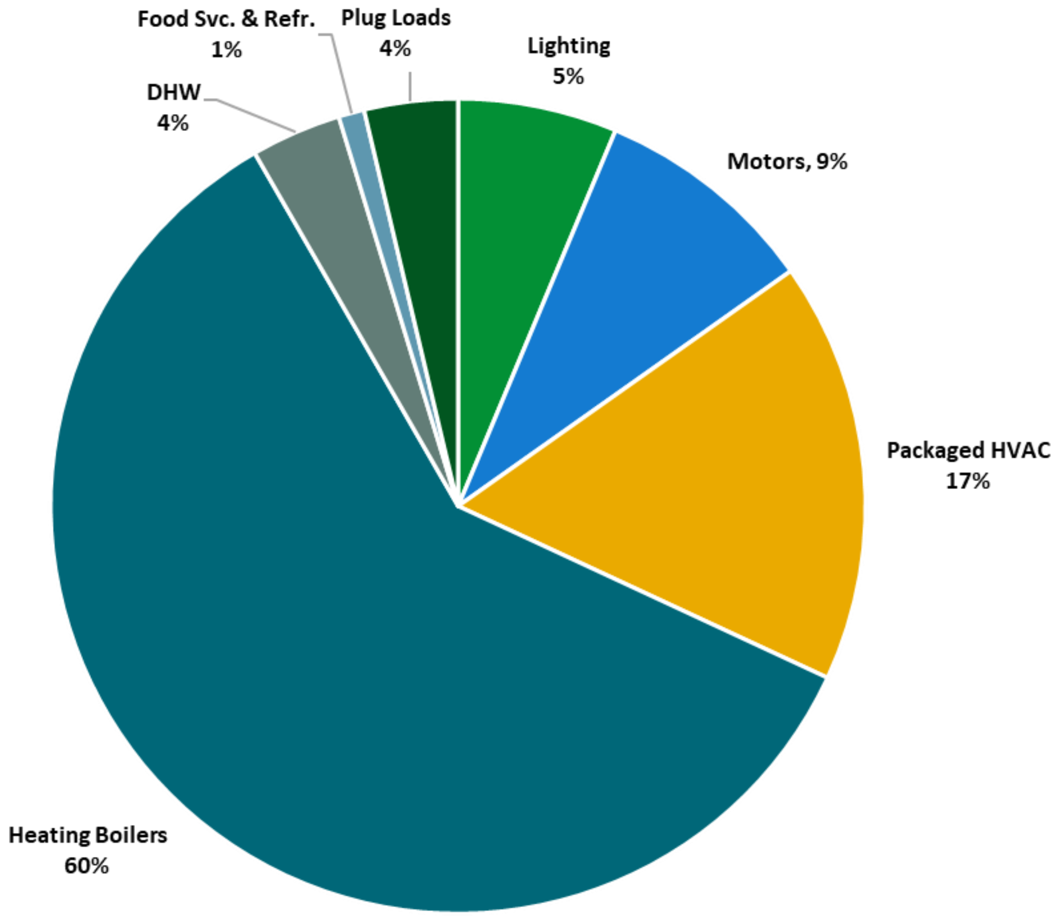
Twelve months of utility billing data are used to develop annual energy consumption and cost data. This information creates a profile of the annual energy consumption and energy costs.

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	160,080 kWh	$24,800
Natural Gas	16,738 Therms	$20,196
Total		**$44,996**



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.

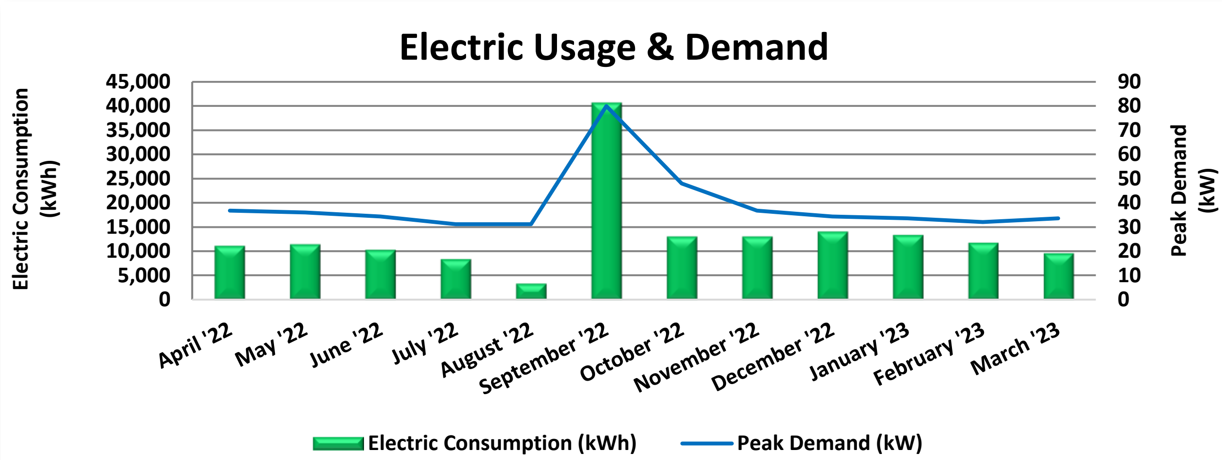
The energy auditor collects information regarding equipment operating hours, capacity, efficiency, and other operational parameters from facility staff, drawings, and on-site observations. This information is used as the inputs to calculate the existing conditions energy use for the site. The calculated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



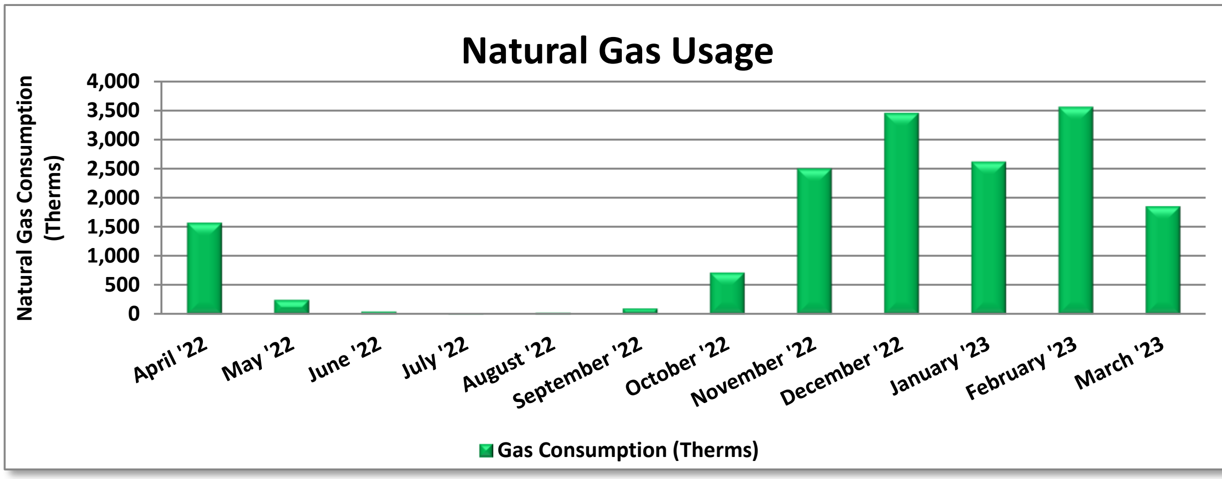
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
4/29/22	30	11,120	37	$146	$1,484
5/31/22	32	11,440	36	$142	$1,546
6/29/22	29	10,320	34	$492	$1,712
7/29/22	30	8,400	31	$457	$1,729
8/29/22	31	3,360	31	$457	$1,231
9/28/22	30	40,560	80	$1,171	$5,394
10/27/22	29	13,040	48	$224	$2,003
11/29/22	33	13,040	37	$171	$2,003
12/29/22	30	14,080	34	$492	$1,720
1/30/23	32	13,360	34	$157	$2,203
3/1/23	30	11,760	32	$149	$2,004
3/30/23	29	9,600	34	$157	$1,771
Totals	**365**	**160,080**	**80**	**$4,215**	**$24,800**
Annual	**365**	**160,080**	**80**	**$4,215**	**$24,800**

Notes:

- Peak demand of 80 kW occurred in September '22.
- Average demand over the past 12 months was 39 kW.
- The average electric cost over the past 12 months was $0.155/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.
- September usage was entered as a true up for the annual usage and not indicative of monthly usage.

