
# Local Government Energy Audit Report

Facilities Complex

July 10, 2024

*Prepared for:*
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523 Route 202
Mahwah, New Jersey 07430

*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.

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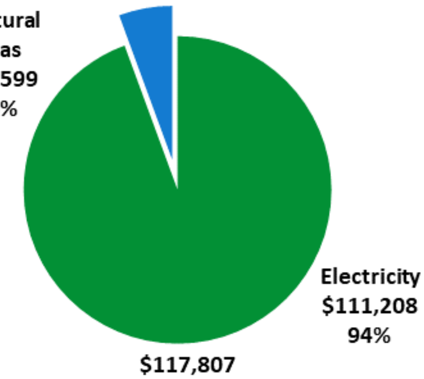
# Table of Contents

# 1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Facilities Complex. 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: $117,807<br>Electricity: 835,609 kWh<br>Natural Gas: 8,130 Therms |  |
| ENERGY STAR® Benchmarking Score | N/A *(1-100 scale)* | A standard energy use benchmark is not available for this facility type. This report contains suggestions about how to improve building performance and reduce energy costs. |

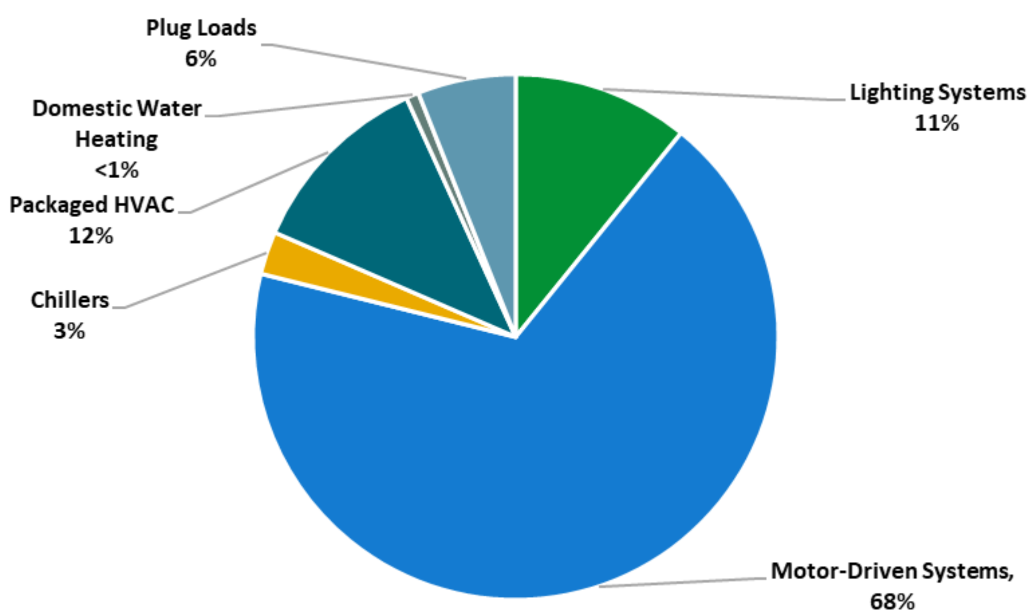


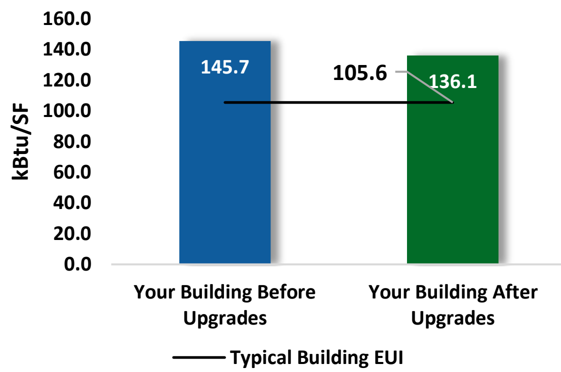

*Figure 1 - Energy Use by System*

## 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.

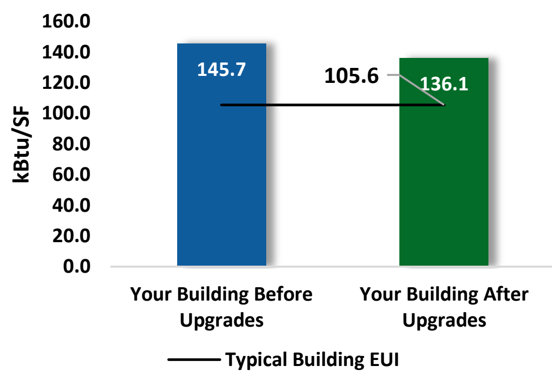
### Scenario 1: Full Package (All Evaluated Measures)

| | |
|---|---|
| Installation Cost | $35,944 |
| Potential Rebates & Incentives[1] | $5,004 |
| Annual Cost Savings | $9,769 |
| Annual Energy Savings | Electricity: 74,090 kWh<br>Natural Gas: -113 Therms |
| Greenhouse Gas Emission Savings | 37 Tons |
| Simple Payback | 3.2 Years |
| Site Energy Savings (All Utilities) | 7% |




### Scenario 2: Cost Effective Package[2]

| | |
|---|---|
| Installation Cost | $35,944 |
| Potential Rebates & Incentives | $5,004 |
| Annual Cost Savings | $9,769 |
| Annual Energy Savings | Electricity: 74,090 kWh<br>Natural Gas: -113 Therms |
| Greenhouse Gas Emission Savings | 37 Tons |
| Simple Payback | 3.2 Years |
| Site Energy Savings (all utilities) | 7% |




### 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** | | | **53,910** | **6.8** | **-8** | **$7,106** | **$17,865** | **$3,238** | **$14,627** | **2.1** | **53,298** |
| ECM 1 | Install LED Fixtures | Yes | 13,504 | 0.0 | 0 | $1,797 | $6,464 | $850 | $5,614 | 3.1 | 13,598 |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | Yes | 4,553 | 1.7 | -1 | $598 | $3,857 | $540 | $3,317 | 5.5 | 4,474 |
| ECM 3 | Retrofit Fixtures with LED Lamps | Yes | 35,853 | 5.1 | -7 | $4,711 | $7,544 | $1,848 | $5,696 | 1.2 | 35,226 |
| **Lighting Control Measures** | | | **13,610** | **2.2** | **-3** | **$1,788** | **$13,606** | **$1,670** | **$11,936** | **6.7** | **13,372** |
| ECM 4 | Install Occupancy Sensor Lighting Controls | Yes | 13,460 | 2.2 | -3 | $1,769 | $13,156 | $1,425 | $11,731 | 6.6 | 13,225 |
| ECM 5 | Install High/Low Lighting Controls | Yes | 149 | 0.0 | 0 | $20 | $450 | $245 | $205 | 10.4 | 147 |
| **HVAC System Improvements** | | | **718** | **0.0** | **0** | **$96** | **$239** | **$40** | **$199** | **2.1** | **723** |
| ECM 6 | Install Pipe Insulation | Yes | 718 | 0.0 | 0 | $96 | $239 | $40 | $199 | 2.1 | 723 |
| **Domestic Water Heating Upgrade** | | | **204** | **0.0** | **0** | **$27** | **$14** | **$6** | **$9** | **0.3** | **206** |
| ECM 7 | Install Low-Flow DHW Devices | Yes | 204 | 0.0 | 0 | $27 | $14 | $6 | $9 | 0.3 | 206 |
| **Food Service & Refrigeration Measures** | | | **1,954** | **0.2** | **0** | **$260** | **$460** | **$50** | **$410** | **1.6** | **1,968** |
| ECM 8 | Vending Machine Control | Yes | 1,954 | 0.2 | 0 | $260 | $460 | $50 | $410 | 1.6 | 1,968 |
| **Custom Measures** | | | **3,693** | **0.0** | **0** | **$492** | **$3,760** | **$0** | **$3,760** | **7.6** | **3,719** |
| ECM 9 | Replace Electric Water Heater with Heat Pump Water Heater | Yes | 3,693 | 0.0 | 0 | $492 | $3,760 | $0 | $3,760 | 7.6 | 3,719 |
| **TOTALS (COST EFFECTIVE MEASURES)** | | | **74,090** | **9.2** | **-11** | **$9,769** | **$35,944** | **$5,004** | **$30,941** | **3.2** | **73,285** |
| **TOTALS (ALL MEASURES)** | | | **74,090** | **9.2** | **-11** | **$9,769** | **$35,944** | **$5,004** | **$30,941** | **3.2** | **73,285** |

* - 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 Facilities Complex. 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 July 7, 2023, TRC performed an energy audit at Facilities Complex located in Mahwah, New Jersey. TRC met with facility staff to review the facility operations and help focus our investigation on specific energy-using systems.

Facilities Complex is a multi-building complex totaling 25,155 square feet. It was built in 1973. Spaces include offices, corridors, stairwells, storage rooms, workshops, and mechanical space.

## 2.2 Building Occupancy

The facility is occupied Monday through Friday during regular business hours. The plant is monitored twenty-four hours a day.

The facility is occupied intermittently, as needed for maintenance and operations.

| Building Name | Weekday/Weekend | Operating Schedule |
|---|---|---|
| Facilities Complex | Weekday | Varied |
| | Weekend | Varied |

*Figure 3 - Building Occupancy Schedule*

## 2.3 Building Envelope

Building walls are concrete block over structural steel with metal siding. The roof is flat and covered with white membrane, and it is in poor condition.

*Facilities Structures*

Most of the windows are single glazed and have aluminum frames. The glass-to-frame seals are in good 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.

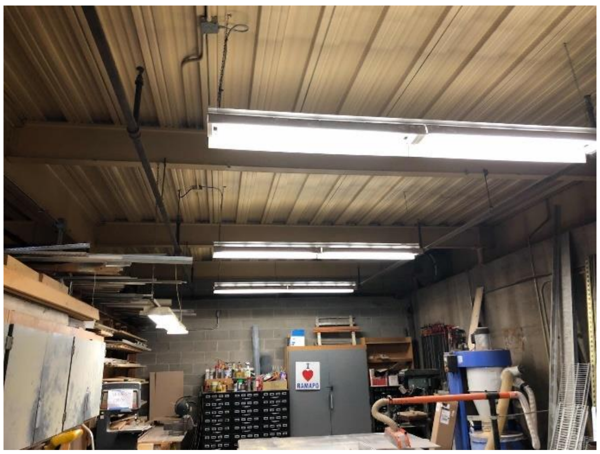

*Garage Door and Window*

## 2.4 Lighting Systems

The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. There are also several 34-Watt T12 fixtures. Fixture types include 2-lamp, 3-lamp, or 4-lamp, 2-foot or 4-foot-long recessed troffer and surface mounted fixtures and 2-foot fixtures with U-bend tube lamps. Typically, T8 fluorescent lamps use electronic ballasts and T12 fluorescent lamps use magnetic 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 lamps. The area housing the chiller has metal halide source lighting.

All exit signs are LED. Most fixtures are in fair condition. Interior lighting levels were generally sufficient.



*Linear and LED Fixtures*

Lighting fixtures are controlled by wall switches or circuit breakers. Exterior fixtures include wall packs and floodlights with high intensity discharge (HID) lamps, and LED wall packs.

Exterior fixtures are timer or photocell controlled.

*Wall Packs*

## 2.5 Air Handling Systems

**Unitary Electric HVAC Equipment**

Some offices are cooled using window air conditioning (AC) units. They provide 1.5 tons of cooling each with an EER rating of 9. The units are in fair condition. They are not ENERGY STAR labeled. Other areas are conditioned with ductless mini split heat pump units. They range in size from 0.75 tons to 1.67-tons of cooling with heating capacities between 10.9 MBh and 27.6 MBh. The EERs range between 10 and 17.

