



Local Government Energy Audit Report

Cobb House

April 2, 2024

Prepared for:

NJ DEP Monmouth Battlefield SP
275 Freehold - Englishtown Rd
Manalapan, New Jersey 07726

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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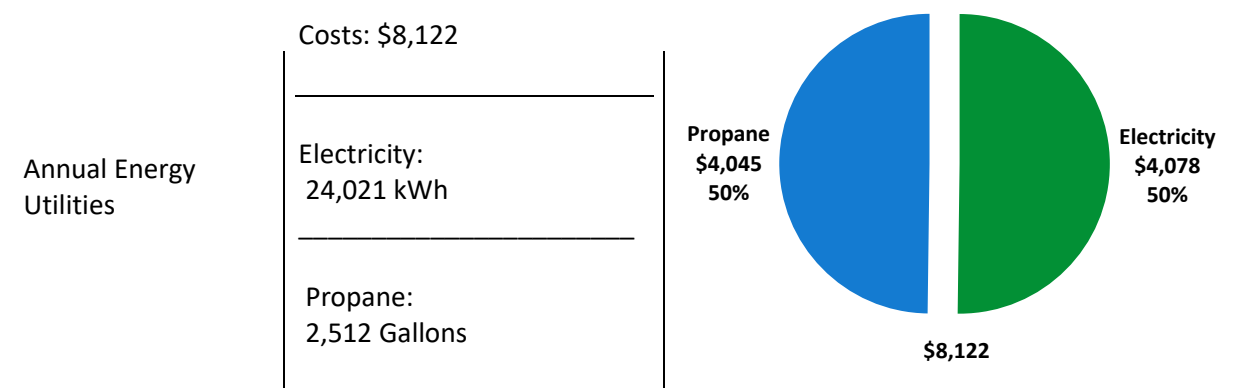


Appendix C: Glossary C-1

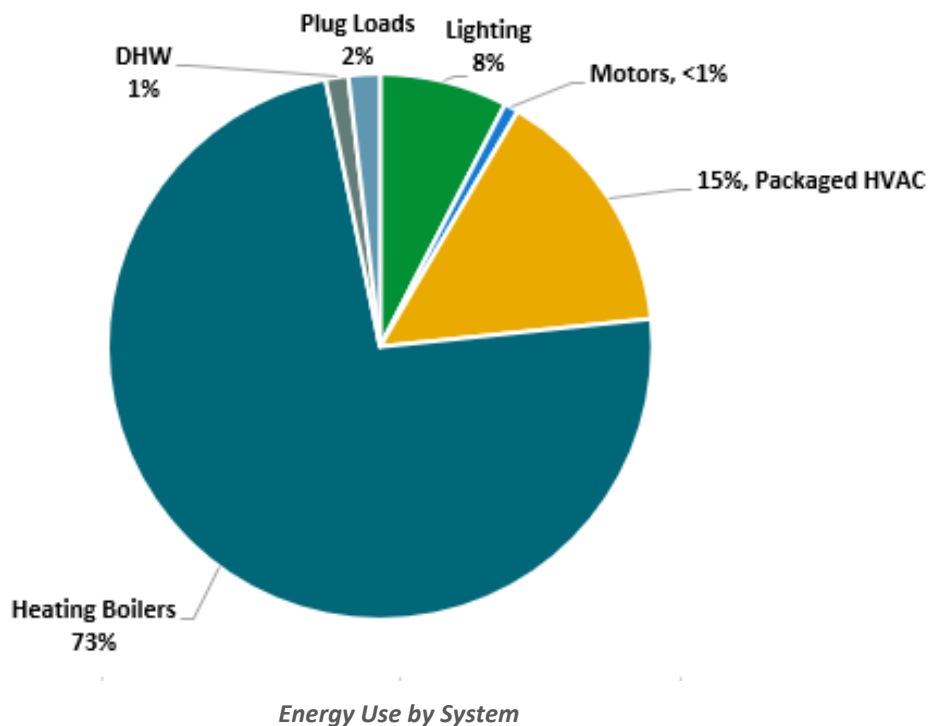
1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBP) has sponsored this Local Government Energy Audit (LGEA) report for Cobb House. 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



| | | |
|---------------------------------|-----------------------------|--|
| ENERGY STAR® Benchmarking Score | N/A <i>(1-100 scale)</i> | 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. |
|---------------------------------|-----------------------------|--|



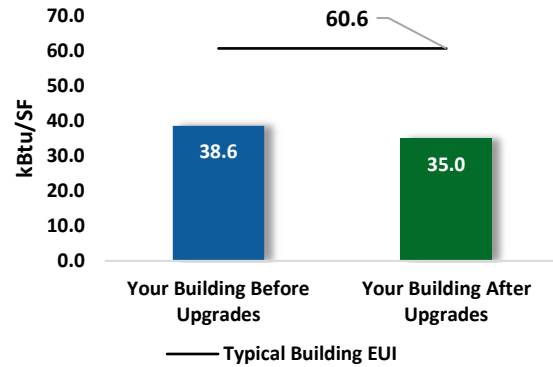
POTENTIAL IMPROVEMENTS



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.

