Local Government Energy Audit Report

STEM Academy of Orange

March 23, 2023

Prepared for:
Orange Board of Education
445 Scotland Road
South Orange, New Jersey 07079

Prepared by:
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Disclaimer

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

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

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

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

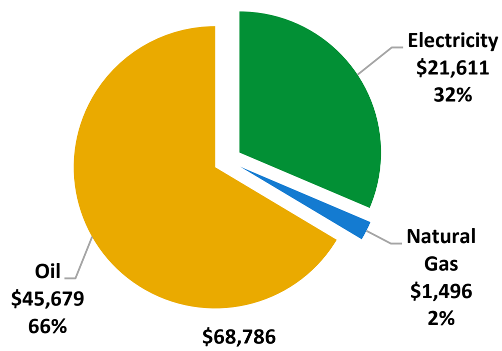
The customer and their respective contractor(s) are responsible to implement energy conservation measures in complete conformance with all applicable local, state, and federal requirements.

Table of Contents

1 Executive Summary

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

BUILDING PERFORMANCE REPORT

Annual Utilities	Costs: $68,786 Electricity: 164,812 kWh Natural Gas: 1,387 Therms No. 2 Fuel Oil: 13,382 Gallons	
ENERGY STAR® Benchmarking Score	75 *(1-100 scale)*	Congratulations, your building performs better than the national average. This report has suggestions about how to keep your building running efficiently, further improve performance, and lower your energy bills even more.

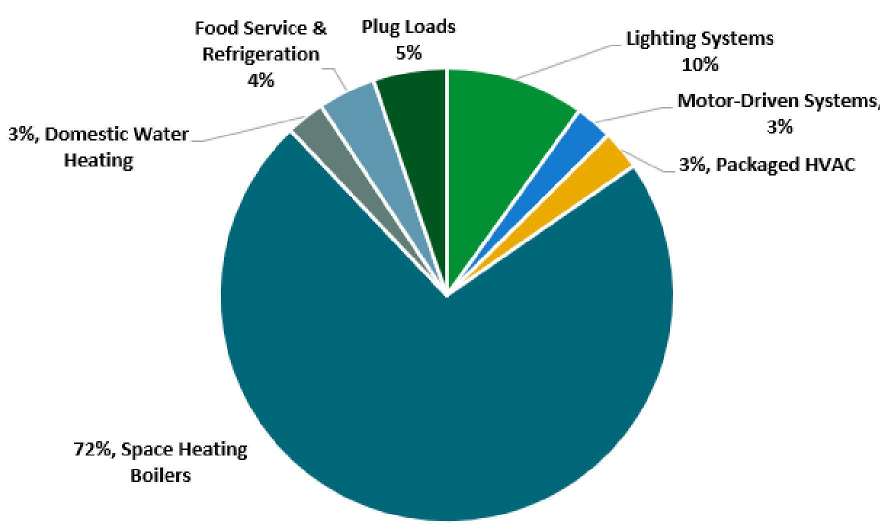


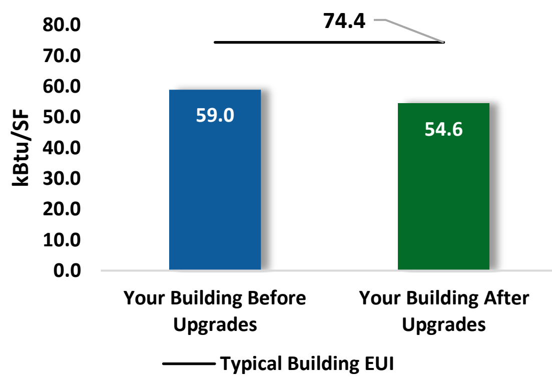
Figure 1 - Energy Use by System

POTENTIAL IMPROVEMENTS

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

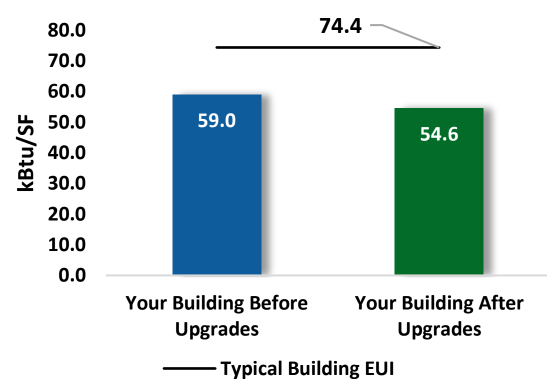
Scenario 1: Full Package (All Evaluated Measures)

Installation Cost	$32,483
Potential Rebates & Incentives[1]	$6,565
Annual Cost Savings	$7,384
Annual Energy Savings	Electricity: 58,238 kWh Natural Gas: 86 Therms No. 2 Fuel Oil: -101 Gallons
Greenhouse Gas Emission Savings	29 Tons
Simple Payback	3.5 Years
Site Energy Savings (All Utilities)	8%



Scenario 2: Cost Effective Package[2]

Installation Cost	$30,424
Potential Rebates & Incentives	$6,565
Annual Cost Savings	$7,338
Annual Energy Savings	Electricity: 57,880 kWh Natural Gas: 86 Therms No. 2 Fuel Oil: -101 Gallons
Greenhouse Gas Emission Savings	28 Tons
Simple Payback	3.3 Years
Site Energy Savings (All Utilities)	8%



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			**49,780**	**17.1**	**-21**	**$6,019**	**$20,919**	**$3,776**	**$17,143**	**2.8**	**46,751**
ECM 1	Install LED Fixtures	Yes	9,369	3.4	-4	$1,132	$6,895	$700	$6,195	5.5	8,794
ECM 2	Retrofit Fixtures with LED Lamps	Yes	40,411	13.7	-17	$4,887	$14,024	$3,076	$10,948	2.2	37,957
Lighting Control Measures			**8,100**	**2.6**	**-3**	**$979**	**$9,184**	**$2,725**	**$6,459**	**6.6**	**7,602**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	5,911	2.2	-2	$714	$6,934	$860	$6,074	8.5	5,548
ECM 4	Install High/Low Lighting Controls	Yes	2,189	0.4	-1	$264	$2,250	$1,865	$385	1.5	2,054
Motor Upgrades			**358**	**0.2**	**0**	**$47**	**$2,059**	**$0**	**$2,059**	**43.9**	**360**
ECM 5	Premium Efficiency Motors	No	358	0.2	0	$47	$2,059	$0	$2,059	43.9	360
HVAC System Improvements			**0**	**0.0**	**10**	**$248**	**$82**	**$10**	**$72**	**0.3**	**1,644**
ECM 6	Install Pipe Insulation	Yes	0	0.0	10	$248	$82	$10	$72	0.3	1,644
Domestic Water Heating Upgrade			**0**	**0.0**	**9**	**$92**	**$239**	**$54**	**$185**	**2.0**	**1,001**
ECM 7	Install Low-Flow DHW Devices	Yes	0	0.0	9	$92	$239	$54	$185	2.0	1,001
TOTALS (COST EFFECTIVE MEASURES)			**57,880**	**19.7**	**-5**	**$7,338**	**$30,424**	**$6,565**	**$23,859**	**3.3**	**56,999**
TOTALS (ALL MEASURES)			**58,238**	**20.0**	**-5**	**$7,384**	**$32,483**	**$6,565**	**$25,917**	**3.5**	**57,359**

* - 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).

Figure 2 – Evaluated Energy Improvements

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

1.1 Planning Your Project

Careful planning makes for a successful energy project. When considering this scope of work, you will have some decisions to make, such as:

- How will the project be funded and/or financed?
- Is it best to pursue individual ECMs, groups of ECMs, or use a comprehensive approach where all ECMs are installed together?
- Are there other facility improvements that should happen at the same time?

Pick Your Installation Approach

Utility-run energy efficiency programs and New Jersey's Clean Energy Programs, give you the flexibility to do a little or a lot. Rebates, incentives, and financing are available to help reduce both your installation costs and your energy bills. If you are planning to take advantage of these programs, make sure to review incentive program guidelines before proceeding. This is important because in most cases you will need to submit applications for the incentives *before* purchasing materials or starting installation.

Options from Your Utility Company

Prescriptive and Custom Rebates

For facilities wishing to pursue only selected individual measures (or planning to phase implementation of selected measures over multiple years), incentives are available through the Prescriptive and Custom Rebates program. To participate, you can use internal resources or an outside firm or contractor to perform the final design of the ECM(s) and install the equipment. Program pre-approval may be required for some incentives. Contact your utility company for more details prior to project installation.

Direct Install

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

Engineered Solutions

The Engineered Solutions program provides tailored energy-efficiency assistance and turnkey engineering services to municipalities, universities, schools, hospitals, and healthcare facilities (MUSH), non-profit entities, and multifamily buildings. The program provides all professional services from audit, design, construction administration, to commissioning and measurement and verification for custom whole-building energy-efficiency projects. Engineered Solutions allows you to install as many measures as possible under a single project as well as address measures that may not qualify for other programs.

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

Options from New Jersey's Clean Energy Program

Financing and Planning Support with the Energy Savings Improvement Program (ESIP)

For larger facilities with limited capital availability to implement ECMs, project financing may be available through the ESIP. Supported directly by the NJBPU, ESIP provides government agencies with project development, design, and implementation support services, as well as attractive financing for implementing ECMs. You have already taken the first step as an LGEA customer, because this report is required to participate in ESIP.

Resiliency with Return on Investment through Combined Heat and Power (CHP)

The CHP program provides incentives for combined heat and power (i.e., cogeneration) and waste heat to power projects. Combined heat and power systems generate power on-site and recover heat from the generation system to meet on-site thermal loads. Waste heat to power systems use waste heat to generate power. You will work with a qualified developer who will design a system that meets your building's heating and cooling needs.