*Window AC Units and Ductless Mini Split*

**Unitary Heating Equipment**

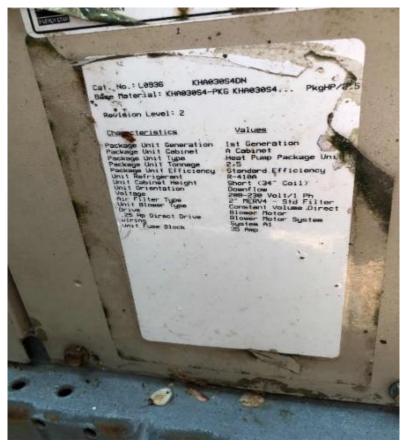
Select areas are heated by electric resistance heaters. These vary in capacity between 1 kW and 4 kW. The units are in fair condition and are controlled by on-board or local thermostats.


*Electric Resistance Heat*

**Packaged Units**

Other offices have PTAC or PTHP units, in fair condition. PTACs have a cooling capacity of 1.5 tons each and an EER of 9. PTHPs have a cooling capacity of 3.0 tons each with a heating capacity of 36 MBh and an EER of 8.

Part of an office building is served by a packaged roof top unit (RTU), providing 2.5-tons of cooling with an EER of 11.9. This unit provides cooling only and it is in fair condition. A York split AC system provides 3.0 tons of cooling to the housekeeping area with the help of a small indoor supply fan.


*Packaged Rooftop unit and PTHPs*

## 2.6 Steam Hot Water Systems

Three Cleaver Brooks 20,922 MBh steam boilers serve the heating load for part of the campus. The burners are fully-modulating with a nominal efficiency of 84 percent. The boilers are configured in a manual control scheme. Only one boiler is required under high load conditions. They are in fair condition. There is no service contract in place. Each boiler is equipped with a combustion air fan ranging from 15 hp to 20 hp. Various fractional hp pumps provide chemical feed and condensate overflow functions. Steam is not used in the facilities complex.

Steam is distributed by three main conduits to several buildings and heated make up water is returned by condensate. According to facility staff, one of the legs has an issue underground in that water is not returned to the central plant. We have evaluated the energy loss from this one leg and included a measure for future consideration in Section 4.7.

*Steam Boilers and Condensate Return*

## 2.7 Chilled Water Systems

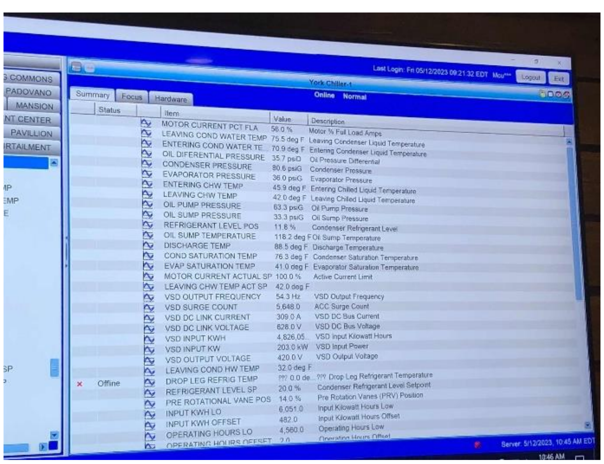
The chiller plant consists of a one, 700-ton, York, R-134a, centrifugal chiller and a one, 910-ton Trane, R-123, centrifugal chiller. The York chiller provides chilled water to buildings on the campus with the Trane unit operating as a backup only. Energy use associated with the backup chiller for testing is included with this building; there are no chilled water using systems at the complex.

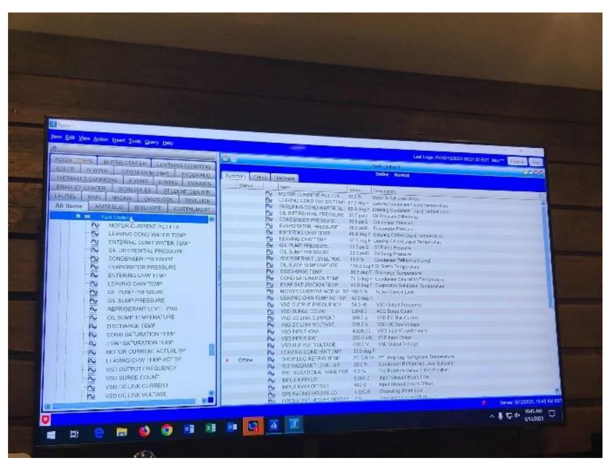
The chillers are connected; however, distribution is provided by separate pumps. Chilled water from the primary York chiller is distributed by a 125 hp primary and a 75 hp secondary pump. The chilled water from the Trane backup is distributed by a 100 hp pump and a 75 hp secondary pump. Four cooling towers with 40 hp fan motor serve the chilled water system.


*York Chiller and Cooling Towers*

## 2.8 Building Automation System (BAS)

A Johnson Controls BAS controls the HVAC equipment. The BAS provides equipment scheduling control and monitors and controls space temperatures, supply air temperatures, humidity, heating water loop temperatures, and chilled water loop temperatures. The site staff expressed an interest in expanding the level of control provided by the BAS, replacing the BAS, and receiving additional training on operating the BAS.



*Johnson Controls BAS*

## 2.9 Domestic Hot Water

Hot water is produced by a three, 4.5 kW electric storage water heaters. They are 28, 30, and 40 gallons in capacity. The domestic hot water pipes are partially insulated, and the insulation should be added.


*Hot Water Storage Heater*

## 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 41 computer workstations throughout the facility. Plug loads include general cafe and office equipment. There are several refrigerators throughout the building. These vary in condition and efficiency. The workshop includes various hand tools.

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



*Stove and Printer*

## 2.11 Water-Using Systems

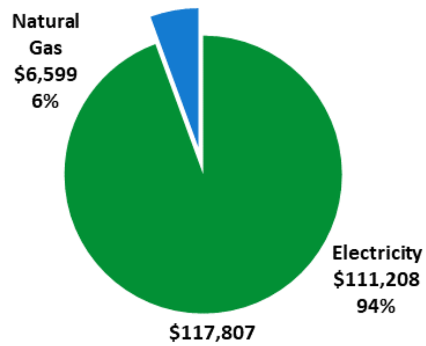
There are four restrooms with toilets, urinals, and sinks. Faucet flow rates are at 0.5 gallons per minute (gpm) or higher.

*Kitchen and Lavatory 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 | 835,609 kWh | $111,208 |
| Natural Gas | 8,130 Therms | $6,599 |
| **Total** | | **$117,807** |




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.

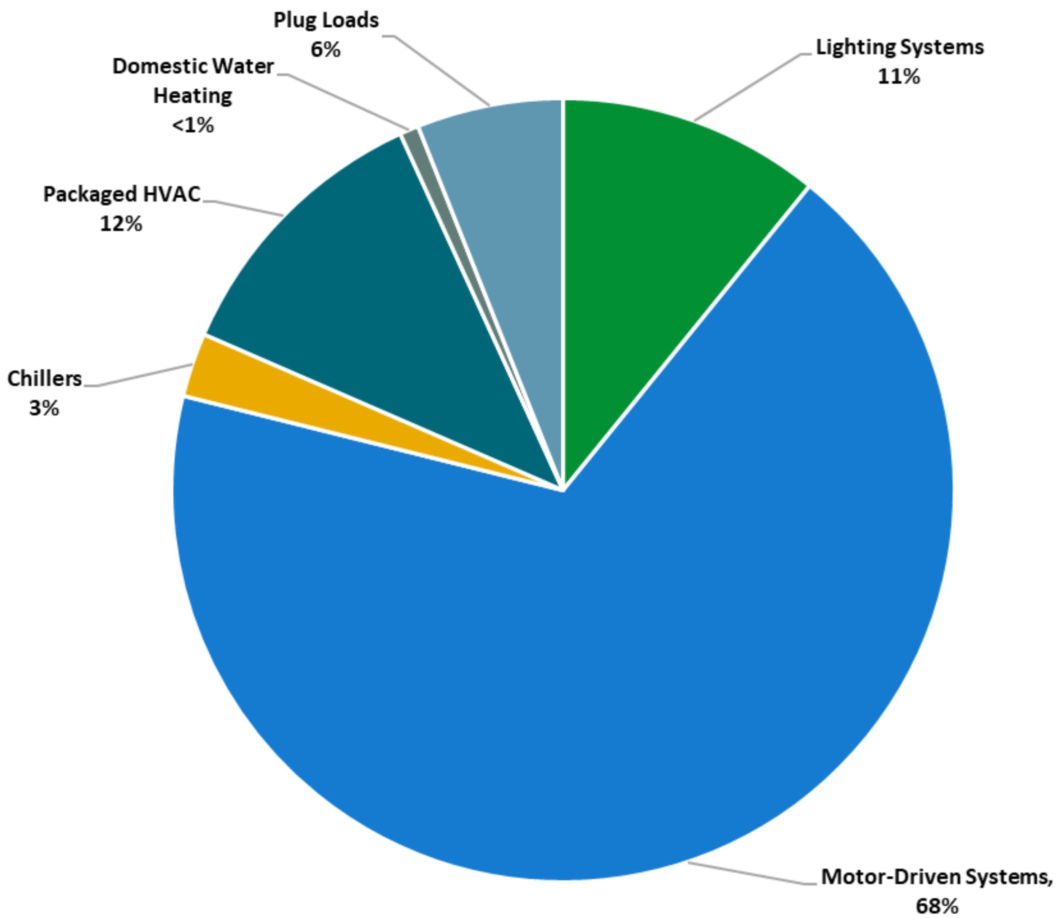
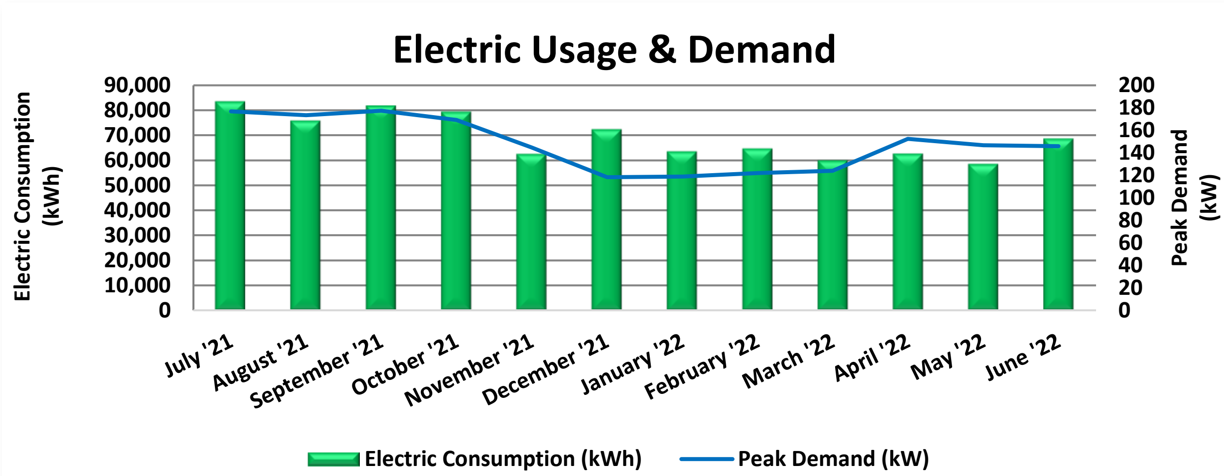



*Figure 4 - Energy Balance*

## 3.1 Electricity

Rockland Electric delivers electricity under rate class Electric Comm Prim (TOU-RE-DEL-PJM), with electric production provided by Direct Energy, a third-party supplier.