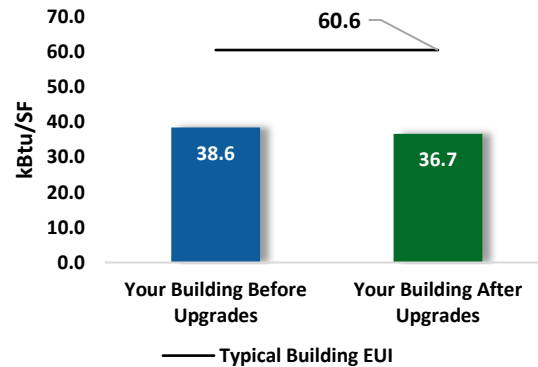
Scenario 1: Full Package (All Evaluated Measures)

| | |
|---|--|
| Installation Cost | \$15,590 |
| Potential Rebates & Incentives ¹ | \$900 |
| Annual Cost Savings | \$1,086 |
| Annual Energy Savings | Electricity: 5,192 kWh Propane: 127 Gallons |
| Greenhouse Gas Emission Savings | 3 Tons |
| Simple Payback | 13.5 Years |
| Site Energy Savings (All Utilities) | 9% |



Scenario 2: Cost Effective Package²

| | |
|-------------------------------------|--|
| Installation Cost | \$4,110 |
| Potential Rebates & Incentives | \$270 |
| Annual Cost Savings | \$803 |
| Annual Energy Savings | Electricity: 4,909 kWh Propane: -18 Gallons |
| Greenhouse Gas Emission Savings | 2 Tons |
| Simple Payback | 4.8 Years |
| Site Energy Savings (all utilities) | 5% |



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 ₂ e Emissions Reduction (lbs) |
|---|---|-----------------|-------------------------------|--------------------------|-----------------------------|---------------------------------|-------------------------|---------------------------|-----------------------------|-------------------------------|---|
| Lighting Upgrades | | | 3,932 | 1.7 | -2 | \$638 | \$1,980 | \$270 | \$1,710 | 2.7 | 3,723 |
| ECM 1 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | Yes | 1,349 | 0.7 | -1 | \$219 | \$1,240 | \$190 | \$1,050 | 4.8 | 1,277 |
| ECM 2 | Retrofit Fixtures with LED Lamps | Yes | 2,583 | 0.9 | -1 | \$419 | \$740 | \$80 | \$660 | 1.6 | 2,445 |
| Lighting Control Measures | | | 284 | 0.1 | 0 | \$46 | \$1,280 | \$230 | \$1,050 | 22.8 | 268 |
| ECM 3 | Install Occupancy Sensor Lighting Controls | No | 245 | 0.1 | 0 | \$40 | \$1,050 | \$160 | \$890 | 22.4 | 232 |
| ECM 4 | Install High/Low Lighting Controls | No | 39 | 0.0 | 0 | \$6 | \$230 | \$70 | \$160 | 25.4 | 37 |
| Gas Heating (HVAC/Process) Replacement | | | 0 | 0.0 | 13 | \$237 | \$10,200 | \$400 | \$9,800 | 41.4 | 1,906 |
| ECM 5 | Install High Efficiency Hot Water Boilers | No | 0 | 0.0 | 13 | \$237 | \$10,200 | \$400 | \$9,800 | 41.4 | 1,906 |
| Domestic Water Heating Upgrade | | | 237 | 0.0 | 0 | \$40 | \$30 | \$0 | \$30 | 0.7 | 239 |
| ECM 6 | Install Low-Flow DHW Devices | Yes | 237 | 0.0 | 0 | \$40 | \$30 | \$0 | \$30 | 0.7 | 239 |
| Custom Measures | | | 739 | 0.0 | 0 | \$125 | \$2,100 | \$0 | \$2,100 | 16.8 | 744 |
| ECM 7 | Replace Electric Water Heater with Heat Pump Water Heater | Yes | 739 | 0.0 | 0 | \$125 | \$2,100 | \$0 | \$2,100 | 16.8 | 744 |
| TOTALS (COST EFFECTIVE MEASURES) | | | 4,909 | 1.7 | -2 | \$803 | \$4,110 | \$270 | \$3,840 | 4.8 | 4,706 |
| TOTALS (ALL MEASURES) | | | 5,192 | 1.8 | 12 | \$1,086 | \$15,590 | \$900 | \$14,690 | 13.5 | 6,880 |

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

All Evaluated Energy Improvements³

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

³ TRC bases estimated material and labor costs primarily on RS Means cost manuals as well as on our experience at similar facilities. This approach is based on standard cost estimating manuals and is vendor neutral. Cost estimates include material and labor pricing associated with one for one equipment replacements. Cost estimates do not include demolition or removal of hazardous waste. The actual implementation costs for energy savings projects are anticipated to be significantly higher based on the specific conditions at your site(s). We strongly recommend that you work with your design engineer or contractor to develop actual project costs for your specific scope of work for the installation of high efficiency equipment. We encourage you to obtain multiple estimates when considering measure installations.