Successor Solar Incentive Program (SuSI)

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

Ongoing Electric Savings with Demand Response

The Demand Response Energy Aggregator program reduces electric loads at commercial facilities when wholesale electricity prices are high or when the reliability of the electric grid is threatened due to peak power demand. By enabling commercial facilities to reduce electric demand during times of peak demand, the grid is made more reliable, and overall transmission costs are reduced for all ratepayers. Curtailment service providers provide regular payments to medium and large consumers of electric power for their participation in demand response (DR) programs. Program participation is voluntary, and facilities receive payments regardless of whether they are called upon to curtail their load during times of peak demand.

Large Energy User Program (LEUP)

LEUP is designed to promote self-investment in energy efficiency. It 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 STEM Academy of Orange. 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 October 4, 2022, TRC performed an energy audit at STEM Academy of Orange located in South Orange, New Jersey. TRC met with facility staff to review the facility operations and help focus our investigation on specific energy-using systems.

STEM Academy of Orange is a two-story, 43,300 square foot building built in 1935. Spaces include classrooms, gymnasium, offices, cafeteria, corridors, stairwells, commercial kitchen, and basement mechanical space.

2.2 Building Occupancy

The school is fully occupied from September through June. Typical weekday occupancy is 25 staff and 167 students. Summer occupancy includes continuing maintenance activities. There are no weekend activities.

Building Name	Weekday/Weekend	Operating Schedule
STEM Academy of Orange	Weekday	6:30 AM - 10:30 PM
	Weekend	Varied

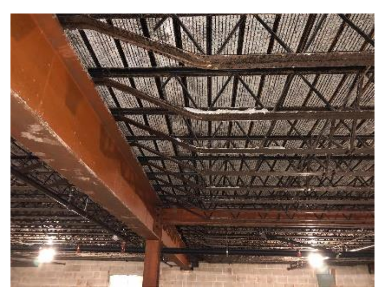
Figure 3 - Building Occupancy Schedule

2.3 Building Envelope

Building walls are concrete block over structural steel with a brick facade. Most of the roof is flat and covered with silver membrane/gravel and is in poor condition. The remaining roof surfaces are pitched with slate shingles.

Building Exterior

Roof Surfaces



Interior View of Structural Steel

Most of the windows have been replaced with double glazed and have aluminum frames with a thermal break. 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.

Older Single-glazed Windows

Exterior Doors

Double-glazed Windows

2.4 Lighting Systems

The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. Fixture types include 2-lamp, 3-lamp, or 4-lamp, 4-foot-long recessed troffer, surface mounted or pendent mounted fixtures and 2-foot fixtures with linear tube lamps. Typically, T8 fluorescent lamps use electronic ballasts.

Some of the linear fixtures have been converted to operate LED tube lamps. Additionally, there are some compact fluorescent lamps (CFL), incandescent, and LED general purpose lamps.

Gymnasium fixtures have manually controlled high bay high intensity discharge (HID) lamps. The gymnasium also has incandescent lamps. All exit signs are LED. Most fixtures are in fair condition. Interior lighting levels were generally sufficient. Most lighting fixtures are controlled manually and the remainder by occupancy sensors.

Linear Fluorescent Pendent

Surface Mounted Fixtures

Recessed Troffer

Exterior fixtures include LED wall packs and flood lights as well as canopy lights with LED lamps. Exterior light fixtures are controlled by a switch or photocell, depending on the fixture.


LED Floodlight


CFL Landscape Light


Wall Pack Light Fixture

2.5 Air Handling Systems

Unit Ventilators

Unit ventilators are equipped with supply fan motors and pneumatically controlled outside air dampers and fan coil valves connected to the hot water distribution system. They provide heating and ventilation to classrooms. Two classrooms have new units with electronic controls.


New Unit Ventilator


Typical Unit Ventilator


Pneumatic Controls

Unitary Electric HVAC Equipment

Classrooms and offices use window air conditioning (AC) units. These vary in capacity between 0.5 tons and 2 tons. The units are in fair condition. They range in efficiency between 9.8 EER to 10.8 EER. They are ENERGY STAR® labeled.



Window AC units

Air Handling Units (AHUs)

The gymnasium is conditioned by two air handling units. These units are equipped with a supply fan motor and a hot water heating coil. It is physically located in mechanical spaces above storage rooms. The supply standard efficiency fan motor is a constant speed ¾ hp unit.

Two ½ hp air compressor located in the mechanical room serves the pneumatic HVAC control system including hot water control valves, and AHU and UV damper actuators.

Air Handling Unit (AHU)

Pneumatic Controls

2.6 Heating Hot Water Systems

One Weil McLain 3,405 MBh hot water boiler serves the building's heating load with a nominal efficiency of 80%. Installed in 2004, it is in fair condition. There is no service contract in place.

The boilers are configured in a constant flow primary distribution with four, ¾ hp constant speed hot water pumps operating with a lead-lag control scheme. The boilers provide hot water to fin tube radiators, unit ventilators, convectors, and AHUs throughout the building.

There is five feet of 6-inch supply pipe with no insulation that should be addressed (ECM 6).

Hot Water Boiler

HHW Pumps

Combustion Air Fan

2.7 Domestic Hot Water

Hot water is produced by a 98 gallon, 75.1 MBh gas-fired storage water heater with a nominal efficiency of 80%.

A fractional hp circulation pump circulates water to end uses. The circulation pump operates continuously.

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


Storage Tank Water Heater


Circulation Pump

2.8 Food Service Equipment

The kitchen has a mix of gas and electric equipment that is used to prepare meals for students. Most cooking is done using a gas-fired oven. Bulk prepared foods are held in an electric holding cabinet. Equipment is not ENERGY STAR® rated 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.


Double Rack Oven


Steam Table


Electric Holding Cabinet

2.9 Refrigeration

The kitchen has several stand-up refrigerators with either solid or glass doors. There is also a stand-up solid door freezer. There is a refrigerator chest. All equipment is standard 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.


Stand-up Refrigerator/Freezers


Refrigerator Chest


Stand-up Refrigerator with Glass Door

2.10 Plug Load and Vending Machines

You may wish to consider paying particular attention to minimizing your plug load usage. This report makes suggestions for ECMs in this area as well as energy efficient best practices.

There are 76 computer workstations throughout the facility. Plug loads include general cafe and office equipment. There are loads typical of classroom such as smartboards, projectors, and fans.

There are several mini refrigerators throughout the building. These vary in condition and efficiency.

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

3D Printer

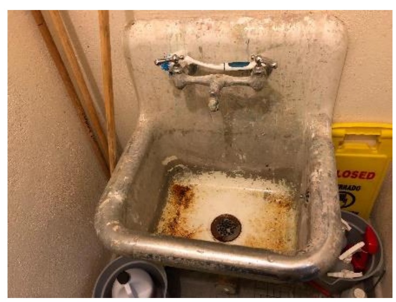
Computer Workstations

Smartboard

2.11 Water-Using Systems

There are eight restrooms with toilets and sinks. Faucet flow rates are at 1.5 gallons per minute (gpm) or higher.

Kitchen Sink

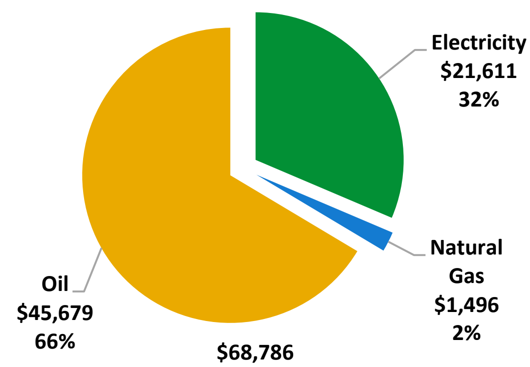


Utility Sink

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	164,812 kWh	$21,611
Natural Gas	1,387 Therms	$1,496
No. 2 Fuel Oil	13,382 Gallons	$45,679
Total		**$68,786**



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

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

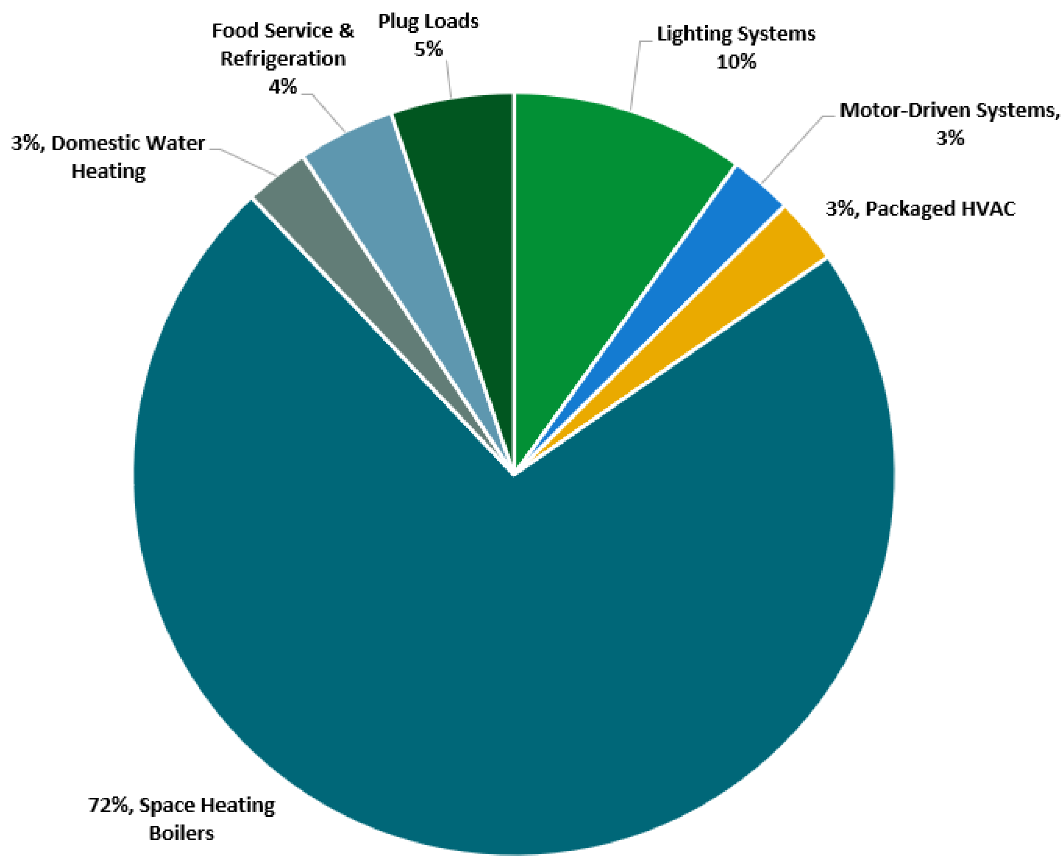
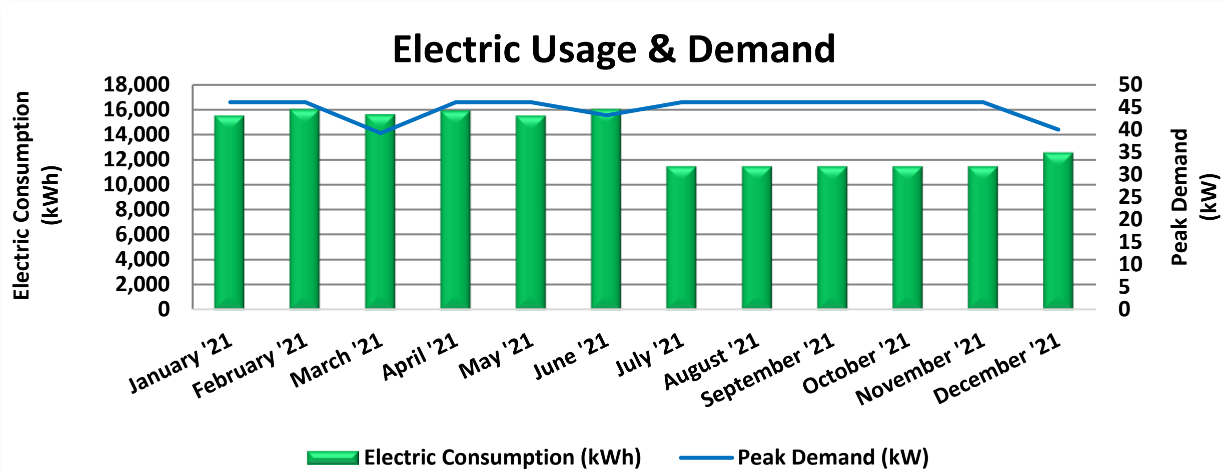