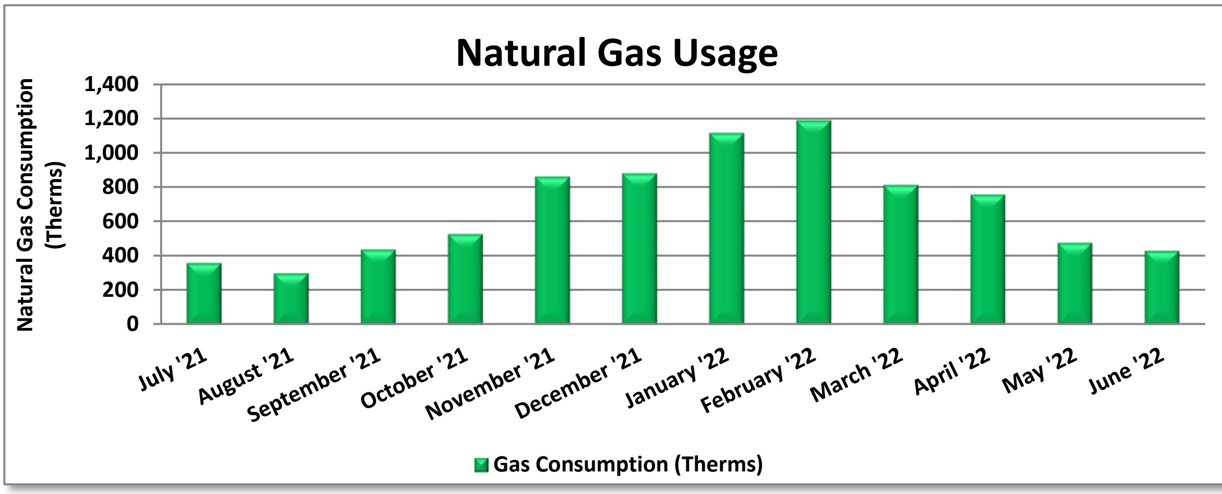

| Electric Billing Data | | | | | |
|---|---|---|---|---|---|
| Period Ending | Days in Period | Electric Usage (kWh) | Demand (kW) | Demand Cost | Total Electric Cost |
| 7/26/21 | 32 | 83,453 | 177 | | $9,794 |
| 8/24/21 | 29 | 75,792 | 173 | | $9,016 |
| 9/23/21 | 30 | 81,797 | 178 | | $9,683 |
| 10/25/21 | 32 | 79,341 | 169 | | $9,380 |
| 11/23/21 | 29 | 62,521 | 145 | | $7,460 |
| 12/27/21 | 34 | 72,406 | 118 | | $8,392 |
| 1/26/22 | 30 | 63,586 | 119 | | $9,493 |
| 2/24/22 | 29 | 64,741 | 122 | | $9,712 |
| 3/25/22 | 29 | 59,934 | 124 | | $9,042 |
| 4/25/22 | 31 | 62,621 | 153 | | $9,567 |
| 5/23/22 | 28 | 58,481 | 147 | | $8,914 |
| 6/23/22 | 31 | 68,647 | 146 | | $10,450 |
| **Totals** | **364** | **833,320** | **178** | **$0** | **$110,903** |
| **Annual** | **365** | **835,609** | **178** | **$0** | **$111,208** |

Notes:

- The average electric cost over the past 12 months was $0.133/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.
- This building is served from the main campus electric meter along with several others. Energy usage (kWh) and demand (kW) was apportioned among those buildings using a formula that accounts for building area (sf) and presumed energy intensity (EUI) by building type.

## 3.2 Natural Gas

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




| Gas Billing Data | | | |
|---|---|---|---|
| Period Ending | Days in Period | Natural Gas Usage (Therms) | Natural Gas Cost |
| 8/2/21 | 33 | 358 | $195 |
| 8/27/21 | 25 | 298 | $162 |
| 9/28/21 | 32 | 436 | $236 |
| 10/28/21 | 30 | 527 | $303 |
| 11/30/21 | 33 | 861 | $650 |
| 12/29/21 | 29 | 878 | $674 |
| 1/28/22 | 30 | 1,114 | $1,072 |
| 3/3/22 | 34 | 1,187 | $1,146 |
| 3/31/22 | 28 | 812 | $832 |
| 5/2/22 | 32 | 755 | $614 |
| 5/31/22 | 29 | 475 | $380 |
| 6/30/22 | 30 | 429 | $335 |
| **Totals** | **365** | **8,130** | **$6,599** |
| **Annual** | **365** | **8,130** | **$6,599** |

Notes:

- Gas is provided by the main gas meters. Usage is attributed to this and other buildings in accordance with a prorate.
- The average gas cost for the past 12 months is $0.812/therm, which is the blended rate used throughout the analysis.

## 3.3 Benchmarking

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

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

| Benchmarking Score | N/A |
|---|---|

Due to its unique characteristics, this building type is not able to receive a benchmarking score. This report contains suggestions about how to improve building performance and reduce energy costs.

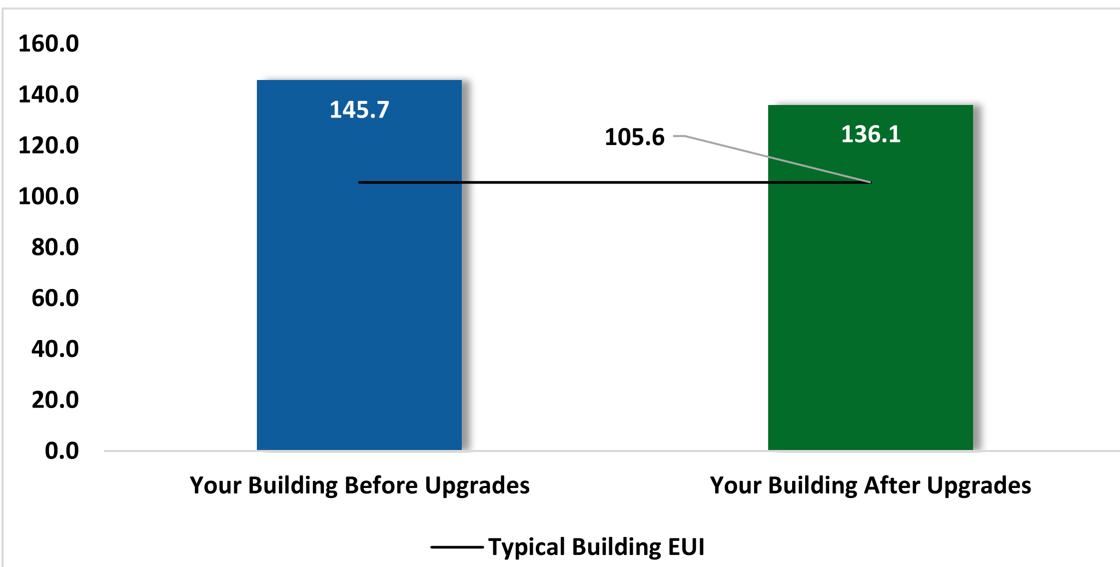



*Figure 5 - Energy Use Intensity Comparison*[3]

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** | | | **53,910** | **6.8** | **-8** | **$7,106** | **$17,865** | **$3,238** | **$14,627** | **2.1** | **53,298** |
| ECM 1 | Install LED Fixtures | Yes | 13,504 | 0.0 | 0 | $1,797 | $6,464 | $850 | $5,614 | 3.1 | 13,598 |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | Yes | 4,553 | 1.7 | -1 | $598 | $3,857 | $540 | $3,317 | 5.5 | 4,474 |
| ECM 3 | Retrofit Fixtures with LED Lamps | Yes | 35,853 | 5.1 | -7 | $4,711 | $7,544 | $1,848 | $5,696 | 1.2 | 35,226 |
| **Lighting Control Measures** | | | **13,610** | **2.2** | **-3** | **$1,788** | **$13,606** | **$1,670** | **$11,936** | **6.7** | **13,372** |
| ECM 4 | Install Occupancy Sensor Lighting Controls | Yes | 13,460 | 2.2 | -3 | $1,769 | $13,156 | $1,425 | $11,731 | 6.6 | 13,225 |
| ECM 5 | Install High/Low Lighting Controls | Yes | 149 | 0.0 | 0 | $20 | $450 | $245 | $205 | 10.4 | 147 |
| **HVAC System Improvements** | | | **718** | **0.0** | **0** | **$96** | **$239** | **$40** | **$199** | **2.1** | **723** |
| ECM 6 | Install Pipe Insulation | Yes | 718 | 0.0 | 0 | $96 | $239 | $40 | $199 | 2.1 | 723 |
| **Domestic Water Heating Upgrade** | | | **204** | **0.0** | **0** | **$27** | **$14** | **$6** | **$9** | **0.3** | **206** |
| ECM 7 | Install Low-Flow DHW Devices | Yes | 204 | 0.0 | 0 | $27 | $14 | $6 | $9 | 0.3 | 206 |
| **Food Service & Refrigeration Measures** | | | **1,954** | **0.2** | **0** | **$260** | **$460** | **$50** | **$410** | **1.6** | **1,968** |
| ECM 8 | Vending Machine Control | Yes | 1,954 | 0.2 | 0 | $260 | $460 | $50 | $410 | 1.6 | 1,968 |
| **Custom Measures** | | | **3,693** | **0.0** | **0** | **$492** | **$3,760** | **$0** | **$3,760** | **7.6** | **3,719** |
| ECM 9 | Replace Electric Water Heater with Heat Pump Water Heater | Yes | 3,693 | 0.0 | 0 | $492 | $3,760 | $0 | $3,760 | 7.6 | 3,719 |
| **TOTALS** | | | **74,090** | **9.2** | **-11** | **$9,769** | **$35,944** | **$5,004** | **$30,941** | **3.2** | **73,285** |

* - 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)** | $CO_2$e Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | **53,910** | **6.8** | **-8** | **$7,106** | **$17,865** | **$3,238** | **$14,627** | **2.1** | **53,298** |
| ECM 1 | Install LED Fixtures | 13,504 | 0.0 | 0 | $1,797 | $6,464 | $850 | $5,614 | 3.1 | 13,598 |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | 4,553 | 1.7 | -1 | $598 | $3,857 | $540 | $3,317 | 5.5 | 4,474 |
| ECM 3 | Retrofit Fixtures with LED Lamps | 35,853 | 5.1 | -7 | $4,711 | $7,544 | $1,848 | $5,696 | 1.2 | 35,226 |
| **Lighting Control Measures** | | **13,610** | **2.2** | **-3** | **$1,788** | **$13,606** | **$1,670** | **$11,936** | **6.7** | **13,372** |
| ECM 4 | Install Occupancy Sensor Lighting Controls | 13,460 | 2.2 | -3 | $1,769 | $13,156 | $1,425 | $11,731 | 6.6 | 13,225 |
| ECM 5 | Install High/Low Lighting Controls | 149 | 0.0 | 0 | $20 | $450 | $245 | $205 | 10.4 | 147 |
| **HVAC System Improvements** | | **718** | **0.0** | **0** | **$96** | **$239** | **$40** | **$199** | **2.1** | **723** |
| ECM 6 | Install Pipe Insulation | 718 | 0.0 | 0 | $96 | $239 | $40 | $199 | 2.1 | 723 |
| **Domestic Water Heating Upgrade** | | **204** | **0.0** | **0** | **$27** | **$14** | **$6** | **$9** | **0.3** | **206** |
| ECM 7 | Install Low-Flow DHW Devices | 204 | 0.0 | 0 | $27 | $14 | $6 | $9 | 0.3 | 206 |
| **Food Service & Refrigeration Measures** | | **1,954** | **0.2** | **0** | **$260** | **$460** | **$50** | **$410** | **1.6** | **1,968** |
| ECM 8 | Vending Machine Control | 1,954 | 0.2 | 0 | $260 | $460 | $50 | $410 | 1.6 | 1,968 |
| **Custom Measures** | | **3,693** | **0.0** | **0** | **$492** | **$3,760** | **$0** | **$3,760** | **7.6** | **3,719** |
| ECM 9 | Replace Electric Water Heater with Heat Pump Water Heater | 3,693 | 0.0 | 0 | $492 | $3,760 | $0 | $3,760 | 7.6 | 3,719 |
| **TOTALS** | | **74,090** | **9.2** | **-11** | **$9,769** | **$35,944** | **$5,004** | **$30,941** | **3.2** | **73,285** |