1.1 Planning Your Project

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

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

Pick Your Installation Approach

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

Options from Your Utility Company

Prescriptive and Custom Rebates

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

Direct Install

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

Engineered Solutions

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

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

Options from New Jersey's Clean Energy Program

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

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

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

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

Successor Solar Incentive Program (SuSI)

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

Ongoing Electric Savings with Demand Response

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

Large Energy User Program (LEUP)

LEUP is designed to promote self-investment in energy efficiency for the largest energy consumers in the state. Customers in this category spend about \$5 million a year on energy bills. This program incentivizes owners/users of buildings to upgrade or install energy conserving measures in existing buildings to help offset the capital costs associated with the project. The efficiency upgrades are customized to meet the requirements of the customers' existing facilities, while advancing the State's energy efficiency, conservation, and greenhouse gas reduction goals.

For more details on these programs please visit [New Jersey's Clean Energy Program website](#).



2 EXISTING CONDITIONS

The New Jersey Board of Public Utilities (NJBPUB) has sponsored this Local Government Energy Audit (LGEA) report for Cobb House. 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 August 30, 2023, TRC performed an energy audit at Cobb House located in Manalapan, New Jersey. TRC met with Ken Genieczko to review the facility operations and help focus our investigation on specific energy-using systems.

The Cobb House is a historical, three-story, 8,085 square foot building built in 1871. Spaces include a basement, corridors, conference room, kitchen, offices, storage rooms, and restrooms. The building is 95% heated by a propane non-condensing hot water boiler and electric resistance heat. Ninety percent (90%) of the facility is cooled by packaged air source heat pumps.



Facility Aerial View

2.2 Building Occupancy

The Cobb House is operational Monday through Friday during regular business hours. Janitorial services are performed during business hours.

| Building Name | Weekday/Weekend | Operating Schedule |
|-------------------------|-----------------|--------------------|
| Cobb House Office Hours | Weekday | 8:00 AM - 5:00 PM |
| | Weekend | N/A |

Building Occupancy Schedule

2.3 Building Envelope

The Cobb House envelope is comprised of a wood frame construction with wood siding. The facility has both a pitched shingle roof section and a flat rolled asphalt roof section.

Both the building envelope and the roof appear to be in good condition. Facility windows are operable single paned units with wood frames. The glass to frame seals are in good condition. Exterior doors consist of solid wood doors with glass windows which are in good condition.



Building Exterior

Rollled Asphalt Roof



Windows



Exterior Door

2.4 Lighting Systems

The primary interior lighting system for the Cobb House consists of a mix of LED and fluorescent sources. Lighting includes LED A19 lamps, LED B13 lamps, LED linear strips, CFL A19 lamps, incandescent A19 lamps, and both 4-foot and 8-foot linear fluorescent T12 tubes.

Additional facility lighting includes, 2-foot x 2-foot ambient LED panels, 4-foot linear fluorescent T8 tubes, and 4-foot linear fluorescent T5 tubes. Fixture types include chandeliers, socketed fixtures, recessed drop ceiling, and surface mounted linear fixtures. Wall switches control all interior lighting. Overall, the current lighting system is in good condition with adequate light levels.

Exterior lighting is provided by LED A19 lamps and a LED wall sconce. A combination of wall switch, timeclock, and photocell control the exterior lights. Exterior fixtures are in good condition.



4-Foot Linear Fluorescent T12 Tubes



Chandelier w/ LED B13 Lamps



Incandescent Bulb



2-foot x 2-foot Ambient LED Panel

2.5 Air Handling Systems

Five air source heat pumps meet a portion of the building's cooling and heating demand. The units provide 2 tons of cooling and 24 MBh of heating. The SEER and HSPF ratings are 18 and 9.5, respectively. The units are in good condition and are operating within their rated useful life.



Air Source Heat Pump

Unitary Heating Equipment

The Cobb House is equipped with four portable electric resistance heaters which serve the offices of Bill White, Brian McDowell, Jason Freeborn, and Larry Tutela. These units each supply 5.1 MBh (1.5 kW) of heat. The units are in good condition and are operating within their rated useful life.



Electric Resistance Heater

2.6 Heating Hot Water Systems

A Weil McLain propane non-condensing hot water boiler provides heat for a portion of the building. Name plate data for the boiler was unavailable and the unit capacity has been estimated using utility data.