Figure 4 - Energy Balance

3.1 Electricity

PSE&G delivers electricity under General Lighting & Power rate class.



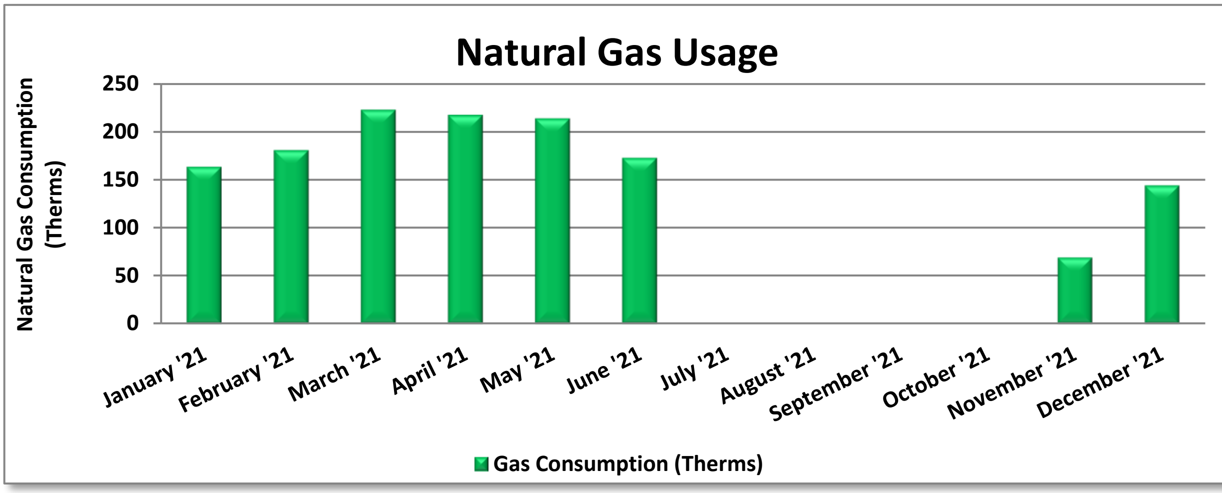
Electric Billing Data					
Period Ending	**Days in Period**	**Electric Usage (kWh)**	**Demand (kW)**	**Demand Cost**	**Total Electric Cost**
1/28/21	29	15,500	46	$295	$1,860
2/28/21	31	16,000	46	$295	$1,920
3/30/21	30	15,600	39	$154	$1,854
4/25/21	26	15,900	46	$295	$1,908
5/28/21	33	15,500	46	$295	$1,860
6/29/21	32	16,000	43	$599	$2,309
7/30/21	31	11,460	46	$295	$1,662
8/30/21	31	11,460	46	$295	$1,662
9/30/21	31	11,460	46	$295	$1,662
10/30/21	30	11,460	46	$295	$1,662
11/30/21	31	11,460	46	$295	$1,662
12/29/21	29	12,560	40	$158	$1,530
Totals	**364**	**164,360**	**46**	**$3,571**	**$21,552**
Annual	**365**	**164,812**	**46**	**$3,581**	**$21,611**

Notes:

- Peak demand of 46 kW occurred in January 2021.
- Average demand over the past 12 months was 45 kW.
- The average electric cost over the past 12 months was $0.131/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.

3.2 Natural Gas

PSE&G delivers natural gas under General Service Gas rate class.



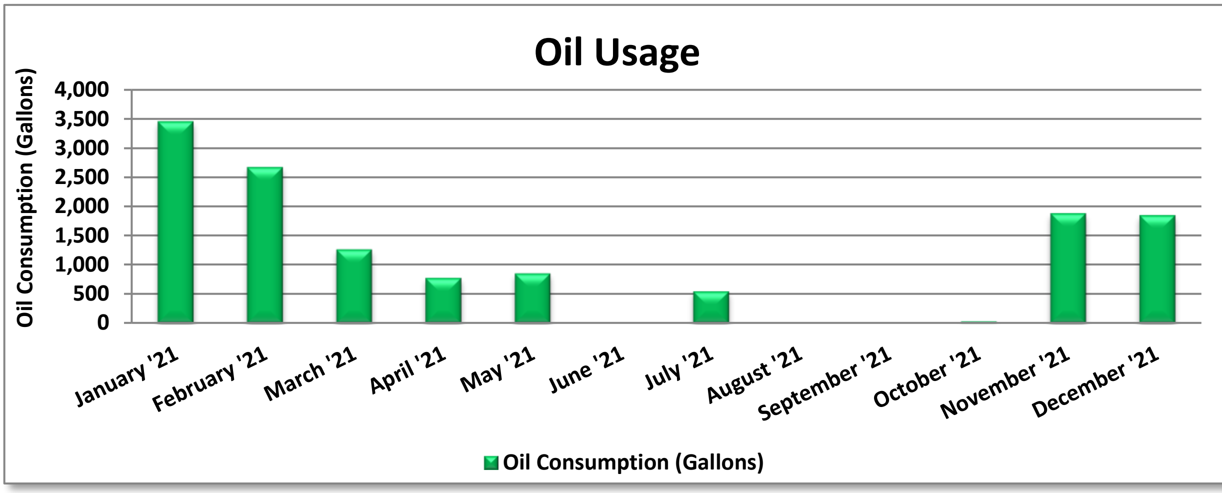
Gas Billing Data			
Period Ending	**Days in Period**	**Natural Gas Usage (Therms)**	**Natural Gas Cost**
1/28/21	29	163	$158
2/28/21	31	181	$179
3/30/21	30	222	$220
4/25/21	26	217	$209
5/28/21	33	214	$213
6/29/21	32	172	$166
7/30/21	31	0	$21
8/30/21	31	0	$21
9/30/21	31	0	$21
10/30/21	30	0	$21
11/29/21	30	69	$76
12/29/21	30	144	$187
Totals	**364**	**1,383**	**$1,491**
Annual	**365**	**1,387**	**$1,496**

Notes:

- The average gas cost for the past 12 months is $1.079/therm, which is the blended rate used throughout the analysis.

3.3 No. 2 Fuel Oil

JW Pierson CO delivers no. 2 fuel oil to the project site.



No. 2 Fuel Oil Billing Data			
Period Ending	Days in Period	Oil Usage (Gallons)	Fuel Cost
1/28/21	29	3,459	$10,734
2/28/21	31	2,673	$8,869
3/30/21	30	1,268	$4,374
4/25/21	26	776	$2,637
5/28/21	33	853	$2,984
6/29/21	32	0	$0
7/30/21	31	544	$1,949
8/30/21	31	0	$0
9/30/21	31	0	$0
10/30/21	30	32	$123
11/29/21	30	1,886	$7,263
12/29/21	30	1,854	$6,746
Totals	**364**	**13,345**	**$45,679**
Annual	**365**	**13,382**	**$45,679**

Notes:

- The average no. 2 fuel oil cost for the past 12 months is $3.414/Gallon, which is the blended rate used throughout the analysis.
- Fuel deliveries do not necessarily correspond to periods of use.