* - 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** | | **53,910** | **6.8** | **-8** | **$7,106** | **$17,865** | **$3,238** | **$14,627** | **2.1** | **53,298** |
| ECM 1 | Install LED Fixtures | 13,504 | 0.0 | 0 | $1,797 | $6,464 | $850 | $5,614 | 3.1 | 13,598 |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | 4,553 | 1.7 | -1 | $598 | $3,857 | $540 | $3,317 | 5.5 | 4,474 |
| ECM 3 | Retrofit Fixtures with LED Lamps | 35,853 | 5.1 | -7 | $4,711 | $7,544 | $1,848 | $5,696 | 1.2 | 35,226 |

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

### ECM 1: Install LED Fixtures

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

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

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

**Affected Building Areas:** exterior fixtures

### ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

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

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

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

### ECM 3: Retrofit Fixtures with LED Lamps

Replace fluorescent, CFL, HID, 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 HID 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** | | **13,610** | **2.2** | **-3** | **$1,788** | **$13,606** | **$1,670** | **$11,936** | **6.7** | **13,372** |
| ECM 4 | Install Occupancy Sensor Lighting Controls | 13,460 | 2.2 | -3 | $1,769 | $13,156 | $1,425 | $11,731 | 6.6 | 13,225 |
| ECM 5 | Install High/Low Lighting Controls | 149 | 0.0 | 0 | $20 | $450 | $245 | $205 | 10.4 | 147 |

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

### ECM 4: Install Occupancy Sensor Lighting Controls

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

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

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

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

**Affected Building Areas:** offices, conference rooms, restrooms, and mechanical rooms

## ECM 5: Install High/Low Lighting Controls

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

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

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

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

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

**Affected Building Areas**: hallways

## 4.3 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** | | **718** | **0.0** | **0** | **$96** | **$239** | **$40** | **$199** | **2.1** | **723** |
| ECM 6 | Install Pipe Insulation | 718 | 0.0 | 0 | $96 | $239 | $40 | $199 | 2.1 | 723 |

## ECM 6: Install Pipe Insulation

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

**Affected Systems:** domestic hot water piping

## 4.4 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** | | **204** | **0.0** | **0** | **$27** | **$14** | **$6** | **$9** | **0.3** | **206** |
| ECM 7 | Install Low-Flow DHW Devices | 204 | 0.0 | 0 | $27 | $14 | $6 | $9 | 0.3 | 206 |

### 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.

## 4.5 Food Service & Refrigeration Measures

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated M&L Cost ($) | Estimated Incentive ($)* | Estimated Net M&L Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Food Service & Refrigeration Measures** | | **1,954** | **0.2** | **0** | **$260** | **$460** | **$50** | **$410** | **1.6** | **1,968** |
| ECM 8 | Vending Machine Control | 1,954 | 0.2 | 0 | $260 | $460 | $50 | $410 | 1.6 | 1,968 |

### ECM 8: Vending Machine Control

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

## 4.6 Custom Measures

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated M&L Cost ($) | Estimated Incentive ($)* | Estimated Net M&L Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Custom Measures** | | **3,693** | **0.0** | **0** | **$492** | **$3,760** | **$0** | **$3,760** | **7.6** | **3,719** |
| ECM 9 | Replace Electric Water Heater with Heat Pump Water Heater | 3,693 | 0.0 | 0 | $492 | $3,760 | $0 | $3,760 | 7.6 | 3,719 |

### CM 9: Replace Electric Water Heater with Heat Pump Water Heater

A typical electric water heater uses electric resistance coils to heat water at a coefficient of performance (COP) of 1. Air source heat pump water heaters (HPWH) use a refrigeration cycle to transfer heat from the surrounding air to the domestic water. The typical average COP for a HPWH is about 2.5, so they require significantly less electricity to produce the same amount of hot water as a traditional electric water heater. There are two types of HPWH, those integrated with the heat pump and storage tank in the same unit, and those that are split into two sections (with the storage tank separate from the heat pump). The following addresses integrated HPWH.

HPWH reject cold air. As such, they need to be installed in an unconditioned space of about 750 cubic feet with good ventilation. Ideal locations are garages, large enclosed, unconditioned storage areas, or areas with excess heat such as a furnace or boiler room.[4] The HPWH will also produce condensate so accommodations for draining the condensate need to be provided.

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

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

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

## 4.7 Measures for Future Consideration

There are additional opportunities for improvement that Ramapo College of New Jersey 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.

Ramapo College of New Jersey 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.

### <u>Electric Sub Metering</u>

Electricity use varies in different facilities, and plant operators need to perform their own investigations and analyses to understand how their facilities consume energy. Facility staff expressed interest in sub metering key buildings, which are currently served by a master meter. Utility bills indicate how much energy a facility uses across the entire facility, but submetering provides more detailed data on the energy consumption of specific systems and even on individual pieces of equipment, depending on how extensively meters are installed. Electric submeters alone do not save energy, but they are a useful tool under the right circumstances. Electric sub-meters can provide facility staff with real-time energy use data for specific buildings, information that enhances the potential for greater energy management activities. Revenue grade submeters are a tool that allow operators to better understand how and where electricity is used at the facility. Better resolution of system energy use can lead to operational changes or even equipment modifications or replacement, which often result in reduced energy use, which often result in reduced energy use.

### <u>Troubleshoot Condensate Return System</u>

Steam is distributed by three main conduits to several buildings and heated make up water is returned by condensate. According to facility staff, one of the legs has an issue underground in that water is not returned to the central plant. We have evaluated the energy loss from this one leg.

There is currently no condensate return on the 3rd leg of the steam system serving the George T Potter Library and the Student Center.

The following calculation uses the gas energy assigned to those two buildings in the prorate to estimate the additional energy use required to heat make-up water to compensate for unreturned condensate. The cost of troubleshooting and repairing the condensate system is unknown but would likely be significant.

| Assumptions | | | | |
|---|---|---|---|---|
| Condensate return | 160 | °F | | |
| Make-up water | 55 | °F | | |
| Steam enthalpy | 1,000 | Btu/lb. | | |
| Boiler efficiency | 80% | | | |
| | | | | |
| Potter Library | 58,206 | therms/yr. | from Utility Prorate | |
| Student Center | 48,677 | therms/yr. | from Utility Prorate | |
| | 106,883 | therms/yr. | | |
| | | | | |
| Central Plant Input | 10,688,300,000 | Btu/yr. associated with the two buildings | | |
| Central Plant Output | 8,550,640,000 | Btu/yr. associated with the two buildings | | |
| Central Plant Output | 8,550,640 | lb. steam/yr. associated with the two buildings | | |
| Make-up | 8,550,640 | lb. water/yr. | 8.33 | lb./gal. water |
| Make-up | 1,026,487 | gal./yr. | | |
| | | | | |
| Heat to bring make-up water to the condensate temperature | | | | |
| 8,550,640 lb. water/yr. * (160 - 55) °F * 1 Btu/lb.-°F = | | | 897,817,200 | Btu heat/yr. |
| | | | 1,122,271,500 | Btu fuel/yr. |
| | | | **11,220** | **therm/yr.** |

Note that in addition to the known condensate return issue described above, there is heat loss associated with steam supply throughout the system, and there may be issues with condensate return in other legs. It is beyond the scope of this report to quantify that heat loss or to estimate the cost of mitigation.

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

## Lighting Maintenance

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

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

## Lighting Controls

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

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

## Motor Maintenance

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

## Thermostat Schedules and Temperature Resets

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

## Economizer Maintenance

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

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

## Chiller Maintenance

Service chillers regularly to keep them operating properly. Chillers are responsible for a substantial portion of a commercial building's overall energy usage, and when they do not work well, there is usually a noticeable increase in energy bills and increased occupant complaints. Regular diagnostics and service can save five to ten percent of the cost of operating your chiller. If you already have a maintenance contract in place, your existing service company should be able to provide these services.

## AC System Evaporator/Condenser Coil Cleaning

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

## HVAC Filter Cleaning and Replacement

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

## Ductwork Maintenance

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

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

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

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

## Steam Trap Repair and Replacement

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

## Boiler Maintenance

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

## Label HVAC Equipment

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

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

## Optimize HVAC Equipment Schedules

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

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

## Water Heater Maintenance

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

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

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

## 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 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] https://www.epa.gov/watersense.

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

# 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.

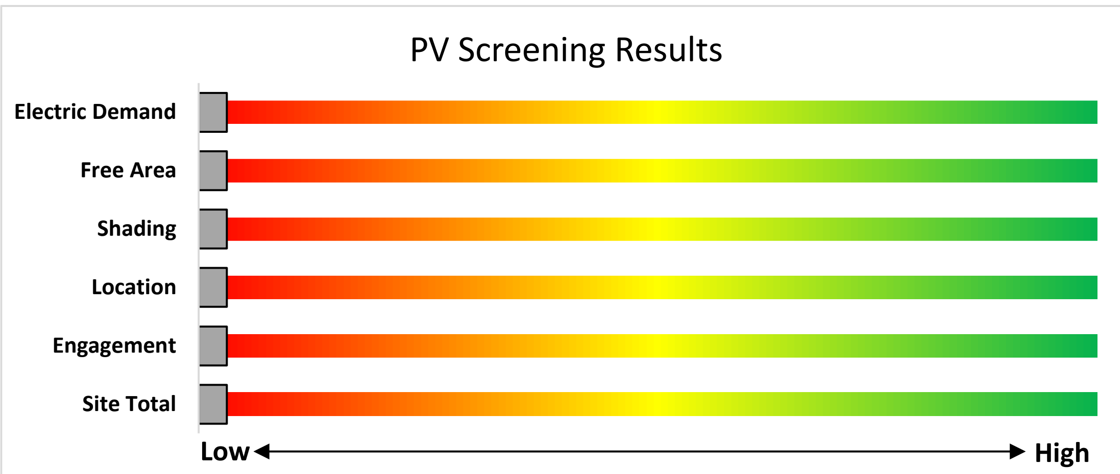



*Figure 8 - Photovoltaic Screening*

**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.

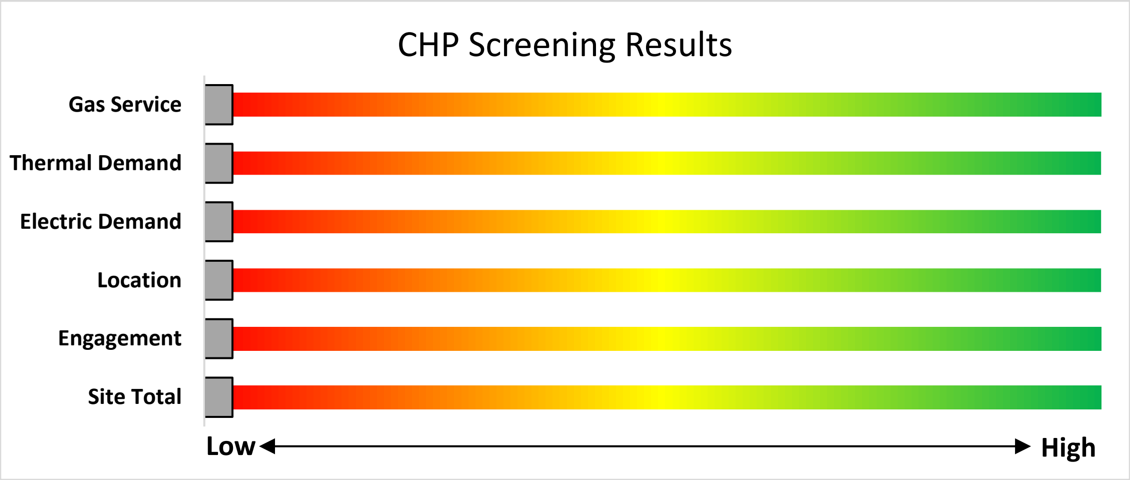



*Figure 9 - Combined Heat and Power Screening*

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)