The boiler operates at a nominal efficiency of 80% and provides an estimated 200 MBh of heating. The boiler terminates at residential radiators located throughout the building. The unit is from 2001, in good condition, and is operating beyond its rated useful life.



Non-Condensing Propane Boiler



Residential Radiator

2.8 Domestic Hot Water

A 30-gallon, 4.5 kW DHW tank serves the Cobb House. The unit appears to be in good condition, and is operating within its rated useful life.



DHW Tank

2.9 Plug Load and Vending Machines

Plug loads throughout the Cobb House include standard office equipment. Typical office loads include coffee machines, microwaves, and printers. Other plug loads include toaster ovens, electric stove top, and televisions. There are approximately seven laptops used throughout the building.

There is one residential-style refrigerator present in the building. Equipment condition and efficiency vary.

2.10 Water-Using Systems

Water is provided by Veolia, a municipal water supplier. Potable water is used for drinking, cleaning, cooking, and sanitary fixtures. No water leaks were observed/reported at the time of the audit.

EPA WaterSense® has set maximum flow rates for sanitary fixtures. They are: 1.28 gallons per flush (gpf) for toilets, 0.5 gpf for urinals, 1.5 gallons per minute (gpm) for lavatory faucets, and 2.0 gpm for showerheads. There are two restrooms with toilets and sinks. Faucet flow rates are at 1.8 gpm or lower. Toilets are rated at 2.5 gpf and urinals are rated at 2.5 gpf.

Note: Provided water billing data is campus wide, meaning individual site water consumption data is unavailable. Water consumption included in the visitor center report represents the entire Monmouth Battlefield State Park.



Kitchen Faucet

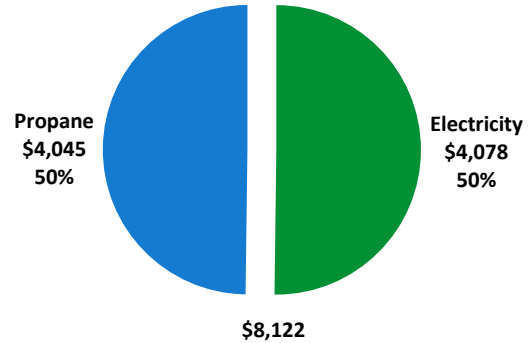


Restroom Faucet

3 ENERGY USE AND COSTS

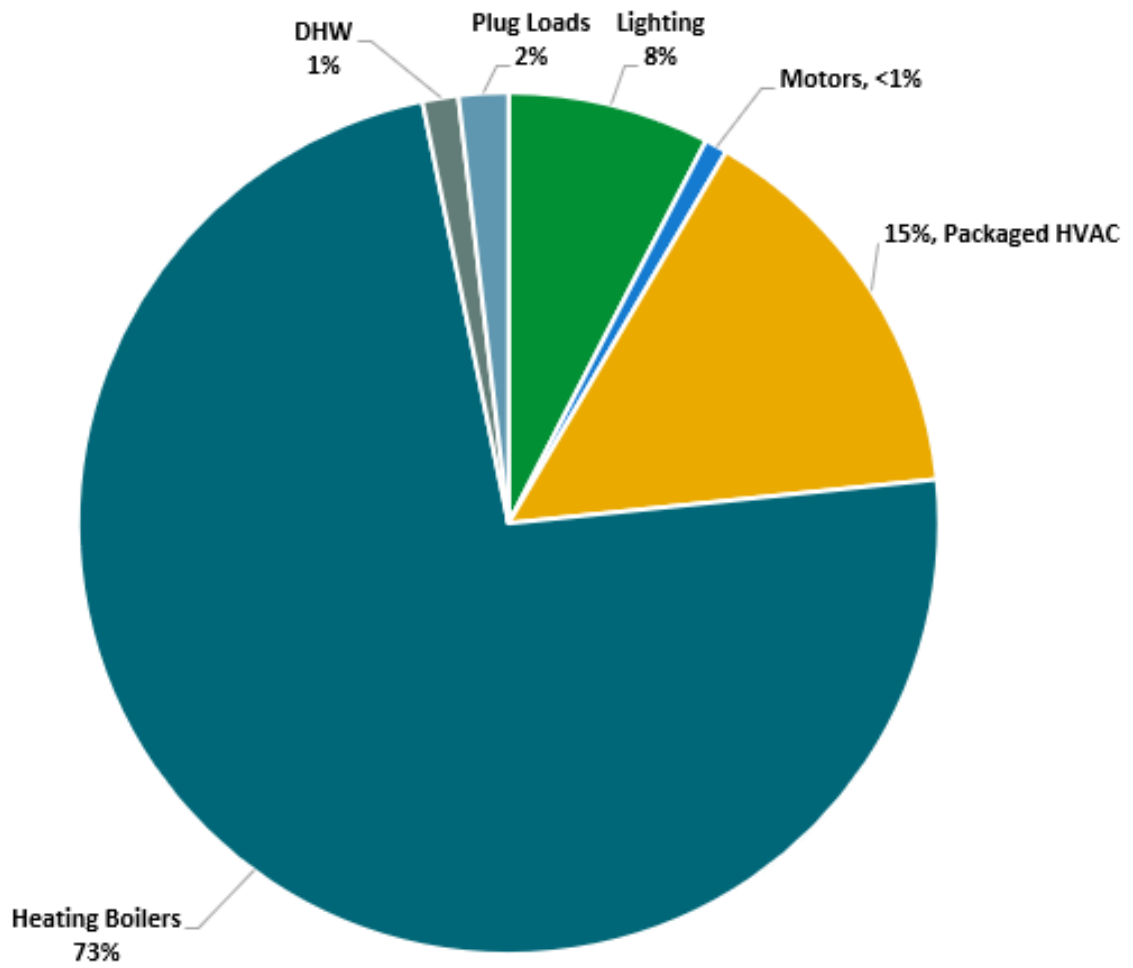
Twelve months of utility billing data are used to develop annual energy consumption and cost data. This information creates a profile of the annual energy consumption and energy costs.