3.4 Benchmarking

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

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

Benchmarking Score	75

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

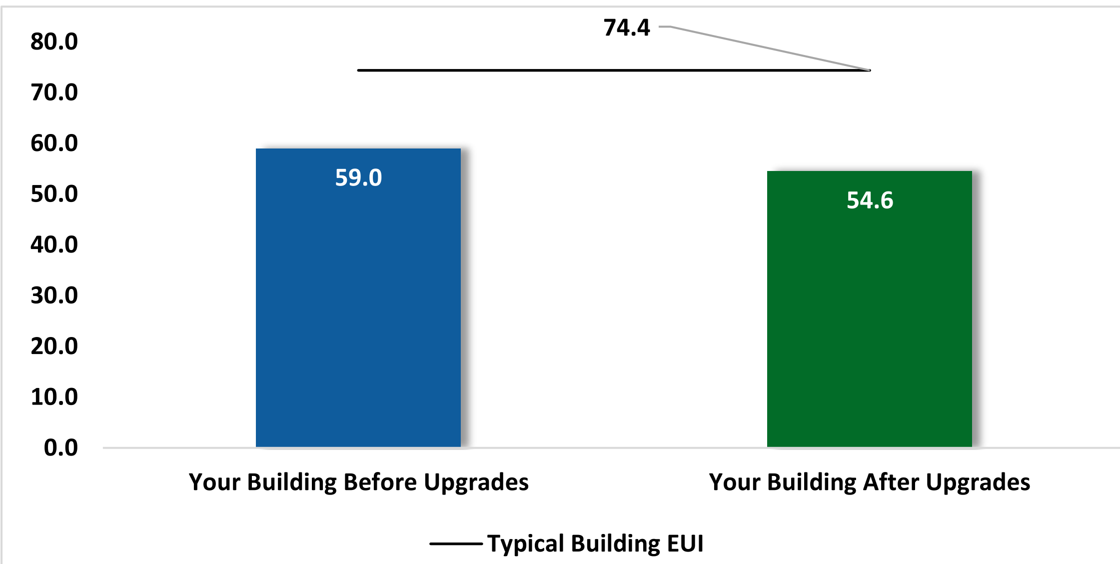


Figure 5 - Energy Use Intensity Comparison[3]

Energy use intensity (EUI) measures energy consumption per square foot and is the standard metric for comparing buildings' energy performance. A lower EUI means better performance and less energy consumed. 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 use on a monthly basis is one of the best ways to keep energy costs in check. Update your utility information in Portfolio Manager® regularly, so that you can keep track of your building's performance.

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

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

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

4 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			**49,780**	**17.1**	**-21**	**$6,019**	**$20,919**	**$3,776**	**$17,143**	**2.8**	**46,751**
ECM 1	Install LED Fixtures	Yes	9,369	3.4	-4	$1,132	$6,895	$700	$6,195	5.5	8,794
ECM 2	Retrofit Fixtures with LED Lamps	Yes	40,411	13.7	-17	$4,887	$14,024	$3,076	$10,948	2.2	37,957
Lighting Control Measures			**8,100**	**2.6**	**-3**	**$979**	**$9,184**	**$2,725**	**$6,459**	**6.6**	**7,602**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	5,911	2.2	-2	$714	$6,934	$860	$6,074	8.5	5,548
ECM 4	Install High/Low Lighting Controls	Yes	2,189	0.4	-1	$264	$2,250	$1,865	$385	1.5	2,054
Motor Upgrades			**358**	**0.2**	**0**	**$47**	**$2,059**	**$0**	**$2,059**	**43.9**	**360**
ECM 5	Premium Efficiency Motors	No	358	0.2	0	$47	$2,059	$0	$2,059	43.9	360
HVAC System Improvements			**0**	**0.0**	**10**	**$248**	**$82**	**$10**	**$72**	**0.3**	**1,644**
ECM 6	Install Pipe Insulation	Yes	0	0.0	10	$248	$82	$10	$72	0.3	1,644
Domestic Water Heating Upgrade			**0**	**0.0**	**9**	**$92**	**$239**	**$54**	**$185**	**2.0**	**1,001**
ECM 7	Install Low-Flow DHW Devices	Yes	0	0.0	9	$92	$239	$54	$185	2.0	1,001
TOTALS			**58,238**	**20.0**	**-5**	**$7,384**	**$32,483**	**$6,565**	**$25,917**	**3.5**	**57,359**

* - 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).

Figure 6 – 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		**49,780**	**17.1**	**-21**	**$6,019**	**$20,919**	**$3,776**	**$17,143**	**2.8**	**46,751**
ECM 1	Install LED Fixtures	9,369	3.4	-4	$1,132	$6,895	$700	$6,195	5.5	8,794
ECM 2	Retrofit Fixtures with LED Lamps	40,411	13.7	-17	$4,887	$14,024	$3,076	$10,948	2.2	37,957
Lighting Control Measures		**8,100**	**2.6**	**-3**	**$979**	**$9,184**	**$2,725**	**$6,459**	**6.6**	**7,602**
ECM 3	Install Occupancy Sensor Lighting Controls	5,911	2.2	-2	$714	$6,934	$860	$6,074	8.5	5,548
ECM 4	Install High/Low Lighting Controls	2,189	0.4	-1	$264	$2,250	$1,865	$385	1.5	2,054
HVAC System Improvements		**0**	**0.0**	**10**	**$248**	**$82**	**$10**	**$72**	**0.3**	**1,644**
ECM 6	Install Pipe Insulation	0	0.0	10	$248	$82	$10	$72	0.3	1,644
Domestic Water Heating Upgrade		**0**	**0.0**	**9**	**$92**	**$239**	**$54**	**$185**	**2.0**	**1,001**
ECM 7	Install Low-Flow DHW Devices	0	0.0	9	$92	$239	$54	$185	2.0	1,001
TOTALS		**57,880**	**19.7**	**-5**	**$7,338**	**$30,424**	**$6,565**	**$23,859**	**3.3**	**56,999**

* - 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).

Figure 7 – 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		**49,780**	**17.1**	**-21**	**$6,019**	**$20,919**	**$3,776**	**$17,143**	**2.8**	**46,751**
ECM 1	Install LED Fixtures	9,369	3.4	-4	$1,132	$6,895	$700	$6,195	5.5	8,794
ECM 2	Retrofit Fixtures with LED Lamps	40,411	13.7	-17	$4,887	$14,024	$3,076	$10,948	2.2	37,957

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 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: gymnasium.

ECM 2: Retrofit Fixtures with LED Lamps

Replace fluorescent, CFL, or incandescent lamps with LED lamps. Many LED tubes are direct replacements for existing fluorescent tubes and can be installed while leaving the fluorescent fixture ballast in place. LED lamps can be used in existing fixtures as a direct replacement for most other lighting technologies. Be sure to specify replacement lamps that are compatible with existing dimming controls, where applicable. In some circumstances, you may need to upgrade your dimming system for optimum performance.

This measure saves energy by installing LEDs, which use less power than other lighting technologies yet provide equivalent lighting output for the space. Maintenance savings may also be available, as longer-lasting LEDs lamps will not need to be replaced as often as the existing lamps.

Affected Building Areas: all areas with fluorescent fixtures with T8 tubes, CFL, or incandescent lamps.

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		**8,100**	**2.6**	**-3**	**$979**	**$9,184**	**$2,725**	**$6,459**	**6.6**	**7,602**
ECM 3	Install Occupancy Sensor Lighting Controls	5,911	2.2	-2	$714	$6,934	$860	$6,074	8.5	5,548
ECM 4	Install High/Low Lighting Controls	2,189	0.4	-1	$264	$2,250	$1,865	$385	1.5	2,054

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

ECM 3: Install Occupancy Sensor Lighting Controls

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

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

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

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

Affected Building Areas: offices, classrooms, and restrooms.

ECM 4: Install High/Low Lighting Controls

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

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

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

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

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

Affected Building Areas: hallways and stairwells.

4.3 Motors

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Motor Upgrades		**358**	**0.2**	**0**	**$47**	**$2,059**	**$0**	**$2,059**	**43.9**	**360**
ECM 5	Premium Efficiency Motors	358	0.2	0	$47	$2,059	$0	$2,059	43.9	360

ECM 5: Premium Efficiency Motors

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

Affected Motors:

Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Additional Motor Description
Mechanical 1	STEM Academy of Orange	4	Heating Hot Water Pump	0.8	

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

4.4 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**	**10**	**$248**	**$82**	**$10**	**$72**	**0.3**	**1,644**
ECM 6	Install Pipe Insulation	0	0.0	10	$248	$82	$10	$72	0.3	1,644

ECM 6: Install Pipe Insulation

Install insulation on heating 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: heating hot water piping.

4.5 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**	**$92**	**$239**	**$54**	**$185**	**2.0**	**1,001**
ECM 7	Install Low-Flow DHW Devices	0	0.0	9	$92	$239	$54	$185	2.0	1,001

ECM 7: 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. Additional cost savings may result from reduced water usage.

4.6 Measures for Future Consideration

There are additional opportunities for improvement that Orange 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.

Orange 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.

Replace Fuel Oil Fired Equipment with Natural Gas Equipment

This site has fuel oil fired boilers to provide space heating. At the utility costs in effect when this study was conducted, fuel oil cost $24.63/MMBtu while natural gas cost $9.81/MMBtu. The facilities staff are considering replacing the fuel oil fired equipment with natural gas fired equipment. Replacing the space heating hot water boilers with natural gas fired hot water boilers with an 82% efficiency would save approximately $28,000 per year in fuel costs primarily due to the lower cost of natural gas.

If the decision is made to replace the space heating boilers, we recommend that the district work with their 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. This type of system upgrade/conversion has significant up-front capital costs, partially due to the need to modify the distribution piping; however, a properly designed hydronic system can have a significantly higher efficiency than a steam system. Condensing hydronic boilers 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 condensing boiler efficiency increases as the return water temperature drops below 130°F.

Switching from fuel oil to natural gas for space heating and domestic hot water equipment will reduce energy costs and reduce CO_2 and other greenhouse gas emissions. From the U.S. Energy Information Administration, the pounds of CO_2 emitted per MMBtu of fuel burned are 161.3 for fuel oil and 117.0 for natural gas.