3.2 Natural Gas

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



Gas Billing Data			
Period Ending	**Days in Period**	**Natural Gas Usage (Therms)**	**Natural Gas Cost**
4/29/22	30	1,578	$1,716
5/31/22	32	253	$464
6/29/22	29	50	$211
7/29/22	30	6	$176
8/29/22	31	26	$191
9/28/22	30	101	$246
10/27/22	29	721	$829
11/29/22	33	2,505	$2,892
12/29/22	30	3,455	$3,854
1/30/23	32	2,625	$3,155
3/1/23	30	3,563	$4,026
3/30/23	29	1,855	$2,435
Totals	**365**	**16,738**	**$20,196**
Annual	**365**	**16,738**	**$20,196**

Notes:

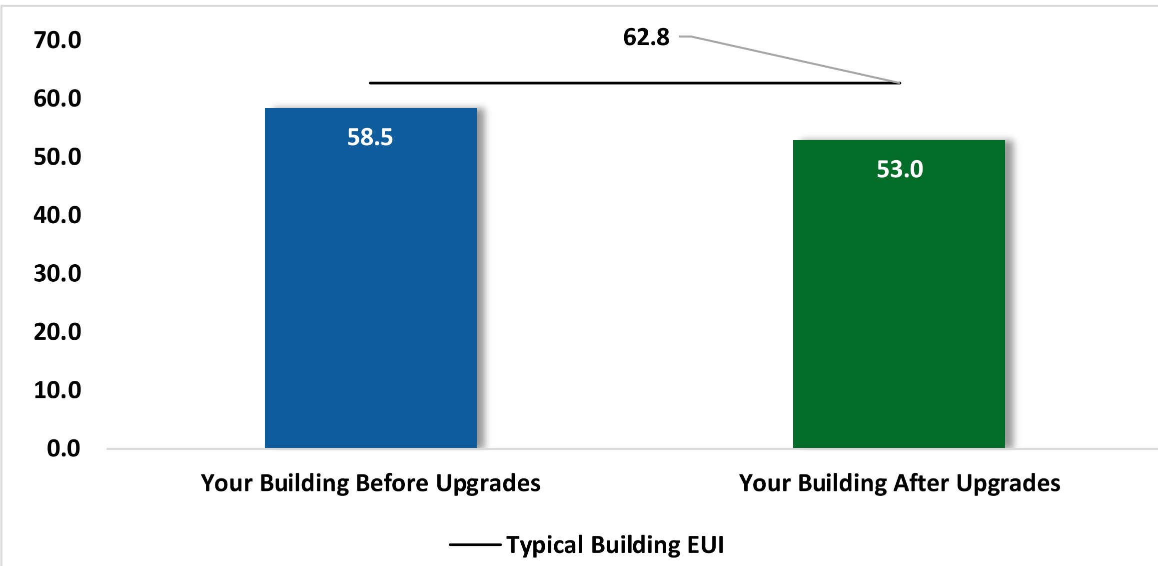
- The average gas cost for the past 12 months is $1.207/therm, which is the blended rate used throughout the analysis.
- Low gas usage is seen in the summer months coinciding with the higher gas usage for heating during the winter months.

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	57



Energy Use Intensity Comparison[3]

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

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

[3] 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			**3,202**	**0.5**	**0**	**$492**	**$1,840**	**$320**	**$1,520**	**3.1**	**3,183**
ECM 1	Install LED Fixtures	Yes	1,480	0.0	0	$229	$710	$100	$610	2.7	1,491
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	201	0.1	0	$31	$130	$10	$120	3.9	197
ECM 3	Retrofit Fixtures with LED Lamps	Yes	1,520	0.5	0	$232	$1,000	$210	$790	3.4	1,495
Lighting Control Measures			**5,157**	**1.2**	**-1**	**$786**	**$10,270**	**$3,090**	**$7,180**	**9.1**	**5,067**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	3,078	0.9	-1	$469	$7,440	$1,400	$6,040	12.9	3,024
ECM 5	Install High/Low Lighting Controls	Yes	2,079	0.3	0	$317	$2,830	$1,690	$1,140	3.6	2,043
Variable Frequency Drive (VFD) Measures			**6,068**	**1.7**	**0**	**$940**	**$18,800**	**$400**	**$18,400**	**19.6**	**6,111**
ECM 6	Install VFDs on Constant Volume (CV) Fans	No	2,803	1.2	0	$434	$9,400	$200	$9,200	21.2	2,822
ECM 7	Install VFDs on Heating Water Pumps	No	3,265	0.5	0	$506	$9,400	$200	$9,200	18.2	3,288
Unitary HVAC Measures			**1,474**	**4.9**	**6**	**$304**	**$91,200**	**$4,700**	**$86,500**	**284.7**	**2,216**
ECM 8	Install High Efficiency Air Conditioning Units	No	1,474	4.9	6	$304	$91,200	$4,700	$86,500	284.7	2,216
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**78**	**$945**	**$122,200**	**$6,000**	**$116,200**	**123.0**	**9,166**
ECM 9	Install High Efficiency Hot Water Boilers	No	0	0.0	78	$945	$122,200	$6,000	$116,200	123.0	9,166
HVAC System Improvements			**0**	**0.0**	**8**	**$96**	**$270**	**$40**	**$230**	**2.4**	**934**
ECM 10	Install Pipe Insulation	Yes	0	0.0	8	$96	$270	$40	$230	2.4	934
Domestic Water Heating Upgrade			**0**	**0.0**	**9**	**$112**	**$1,740**	**$140**	**$1,600**	**14.3**	**1,086**
ECM 11	Install High Efficiency Gas-Fired Water Heater	No	0	0.0	5	$57	$1,600	$100	$1,500	26.5	550
ECM 12	Install Low-Flow DHW Devices	Yes	0	0.0	5	$55	$140	$40	$100	1.8	536
Custom Measures			**-7,484**	**0.0**	**80**	**-$194**	**$2,900**	**$0**	**$2,900**	**-14.9**	**1,831**
ECM 13	Replace Gas Fired Water Heater with Heat Pump Water Heater***	No	-7,484	0.0	80	-$194	$2,900	$0	$2,900	-14.9	1,831
TOTALS			**8,417**	**8.3**	**180**	**$3,480**	**$249,220**	**$14,690**	**$234,530**	**67.4**	**29,593**