| Utility Summary | | |
|-----------------|---------------|----------------|
| Fuel | Usage | Cost |
| Electricity | 24,021 kWh | \$4,078 |
| Propane | 2,512 Gallons | \$4,045 |
| Total | | \$8,122 |



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

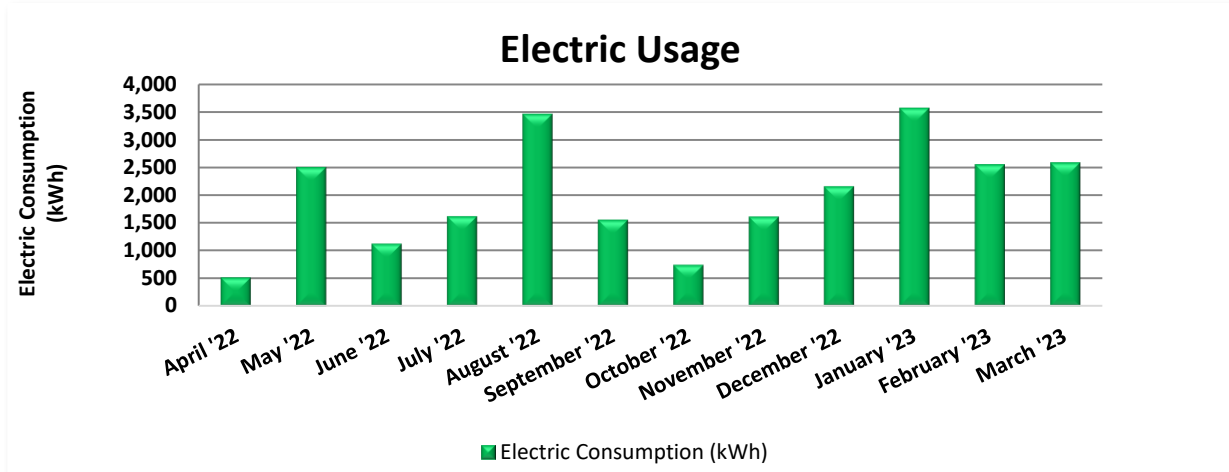
The energy auditor collects information regarding equipment operating hours, capacity, efficiency, and other operational parameters from facility staff, drawings, and on-site observations. This information is used as the inputs to calculate the existing conditions energy use for the site. The calculated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



Energy Balance by System

3.1 Electricity

JCP&L delivers electricity under rate class General Service Secondary (JC_GS1_01D), with electric production provided by Champion, a third-party supplier.