Window Replacements

Energy efficient windows are an important consideration when improving the building envelope. The heat transfer through the glass panes is responsible for a significant portion of the facility's heating and cooling energy consumption. We recommend replacing single-pane windows with double-pane windows, and we recommend models that are gas-filled with low-e coatings to reduce heat loss. Windows should be selected with low U-factors to maximize energy savings. The U-factor is the rate at which the window conducts non-solar heat flow and is a key indicator of performance. The lower the U-factor, the higher the efficiency of the window. Window frames and sashes should be efficient as well. If metal frames are specified or required by code, the frame extrusions should have a thermal break to reduce conduction through the frame. As part of the installation, the window frames should be properly sealed with caulk materials to ensure the mitigation of air infiltration. Building envelopes that limit air infiltration and that have adequate fenestrations play a key role in optimizing heating and cooling efficiency, controlling moisture, and providing occupant comfort. Window system replacement is an expensive upgrade that involves architectural elements. We recommend this as a measure for further study.

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

Window Treatments/Coverings

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

Lighting Maintenance

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

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

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

Lighting Controls

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

Motor Maintenance

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

Fans to Reduce Cooling Load

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

Destratification Fans

For areas with high ceilings, destratification fans balance the air temperature from floor to ceiling. They help reduce the recovery time needed to warm the space after nightly temperature setbacks, and they will increase occupants' the comfort level.

Areas with high ceilings require the heating system to heat a larger volume of space than that which is occupied. As the warm air rises, the warmest space is at the ceiling level, rather than floor level. Higher temperatures at the ceiling accelerate heat loss through the roof, which requires additional energy consumption by the heating equipment to compensate for this accelerated heat transfer.

Thermostat Schedules and Temperature Resets

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

AC System Evaporator/Condenser Coil Cleaning

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

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 sections to improve heat transfer.

Water Heater Maintenance

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

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

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

Compressed Air System Maintenance

Compressed air systems require periodic maintenance to operate at peak efficiency. A maintenance plan for compressed air systems should include:

- Inspection, cleaning, and replacement of inlet filter cartridges.
- Cleaning of drain traps.
- Daily inspection of lubricant levels to reduce unwanted friction.
- Inspection of belt condition and tension.
- Check for leaks and adjust loose connections.
- Overall system cleaning.
- Reduce pressure setting to minimum needed for air operated equipment.
- Turn off compressor if not routinely needed.
- Use low pressure blower air rather than high pressure compressed air.

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

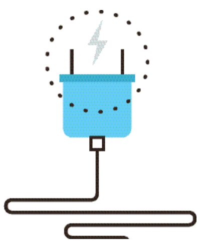
Refrigeration Equipment Maintenance

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

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

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

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

Water Conservation

Installing dual flush or low-flow toilets and low-flow/waterless urinals are ways to reduce water use. The EPA WaterSense™ ratings for urinals is 0.5 gallons per flush (gpf) and for flush valve toilets is 1.28 gpf (this is lower than the current 1.6 gpf federal standard).

For more information regarding water conservation go to the EPA's WaterSense™ website[6] or download a copy of EPA's "WaterSense™ at Work: Best Management Practices for Commercial and Institutional Facilities"[7] to get ideas for creating a water management plan and best practices for a wide range of water using systems.

Water conservation devices that do not reduce hot water consumption will not provide energy savings at the site level, but they may significantly affect your water and sewer usage costs. Any reduction in water use does however ultimately reduce grid-level electricity use since a significant amount of electricity is used to deliver water from reservoirs to end users.

If the facility has detached buildings with a master water meter for the entire campus, check for unnatural wet areas in the lawn or water seeping in the foundation at water pipe penetrations through the

[5] 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.

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

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

foundation. Periodically check overnight meter readings when the facility is unoccupied, and there is no other scheduled water usage.

Manage irrigation systems to use water more effectively outside the building. Adjust spray patterns so that water lands on intended lawns and plantings and not on pavement and walls. Consider installing an evapotranspiration irrigation controller that will prevent over-watering.

Procurement Strategies

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

6 On-site Generation

You don't have to look far in New Jersey to see one of the thousands of solar electric systems providing clean power to homes, businesses, schools, and government buildings. On-site generation includes both renewable (e.g., solar, wind) and non-renewable (e.g., fuel cells) technologies that generate power to meet all or a portion of the facility's electric energy needs. Also referred to as distributed generation, these systems contribute to greenhouse gas (GHG) emission reductions, demand reductions, and reduced customer electricity purchases, which results in improved electric grid reliability through better use of transmission and distribution systems.

Preliminary screenings were performed to determine if an on-site generation measure could be a cost-effective solution for your facility. Before deciding to install an on-site generation system, we recommend conducting a feasibility study to analyze existing energy profiles, siting, interconnection, and the costs associated with the generation project including interconnection costs, departing load charges, and any additional special facilities charges.

6.1 Solar Photovoltaic

Photovoltaic (PV) panels convert sunlight into electricity. Individual panels are combined into an array that produces direct current (DC) electricity. The DC current is converted to alternating current (AC) through an inverter. The inverter is then connected to the building's electrical distribution system.

A preliminary screening based on the facility's electric demand, size and location of free area, and shading elements shows that the facility has 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.

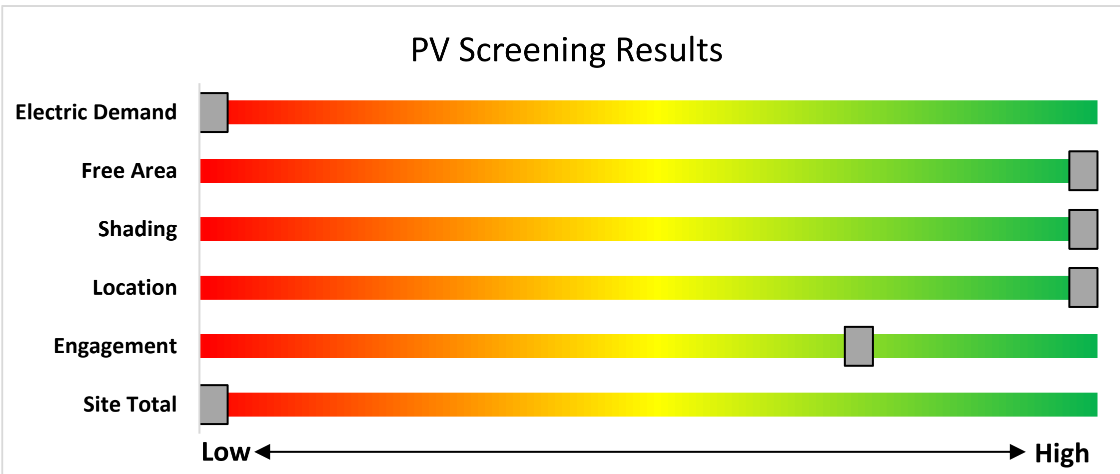


Figure 8 - Photovoltaic Screening

Successor Solar Incentive Program (SuSI)

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

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

Successor Solar Incentive Program (SuSI): https://www.njcleanenergy.com/renewable-energy/programs/susi-program

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

6.2 Combined Heat and Power

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

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

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

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

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

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.

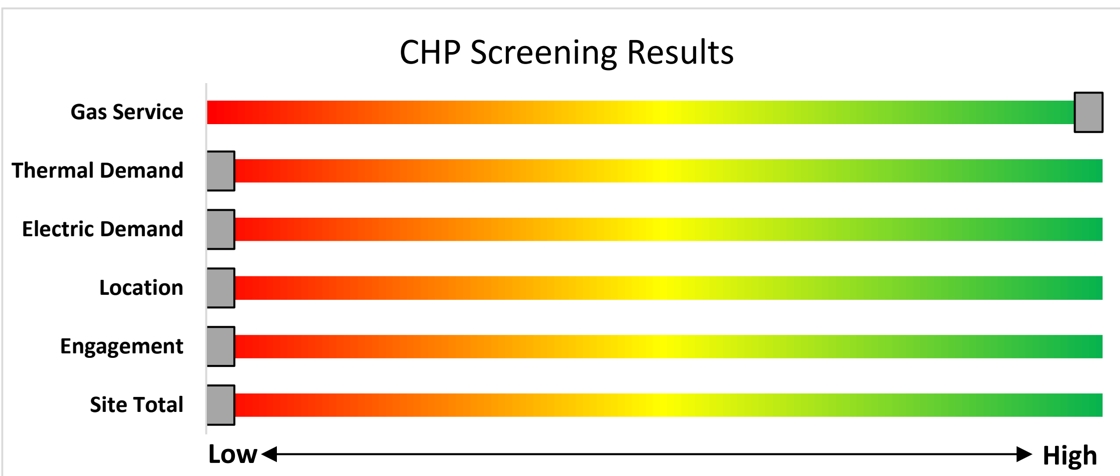


Figure 9 - Combined Heat and Power Screening

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

7 Electric Vehicles (EV)

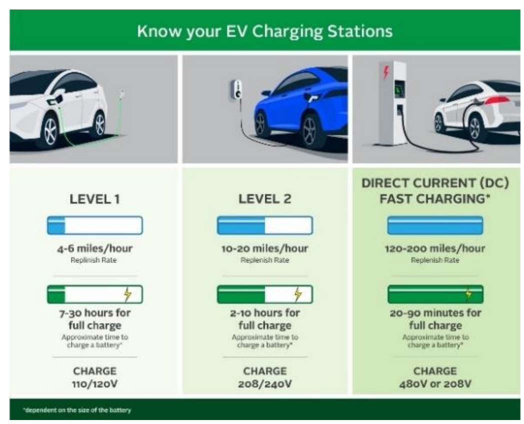
All electric vehicles (EVs) have an electric motor instead of an internal combustion engine. EVs function by plugging into a charge point, taking electricity from the grid, and then storing it in rechargeable batteries. Although electricity production may contribute to air pollution, the U.S. EPA categorizes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

7.1 Electric Vehicle 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 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.