* - 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 4.8

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		**3,202**	**0.5**	**0**	**$492**	**$1,840**	**$320**	**$1,520**	**3.1**	**3,183**
ECM 1	Install LED Fixtures	1,480	0.0	0	$229	$710	$100	$610	2.7	1,491
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	201	0.1	0	$31	$130	$10	$120	3.9	197
ECM 3	Retrofit Fixtures with LED Lamps	1,520	0.5	0	$232	$1,000	$210	$790	3.4	1,495
Lighting Control Measures		**5,157**	**1.2**	**-1**	**$786**	**$10,270**	**$3,090**	**$7,180**	**9.1**	**5,067**
ECM 4	Install Occupancy Sensor Lighting Controls	3,078	0.9	-1	$469	$7,440	$1,400	$6,040	12.9	3,024
ECM 5	Install High/Low Lighting Controls	2,079	0.3	0	$317	$2,830	$1,690	$1,140	3.6	2,043
HVAC System Improvements		**0**	**0.0**	**8**	**$96**	**$270**	**$40**	**$230**	**2.4**	**934**
ECM 10	Install Pipe Insulation	0	0.0	8	$96	$270	$40	$230	2.4	934
Domestic Water Heating Upgrade		**0**	**0.0**	**5**	**$55**	**$140**	**$40**	**$100**	**1.8**	**536**
ECM 12	Install Low-Flow DHW Devices	0	0.0	5	$55	$140	$40	$100	1.8	536
TOTALS		**8,359**	**1.8**	**11**	**$1,429**	**$12,520**	**$3,490**	**$9,030**	**6.3**	**9,720**

* - 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 4.8

Cost Effective ECMs

4.1 Lighting

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**3,202**	**0.5**	**0**	**$492**	**$1,840**	**$320**	**$1,520**	**3.1**	**3,183**
ECM 1	Install LED Fixtures	1,480	0.0	0	$229	$710	$100	$610	2.7	1,491
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	201	0.1	0	$31	$130	$10	$120	3.9	197
ECM 3	Retrofit Fixtures with LED Lamps	1,520	0.5	0	$232	$1,000	$210	$790	3.4	1,495

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

ECM 1: Install LED Fixtures

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

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

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

Affected Building Areas: exterior pole arm fixture

ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

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

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

Affected Building Areas: all areas with fluorescent fixtures with T12 tubes

ECM 3: Retrofit Fixtures with LED Lamps

Replace fluorescent 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: classrooms, library, elevator motor room, storage, and roof access area

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		**5,157**	**1.2**	**-1**	**$786**	**$10,270**	**$3,090**	**$7,180**	**9.1**	**5,067**
ECM 4	Install Occupancy Sensor Lighting Controls	3,078	0.9	-1	$469	$7,440	$1,400	$6,040	12.9	3,024
ECM 5	Install High/Low Lighting Controls	2,079	0.3	0	$317	$2,830	$1,690	$1,140	3.6	2,043

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

ECM 4: Install Occupancy Sensor Lighting Controls

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

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

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

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

Affected Building Areas: classrooms, stage area, gymnasium, library, restrooms, and storage rooms

ECM 5: Install High/Low Lighting Controls

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

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

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

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

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

Affected Building Areas: stairs and hallways

4.3 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		**6,068**	**1.7**	**0**	**$940**	**$18,800**	**$400**	**$18,400**	**19.6**	**6,111**
ECM 6	Install VFDs on Constant Volume (CV) Fans	2,803	1.2	0	$434	$9,400	$200	$9,200	21.2	2,822
ECM 7	Install VFDs on Heating Water Pumps	3,265	0.5	0	$506	$9,400	$200	$9,200	18.2	3,288

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 VFD on Variable Air Volume (VAV) Fans

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

Energy savings result from using a more efficient control device to regulate the air flow provided by the fan. Additional maintenance savings may result from this measure. VFDs are solid state electronic devices, which generally require less maintenance than mechanical air volume control devices.

Affected Air Handlers: AHU-1 and AHU-2

ECM 7: Install VFDs on Heating Water Pumps

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

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

Affected Pumps: 2.0 hp heating water pumps

4.4 Unitary HVAC

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Unitary HVAC Measures		**1,474**	**4.9**	**6**	**$304**	**$91,200**	**$4,700**	**$86,500**	**284.7**	**2,216**
ECM 8	Install High Efficiency Air Conditioning Units	1,474	4.9	6	$304	$91,200	$4,700	$86,500	284.7	2,216

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

ECM 8: Install High Efficiency Air Conditioning Units

We evaluated replacing standard efficiency packaged air conditioning units with high efficiency packaged air conditioning units. All of the replacement units will incorporate efficient gas furnaces. 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: five RTUs

4.5 Gas-Fired 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)
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**78**	**$945**	**$122,200**	**$6,000**	**$116,200**	**123.0**	**9,166**
ECM 9	Install High Efficiency Hot Water Boilers	0	0.0	78	$945	$122,200	$6,000	$116,200	123.0	9,166

ECM 9: Install High Efficiency Hot Water Boilers

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

The most notable efficiency improvement is condensing hydronic boilers that can achieve over 90% efficiency under the proper conditions. Condensing hydronic boilers typically operate at efficiencies between 85% and 87% (comparable to other high efficiency boilers) when the return water temperature is above 130°F. The boiler efficiency increases as the return water temperature drops below 130°F. Therefore, condensing hydronic boilers are evaluated when the return water temperature is less than 130°F during most of the operating hours.

For the purposes of this analysis, we evaluated the replacement of boilers on a one-for-one basis with equipment of the same capacity. We recommend that you work with your mechanical design team to select boilers that are sized appropriately for the heating load. In many cases installing multiple modular boilers, rather than one or two large boilers, will result in higher overall plant efficiency while providing additional system redundancy.

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

4.6 HVAC Improvements

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
HVAC System Improvements		**0**	**0.0**	**8**	**$96**	**$270**	**$40**	**$230**	**2.4**	**934**
ECM 10	Install Pipe Insulation	0	0.0	8	$96	$270	$40	$230	2.4	934

ECM 10: Install Pipe Insulation

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

Affected Systems: domestic hot water piping

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**	**9**	**$112**	**$1,740**	**$140**	**$1,600**	**14.3**	**1,086**
ECM 11	Install High Efficiency Gas-Fired Water Heater	0	0.0	5	$57	$1,600	$100	$1,500	26.5	550
ECM 12	Install Low-Flow DHW Devices***	0	0.0	5	$55	$140	$40	$100	1.8	536

ECM 11: Install High Efficiency Gas-Fired Water Heater

We evaluated replacing 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.

ECM 12: 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 Custom Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Custom Measures		**-7,484**	**0.0**	**80**	**-$194**	**$2,900**	**$0**	**$2,900**	**-14.9**	**1,831**
ECM 13	Replace Gas Fired Water Heater with Heat Pump Water Heater****	-7,484	0.0	80	-$194	$2,900	$0	$2,900	-14.9	1,831

ECM 13: Replace Gas Fired Water Heater with Heat Pump Water Heater

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

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

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

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

Water Heater Type	*Minimum UEF*	*Other*
Integrated HPWH	3.3	
Integrated HPWH	2.2	120 Volt, 15 Amp circuit
Split System HPWH	2.2	
Gas Fired Storage	0.64	≤ 55 gal, Medium Draw Pattern
Gas Fired Storage	0.68	≤ 55 gal, High Draw Pattern

Water Heater Type	*Minimum UEF*	*Other*
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.*[4]

HPWH reject cold air. As such, they need to be installed in an unconditioned space of about 750 cubic feet with good ventilation[5]. 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[6] 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

4 https://www.energy.gov/sites/prod/files/2014/06/f17/rwh_tp_final_rule.pdf

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

6 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.

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: domestic hot water heater

4.9 Measures for Future Consideration

There are additional opportunities for improvement that Verona 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.

Verona 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.