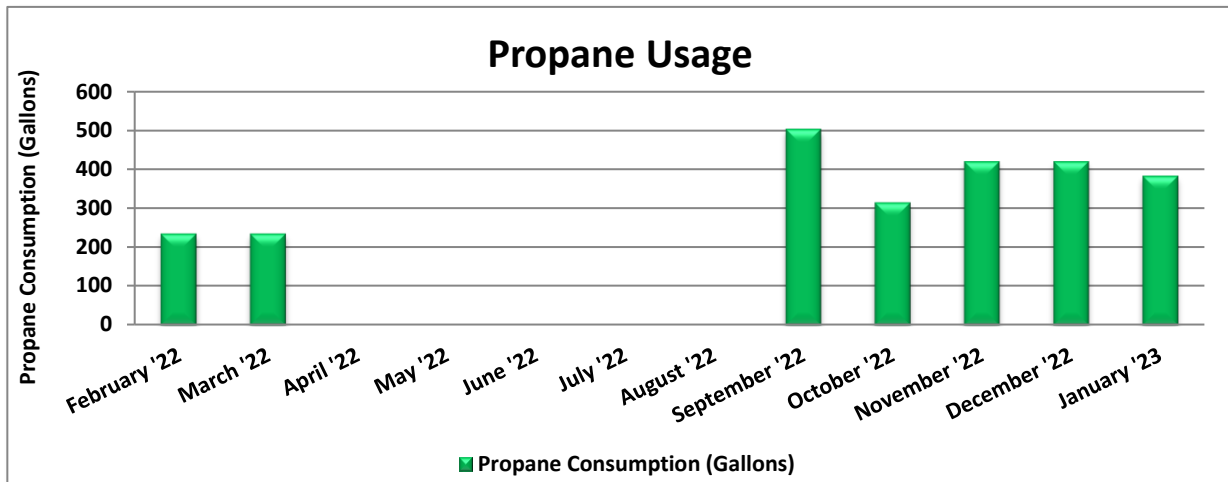
| Electric Billing Data | | | | | |
|-----------------------|----------------|----------------------|-------------|-------------|---------------------|
| Period Ending | Days in Period | Electric Usage (kWh) | Demand (kW) | Demand Cost | Total Electric Cost |
| 4/26/22 | 29 | 519 | 0 | \$0 | \$99 |
| 5/26/22 | 30 | 2,507 | 0 | \$0 | \$376 |
| 6/28/22 | 33 | 1,125 | 0 | \$0 | \$291 |
| 7/28/22 | 30 | 1,621 | 0 | \$0 | \$391 |
| 8/26/22 | 29 | 3,461 | 0 | \$0 | \$501 |
| 9/27/22 | 32 | 1,556 | 0 | \$0 | \$261 |
| 10/26/22 | 29 | 745 | 0 | \$0 | \$140 |
| 11/23/22 | 28 | 1,616 | 0 | \$0 | \$265 |
| 12/23/22 | 30 | 2,157 | 0 | \$0 | \$334 |
| 1/26/23 | 34 | 3,568 | 0 | \$0 | \$567 |
| 2/23/23 | 28 | 2,557 | 0 | \$0 | \$424 |
| 3/28/23 | 33 | 2,589 | 0 | \$0 | \$428 |
| Totals | 365 | 24,021 | 0 | \$0 | \$4,078 |
| Annual | 365 | 24,021 | 0 | \$0 | \$4,078 |

Notes:

- Peak demand was not provided with the billing data.
- The average electric cost over the past 12 months was \$0.170/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.

3.2 Propane

Suburban Propane delivers propane to the project site.



| Propane Billing Data | | | |
|----------------------|----------------|-------------------------|----------------|
| Period Ending | Days in Period | Propane Usage (Gallons) | Fuel Cost |
| 3/1/22 | 28 | 235 | \$535 |
| 4/1/22 | 31 | 235 | \$486 |
| 5/1/22 | 30 | 0 | \$0 |
| 6/1/22 | 31 | 0 | \$0 |
| 7/1/22 | 30 | 0 | \$0 |
| 8/1/22 | 31 | 0 | \$0 |
| 9/1/22 | 31 | 0 | \$0 |
| 10/1/22 | 30 | 503 | \$766 |
| 11/1/22 | 31 | 315 | \$482 |
| 12/1/22 | 30 | 420 | \$578 |
| 1/1/23 | 31 | 420 | \$624 |
| 2/1/23 | 31 | 383 | \$574 |
| Totals | 365 | 2,512 | \$4,045 |
| Annual | 365 | 2,512 | \$4,045 |

Notes:

- The average propane cost for the past 12 months is \$1.610/Gallon, which is the blended rate used throughout the analysis.
- Fuel deliveries do not necessarily correspond to periods of use; usage data is based on propane delivery which explains the infrequent consumption.