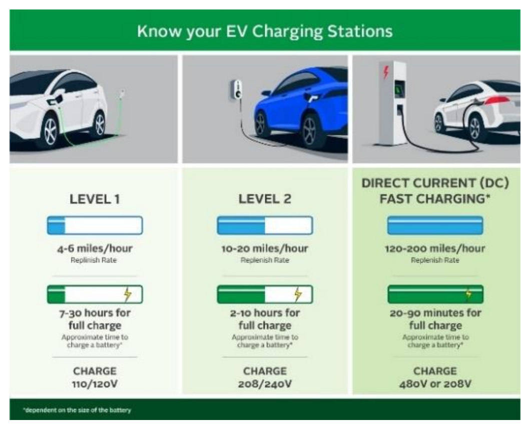
All electric vehicles (EVs) have an electric motor instead of an internal combustion engine. EVs function by plugging into a charge point, taking electricity from the grid, and then storing it in rechargeable batteries. Although electricity production may contribute to air pollution, the U.S. EPA categorizes 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 no potential for adding EV chargers to the facility's parking, based on potential costs of installation and other site factors.

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

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

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

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

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

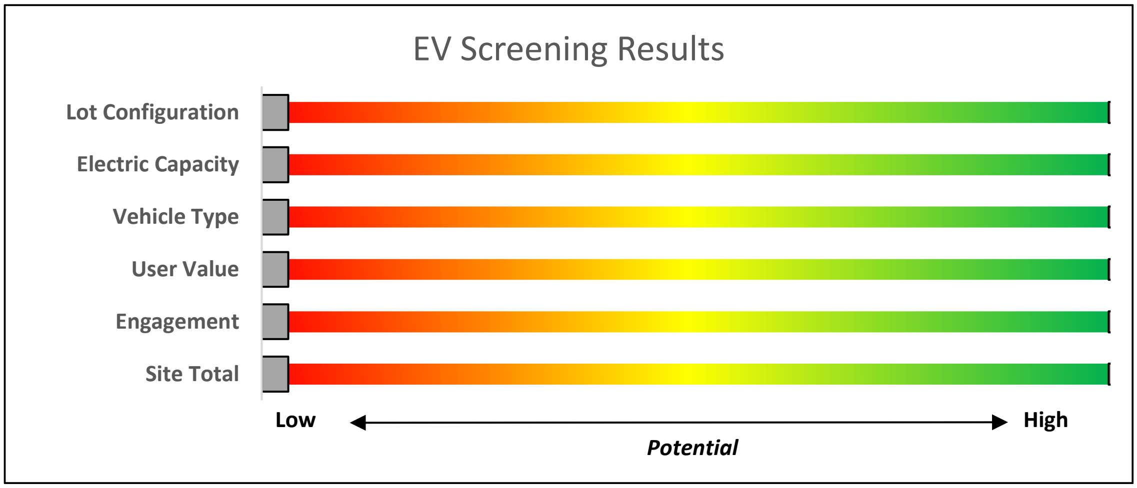



*Figure 10 – EV Charger Screening*

**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 generally a good option for medium to large sized facilities with a peak demand over 200 kW looking to implement as many measures as possible under a single project to achieve deep energy savings. Engineered Solutions has an added benefit of addressing measures that may not qualify for other programs. Many facilities pursuing an Energy Savings Improvement Program loan also use this program. Incentives for this program are based on project scope and energy savings achieved.

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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.

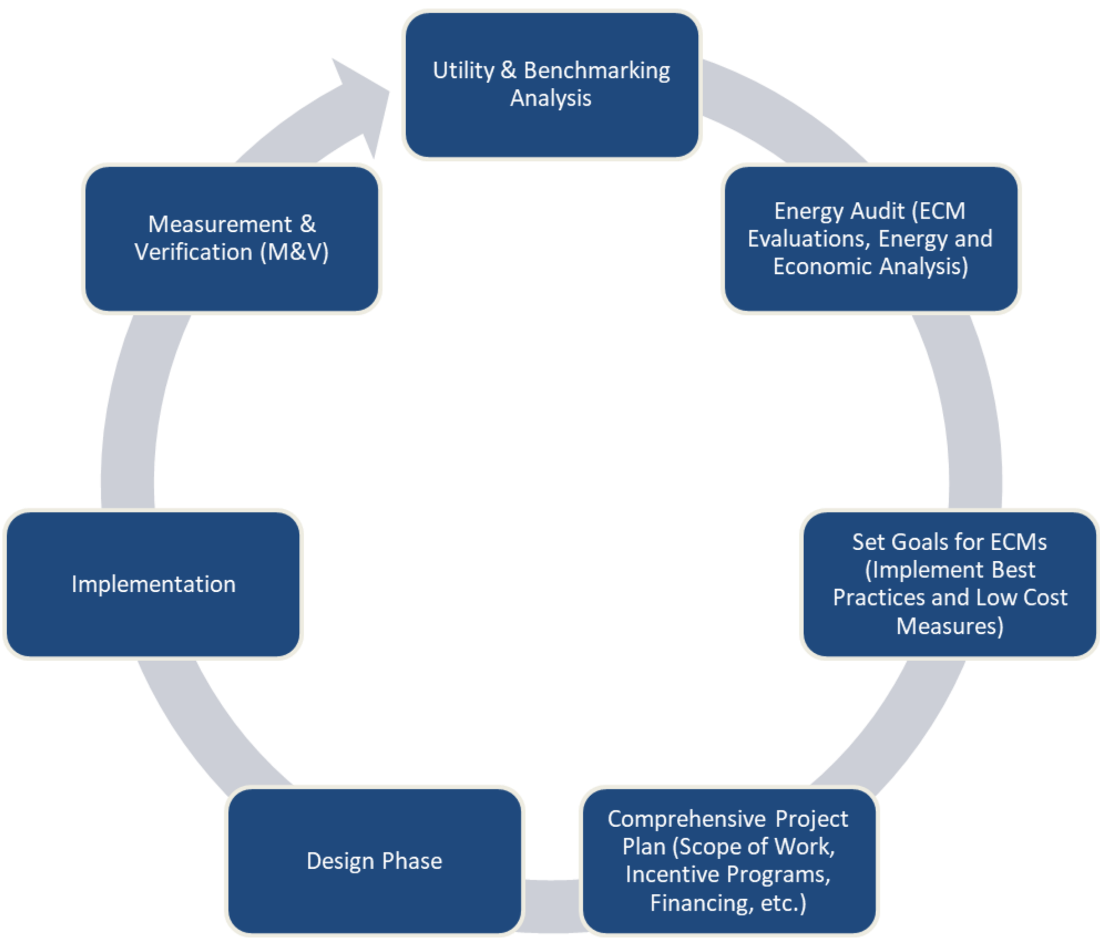


*Figure 11 – Project Development Cycle*

# 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 |
| Facilities Complex - Conference MT | 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 |
| Facilities Complex - Conference MT | 8 | LED - Fixtures: Downlight Surface Mount | Wall Switch | S | 10 | 2,380 | 4 | None | Yes | 8 | LED - Fixtures: Downlight Surface Mount | Occupancy Sensor | 10 | 1,642 | 0.0 | 65 | 0 | $9 | $270 | $35 | 27.5 |
| Facilities Complex - Conference MT | 1 | LED - Fixtures: Decorative: Other | Wall Switch | S | 20 | 2,380 | | None | No | 1 | LED - Fixtures: Decorative: Other | Wall Switch | 20 | 2,380 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Conference MT P303 | 4 | LED - Fixtures: Ambient 1x4 Fixture | Wall Switch | S | 30 | 2,380 | 4 | None | Yes | 4 | LED - Fixtures: Ambient 1x4 Fixture | Occupancy Sensor | 30 | 1,642 | 0.0 | 97 | 0 | $13 | $270 | $35 | 18.4 |
| Facilities Complex - Corridor MT A | 2 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 2 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Corridor MT A | 4 | Linear Fluorescent - T8: 2' T8 (17W) - 2L | Wall Switch | S | 33 | 2,380 | 3, 5 | Relamp | Yes | 4 | LED - Linear Tubes: (2) 2' Lamps | High/Low Control | 17 | 1,642 | 0.1 | 223 | 0 | $29 | $355 | $164 | 6.5 |
| Facilities Complex - Corridor MT A | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 5 | Relamp | Yes | 1 | LED - Linear Tubes: (2) 4' Lamps | High/Low Control | 29 | 1,642 | 0.0 | 110 | 0 | $14 | $37 | $10 | 1.8 |
| Facilities Complex - Corridor Trailer B Housekeeping | 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 |
| Facilities Complex - Corridor Trailer B Housekeeping | 3 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 5 | Relamp | Yes | 3 | LED - Linear Tubes: (2) 4' Lamps | High/Low Control | 29 | 1,642 | 0.1 | 330 | 0 | $43 | $335 | $135 | 4.6 |
| Facilities Complex - Exterior 1 | 1 | High-Pressure Sodium: (1) 400W Lamp | Photocell | | 465 | 4,380 | 1 | Fixture Replacement | No | 1 | LED - Fixtures: Outdoor Wall-Mounted Area Fixture | Photocell | 120 | 4,380 | 0.0 | 1,511 | 0 | $201 | $555 | $50 | 2.5 |
| Facilities Complex - Exterior 1 | 10 | High-Pressure Sodium: (1) 150W Lamp | Timeclock | | 188 | 4,380 | 1 | Fixture Replacement | No | 10 | LED - Fixtures: Outdoor Wall-Mounted Area Fixture | Timeclock | 45 | 4,380 | 0.0 | 6,263 | 0 | $834 | $3,458 | $500 | 3.5 |
| Facilities Complex - Exterior 1 | 3 | Metal Halide: (1) 400W Lamp | Photocell | | 458 | 4,380 | 1 | Fixture Replacement | No | 3 | LED - Fixtures: Outdoor Wall-Mounted Area Fixture | Photocell | 120 | 4,380 | 0.0 | 4,441 | 0 | $591 | $1,664 | $150 | 2.6 |
| Facilities Complex - Exterior 1 | 3 | Metal Halide: (1) 100W Lamp | Timeclock | | 128 | 4,380 | 1 | Fixture Replacement | No | 3 | LED - Fixtures: Outdoor Wall-Mounted Area Fixture | Timeclock | 30 | 4,380 | 0.0 | 1,288 | 0 | $171 | $788 | $150 | 3.7 |
| Facilities Complex - Exterior Housekeeping | 1 | LED - Fixtures: Wall Pack | Photocell | | 15 | 4,380 | | None | No | 1 | LED - Fixtures: Wall Pack | Photocell | 15 | 4,380 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Exterior MT | 2 | LED - Fixtures: Wall Pack | Photocell | | 15 | 4,380 | | None | No | 2 | LED - Fixtures: Wall Pack | Photocell | 15 | 4,380 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Kitchen Housekeeping | 3 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | S | 93 | 2,380 | 3, 4 | Relamp | Yes | 3 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,642 | 0.1 | 495 | 0 | $65 | $434 | $80 | 5.5 |
| Facilities Complex - Kitchen MT | 6 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 4 | Relamp | Yes | 6 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.2 | 660 | 0 | $87 | $489 | $95 | 4.5 |
| Facilities Complex - Locker Room Housekeeping | 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 |
| Facilities Complex - Locker Room Housekeeping | 3 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | S | 93 | 2,380 | 3, 4 | Relamp | Yes | 3 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,642 | 0.1 | 495 | 0 | $65 | $434 | $80 | 5.5 |
| Facilities Complex - Locker Room Housekeeping | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | S | 93 | 2,380 | 3 | Relamp | No | 1 | LED - Linear Tubes: (3) 4' Lamps | Wall Switch | 44 | 2,380 | 0.0 | 130 | 0 | $17 | $55 | $15 | 2.3 |
| Facilities Complex - Mechanical 2 Gas Room | 2 | Induction: (1) 20W Lamp | Wall Switch | S | 20 | 500 | | None | No | 2 | Induction: (1) 20W Lamp | Wall Switch | 20 | 500 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Mechanical 3 Chiller | 2 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 2 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Mechanical 3 Chiller | 1 | Linear Fluorescent - T5HO: 4' T5HO (54W) - 4L | Wall Switch | S | 234 | 8,760 | 3 | Relamp | No | 1 | LED - Linear Tubes: (4) 4' T5HO (25W) Lamps | Wall Switch | 102 | 8,760 | 0.1 | 1,272 | 0 | $167 | $106 | $20 | 0.5 |
| Facilities Complex - Mechanical 3 Chiller | 1 | Linear Fluorescent - T5HO: 4' T5HO (54W) - 4L | Wall Switch | S | 234 | 8,760 | 3 | Relamp | No | 1 | LED - Linear Tubes: (4) 4' T5HO (25W) Lamps | Wall Switch | 102 | 8,760 | 0.1 | 1,272 | 0 | $167 | $106 | $20 | 0.5 |
| Facilities Complex - Mechanical 3 Chiller | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 8,760 | 3 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 8,760 | 0.0 | 318 | 0 | $42 | $37 | $10 | 0.6 |