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

Doors and Windows

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

Lighting Maintenance

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

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

Lighting Controls

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

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

Motor Controls

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

Motor Maintenance

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

Fans to Reduce Cooling Load

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

Thermostat Schedules and Temperature Resets

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

Economizer Maintenance

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

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

AC System Evaporator/Condenser Coil Cleaning

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

HVAC Filter Cleaning and Replacement

Air filters should be checked regularly (often monthly) and cleaned or replaced when appropriate. Air filters reduce indoor air pollution, increase occupant comfort, and help keep equipment operating efficiently. If the building has a building management system, consider installing a differential pressure switch across filters to send an alarm about premature fouling or overdue filter replacement. Over time, filters become less 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.

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.

Boiler Maintenance

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

Label HVAC Equipment

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

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

Optimize HVAC Equipment Schedules

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

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

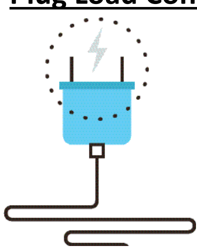
Water Heater Maintenance

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

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

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

Plug Load Controls



Reducing plug loads is a common way to decrease your electrical use. Limiting the energy use of plug loads can include increasing occupant awareness, removing under-used equipment, installing hardware controls, and using software controls. Consider enabling the most aggressive power settings on existing devices or install load sensing or occupancy sensing (advanced) power strips[8]. Your local utility may offer incentives or rebates for this equipment.

Computer Monitor Replacement

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

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

Computer Power Management Software

Many computers consume power during nights, weekends, and holidays. Screen savers are commonly confused as a power management strategy. This contributes to avoidable, excessive electrical energy consumption. There are innovative power management software packages available that are designed to deliver significant energy saving and provide ongoing tracking measurements. A central power management platform helps enforce energy savings policies as well as identify and eliminate underutilized devices.

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[9]. 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[10].

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[11] or download a copy of EPA's "WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities"[12] 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

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

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

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

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

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 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.

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.

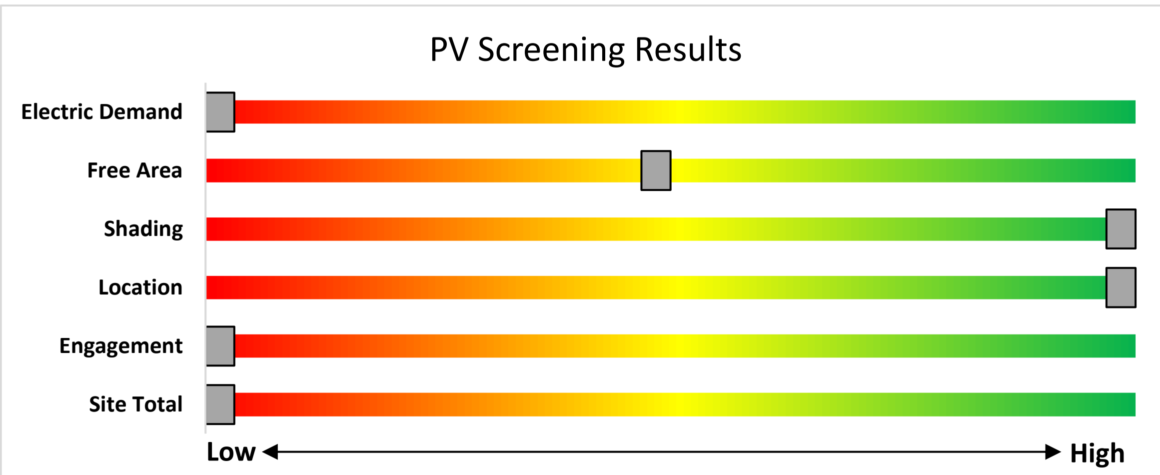
7.1 Solar Photovoltaic

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 no potential for installing a PV array.

This facility does not appear to meet the minimum criteria for a cost-effective solar PV installation. To be cost-effective, a solar PV array needs certain minimum criteria, such as sufficient and sustained electric demand and sufficient flat or south-facing rooftop or other unshaded space on which to place the PV panels.

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.



PV 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.

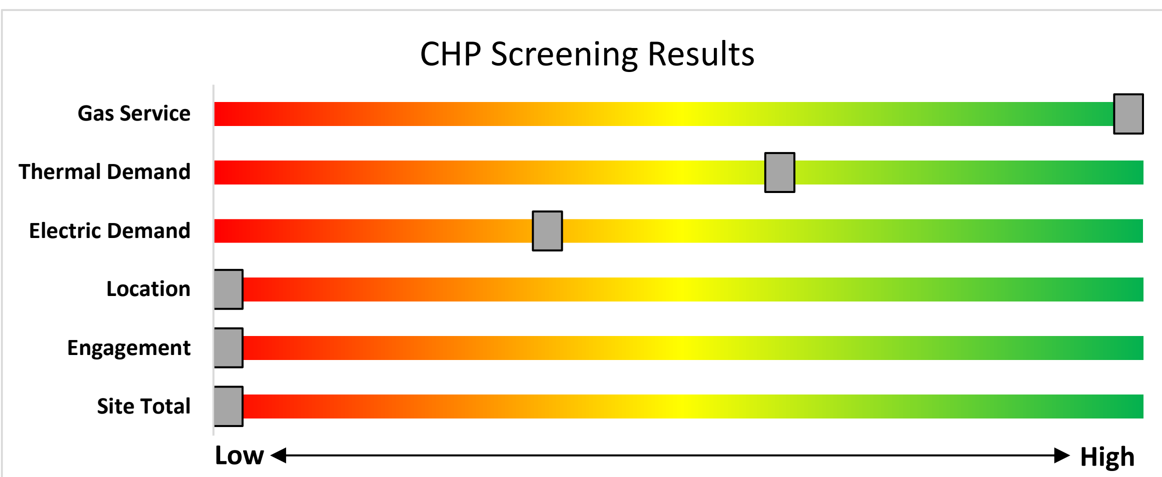
CHP systems typically produce a portion of the electric power used on-site, with the balance of electric power needs supplied by the local utility company. The heat is used to supplement (or replace) existing boilers and provide space heating and/or domestic hot water heating. Waste heat can also be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

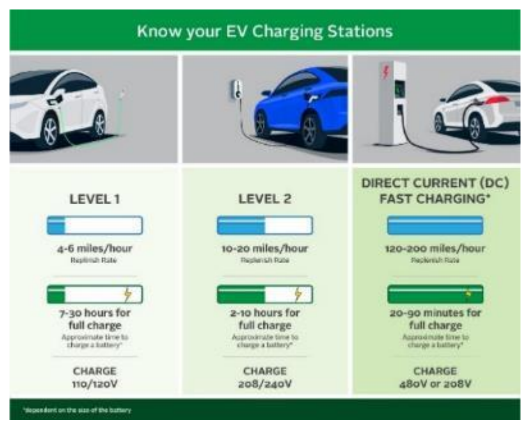
All electric vehicles (EVs) have an electric motor instead of an internal combustion engine. EVs function by plugging into a charge point, taking electricity from the grid, and then storing it in rechargeable batteries. Although electricity production may contribute to air pollution, the U.S. EPA categorizes 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.