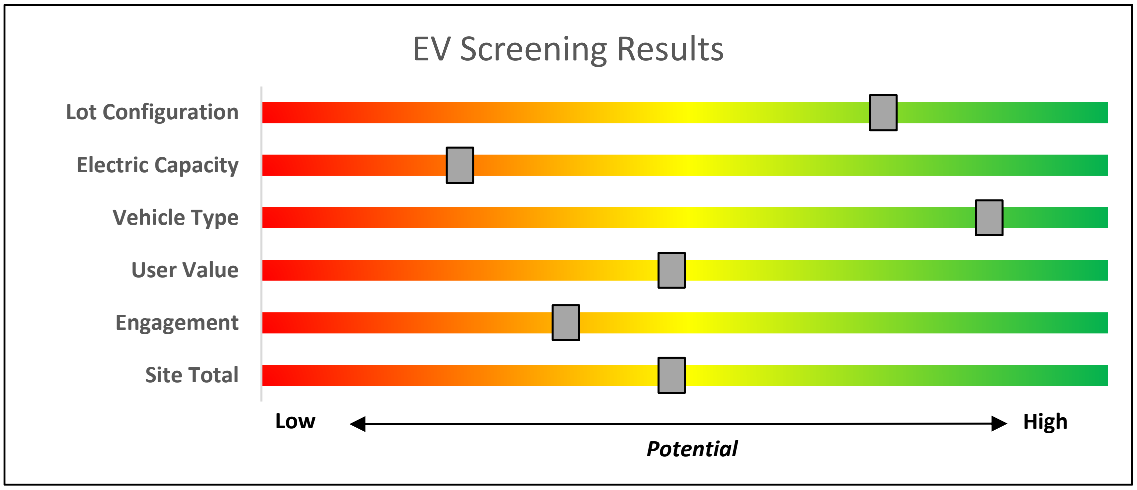


Figure 10 – EV Charger Screening

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) or Public Service Electric & Gas Company (PSE&G), 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 or PSE&G, up to 90% of the combined charger purchase and installation costs. Please check ACE or PSE&G program eligibility requirements before purchasing EV charging equipment, as additional conditions on types of eligible chargers may apply for utility incentives.

Both Jersey Central Power & Light (JCP&L) and Rockland Electric (RECO) have filed proposals for EV charging programs. BPU staff is currently reviewing those proposals.

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

8 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.

8.1 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 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.

8.2 New Jersey's Clean Energy Programs

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 that annually contribute at least $200,000 to the NJCEP aggregate of all buildings/sites. This equates to roughly $5 million in 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 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

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

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

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

How to Participate

You 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 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 Program

The Competitive Solar Incentive (CSI) Program will provide competitively set incentives for grid supply projects and net metered non-residential projects greater than 5MW (dc). The program is currently under development. For updates, please continue to check the Solar Proceedings page on the New Jersey's Clean Energy Program website.

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 photovoltaics 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 into 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.

9 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.

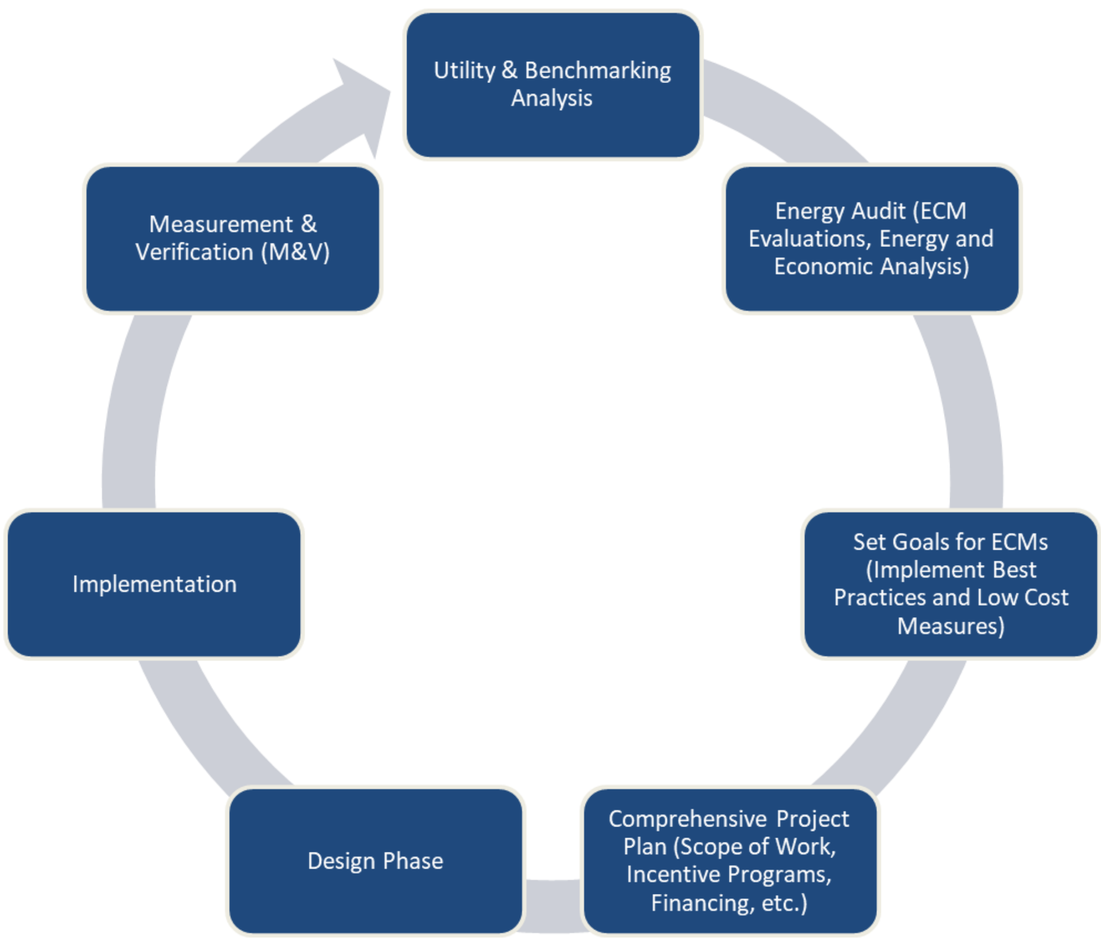


Figure 11 – Project Development Cycle

10 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

10.1 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[8].

10.2 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[9].

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

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

APPENDIX A: EQUIPMENT INVENTORY & RECOMMENDATIONS

Lighting Inventory & Recommendations

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Classroom 15	6	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor		30	1,800		None	No	6	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	30	1,800	0.0	0	0	$0	$0	$0	0.0
Classroom Art EX-05/03	10	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	1,800	2, 3	Relamp	Yes	10	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,242	0.5	1,465	-1	$177	$1,000	$235	4.3
Classroom B-06	9	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor		30	1,260		None	No	9	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	30	1,260	0.0	0	0	$0	$0	$0	0.0
Classroom EX01	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	1,800	2, 3	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,242	0.3	879	0	$106	$708	$155	5.2
Classroom EX02	8	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	1,800	2, 3	Relamp	Yes	8	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,242	0.4	1,172	0	$142	$854	$195	4.7
Classroom EX04	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	1,800	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,800	0.0	111	0	$13	$73	$20	4.0
Classroom EX07	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	1,800	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,800	0.0	111	0	$13	$73	$20	4.0
Classroom EX10	1	Incandescent: (1) 300W A23 Screw-In Lamp	Wall Switch		300	1,800	2	Relamp	No	1	LED Lamps: A23 Lamps	Wall Switch	30	1,800	0.2	535	0	$65	$50	$0	0.8
Classroom EX10	1	LED Lamps: (1) 18W A23 Screw-In Lamp	Wall Switch		18	1,800		None	No	1	LED Lamps: (1) 18W A23 Screw-In Lamp	Wall Switch	18	1,800	0.0	0	0	$0	$0	$0	0.0
Classroom EX10	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	1,800	2, 3	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,242	0.3	879	0	$106	$708	$155	5.2
Corridor 1	6	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	6	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor 1	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch		10	3,380		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	3,380	0.0	0	0	$0	$0	$0	0.0
Corridor 1	1	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch		30	3,380		None	No	1	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	30	3,380	0.0	0	0	$0	$0	$0	0.0
Corridor 1	20	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	3,380	2, 4	Relamp	Yes	20	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	2,332	0.6	3,122	-1	$377	$1,405	$875	1.4
Dining Area B-01	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	1,800	2, 3	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,242	0.2	665	0	$80	$562	$115	5.6
Dining Area B-01	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	1,800	2, 3	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,242	0.3	831	0	$100	$365	$100	2.6
Dining Area B-01	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	1,800	2, 3	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,242	0.3	831	0	$100	$365	$100	2.6
Electrical Room 1	1	LED Lamps: (1) 20W Corn Bulb Screw-In Lamp	Wall Switch		20	500		None	No	1	LED Lamps: (1) 20W Corn Bulb Screw-In Lamp	Wall Switch	20	500	0.0	0	0	$0	$0	$0	0.0
Exterior 2	1	Compact Fluorescent: (2) 13W Biaxial Plug-In Lamps	Wall Switch		26	4,004	2	Relamp	No	1	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	19	4,004	0.0	28	0	$4	$25	$2	6.3
Exterior 2	8	Incandescent: (1) 12W PAR30 Screw-In Lamp	Photocell		12	4,380	2	Relamp	No	8	LED Lamps: PAR30 Lamps	Photocell	2	4,380	0.0	350	0	$46	$186	$24	3.5
Exterior 2	1	Incandescent: (1) 12W PAR30 Screw-In Lamp	Wall Switch		12	4,004	2	Relamp	No	1	LED Lamps: PAR30 Lamps	Wall Switch	2	4,004	0.0	40	0	$5	$23	$3	3.9
Exterior 2	4	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch		10	4,004		None	No	4	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	4,004	0.0	0	0	$0	$0	$0	0.0
Exterior 2	4	LED - Fixtures: Flood Fixture	Photocell		45	4,380		None	No	4	LED - Fixtures: Flood Fixture	Photocell	45	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior 2	1	LED - Fixtures: Post Top	Wall Switch		20	4,004		None	No	1	LED - Fixtures: Post Top	Wall Switch	20	4,004	0.0	0	0	$0	$0	$0	0.0
Exterior 2	2	LED - Fixtures: Wall Pack	Photocell		30	4,380		None	No	2	LED - Fixtures: Wall Pack	Photocell	30	4,380	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Janitorial 1	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch		10	500		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	500	0.0	0	0	$0	$0	$0	0.0
Janitorial 2	1	Compact Fluorescent: (1) 23W Spiral Screw-In Lamp	Wall Switch		23	500	2	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	10	500	0.0	7	0	$1	$17	$1	18.8
Kitchen 1	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Kitchen 1	1	Incandescent: (1) 60W A19 Screw-In Lamp	Wall Switch		60	1,800	2	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	10	1,800	0.0	99	0	$12	$17	$1	1.4
Kitchen 1	3	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch		10	1,800		None	No	3	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	1,800	0.0	0	0	$0	$0	$0	0.0
Kitchen 1	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	1,800	2, 3	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,242	0.3	748	0	$90	$599	$125	5.2
Mechanical 1	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Mechanical 1	4	LED - Fixtures: Ambient 1x4 Fixture	Wall Switch		30	500		None	No	4	LED - Fixtures: Ambient 1x4 Fixture	Wall Switch	30	500	0.0	0	0	$0	$0	$0	0.0
Restroom - Female 1	3	LED - Fixtures: Ceiling Mount	Wall Switch		20	1,800	3	None	Yes	3	LED - Fixtures: Ceiling Mount	Occupancy Sensor	20	1,242	0.0	37	0	$4	$270	$35	52.8
Restroom - Male -1	2	LED - Fixtures: Ceiling Mount	Wall Switch		20	1,800	3	None	Yes	2	LED - Fixtures: Ceiling Mount	Occupancy Sensor	20	1,242	0.0	25	0	$3	$116	$20	32.4
Restroom - Unisex 2	1	LED - Fixtures: Linear Strip	Wall Switch		30	1,800		None	No	1	LED - Fixtures: Linear Strip	Wall Switch	30	1,800	0.0	0	0	$0	$0	$0	0.0
Restroom - Unisex B-04	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch		10	1,800		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	1,800	0.0	0	0	$0	$0	$0	0.0
Storage 127d	1	LED - Fixtures: Ambient 1x4 Fixture	Wall Switch		30	500		None	No	1	LED - Fixtures: Ambient 1x4 Fixture	Wall Switch	30	500	0.0	0	0	$0	$0	$0	0.0
Storage 5 B03	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	500	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	345	0.1	46	0	$6	$189	$20	30.3
Storage 6 Sprinkler Rm	1	Compact Fluorescent: (1) 23W Spiral Screw-In Lamp	Wall Switch		23	500	2	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	10	500	0.0	7	0	$1	$17	$1	18.8
Storage 6 Sprinkler Rm	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
Storage 6 Sprinkler Rm	8	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch		10	500		None	No	8	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	500	0.0	0	0	$0	$0	$0	0.0
Storage EX12	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
Storage EX12	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	500	2, 3	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	345	0.2	163	0	$20	$562	$80	24.5
Classroom 109	4	Compact Fluorescent: (2) 26W Biaxial Plug-In Lamps	Wall Switch		52	1,800	2, 3	Relamp	Yes	4	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	26	1,242	0.1	270	0	$33	$100	$8	2.8
Classroom 109	16	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch		93	1,800	2, 3	Relamp	Yes	16	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,242	0.7	1,995	-1	$241	$1,146	$275	3.6
Classroom 109A	2	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch		10	1,800	3	None	Yes	2	LED Lamps: (1) 10W A19 Screw-In Lamp	Occupancy Sensor	10	1,242	0.0	12	0	$1	$116	$20	64.7
Classroom 109A	10	LED Lamps: (1) 12W BR30 Screw-In Lamp	Wall Switch		12	1,800	3	None	Yes	10	LED Lamps: (1) 12W BR30 Screw-In Lamp	Occupancy Sensor	12	1,242	0.0	74	0	$9	$270	$35	26.4
Classroom 111	1	LED - Fixtures: Wrapped Lens	Wall Switch		25	1,800	3	None	Yes	1	LED - Fixtures: Wrapped Lens	Occupancy Sensor	25	1,242	0.0	15	0	$2	$0	$0	0.0
Classroom 111	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	1,800	2, 3	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,242	0.0	83	0	$10	$37	$10	2.6