| | 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 |
| Facilities Complex - Mechanical 3 Chiller | 5 | Metal Halide: (1) 400W Lamp | Wall Switch | S | 458 | 8,760 | 3, 4 | Relamp | Yes | 5 | LED Lamps - E39: ≤125 W Lamp | Occupancy Sensor | 120 | 6,044 | 1.4 | 18,077 | -4 | $2,375 | $1,767 | $285 | 0.6 |
| Facilities Complex - Office - Housekeeping Trailer B Office A | 2 | Linear Fluorescent - EST12: 4' T12 (34W) - 2L | Wall Switch | S | 72 | 2,380 | 2, 4 | Relamp & Reballast | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.1 | 272 | 0 | $36 | $254 | $40 | 6.0 |
| Facilities Complex - Office - Housekeeping Trailer B Office B | 2 | Linear Fluorescent - EST12: 4' T12 (34W) - 2L | Wall Switch | S | 72 | 2,380 | 2, 4 | Relamp & Reballast | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.1 | 272 | 0 | $36 | $254 | $40 | 6.0 |
| Facilities Complex - Office - Housekeeping Trailer B Office C | 4 | Linear Fluorescent - EST12: 4' T12 (34W) - 2L | Wall Switch | S | 72 | 2,380 | 2, 4 | Relamp & Reballast | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.1 | 544 | 0 | $72 | $545 | $75 | 6.6 |
| Facilities Complex - Office - Housekeeping Trailer B Office D | 4 | Linear Fluorescent - EST12: 4' T12 (34W) - 2L | Wall Switch | S | 72 | 2,380 | 2, 4 | Relamp & Reballast | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.1 | 544 | 0 | $72 | $545 | $75 | 6.6 |
| Facilities Complex - Office - Housekeeping Trailer B Office E | 4 | Linear Fluorescent - EST12: 4' T12 (34W) - 2L | Wall Switch | S | 72 | 2,380 | 2, 4 | Relamp & Reballast | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.1 | 544 | 0 | $72 | $545 | $75 | 6.6 |
| Facilities Complex - Office - Enclosed Architect | 8 | LED - Fixtures: Downlight Surface Mount | Wall Switch | S | 10 | 2,380 | 4 | None | Yes | 8 | LED - Fixtures: Downlight Surface Mount | Occupancy Sensor | 10 | 1,642 | 0.0 | 65 | 0 | $9 | $270 | $35 | 27.5 |
| Facilities Complex - Office - Enclosed Housekeeping B | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 4 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.1 | 220 | 0 | $29 | $189 | $40 | 5.2 |
| Facilities Complex - Office - Enclosed Housekeeping C | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 4 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.1 | 220 | 0 | $29 | $189 | $40 | 5.2 |
| Facilities Complex - Office - Enclosed Housekeeping Office A | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 8,760 | 3, 4 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 6,044 | 0.1 | 809 | 0 | $106 | $189 | $40 | 1.4 |
| Facilities Complex - Office - Enclosed HVAC | 5 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 4 | Relamp | Yes | 5 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.2 | 550 | 0 | $72 | $453 | $85 | 5.1 |
| Facilities Complex - Office - Enclosed MT Office A | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 4 | Relamp | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.1 | 440 | 0 | $58 | $416 | $75 | 5.9 |
| Facilities Complex - Office - Enclosed MT Office B | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 4 | Relamp | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.1 | 440 | 0 | $58 | $416 | $75 | 5.9 |
| Facilities Complex - Office - Enclosed MT Office C | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 4 | Relamp | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.1 | 440 | 0 | $58 | $416 | $75 | 5.9 |
| Facilities Complex - Office - Enclosed MT Office D | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 4 | Relamp | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.1 | 440 | 0 | $58 | $416 | $75 | 5.9 |
| Facilities Complex - Office - Enclosed MT-P General | 6 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 4 | Relamp | Yes | 6 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.2 | 660 | 0 | $87 | $489 | $95 | 4.5 |
| Facilities Complex - Office - Enclosed MT P301 | 4 | LED - Fixtures: Ambient 1x4 Fixture | Wall Switch | S | 30 | 2,380 | 4 | None | Yes | 4 | LED - Fixtures: Ambient 1x4 Fixture | Occupancy Sensor | 30 | 1,642 | 0.0 | 97 | 0 | $13 | $270 | $35 | 18.4 |
| Facilities Complex - Office - Enclosed MT P302 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 4 | Relamp | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.1 | 440 | 0 | $58 | $416 | $75 | 5.9 |
| Facilities Complex - Office - Enclosed MT P305 | 4 | LED - Fixtures: Ambient 1x4 Fixture | Wall Switch | S | 30 | 2,380 | 4 | None | Yes | 4 | LED - Fixtures: Ambient 1x4 Fixture | Occupancy Sensor | 30 | 1,642 | 0.0 | 97 | 0 | $13 | $270 | $35 | 18.4 |
| Facilities Complex - Office - Enclosed MT P306 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 4 | Relamp | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.1 | 440 | 0 | $58 | $416 | $75 | 5.9 |
| Facilities Complex - Office - Enclosed MT P307 | 4 | LED - Fixtures: Ambient 1x4 Fixture | Wall Switch | S | 30 | 2,380 | 4 | None | Yes | 4 | LED - Fixtures: Ambient 1x4 Fixture | Occupancy Sensor | 30 | 1,642 | 0.0 | 97 | 0 | $13 | $270 | $35 | 18.4 |
| Facilities Complex - Office - Enclosed MT P308 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 4 | Relamp | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.1 | 440 | 0 | $58 | $416 | $75 | 5.9 |
| Facilities Complex - Office - Enclosed MT P309 | 2 | Linear Fluorescent - EST12: 4' T12 (34W) - 2L | Wall Switch | S | 72 | 2,380 | 2, 4 | Relamp & Reballast | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.1 | 272 | 0 | $36 | $254 | $40 | 6.0 |
| Facilities Complex - Office - Enclosed MT P309 | 3 | Linear Fluorescent - EST12: 4' T12 (34W) - 2L | Wall Switch | S | 72 | 2,380 | 2, 4 | Relamp & Reballast | Yes | 3 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.1 | 408 | 0 | $54 | $476 | $65 | 7.7 |
| Facilities Complex - Office - Enclosed MT P309 | 8 | Linear Fluorescent - EST12: 4' T12 (34W) - 2L | Wall Switch | S | 72 | 2,380 | 2, 4 | Relamp & Reballast | Yes | 8 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.3 | 1,089 | 0 | $143 | $820 | $115 | 4.9 |