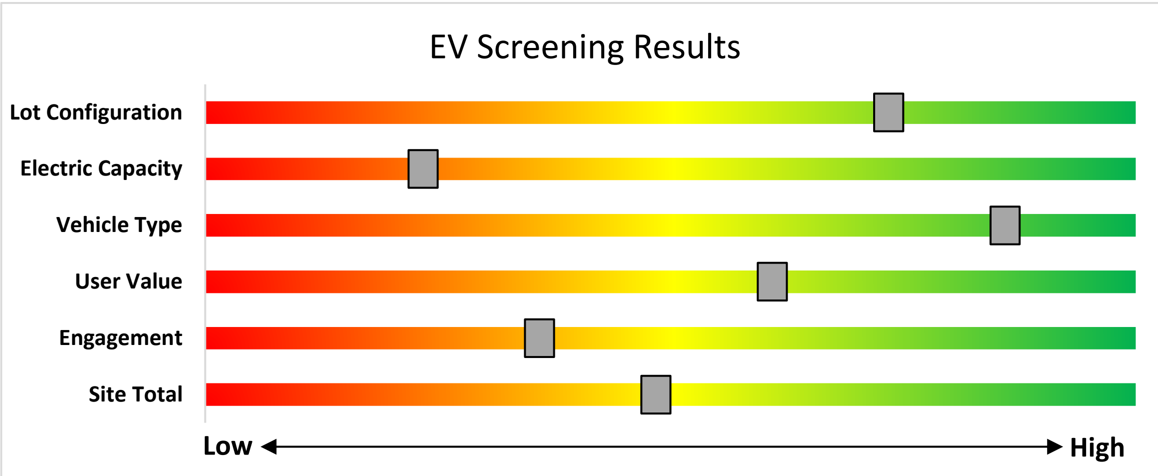
The primary costs associated with installing EV charging are the charger hardware and the cost to extend power from the facility to parking spaces. This may include upgrades to electric panels to serve increased loads.

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.

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[13]

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

13

[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[14]. 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[15].

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.

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

[15] 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.

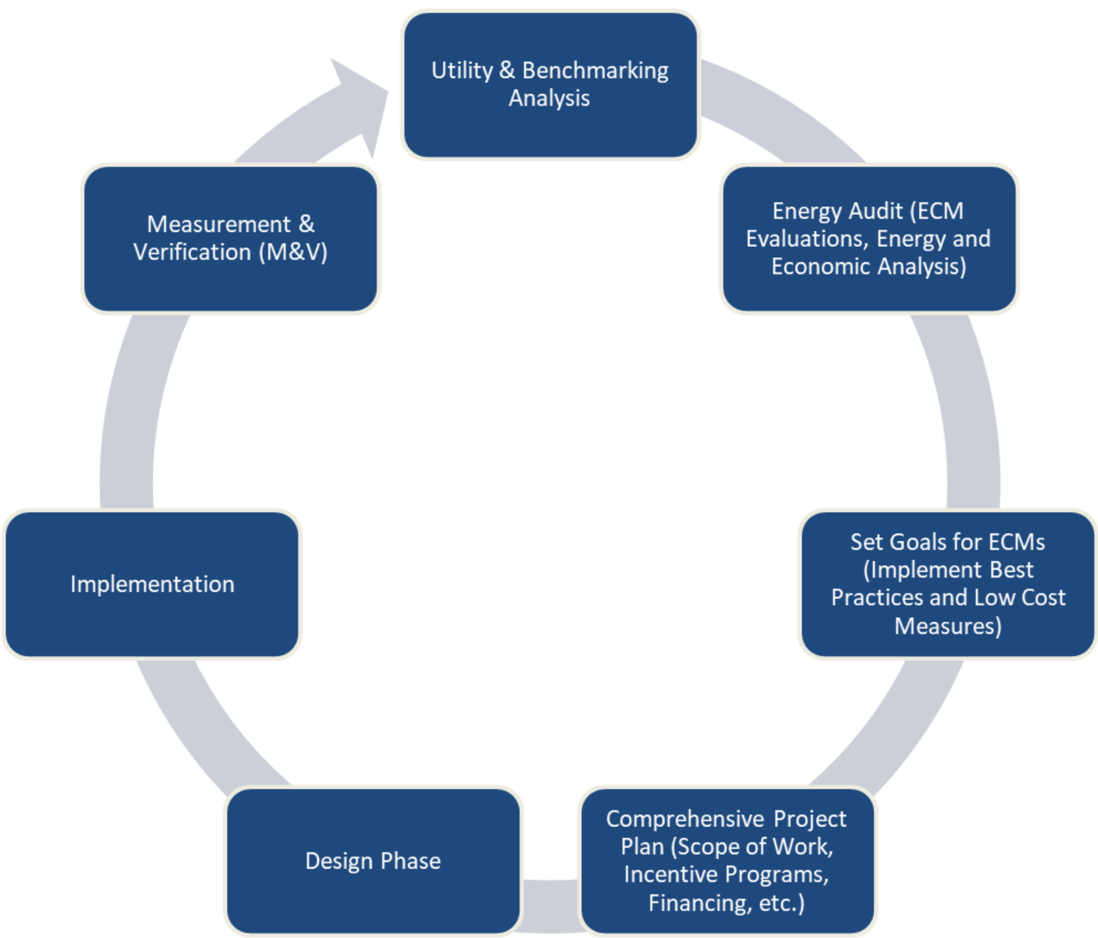
Engineered Solutions

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[16].

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[17].