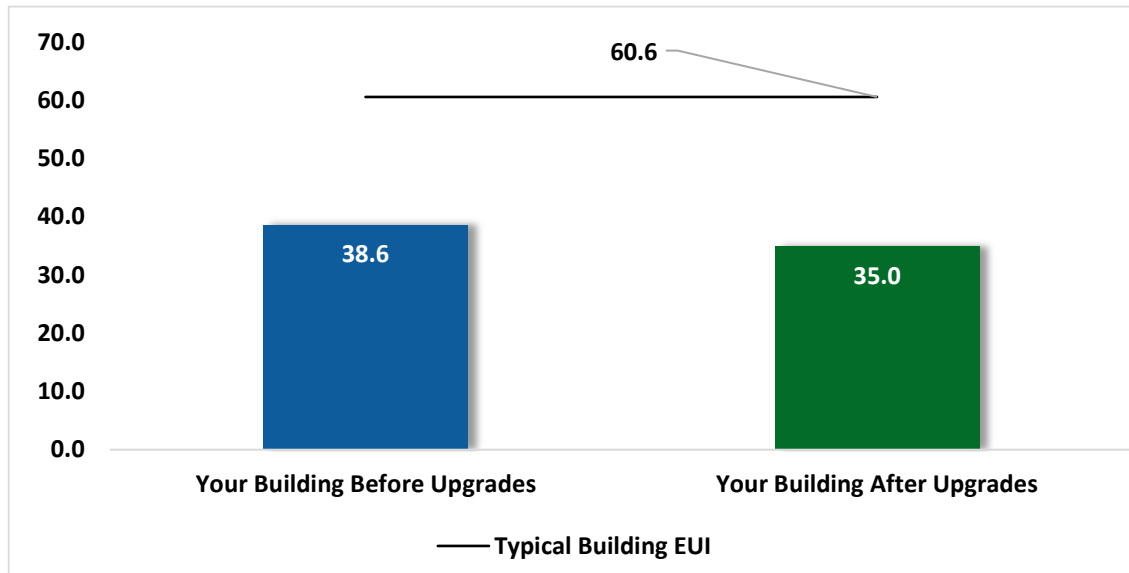
3.3 Benchmarking

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.



Energy Use Intensity Comparison⁴

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

⁴ Based on all evaluated ECMs



Tracking your Energy Performance

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

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

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

For more information on ENERGY STAR and Portfolio Manager, visit their [website](#).

3.4 Understanding Your Utility Bills

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

Sample bills, with annotation, may be viewed at:

https://www.nj.gov/rpa/docs/Understanding_Electric_Bill.pdf

https://www.nj.gov/rpa/docs/Understanding_Gas_Bill.pdf

Why Utility Bills Vary

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

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

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

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

4 ENERGY CONSERVATION MEASURES

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

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

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

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

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

| # | Energy Conservation Measure | Cost Effective? | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings (\$) | Estimated M&L Cost (\$) | Estimated Incentive (\$)* | Estimated Net M&L Cost (\$) | Simple Payback Period (yrs)** | CO ₂ e Emissions Reduction (lbs) |
|---|---|-----------------|-------------------------------|--------------------------|-----------------------------|---------------------------------|-------------------------|---------------------------|-----------------------------|-------------------------------|---|
| Lighting Upgrades | | | 3,932 | 1.7 | -2 | \$638 | \$1,980 | \$270 | \$1,710 | 2.7 | 3,723 |
| ECM 1 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | Yes | 1,349 | 0.7 | -1 | \$219 | \$1,240 | \$190 | \$1,050 | 4.8 | 1,277 |
| ECM 2 | Retrofit Fixtures with LED Lamps | Yes | 2,583 | 0.9 | -1 | \$419 | \$740 | \$80 | \$660 | 1.6 | 2,445 |
| Lighting Control Measures | | | 284 | 0.1 | 0 | \$46 | \$1,280 | \$230 | \$1,050 | 22.8 | 268 |
| ECM 3 | Install Occupancy Sensor Lighting Controls | No | 245 | 0.1 | 0 | \$40 | \$1,050 | \$160 | \$890 | 22.4 | 232 |
| ECM 4 | Install High/Low Lighting Controls | No | 39 | 0.0 | 0 | \$6 | \$230 | \$70 | \$160 | 25.4 | 37 |
| Gas Heating (HVAC/Process) Replacement | | | 0 | 0.0 | 13 | \$237 | \$10,200 | \$400 | \$9,800 | 41.4 | 1,906 |
| ECM 5 | Install High Efficiency Hot Water Boilers | No | 0 | 0.0 | 13 | \$237 | \$10,200 | \$400 | \$9,800 | 41.4 | 1,906 |
| Domestic Water Heating Upgrade | | | 237 | 0.0 | 0 | \$40 | \$30 | \$0 | \$30 | 0.7 | 239 |
| ECM 6 | Install Low-Flow DHW Devices | Yes | 237 | 0.0 | 0 | \$40 | \$30 | \$0 | \$30 | 0.7 | 239 |
| Custom Measures | | | 739 | 0.0 | 0 | \$125 | \$2,100 | \$0 | \$2,100 | 16.8 | 744 |
| ECM 7 | Replace Electric Water Heater with Heat Pump Water Heater | Yes | 739 | 0.0 | 0 | \$125 | \$2,100 | \$0 | \$2,100 | 16.8 | 744 |
| TOTALS | | | 5,192 | 1.8 | 12 | \$1,086 | \$15,590 | \$900 | \$14,690 | 13.5 | 6,880 |