| | Existing Conditions | | | | | | Proposed Conditions | | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Fixture Quantity | Fixture Description | Control System | Light Level | Watts per Fixture | Annual Operating Hours | ECM # | Fixture Recommendation | Add Controls? | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Estimated M&L Cost ($) | Total Incentives | Simple Payback w/ Incentives in Years |
| Facilities Complex - Office - Enclosed MT Supervisor | 4 | LED - Fixtures: Downlight Surface Mount | Wall Switch | S | 10 | 2,380 | 4 | None | Yes | 4 | LED - Fixtures: Downlight Surface Mount | Occupancy Sensor | 10 | 1,642 | 0.0 | 32 | 0 | $4 | $116 | $20 | 22.5 |
| Facilities Complex - Office - Enclosed Print Rm | 6 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 4 | Relamp | Yes | 6 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.2 | 660 | 0 | $87 | $489 | $95 | 4.5 |
| Facilities Complex - Office - Enclosed Shipping & Receiving | 5 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 4 | Relamp | Yes | 5 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.2 | 550 | 0 | $72 | $453 | $85 | 5.1 |
| Facilities Complex - Restroom - Female MT | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Wall Switch | S | 114 | 2,380 | 3 | Relamp | No | 1 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | 58 | 2,380 | 0.0 | 147 | 0 | $19 | $73 | $20 | 2.8 |
| Facilities Complex - Restroom - Male 1 | 3 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 4 | Relamp | Yes | 3 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.1 | 330 | 0 | $43 | $380 | $65 | 7.3 |
| Facilities Complex - Restroom - Male MT | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Wall Switch | S | 114 | 2,380 | 3 | Relamp | No | 1 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | 58 | 2,380 | 0.0 | 147 | 0 | $19 | $73 | $20 | 2.8 |
| Facilities Complex - Restroom - Unisex Housekeeping | 2 | U-Bend Fluorescent - EST12: U T12 (34W) - 2L | Wall Switch | S | 72 | 2,380 | 2, 4 | Relamp & Reballast | Yes | 2 | LED - Linear Tubes: (2) U-Lamp | Occupancy Sensor | 33 | 1,642 | 0.1 | 258 | 0 | $34 | $479 | $55 | 12.5 |
| Facilities Complex - Storage File Trailer A | 2 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 2 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Storage File Trailer A | 16 | Linear Fluorescent - EST12: 4' T12 (34W) - 2L | Wall Switch | S | 72 | 500 | 2, 4 | Relamp & Reballast | Yes | 16 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 345 | 0.6 | 458 | 0 | $60 | $1,640 | $160 | 24.6 |
| Facilities Complex - Storage Housekeeping | 2 | U-Bend Fluorescent - EST12: U T12 (34W) - 2L | Wall Switch | S | 72 | 500 | 2, 4 | Relamp & Reballast | Yes | 2 | LED - Linear Tubes: (2) U-Lamp | Occupancy Sensor | 33 | 345 | 0.1 | 54 | 0 | $7 | $325 | $20 | 42.9 |
| Facilities Complex - Storage Plumbing | 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 |
| Facilities Complex - Storage Plumbing | 10 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 500 | 3, 4 | Relamp | Yes | 10 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 345 | 0.3 | 231 | 0 | $30 | $635 | $100 | 17.6 |
| Facilities Complex - Storage WH Paint Rm | 4 | Linear Fluorescent - EST12: 4' T12 (34W) - 2L | Wall Switch | S | 72 | 500 | 2, 4 | Relamp & Reballast | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 345 | 0.1 | 114 | 0 | $15 | $545 | $40 | 33.6 |
| Facilities Complex - Warehouse 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 |
| Facilities Complex - Warehouse 1 | 12 | LED - Fixtures: High-Bay | Wall Switch | S | 115 | 8,760 | 4 | None | Yes | 12 | LED - Fixtures: High-Bay | Occupancy Sensor | 115 | 6,044 | 0.3 | 4,122 | -1 | $542 | $270 | $35 | 0.4 |
| Facilities Complex - Warehouse 1 | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 8,760 | 3, 4 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 6,044 | 0.1 | 809 | 0 | $106 | $189 | $40 | 1.4 |
| Facilities Complex - Warehouse 1 | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 8,760 | 3 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 8,760 | 0.0 | 318 | 0 | $42 | $37 | $10 | 0.6 |
| Facilities Complex - Warehouse 1 | 3 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Wall Switch | S | 114 | 8,760 | 3, 4 | Relamp | Yes | 3 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 6,044 | 0.2 | 2,139 | 0 | $281 | $489 | $95 | 1.4 |
| Facilities Complex - WH Office - Enclosed Repair Supervisor | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 4 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.1 | 220 | 0 | $29 | $189 | $40 | 5.2 |
| Facilities Complex - Workshop Mechanic | 8 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 4 | Relamp | Yes | 8 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.2 | 879 | 0 | $116 | $562 | $115 | 3.9 |
| Facilities Complex - Workshop Mechanic | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | S | 93 | 2,380 | 3 | Relamp | No | 1 | LED - Linear Tubes: (3) 4' Lamps | Wall Switch | 44 | 2,380 | 0.0 | 130 | 0 | $17 | $55 | $15 | 2.3 |
| Facilities Complex - Workshop Woodshop | 7 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Wall Switch | S | 114 | 2,380 | 3, 4 | Relamp | Yes | 7 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 1,642 | 0.4 | 1,356 | 0 | $178 | $781 | $175 | 3.4 |
| Facilities Complex - Mechanical 1 Boiler Room | 3 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 3 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Mechanical 1 Boiler Room | 3 | LED Lamps: (1) 125W Corn Bulb Screw-In Lamp | Wall Switch | S | 125 | 8,760 | 4 | None | Yes | 3 | LED Lamps: (1) 125W Corn Bulb Screw-In Lamp | Occupancy Sensor | 125 | 6,044 | 0.1 | 1,120 | 0 | $147 | $270 | $35 | 1.6 |
| Facilities Complex - Mechanical 1 Boiler Room | 1 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | S | 88 | 8,760 | 2 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 8,760 | 0.0 | 569 | 0 | $75 | $69 | $10 | 0.8 |

| | 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 |
| Facilities Complex - Mechanical 1 Boiler Room | 9 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 8,760 | 3, 4 | Relamp | Yes | 9 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 6,044 | 0.3 | 3,642 | -1 | $478 | $599 | $125 | 1.0 |
| Facilities Complex - Mechanical 1 Boiler Room | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 8,760 | 3 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 8,760 | 0.0 | 318 | 0 | $42 | $37 | $10 | 0.6 |
| Facilities Complex - Office - Enclosed Electrical | 4 | Compact Fluorescent: (1) 32W Biaxial Plug-In Lamp | Wall Switch | S | 32 | 2,380 | 3, 4 | Relamp | Yes | 4 | LED Lamps: GX23 (Plug-In) Lamps | Occupancy Sensor | 23 | 1,642 | 0.0 | 169 | 0 | $22 | $320 | $39 | 12.7 |
| Facilities Complex - Office - Enclosed Electrical | 2 | Incandescent: (2) 35W Screw-in Lamps | Wall Switch | S | 70 | 500 | 3, 4 | Relamp | Yes | 2 | LED Lamps: LED Lamps | Occupancy Sensor | 10 | 345 | 0.1 | 69 | 0 | $9 | $185 | $20 | 18.1 |
| Facilities Complex - Storage Electrical | 2 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 2 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Storage Electrical | 3 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | S | 29 | 2,380 | 4 | None | Yes | 3 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.0 | 71 | 0 | $9 | $270 | $0 | 29.1 |
| Facilities Complex - Storage Electrical | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | S | 29 | 2,380 | | None | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 2,380 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Storage Electrical | 30 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | S | 29 | 2,380 | 4 | None | Yes | 30 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.2 | 706 | 0 | $93 | $540 | $0 | 5.8 |
| Facilities Complex - Storage Electrical | 8 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,380 | 3, 4 | Relamp | Yes | 8 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,642 | 0.2 | 879 | 0 | $116 | $562 | $80 | 4.2 |
| Facilities Complex - Storage Lock Smith | 6 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 500 | 3, 4 | Relamp | Yes | 6 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 345 | 0.2 | 139 | 0 | $18 | $489 | $60 | 23.6 |

**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 3 Chiller | Facilities Complex | 1 | Chilled Water Pump | 75.0 | 95.0% | Yes | WEG | PES199041-5 | W | 3,000 | | No | 95.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Mechanical 3 Chiller | Facilities Complex | 1 | Chilled Water Pump | 75.0 | 95.0% | Yes | US Electrical Motors | R309A | W | 50 | | No | 95.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Mechanical 3 Chiller | Facilities Complex | 1 | Chilled Water Pump | 100.0 | 95.4% | Yes | US Electrical Motors | R3198 | W | 50 | | No | 95.4% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Mechanical 3 Chiller | Facilities Complex | 1 | Chilled Water Pump | 125.0 | 95.4% | Yes | WEG | PES199041-7 | W | 3,000 | | No | 95.4% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Mechanical 1 Boiler Room | Facilities Complex | 3 | Condensate Pump | 2.0 | 86.5% | Yes | Grundfos | A99341022P118 240003 | W | 2,745 | | No | 86.5% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Mechanical 1 Boiler Room | Facilities Complex | 2 | Condenser Water Pump | 0.5 | 70.0% | No | Elektrim Motors | 38CR-1-.50-36FK | W | 2,745 | | No | 70.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Exterior 1 | Facilities Complex | 4 | Cooling Tower Fan | 40.0 | 94.1% | No | Reliance | P32G6599A-G1 | W | 2,000 | | No | 94.1% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Exterior 2 | Facilities Complex | 7 | Exhaust Fan | 1.0 | 85.5% | No | GE Motors | 5K46MN4087 | W | 2,745 | | No | 85.5% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Exterior 2 | Facilities Complex | 4 | Exhaust Fan | 1.0 | 85.5% | No | Unknown | Unknown | W | 2,745 | | No | 85.5% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Exterior Fuel Canopy | Facilities Complex | 1 | Other | 0.3 | 65.0% | No | Unknown | Unknown | W | 200 | | No | 65.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Exterior Fuel Canopy | Facilities Complex | 1 | Other | 0.1 | 65.0% | No | Unknown | Unknown | W | 2,745 | | No | 65.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Mechanical 1 Boiler Room | Facilities Complex | 1 | Other | 0.6 | 70.0% | No | Iwaki | EWN-B11PCUR | W | 2,745 | | No | 70.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Mechanical 3 Chiller | Facilities Complex | 2 | Supply Fan | 0.3 | 65.0% | No | Unknown | Unknown | W | 8,760 | | No | 65.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Mechanical 1 Boiler Room | Facilities Complex | 1 | Supply Fan | 0.3 | 65.0% | No | Unknown | Unknown | W | 8,760 | | No | 65.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Mechanical 3 Chiller | Facilities Complex | 1 | Air Compressor | 5.0 | 87.5% | No | Leland Faraday | LFI-8050 | W | 1,000 | | No | 87.5% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Mechanical 3 Chiller | Facilities Complex | 1 | Air Compressor | 2.0 | 76.0% | No | Baldor | M3157T | W | 1,000 | | No | 76.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Warehouse | Facilities Complex | 1 | Other | 2.0 | 86.5% | No | Doerr | LR22132 | W | 100 | | No | 86.5% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Mechanical 1 | Facilities Complex | 1 | Combustion Air Fan | 15.0 | 90.2% | Yes | Cleaver Brooks | Unknown | W | 3,391 | | No | 90.2% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Mechanical 1 | Facilities Complex | 1 | Combustion Air Fan | 20.0 | 91.0% | Yes | Weg | CC029A | W | 3,391 | | No | 91.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Mechanical 1 | Facilities Complex | 1 | Combustion Air Fan | 20.0 | 91.0% | Yes | Unknown | Unknown | W | 3,391 | | No | 91.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

| | | Existing Conditions | | | | | | | | | Proposed Conditions | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | Motor Quantity | Motor Application | HP Per Motor | Full Load Efficiency | VFD Control? | Manufacturer | Model | Remaining Useful Life | Annual Operating Hours | ECM # | Install High Efficiency Motors? | Full Load Efficiency | Install VFDs? | Number of VFDs | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Estimated M&L Cost ($) | Total Incentives | Simple Payback w/ Incentives in Years |
| Facilities Complex | Facilities Complex | 14 | Supply Fan | 0.3 | 73.0% | No | Package Units | | W | 3,000 | | No | 73.0% | 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 |
| Facilities Complex | Facilities Complex | 5 | Electric Resistance Heat | | 13.65 | | 1 COP | Varied | Varied | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex | Facilities Complex | 3 | Electric Resistance Heat | | 6.82 | | 1 COP | Varied | Varied | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex | Facilities Complex | 4 | Electric Resistance Heat | | 3.41 | | 1 COP | Plex | N481031 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Exterior MT | Facilities Complex | 1 | Ductless Mini-Split HP | 1.67 | 25.50 | 12.00 | 4 COP | Mitsubishi | MXZ-2C20NAHZ | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Exterior MT | Facilities Complex | 1 | Ductless Mini-Split HP | 1.00 | 13.60 | 13.10 | 3.3 COP | Mitsubishi | MUZ-FH12NA | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Exterior MT | Facilities Complex | 1 | Ductless Mini-Split HP | 1.67 | 25.50 | 17.10 | 4 COP | Mitsubishi | MXZ-2C20NAHZ | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Exterior Trailer A | Facilities Complex | 1 | Ductless Mini-Split HP | 1.87 | 27.60 | 12.00 | 3.46 COP | Mitsubishi | MUZ-GL24NA | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Warehouse 1 | Facilities Complex | 1 | Ductless Mini-Split HP | 1.00 | 16.40 | 10.00 | 3.3 COP | Samsung | AQV12JAX | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Warehouse 1 | Facilities Complex | 1 | Ductless Mini-Split HP | 0.75 | 10.90 | 13.10 | 3.63 COP | Mitsubishi | MUZ-GL09NA | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Warehouse 1 | Facilities Complex | 1 | Ductless Mini-Split HP | 1.00 | 18.10 | 13.10 | 3.84 COP | Mitsubishi | MUZ-GL12NA | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Housekeeping Office A | Facilities Complex | 1 | Window AC | 1.00 | | 9.00 | | General Electric | Unknown | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Office - Enclosed MT-P General | Facilities Complex | 1 | Window AC | 1.50 | | 9.00 | | Unknown | Unknown | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Office - Enclosed MT-P302 | Facilities Complex | 1 | Window AC | 1.50 | | 9.00 | | Unknown | Unknown | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Office - Enclosed MT-P306 | Facilities Complex | 1 | Window AC | 1.50 | | 9.00 | | Unknown | Unknown | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Office - Enclosed MT-P308 | Facilities Complex | 1 | Window AC | 1.50 | | 8.00 | | Unknown | Unknown | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Office - Enclosed MT P309 | Facilities Complex | 1 | Packaged Terminal AC | 1.50 | | 9.00 | | General Electric | Unknown | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Mechanical 1 boiler room | Facilities Complex | 1 | Packaged Terminal AC | 1.50 | | 9.00 | | Unknown | Unknown | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Office - Enclosed Electrical | Facilities Complex | 1 | Window AC | 1.50 | | 9.00 | | Friedrich | Unknown | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Storage Lock Smith | Facilities Complex | 1 | Packaged Terminal AC | 1.50 | | 9.00 | | Fedders | B7D18E2A | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Housekeeping | Facilities Complex | 1 | Split-System | 3.00 | | 11.00 | | York | YHJD36S41S4A | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