	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
Classroom 111	9	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	1,800	2, 3	Relamp	Yes	9	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,242	0.5	1,318	-1	$159	$927	$215	4.5
Classroom 118	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	1,800	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,800	0.0	111	0	$13	$73	$20	4.0
Classroom 123	2	LED - Fixtures: Wrapped Lens	Wall Switch		25	1,800	3	None	Yes	2	LED - Fixtures: Wrapped Lens	Occupancy Sensor	25	1,242	0.0	31	0	$4	$0	$0	0.0
Classroom 123	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	1,800	2, 3	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,242	0.3	879	0	$106	$708	$155	5.2
Classroom 124	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 124	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	1,800	2, 3	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,242	0.3	879	0	$106	$708	$155	5.2
Classroom 129	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	1,800	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,800	0.0	65	0	$8	$37	$10	3.4
Classroom 129	8	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	1,800	2, 3	Relamp	Yes	8	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,242	0.4	1,172	0	$142	$854	$195	4.7
Classroom 131	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	1,800	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,800	0.0	65	0	$8	$37	$10	3.4
Classroom 131	8	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	1,800	2, 3	Relamp	Yes	8	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,242	0.4	1,172	0	$142	$854	$195	4.7
Conference 1	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	1,800	2, 3	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,242	0.1	293	0	$35	$262	$60	5.7
Corridor 2	3	Compact Fluorescent: (1) 23W BR30 Screw-In Lamp	Wall Switch		23	3,380	2, 4	Relamp	Yes	3	LED Lamps: BR30 Lamps	High/Low Control	17	2,332	0.0	126	0	$15	$72	$9	4.1
Corridor 2	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 2	3	LED - Fixtures: Ambient 1x4 Fixture	Wall Switch		30	3,380	4	None	Yes	3	LED - Fixtures: Ambient 1x4 Fixture	High/Low Control	30	2,332	0.0	104	0	$13	$0	$0	0.0
Corridor 2	30	Linear Fluorescent - T8: 2' T8 (17W) - 4L	Wall Switch		63	3,380	2, 4	Relamp	Yes	30	LED - Linear Tubes: (4) 2' Lamps	High/Low Control	34	2,332	0.9	4,410	-2	$533	$3,076	$1,410	3.1
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	36	Incandescent: (1) 300W A23 Screw-In Lamp	Wall Switch		300	1,800	2, 3	Relamp	Yes	36	LED Lamps: A23 Lamps	Occupancy Sensor	30	1,242	7.2	19,909	-8	$2,405	$2,610	$105	1.0
Gymnasium 1	14	Metal Halide: (1) 400W Lamp	Wall Switch		458	1,800	1, 3	Fixture Replacement	Yes	14	LED - Fixtures: High-Bay	Occupancy Sensor	120	1,242	3.8	10,401	-4	$1,257	$7,115	$735	5.1
Janitorial 3	1	Compact Fluorescent: (1) 23W Spiral Screw-In Lamp	Wall Switch		23	500	2	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	10	500	0.0	7	0	$1	$17	$1	18.8
Janitorial 4, 128	1	Compact Fluorescent: (1) 23W Spiral Screw-In Lamp	Wall Switch		23	500	2	Relamp	No	1	LED Lamps: A19 Lamps	Wall Switch	10	500	0.0	7	0	$1	$17	$1	18.8
Laboratory 117	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	1,800	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,800	0.0	111	0	$13	$73	$20	4.0
Locker Room 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	1,800	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,800	0.0	65	0	$8	$37	$10	3.4
Lounge 125	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	1,800	2, 3	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,242	0.1	293	0	$35	$262	$60	5.7
Office - Enclosed 1 Gym	3	LED - Fixtures: Ceiling Mount	Wall Switch		20	1,800	3	None	Yes	3	LED - Fixtures: Ceiling Mount	Occupancy Sensor	20	1,242	0.0	37	0	$4	$270	$35	52.8
Office - Enclosed 10	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	1,800	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,800	0.0	111	0	$13	$73	$20	4.0

	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
Office - Enclosed 103	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	1,800	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,800	0.0	65	0	$8	$37	$10	3.4
Office - Enclosed 126	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch		10	1,800		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	1,800	0.0	0	0	$0	$0	$0	0.0
Office - Enclosed 126	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	1,800	2, 3	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,242	0.1	293	0	$35	$262	$60	5.7
Office - Enclosed 134	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	1,800	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,800	0.0	65	0	$8	$37	$10	3.4
Office - Enclosed 2	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch		93	1,800	2	Relamp	No	3	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	1,800	0.1	294	0	$36	$164	$45	3.4
Office - Enclosed 3	1	Linear Fluorescent - T8: 4' T8 (32W) - 6L	Wall Switch		176	1,800	2	Relamp	No	1	LED - Linear Tubes: (6) 4' Lamps	Wall Switch	87	1,800	0.1	176	0	$21	$110	$30	3.7
Office - Open Plan 1	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	1,800	2, 3	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,242	0.1	293	0	$35	$262	$60	5.7
Restroom - Female 2	3	LED - Fixtures: Ceiling Mount	Wall Switch		20	1,800	3	None	Yes	3	LED - Fixtures: Ceiling Mount	Occupancy Sensor	20	1,242	0.0	37	0	$4	$270	$35	52.8
Restroom - Male -2	2	LED - Fixtures: Ceiling Mount	Wall Switch		20	1,800	3	None	Yes	2	LED - Fixtures: Ceiling Mount	Occupancy Sensor	20	1,242	0.0	25	0	$3	$116	$20	32.4
Restroom - Male -3	2	LED - Fixtures: Ceiling Mount	Wall Switch		20	1,800	3	None	Yes	2	LED - Fixtures: Ceiling Mount	Occupancy Sensor	20	1,242	0.0	25	0	$3	$116	$20	32.4
Restroom - Unisex 3	2	LED Lamps: (1) 10W A19 Screw-In Lamps	Wall Switch		20	1,800		None	No	2	LED Lamps: (1) 10W A19 Screw-In Lamps	Wall Switch	20	1,800	0.0	0	0	$0	$0	$0	0.0
Storage - Stage	4	LED - Fixtures: Ceiling Mount	Wall Switch		20	500	3	None	Yes	4	LED - Fixtures: Ceiling Mount	Occupancy Sensor	20	345	0.0	14	0	$2	$270	$0	163.8
Storage 2 Gym Attic	2	LED Lamps: (1) 12W BR30 Screw-In Lamp	Wall Switch		12	500		None	No	2	LED Lamps: (1) 12W BR30 Screw-In Lamp	Wall Switch	12	500	0.0	0	0	$0	$0	$0	0.0
Storage 2 Gym Attic B	2	LED Lamps: (1) 12W BR30 Screw-In Lamp	Wall Switch		12	500		None	No	2	LED Lamps: (1) 12W BR30 Screw-In Lamp	Wall Switch	12	500	0.0	0	0	$0	$0	$0	0.0
Storage 7	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch		10	500		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	500	0.0	0	0	$0	$0	$0	0.0
Stairs 1	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Stairs 1	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch		10	3,380	4	None	Yes	1	LED Lamps: (1) 10W A19 Screw-In Lamp	High/Low Control	10	2,332	0.0	12	0	$1	$0	$0	0.0
Stairs 1	2	LED - Fixtures: Linear Strip	Wall Switch		30	3,380	4	None	Yes	2	LED - Fixtures: Linear Strip	High/Low Control	30	2,332	0.0	69	0	$8	$225	$70	18.5
Stairs 2	1	LED - Fixtures: Ambient 1x4 Fixture	None		30	3,380	4	None	Yes	1	LED - Fixtures: Ambient 1x4 Fixture	High/Low Control	30	2,332	0.0	35	0	$4	$0	$0	0.0
Stairs 2	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	3,380	2, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	2,332	0.1	312	0	$38	$298	$90	5.5