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

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

TRC

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
Boiler Room	2	LED - Linear Tubes: (2) 4' Lamps	None	S	29	2,860		None	No	2	LED - Linear Tubes: (2) 4' Lamps	None	29	2,860	0.0	0	0	$0	$0	$0	0.0
Boiler Room	3	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	2,860		None	No	3	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,860	0.0	0	0	$0	$0	$0	0.0
Cafeteria	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
Cafeteria	20	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	1,780		None	No	20	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,780	0.0	0	0	$0	$0	$0	0.0
Classroom 101	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
Classroom 101	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	1,780		None	No	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,780	0.0	0	0	$0	$0	$0	0.0
Classroom 102 - art room	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
Classroom 102 - art room	12	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	2,570	4	None	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,773	0.1	457	0	$70	$330	$40	4.2
Classroom 103	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	1,780		None	No	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,780	0.0	0	0	$0	$0	$0	0.0
Classroom 104	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	1,780		None	No	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,780	0.0	0	0	$0	$0	$0	0.0
Classroom 105 - music room	1	Compact Fluorescent: (1) 23W Spiral Plug-In Lamp	Wall Switch	S	23	2,570	3	Relamp	No	1	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	17	2,570	0.0	17	0	$3	$30	$0	11.6
Classroom 105 - music room	9	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	1,780		None	No	9	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,780	0.0	0	0	$0	$0	$0	0.0
Classroom 105 - music room	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	2,570	3	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,570	0.0	140	0	$21	$60	$20	1.9
Corridor 1	8	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	8	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor 1	16	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	4,380	5	None	Yes	16	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,022	0.1	693	0	$106	$850	$560	2.7
Corridor 1	3	LED - Linear Tubes: (2) 4' Lamps	None	S	29	4,380	5	None	Yes	3	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,022	0.0	130	0	$20	$280	$110	8.6
Elevator motor room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,144	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,144	0.0	42	0	$6	$50	$10	6.3
Exterior 1	1	Compact Fluorescent: (1) 26W Double Biaxial Plug-In Lamp	Timeclock		26	4,380	3	Relamp	No	1	LED Lamps: GX23 (Plug-In) Lamps	Timeclock	19	4,380	0.0	31	0	$5	$10	$0	2.1
Exterior 1	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Timeclock		10	4,380		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Timeclock	10	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior 1	3	LED - Fixtures: Outdoor Porch Wall Mount	Timeclock		20	4,380		None	No	3	LED - Fixtures: Outdoor Porch Wall Mount	Timeclock	20	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior 1	7	LED - Fixtures: Wall Pack	Photocell		40	4,380		None	No	7	LED - Fixtures: Wall Pack	Photocell	40	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior 1	1	Metal Halide: (1) 400W Lamp	Timeclock		458	4,380	1	Fixture Replacement	No	1	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Timeclock	120	4,380	0.0	1,480	0	$229	$710	$100	2.7
Gymnasium 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
Gymnasium 1	1	LED - Fixtures: Architectural Flood/Spot Luminaire	Wall Switch	S	100	2,570		None	No	1	LED - Fixtures: Architectural Flood/Spot Luminaire	Wall Switch	100	2,570	0.0	0	0	$0	$0	$0	0.0
Gymnasium 1	21	LED - Fixtures: High-Bay	Daylight Dimming	S	200	1,540		None	No	21	LED - Fixtures: High-Bay	Daylight Dimming	200	1,540	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Janitorial - Caf	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,144		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,144	0.0	0	0	$0	$0	$0	0.0
Kitchen 1	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,570	4	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,773	0.0	51	0	$8	$150	$20	16.8
Maintenance office	4	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	2,570	4	None	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,773	0.0	152	0	$23	$330	$40	12.5
Restroom- Female caf	2	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,570	4	None	Yes	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,773	0.0	25	0	$4	$0	$0	0.0
Restroom- Female caf	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,570	4	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,773	0.0	51	0	$8	$330	$40	37.4
Server Room - art room	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,570		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,570	0.0	0	0	$0	$0	$0	0.0
Stage	4	LED - Fixtures: Ambient - 4' - Direct Fixture	Wall Switch	S	20	1,144	4	None	Yes	4	LED - Fixtures: Ambient - 4' - Direct Fixture	Occupancy Sensor	20	789	0.0	31	0	$5	$330	$40	61.0
Stage	10	LED - Fixtures: Ambient - 4' - Direct Fixture	Wall Switch	S	50	1,144	4	None	Yes	10	LED - Fixtures: Ambient - 4' - Direct Fixture	Occupancy Sensor	50	789	0.1	195	0	$30	$330	$40	9.8
Stage	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,144	4	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	789	0.0	23	0	$3	$0	$0	0.0
Stage	7	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	1,144	4	None	Yes	7	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	789	0.1	119	0	$18	$330	$40	16.0
Stairs Exit D1	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Stairs Exit D1	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch		29	2,570	4	None	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,773	0.0	102	0	$15	$280	$140	9.0
Stairs Exit D1	2	Linear Fluorescent - T12: 3' T12 (30W) - 1L	Wall Switch		46	2,570	2, 4	Relamp & Reballast	Yes	2	LED - Linear Tubes: (1) 3' Lamp	Occupancy Sensor	11	1,773	0.1	219	0	$33	$410	$80	9.9
Storage 1	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,144	4	None	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	789	0.0	34	0	$5	$330	$0	63.8
Storage 2	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,144	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	789	0.1	106	0	$16	$240	$20	13.7
Classroom- Library	10	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,570	4	None	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,773	0.1	254	0	$39	$330	$40	7.5
Classroom 202	14	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	1,780		None	No	14	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,780	0.0	0	0	$0	$0	$0	0.0
Classroom 202 storage	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,570	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,570	0.0	93	0	$14	$50	$10	2.8
Classroom 203	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	1,780		None	No	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,780	0.0	0	0	$0	$0	$0	0.0
Classroom 204	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	1,780		None	No	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,780	0.0	0	0	$0	$0	$0	0.0
Classroom 204	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,570	3	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,570	0.0	158	0	$24	$90	$20	2.9
Corridor 2	7	Exit Signs: LED - 2 W Lamp	None		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
Corridor 2	13	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	4,380	5	None	Yes	13	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,022	0.1	563	0	$86	$850	$460	4.5
Janitorial 2	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,144		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,144	0.0	0	0	$0	$0	$0	0.0
Library 1	7	Compact Fluorescent: (1) 32W Triple Biaxial Plug-In Lamp	Wall Switch	S	32	2,570	3, 4	Relamp	Yes	7	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	23	1,773	0.1	319	0	$49	$420	$50	7.6

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Library 1	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Library 1	16	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,570	4	None	Yes	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,773	0.1	407	0	$62	$660	$70	9.5
Library 1	3	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	2,570	4	None	Yes	3	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	1,773	0.0	45	0	$7	$0	$0	0.0
Library MDF	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,570		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,570	0.0	0	0	$0	$0	$0	0.0
Main entrance	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,570		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,570	0.0	0	0	$0	$0	$0	0.0
Office - Main	6	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	S	17	1,780		None	No	6	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	1,780	0.0	0	0	$0	$0	$0	0.0
Office - Nurse	7	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	S	17	1,780		None	No	7	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	1,780	0.0	0	0	$0	$0	$0	0.0
Office - Principal	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	1,780		None	No	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,780	0.0	0	0	$0	$0	$0	0.0
Office- Library	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	1,780		None	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,780	0.0	0	0	$0	$0	$0	0.0
Restroom- 201	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,570		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,570	0.0	0	0	$0	$0	$0	0.0
Restroom- 202	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,570		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,570	0.0	0	0	$0	$0	$0	0.0
Restroom- Female 2	2	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,570	4	None	Yes	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,773	0.0	25	0	$4	$0	$0	0.0
Restroom- Female 2	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,570	4	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,773	0.0	51	0	$8	$330	$40	37.4
Restroom- Male 2	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,570	4	None	Yes	1	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,773	0.0	13	0	$2	$0	$0	0.0
Restroom- Male 2	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,570	4	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,773	0.0	51	0	$8	$330	$40	37.4
Teacher lounge 201	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	1,780		None	No	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,780	0.0	0	0	$0	$0	$0	0.0
Teacher lounge 201	6	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	2,570	4	None	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,773	0.1	229	0	$35	$330	$40	8.3
Classroom 301	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	1,780		None	No	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,780	0.0	0	0	$0	$0	$0	0.0
Classroom 301	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,570	3	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,570	0.0	158	0	$24	$90	$20	2.9
Classroom 302	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	1,780		None	No	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,780	0.0	0	0	$0	$0	$0	0.0
Classroom 302	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,570	3	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,570	0.0	158	0	$24	$90	$20	2.9
Classroom 303	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	1,780		None	No	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,780	0.0	0	0	$0	$0	$0	0.0
Classroom 303	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,570	3	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,570	0.0	158	0	$24	$90	$20	2.9
Classroom 304	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	1,780		None	No	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,780	0.0	0	0	$0	$0	$0	0.0
Classroom 304	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,570	3	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,570	0.0	158	0	$24	$90	$20	2.9

	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
Classroom 305	10	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	1,780		None	No	10	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,780	0.0	0	0	$0	$0	$0	0.0
Classroom 306	10	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	1,780		None	No	10	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,780	0.0	0	0	$0	$0	$0	0.0
Classroom 307	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	1,780		None	No	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,780	0.0	0	0	$0	$0	$0	0.0
Classroom 308	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	1,780		None	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,780	0.0	0	0	$0	$0	$0	0.0
Copy Room	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,570		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,570	0.0	0	0	$0	$0	$0	0.0
Corridor 3	5	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	5	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor 3	16	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	4,380	5	None	Yes	16	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	3,022	0.1	693	0	$106	$850	$560	2.7
Janitorial 3	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,144		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,144	0.0	0	0	$0	$0	$0	0.0
Restroom- Female 3	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,570	4	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,773	0.0	51	0	$8	$330	$40	37.4
Restroom- Male 3	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,570	4	None	Yes	1	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,773	0.0	13	0	$2	$0	$0	0.0
Restroom- Male 3	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,570	4	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,773	0.0	51	0	$8	$330	$40	37.4
Restroom- Male 3 (1)	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,570	4	None	Yes	1	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,773	0.0	13	0	$2	$0	$0	0.0
Restroom- Male 3 (1)	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,570	4	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,773	0.0	51	0	$8	$330	$40	37.4
Roof access	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	1,144	3	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	1,144	0.0	62	0	$9	$60	$20	4.2
Storage 3	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,144	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	789	0.1	106	0	$16	$240	$20	13.7
Elevator	1	LED - Linear Tubes: (2) 4' Lamps	None	S	29	2,570		None	No	1	LED - Linear Tubes: (2) 4' Lamps	None	29	2,570	0.0	0	0	$0	$0	$0	0.0
Stairs Ext B2	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch		29	2,570	4	None	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,773	0.0	127	0	$19	$280	$180	5.2
Stairs Ext C4	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch		29	2,570	4	None	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,773	0.0	127	0	$19	$280	$180	5.2
Stairs Ext D2	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch		29	2,570	4	None	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,773	0.0	127	0	$19	$280	$180	5.2