| | | Existing Conditions | | | | | | | | | Proposed Conditions | | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | System Quantity | System Type | Cooling Capacity per Unit (Tons) | Heating Capacity per Unit (MBh) | Cooling Mode Efficiency (SEER/IEER/EER) | Heating Mode Efficiency | Manufacturer | Model | Remaining Useful Life | ECM # | Install High Efficiency System? | System Quantity | System Type | Cooling Capacity per Unit (Tons) | Heating Capacity per Unit (kBtu/hr) | Cooling Mode Efficiency (SEER/EER) | Heating Mode Efficiency | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Estimated M&L Cost ($) | Total Incentives | Simple Payback w/ Incentives in Years |
| Facilities Complex | Facilities Complex | 2 | Packaged Air-Source HP | 3.00 | 36.00 | 8.00 | 3 COP | Unknown | Unknown | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex | Facilities Complex | 1 | Package Unit | 2.50 | | 11.90 | | Lennox | KHA030S4DN2P | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

## Electric Chiller Inventory & Recommendations

| | | Existing Conditions | | | | | | Proposed Conditions | | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | Chiller Quantity | System Type | Cooling Capacity per Unit (Tons) | Manufacturer | Model | Remaining Useful Life | ECM # | Install High Efficiency Chillers? | Chiller Quantity | System Type | Constant/ Variable Speed | Cooling Capacity (Tons) | Full Load Efficiency (kW/Ton) | IPLV Efficiency (kW/Ton) | 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 |
| Facilities Complex - Mechanical 1 | Facilities Complex | 1 | Water-Cooled Centrifugal Chiller | 700.00 | York | YKGEEXP9-ETG | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Mechanical 1 | Facilities Complex | 1 | Water-Cooled Centrifugal Chiller | 910.00 | Trane | CVHF910 | 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 |
| Facilities Complex - Mechanical 1 | Facilities Complex | 1 | Forced Draft Steam Boiler | 16,738 | Cleaver Brooks | CB 700-500 | B | | No | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Mechanical 1 | Facilities Complex | 1 | Forced Draft Steam Boiler | 16,738 | Cleaver Brooks | CB 700-500-15ST | W | | No | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex - Mechanical 1 | Facilities Complex | 1 | Forced Draft Steam Boiler | 16,738 | Cleaver Brooks | CBLE 700-500 15 ST | 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 | DHW | 6 | 20 | 1.00 | 0.0 | 718 | 0 | $96 | $239 | $40 | 2.1 |

## 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 |
| Facilities Complex | Facilities Complex | 1 | Storage Tank Water Heater (≤ 50 Gal) | Bradford White | RE340T6-1NCWW | W | | No | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex | Facilities Complex | 1 | Storage Tank Water Heater (≤ 50 Gal) | Bradford White | RE230L6 | W | | No | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facilities Complex | Facilities Complex | 1 | Storage Tank Water Heater (≤ 50 Gal) | Rheem | 82V30-2 | W | | No | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

## Low-Flow Device Recommendations

| | Recommendation Inputs | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | ECM # | Device Quantity | Device Type | Existing Flow Rate (gpm) | Proposed Flow Rate (gpm) | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Estimated M&L Cost ($) | Total Incentives | Simple Payback w/ Incentives in Years |
| Facilities Complex | 7 | 1 | Faucet Aerator (Kitchen) | 2.00 | 1.50 | 0.0 | 41 | 0 | $5 | $7 | $2 | 1.0 |
| Facilities Complex | 7 | 1 | Faucet Aerator (Lavatory) | 2.50 | 0.50 | 0.0 | 164 | 0 | $22 | $7 | $4 | 0.2 |

## Plug Load Inventory

| Location | Existing Conditions | | | | | |
|---|---|---|---|---|---|---|
| | Quantity | Equipment Description | Energy Rate (W) | ENERGY STAR Qualified? | Manufacturer | Model |
| Facilities Complex | 9 | Coffee Machine | 1,575 | No | Bunn | VPR,BLK |
| Facilities Complex | 41 | Desktop | 270 | Yes | Unknown | Unknown |
| Facilities Complex | 3 | Eletric Space Heater | 1,500 | No | Unknown | Unknown |
| Facilities Complex | 3 | Fan (Portable) | 200 | No | Unknown | Unknown |
| Facilities Complex | 6 | Laptop | 75 | Yes | Unknown | Unknown |
| Facilities Complex | 20 | Microwave | 1,500 | No | Unknown | Unknown |
| Facilities Complex | 3 | Paper Shredder | 200 | No | Unknown | Unknown |
| Facilities Complex | 20 | Printer (Medium/Small) | 600 | Yes | Unknown | Unknown |
| Facilities Complex | 4 | Printer / Coier (Large) | 1,440 | Yes | Xerox | 6204 Wide Format |
| Facilities Complex | 20 | Refrigerator (Mini) | 126 | No | Unknown | Unknown |
| Facilities Complex | 7 | Refrigerator (Residential) | 572 | No | Unknown | Unknown |
| Facilities Complex | 2 | Television (Large) | 240 | Yes | Unknown | Unknown |
| Facilities Complex | 1 | Television (Medium) | 200 | Yes | Unknown | Unknown |
| Facilities Complex | 1 | Television (Small) | 130 | Yes | Unknown | Unknown |
| Facilities Complex | 2 | Toaster | 1,000 | No | Unknown | Unknown |
| Facilities Complex | 4 | Toaster Oven | 1,500 | No | Unknown | Unknown |
| Facilities Complex | 1 | Water Fountain | 115 | No | Elkay | LZWSR_1D |
| Facilities Complex | 1 | Hand Drier | 2,300 | No | Dayton | 5W831A |
| Facilities Complex | 2 | Water Cooler | 150 | No | Unknown | Unknown |
| Facilities Complex - Kitchen Housekeeping | 1 | Range/Oven | 3,000 | No | Maytag | MER5552BAS |
| Facilities Complex - Workshop | 1 | Table Saw | 1,500 | No | Delta | Unknown |

## Vending Machine Inventory & Recommendations

| Location | Existing Conditions | | Proposed Conditions | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 |
| Facilities Complex - Warehouse | 1 | Refrigerated | 8 | Yes | 0.2 | 1,612 | 0 | $215 | $230 | $50 | 0.8 |
| Facilities Complex - Warehouse | 1 | Non-Refrigerated | 8 | Yes | 0.0 | 343 | 0 | $46 | $230 | $0 | 5.0 |

## Custom (High Level) Measure Analysis

**Electric Tank Water Heater to HPWH**

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

| Existing Conditions | | | | | | Proposed Conditions | | | | Energy Impact & Financial Analysis | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Description | Area(s)/System(s) Served | SF of Area Served | Fuel Type | Input Capacity per Unit (kW) | Tank Capacity per Unit (Gal) | Description | COP | Tank Capacity per Unit (Gal) | Estimated Unit Cost | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Estimated M&L Cost ($) | Base Incentives | Enhanced Incentives | Total Incentives | Total Net Cost | Payback w/o Incentives in Years | Payback w/ Incentives in Years |
| Storage Tank Water Heater (≤50 Gal) | Facilities Complex | 2,000 | Electric | 4.5 | 40 | Heat Pump Water Heater | 2.5 | 40 | $2,070.00 | 0.00 | 2,462 | 0 | $328 | $2,070 | $0 | $0 | $0 | $2,070 | 6.31 | 6.31 |
| Storage Tank Water Heater (≤50 Gal) | Facilities Complex | 1,000 | Electric | 4.5 | 28 | Heat Pump Water Heater | 2.5 | 28 | $1,690.00 | 0.00 | 1,231 | 0 | $164 | $1,690 | $0 | $0 | $0 | $1,690 | 10.30 | 10.30 |
| | | | Electric | | | | | | | | | | | | | | | | | |

# Appendix B: ENERGY STAR Statement of Energy Performance

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

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## ENERGY STAR® Statement of Energy Performance

**N/A**

ENERGY STAR® Score[1]

### Ramapo College of New Jersey (Campus)

**Primary Property Type:** College/University
**Gross Floor Area (ft²):** 1,894,712
**Built:** 1973

**For Year Ending:** May 31, 2022
**Date Generated:** February 07, 2024

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

**Property & Contact Information**

| Property Address | Property Owner | Primary Contact |
|---|---|---|
| Ramapo College of New Jersey (Campus)<br>505 Ramapo Valley Road & 523 Route 202<br>Mahwah, New Jersey 07430<br><br>Property ID: 26333864 | Ramapo College of New Jersey<br>505 Ramapo Valley Road<br>Mahwah, NJ 07430<br>(201) 684-7666 | Mike Cunningham<br>505 Ramapo Valley Road<br>Mahwah, NJ 07430<br>(201) 684-7666<br>mcunning@ramapo.edu |

**Energy Consumption and Energy Use Intensity (EUI)**

**Site EUI**
102.1 kBtu/ft²

**Source EUI**
174.7 kBtu/ft²

| Annual Energy by Fuel | |
|---|---|
| Electric - Grid (kBtu) | 73,580,913 (38%) |
| Electric - Solar (kBtu) | 17,652,538 (9%) |
| Natural Gas (kBtu) | 102,253,203 (53%) |

| National Median Comparison | |
|---|---|
| National Median Site EUI (kBtu/ft²) | 105.6 |
| National Median Source EUI (kBtu/ft²) | 180.6 |
| % Diff from National Median Source EUI | -3% |
| **Annual Emissions** | |
| Total (Location-Based) GHG Emissions (Metric Tons CO2e/year) | 7,720 |

### Signature & Stamp of Verifying Professional

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

LP Signature: ____________________ Date: __________

**Licensed Professional**

____ ________
,
(___)___-_____
_______________

Professional Engineer or Registered Architect Stamp
(if applicable)

# APPENDIX C: GLOSSARY

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

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

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