Motor Inventory & Recommendations

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Manufacturer	Model	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical 1	STEM Academy of Orange	2	Air Compressor	0.5	70.0%	No	Dayton	3N041L	W	2,190		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	STEM Academy of Orange	1	Combustion Air Fan	1.5	84.0%	No	US Motors	C63CXHLG-5016	W	2,745		No	84.0%	No		0.0	0	0	$0	$0	$0	0.0
Storage 127D	Storage 127D	1	Exhaust Fan	0.2	65.0%	No	Unknown	Unknown	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior 1	STEM Academy of Orange	7	Exhaust Fan	0.2	65.0%	No	Unknown	Unknown	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	STEM Academy of Orange	4	Heating Hot Water Pump	0.8	70.0%	No	Bell & Goss	1M12	W	1,090	5	Yes	81.1%	No		0.2	358	0	$47	$2,059	$0	43.9
Mechanical 1	STEM Academy of Orange	1	DHW Circulation Pump	0.2	65.0%	No	Bell & Goss	Unknown	W	8,760		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Storage 2 Gym Attic	Gymnasium	1	Supply Fan	0.8	81.1%	No	Baldor	EM31112	W	2,745		No	81.1%	No		0.0	0	0	$0	$0	$0	0.0
Storage 2 Gym Attic B	Gymnasium	1	Supply Fan	0.8	81.1%	No	Baldor	EM31112	W	2,745		No	81.1%	No		0.0	0	0	$0	$0	$0	0.0
STEM Academy of Orange	STEM Academy of Orange	2	Supply Fan	0.2	65.0%	No	Unknown	Unknown	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
STEM Academy of Orange	STEM Academy of Orange	16	Supply Fan	0.1	65.0%	No	Unknown	Unknown	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0

Packaged HVAC Inventory & Recommendations

		Existing Conditions									Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/IEER/EER)	Heating Mode Efficiency	Manufacturer	Model	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/IEER/EER)	Heating Mode Efficiency	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
STEM Academy of Orange	STEM Academy of Orange	13	Window AC	2.00		10.30		Friedrich	CCW24B30A	W		No							0.0	0	0	$0	$0	$0	0.0
Classroom EX07	Classroom EX07	2	Window AC	0.83		9.80		Friedrich	7Q10A10A	W		No							0.0	0	0	$0	$0	$0	0.0
Office - Enclosed 103	Office - Enclosed 103	1	Window AC	0.67		10.80		Electrolux	FAA085P7A	W		No							0.0	0	0	$0	$0	$0	0.0
Office - Enclosed 3	Office - Enclosed 3	1	Window AC	0.65		10.80		Friedrich	KQ08E10	W		No							0.0	0	0	$0	$0	$0	0.0
STEM Academy of Orange	STEM Academy of Orange	2	Window AC	0.50		10.00		Unknown	Unknown	W		No							0.0	0	0	$0	$0	$0	0.0

Space Heating Boiler Inventory & Recommendations

		Existing Conditions						Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Manufacturer	Model	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical 1	STEM Academy of Orange	1	Non-Condensing Hot Water Boiler	2,724	Weil-McLain	Modell 88 Series 1	W		No						0.0	0	0	$0	$0	$0	0.0

Pipe Insulation Recommendations

		Recommendation Inputs			Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	ECM #	Length of Uninsulated Pipe (ft)	Pipe Diameter (in)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical 1	STEM Academy of Orange	6	5	6.00	0.0	0	10	$248	$82	$10	0.3

DHW Inventory & Recommendations

		Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Manufacturer	Model	Remaining Useful Life	ECM #	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical 1	STEM Academy of Orange	1	Storage Tank Water Heater (> 50 Gal)	AO Smith	BT-100 400	W		No						0.0	0	0	$0	$0	$0	0.0

Low-Flow Device Recommendations

	Recommedation Inputs					Energy Impact & Financial Analysis						
Location	ECM #	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen 1	7	1	Pre-Rinse Spray Valve	2.50	1.28	0.0	0	1	$15	$124	$0	8.5
STEM Academy of Orange	7	2	Faucet Aerator (Kitchen)	2.50	1.50	0.0	0	1	$6	$14	$4	1.7
STEM Academy of Orange	7	14	Faucet Aerator (Lavatory)	2.20	0.50	0.0	0	7	$72	$100	$50	0.7

Commercial Refrigerator/Freezer Inventory & Recommendations

	Existing Conditions					Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Refrigerator/ Freezer Type	Manufacturer	Model	ENERGY STAR Qualified?	ECM #	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen 1	1	Refrigerator Chest	Powers	Unknown	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen 1	1	Stand-Up Freezer, Solid Door (16 - 30 cu. ft.)	Turbo Air	Unknown	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen 1	1	Stand-Up Refrigerator, Solid Door (16 - 30 cu. ft.)	True Refrigeration	Unknown	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen 1	1	Stand-Up Refrigerator, Glass Door (≤15 cu. ft.)	Unknown	Unknown	No		No	0.0	0	0	$0	$0	$0	0.0

Cooking Equipment Inventory & Recommendations

	Existing Conditions					Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Equipment Type	Manufacturer	Model	High Efficiency Equipement?	ECM #	Install High Efficiency Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen 1	1	Insulated Food Holding Cabinet (3/4 Size)	Unknown	Unknown	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen 1	1	Gas Combination Oven/Steam Cooker (<15 Pans)	Garland	Unknown	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen 1	1	Gas Rack Oven (Double)	Blodgett	Unknown	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen 1	1	Electric Steamer	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
STEM Academy of Orange	5	Coffee Macine	800	No	Unknown	Unknown
STEM Academy of Orange	76	Desktop	270	No	Dell	Unknown
STEM Academy of Orange	2	Electric Space Heater	1,500	No	Varied	Varied
STEM Academy of Orange	16	Fan	200	No	Varied	Varied
STEM Academy of Orange	19	Laptop	200	No	Varied	Varied
STEM Academy of Orange	4	Microwave	1,000	No	Varied	Varied
Classroom EX07	1	3D Printer	960	No	Intelitek	Benchmill
Classroom 109A	1	3D Printer	450	No	Qidi	X-Max
Conference 1	1	Paper Shredder	200	No	Unknown	Unknown
STEM Academy of Orange	6	Printer	200	No	Varied	Varied
STEM Academy of Orange	6	Copier	1,200	Yes	Canon	Varied
STEM Academy of Orange	3	Mini Refrigerator	126	No	Varied	Varied
Laboratory 117	1	Refrigerator	383	No	Unknown	Unknown
STEM Academy of Orange	17	Smartboard	200	Yes	Smart	Unknown
STEM Academy of Orange	5	Water Cooler	200	Yes	Pure Water Technology	3i-R

Vending Machine Inventory & Recommendations

	Existing Conditions		Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Vending Machine Type	ECM #	Install Controls?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Cafeteria	1	Glass Fronted Refrigerated	N/A	No	0.0	0	0	$0	$0	$0	0.0
Cafeteria	1	Non-Refrigerated	N/A	No	0.0	0	0	$0	$0	$0	0.0

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.

LEARN MORE AT energystar.gov

ENERGY STAR® Statement of Energy Performance

75

ENERGY STAR® Score[1]

STEM Innovation Academy of Orange

Primary Property Type: K-12 School
Gross Floor Area (ft²): 43,300
Built: 1935

For Year Ending: December 31, 2021
Date Generated: November 27, 2022

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
STEM Innovation Academy of Orange
445 Scotland Road
South Orange, New Jersey 07079

Property Owner
Orange Board of Education
451 Lincoln Avenue
Orange, NJ 07050
(973) 677-6000

Primary Contact
Jason E. Ballard
451 Lincoln Avenue
Orange, NJ 07050
(973) 677-6000
ballarja@orange.k12.nj.us

Property ID: 21694617

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
55.8 kBtu/ft²

Source EUI
79.5 kBtu/ft²

Annual Energy by Fuel

Electric - Grid (kBtu)	557,149 (23%)
Natural Gas (kBtu)	137,150 (6%)
Fuel Oil (No. 2) (kBtu)	1,722,971 (71%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	74.4
National Median Source EUI (kBtu/ft²)	106
% Diff from National Median Source EUI	-25%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	184

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.