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	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
Boiler room	Whole building	1	DHW Circulation Pump	0.04	66.6%	No	Bell & Gosset	NPF-22	W	8,760		No	66.6%	No		0.0	0	0	$0	$0	$0	0.0
Boiler room	Whole building	2	Combustion Air Fan	2.00	84.0%	No	Cleaver Brooks	5VC145TTDR5905 AB	B	1,060		No	84.0%	No		0.0	0	0	$0	$0	$0	0.0
Boiler room	Whole building	2	Heating Hot Water Pump	0.25	69.5%	No	Bell & Gossett	M10532	W	2,190		No	69.5%	No		0.0	0	0	$0	$0	$0	0.0
Upper Roof	Whole building	2	Exhaust Fan	0.25	69.5%	No	Dayton	4YC71H	W	2,000		No	69.5%	No		0.0	0	0	$0	$0	$0	0.0
Upper Roof	Whole building	1	Exhaust Fan	0.50	78.2%	No	Marathon	DWM48A170322 D	W	2,000		No	78.2%	No		0.0	0	0	$0	$0	$0	0.0
Upper Roof	Whole building	2	Exhaust Fan	0.13	69.5%	No	Cook	90 ACEM 90C15DM	W	2,000		No	69.5%	No		0.0	0	0	$0	$0	$0	0.0
Upper Roof	Whole building	2	Exhaust Fan	0.33	73.4%	No	Unknown	Unknown	W	2,000		No	73.4%	No		0.0	0	0	$0	$0	$0	0.0
Upper Roof	Whole building	3	Exhaust Fan	0.17	69.5%	No	Unknown	Unknown	W	2,000		No	69.5%	No		0.0	0	0	$0	$0	$0	0.0
Lower Roof	Whole building	1	Exhaust Fan	0.33	73.4%	No	Unknown	Unknown	W	2,000		No	73.4%	No		0.0	0	0	$0	$0	$0	0.0
Lower Roof	Whole building	1	Exhaust Fan	0.17	69.5%	No	Unknown	Unknown	W	2,000		No	69.5%	No		0.0	0	0	$0	$0	$0	0.0
Boiler Room	Whole building	1	Heating Hot Water Pump	2.00	86.5%	No	Baldor	EM315T-G	W	2,190	7	No	86.5%	Yes	1	0.2	1,417	0	$219	$4,700	$100	21.0
Boiler Room	Whole building	1	Heating Hot Water Pump	2.00	78.0%	No	Unknown	Unknown	W	2,190	7	No	86.5%	Yes	1	0.3	1,849	0	$286	$4,700	$100	16.1
Kitchen 1	Whole building	1	Kitchen Hood Exhaust Fan	1.00	83.5%	No	Captive Aire Systems	4224ND-2	W	1,000		No	83.5%	No		0.0	0	0	$0	$0	$0	0.0
Elevator motor room	Whole building	1	Other	25.00	75.5%	No	US motors	160ZBS	W	100		No	75.5%	No		0.0	0	0	$0	$0	$0	0.0
Various	Classrooms	26	Supply Fan	0.08	65.0%	Yes	Trane	NEST800 UV 4619-2582-0100	W	2,000		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Various	Various	7	Supply Fan	0.50	80.0%	No				2,000		No	80.0%	No		0.0	0	0	$0	$0	$0	0.0
Various	Various	2	Supply Fan	1.50	86.0%	No				2,000		No	86.0%	No		0.0	0	0	$0	$0	$0	0.0
Various	Various	2	Supply Fan	3.00	86.0%	No				2,000		No	86.0%	No		0.0	0	0	$0	$0	$0	0.0
Various	Various	1	Supply Fan	5.00	87.0%	No				2,000		No	87.0%	No		0.0	0	0	$0	$0	$0	0.0
Various	Various	1	Supply Fan	7.50	88.0%	No				2,000		No	88.0%	No		0.0	0	0	$0	$0	$0	0.0

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Stage	Stage	2	Supply Fan	2.00	84.0%	No				2,000	6	No	86.5%	Yes	2	1.2	2,803	0	$434	$9,400	$200	21.2

C 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
Lower Roof	Various	1	Split-System	5.00		17.00		Trane	4TTA7060A3000AB	W		No							0.0	0	0	$0	$0	$0	0.0
Lower Roof	Various	1	Split-System	5.00		17.00		Unknown	Unknown	W		No							0.0	0	0	$0	$0	$0	0.0
Lower Roof	Various	2	Split-System	1.46	58.00	13.00	1 COP	York	H2RD018S06A	W		No							0.0	0	0	$0	$0	$0	0.0
Lower Roof	Various	2	Split-System	10.00	135.00	11.40	11 HSPF	Mitsubishi Electric Trane	TUHYP1203AN40AN	W		No							0.0	0	0	$0	$0	$0	0.0
Lower Roof	Various	1	Split-System	4.00		13.00		York	H1RD048S25B	W		No							0.0	0	0	$0	$0	$0	0.0
Corridor 1	Corridor 1	1	Unit Heater		10.24		1 COP	Unknown	Unknown	W		No							0.0	0	0	$0	$0	$0	0.0
Corridor 1	Corridor 1	2	Unit Heater		10.24		1 COP	Unknown	Unknown	W		No							0.0	0	0	$0	$0	$0	0.0
Gymnasium 1	Gymnasium 1	1	Unit Heater		10.24		1 COP	Unknown	Unknown	W		No							0.0	0	0	$0	$0	$0	0.0
Stairs Exit D1	Stairs Exit D1	1	Unit Heater		10.24		1 COP	Unknown	Unknown	W		No							0.0	0	0	$0	$0	$0	0.0
Main entrance	Main entrance	1	Unit Heater		10.24		1 COP	Unknown	Unknown	W		No							0.0	0	0	$0	$0	$0	0.0
Stairs Ext B2	Stairs Ext B2	1	Unit Heater		10.24		1 COP	Unknown	Unknown	W		No							0.0	0	0	$0	$0	$0	0.0
Stairs Ext C4	Stairs Ext C4	1	Unit Heater		10.24		1 COP	Unknown	Unknown	W		No							0.0	0	0	$0	$0	$0	0.0
Stairs Ext D2	Stairs Ext D2	1	Unit Heater		10.24		1 COP	Solid State	Unknown	W		No							0.0	0	0	$0	$0	$0	0.0
Upper Roof	Various	1	Package Unit	4.00	75.00	13.00	0.8 AFUE	York	DH048S06P2WZZ20002A	B	8	Yes	1	Package Unit	4.00	75.00	16.00	0.82 AFUE	0.3	104	0	$21	$11,300	$400	517.7
Upper Roof	Various	1	Package Unit	12.33	240.00	10.00	0.8 AFUE	York	DH150S20S2UZZ30002C	B	8	Yes	1	Package Unit	12.33	240.00	14.00	0.82 Et	2.1	634	1	$114	$20,900	$1,100	173.4
Upper Roof	Various	2	Package Unit	15.00	350.00	12.10	0.8 AFUE	Trane	YHD180G3RHD16HGC1A1B700A1A0000000	W	8	Yes	2	Package Unit	15.00	350.00	14.00	0.82 Et	2.0	606	4	$140	$46,000	$2,700	308.9
Lower Roof	Gymnasium 1	1	Package Unit	25.00		10.00		Trane	THD300G3R0D16H6C1A1B700A1A1	W		No							0.0	0	0	$0	$0	$0	0.0
Lower Roof	Various	1	Package Unit	5.00	125.00	13.00	0.8 AFUE	York	DH060S10P2WZZ30002A	B	8	Yes	1	Package Unit	5.00	125.00	16.00	0.82 AFUE	0.4	130	1	$28	$13,000	$500	440.3

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
Boiler Room	Whole Building	2	Non-Condensing Hot Water Boiler	2,009	Cleaver Brooks	CB700 060030	B	8	Yes	2	Non-Condensing Hot Water Boiler	2,009	85.00%	Et	0.0	0	78	$945	$122,200	$6,000	123.0

Recommendations

Location	Area(s)/System(s) Affected	Recommendation Inputs: ECM #	Length of Uninsulated Pipe (ft)	Pipe Diameter (in)	Energy Impact & Financial Analysis: Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Domestic Hot Water	9	20	1.00	0.0	0	8	$96	$270	$40	2.4

HW Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions: System Quantity	System Type	Manufacturer	Model	Remaining Useful Life	Proposed Conditions: ECM #	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Energy Impact & Financial Analysis: Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Boiler room	Whole Building	1	Storage Tank Water Heater (≤ 50 Gal)	AO Smith	PGCG50226	B	10	Yes	1	Storage Tank Water Heater (≤ 50 Gal)	Natural Gas	85.00%	UEF	0.0	0	5	$57	$1,600	$100	26.5
Boiler room	Whole Building	1	Storage Tank Water Heater (≤ 50 Gal)	AO Smith	ECL 40 200	B		No						0.0	0	0	$0	$0	$0	0.0

Low-Flow Device Recommendations

Location	Recommedation Inputs: ECM #	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Energy Impact & Financial Analysis: Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Various	11	2	Faucet Aerator (Lavatory)	1.00	0.50	0.0	0	1	$7	$20	$10	1.5
Various	11	13	Faucet Aerator (Kitchen)	2.00	1.50	0.0	0	4	$44	$110	$30	1.8
Various	11	1	Faucet Aerator (Kitchen)	2.20	1.50	0.0	0	0	$5	$10	$0	2.1

ommercial Refrigerator/Freezer Inventory & Recommendations

Location	Existing Conditions: Quantity	Refrigerator/ Freezer Type	Manufacturer	Model	ENERGY STAR Qualified?	Proposed Conditions: ECM #	Install ENERGY STAR Equipment?	Energy Impact & Financial Analysis: Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Freezer Chest	Frigidaire	Unknown	No		No	0.0	0	0	$0	$0	$0	0.0

ooking Equipment Inventory & Recommendations

Location	Existing Conditions: Quantity	Equipment Type	Manufacturer	Model	High Efficiency Equipement?	Proposed Conditions: ECM #	Install High Efficiency Equipment?	Energy Impact & Financial Analysis: Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Insulated Food Holding Cabinet (3/4 Size)	Unknown	Unknown	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**
Various	1	Coffee Machine	800	No	Unknown	Unknown
Various	9	Desktop	200	No	Unknown	Unknown
Various	34	Fan (Ceiling)	200	No	Unknown	Unknown
Various	1	Laptop	200	No	Unknown	Unknown
Various	1	Microwave	1,000	No	Unknown	Unknown
Various	1	Microwave	1,000	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Laptop charging cart	40	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Kiln	5,550	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Server	200	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	MDF	400	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Laptop charging cart	40	No	Unknown	Unknown
Various	1	server	200	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Laptop charging cart	40	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Kettle	80	No	Unknown	Unknown
Various	1	Laminate	1,400	No	Unknown	Unknown
Various	1	Laptop charging cart	40	No	Unknown	Unknown
Various	1	Server	200	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Laptop charging cart	40	No	Unknown	Unknown
Various	1	MDF	400	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown

	Existing Conditions					
Location	**Quantity**	**Equipment Description**	**Energy Rate (W)**	**ENERGY STAR Qualified?**	**Manufacturer**	**Model**
Various	1	Laptop charging cart	40	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Laptop charging cart	40	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Air purifier	120	No	Unknown	Unknown
Various	1	Paper Shredder	500	No	Unknown	Unknown
Various	1	Printer (Medium/Small)	100	No	Unknown	Unknown
Various	1	Printer (Medium/Small)	100	No	Unknown	Unknown
Various	1	Printer (Medium/Small)	100	No	Unknown	Unknown
Various	1	Printer/Copier (Large)	300	No	Unknown	Unknown
Various	1	Printer/Copier (Large)	300	No	Unknown	Unknown
Various	10	Projector	300	No	Unknown	Unknown
Various	2	Refrigerator (Mini)	200	No	Unknown	Unknown
Various	2	Refrigerator (Residential)	700	No	Unknown	Unknown
Various	2	Smart Board	200	No	Unknown	Unknown
Various	1	Television	200	No	Unknown	Unknown
Various	1	Television	200	No	Unknown	Unknown
Various	1	Television	400	No	Unknown	Unknown
Various	1	Toaster Oven	1,200	No	Unknown	Unknown
Various	7	Water Fountain	50	No	Unknown	Unknown

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]

Brookdale Avenue Elementary

Primary Property Type: K-12 School
Gross Floor Area (ft²): 37,972
Built: 1927

For Year Ending: March 31, 2023
Date Generated: January 30, 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
Brookdale Avenue Elementary 14 Brookdale Court Verona, New Jersey 07044	Verona Board of Education 121 Fairview Avenue Verona, NJ 07044 (973) 571-2029	Henry Bottiglierie, CEFM 121 Fairview Avenue Verona, NJ 07044 (973) 571-2029 hbottiglierie@veronaschools.org

Property ID: 30587124

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
58.1 kBtu/ft²

Annual Energy by Fuel

Electric - Grid (kBtu)	543,664 (25%)
Natural Gas (kBtu)	1,663,263 (75%)

Source EUI
86.1 kBtu/ft²

National Median Comparison

National Median Site EUI (kBtu/ft²)	62.8
National Median Source EUI (kBtu/ft²)	93.1
% Diff from National Median Source EUI	-8%

Annual Emissions

Total (Location-Based) GHG Emissions (Metric Tons CO2e/year)	137

Signature & Stamp of Verifying Professional

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

LP Signature: ______________________Date: ___________

Licensed Professional

____ ________
,
(___)____-______
____

Professional Engineer or Registered Architect Stamp (if applicable)

Appendix C: Glossary

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

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

SEER	*Seasonal energy efficiency ratio:* a measure of efficiency in terms of annual cooling energy provided divided by total electric input.
SEP	*Statement of energy performance:* a summary document from the ENERGY STAR Portfolio Manager.
Simple Payback	The amount of time needed to recoup the funds expended in an investment or to reach the break-even point between investment and savings.
SREC (II)	*Solar renewable energy credit*: a credit you can earn from the state for energy produced from a photovoltaic array.
T5, T8, T12	A reference to a linear lamp diameter. The number represents increments of 1/8th 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.