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

All Evaluated ECMs

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings (\$) | Estimated M&L Cost (\$) | Estimated Incentive (\$)* | Estimated Net M&L Cost (\$) | Simple Payback Period (yrs)** | CO ₂ e Emissions Reduction (lbs) |
|---------------------------------------|---|-------------------------------|--------------------------|-----------------------------|---------------------------------|-------------------------|---------------------------|-----------------------------|-------------------------------|---|
| Lighting Upgrades | | 3,932 | 1.7 | -2 | \$638 | \$1,980 | \$270 | \$1,710 | 2.7 | 3,723 |
| ECM 1 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | 1,349 | 0.7 | -1 | \$219 | \$1,240 | \$190 | \$1,050 | 4.8 | 1,277 |
| ECM 2 | Retrofit Fixtures with LED Lamps | 2,583 | 0.9 | -1 | \$419 | \$740 | \$80 | \$660 | 1.6 | 2,445 |
| Domestic Water Heating Upgrade | | 237 | 0.0 | 0 | \$40 | \$30 | \$0 | \$30 | 0.7 | 239 |
| ECM 6 | Install Low-Flow DHW Devices | 237 | 0.0 | 0 | \$40 | \$30 | \$0 | \$30 | 0.7 | 239 |
| Custom Measures | | 739 | 0.0 | 0 | \$125 | \$2,100 | \$0 | \$2,100 | 16.8 | 744 |
| ECM 7 | Replace Electric Water Heater with Heat Pump Water Heater | 739 | 0.0 | 0 | \$125 | \$2,100 | \$0 | \$2,100 | 16.8 | 744 |
| TOTALS | | 4,909 | 1.7 | -2 | \$803 | \$4,110 | \$270 | \$3,840 | 4.8 | 4,706 |

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

Cost Effective ECMs

4.1 Lighting

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings (\$) | Estimated M&L Cost (\$) | Estimated Incentive (\$)* | Estimated Net M&L Cost (\$) | Simple Payback Period (yrs)** | CO ₂ e Emissions Reduction (lbs) |
|--------------------------|--|-------------------------------|--------------------------|-----------------------------|---------------------------------|-------------------------|---------------------------|-----------------------------|-------------------------------|---|
| Lighting Upgrades | | 3,932 | 1.7 | -2 | \$638 | \$1,980 | \$270 | \$1,710 | 2.7 | 3,723 |
| ECM 1 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | 1,349 | 0.7 | -1 | \$219 | \$1,240 | \$190 | \$1,050 | 4.8 | 1,277 |
| ECM 2 | Retrofit Fixtures with LED Lamps | 2,583 | 0.9 | -1 | \$419 | \$740 | \$80 | \$660 | 1.6 | 2,445 |

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

ECM 1: Retrofit 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: basement T12 fixtures

ECM 2: Retrofit Fixtures with LED Lamps

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

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

Affected Building Areas: basement, second-floor corridor, first-floor storage room, front foyer, kitchen restroom, second-floor book storage room, Bill White's office, Brian McDowell's office, Jason Freeborn's office, Larry Tutela's office, and second-floor restroom

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 ₂ e Emissions Reduction (lbs) |
|----------------------------------|--|-------------------------------|--------------------------|-----------------------------|---------------------------------|-------------------------|---------------------------|-----------------------------|-------------------------------|---|
| Lighting Control Measures | | 284 | 0.1 | 0 | \$46 | \$1,280 | \$230 | \$1,050 | 22.8 | 268 |
| ECM 3 | Install Occupancy Sensor Lighting Controls | 245 | 0.1 | 0 | \$40 | \$1,050 | \$160 | \$890 | 22.4 | 232 |
| ECM 4 | Install High/Low Lighting Controls | 39 | 0.0 | 0 | \$6 | \$230 | \$70 | \$160 | 25.4 | 37 |

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

ECM 3: Install Occupancy Sensor Lighting Controls

We evaluated installing 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: second-floor conference room, Bill White's office, Jason Freeborn's office, Larry Tutela's office, and second-floor restroom

ECM 4: Install High/Low Lighting Controls

We evaluated installing 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: second-floor corridor

4.3 Gas-Fired Heating

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings (\$) | Estimated M&L Cost (\$) | Estimated Incentive (\$)* | Estimated Net M&L Cost (\$) | Simple Payback Period (yrs)** | CO ₂ e Emissions Reduction (lbs) |
|-------|---|-------------------------------|--------------------------|-----------------------------|---------------------------------|-------------------------|---------------------------|-----------------------------|-------------------------------|---|
| | Gas Heating (HVAC/Process) Replacement | 0 | 0.0 | 13 | \$237 | \$10,200 | \$400 | \$9,800 | 41.4 | 1,906 |
| ECM 5 | Install High Efficiency Hot Water Boilers | 0 | 0.0 | 13 | \$237 | \$10,200 | \$400 | \$9,800 | 41.4 | 1,906 |

ECM 5: Install High Efficiency Hot Water Boilers

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

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

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

4.4 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 ₂ e Emissions Reduction (lbs) |
|---------------------------------------|------------------------------|-------------------------------|--------------------------|-----------------------------|---------------------------------|-------------------------|---------------------------|-----------------------------|-------------------------------|---|
| Domestic Water Heating Upgrade | | 237 | 0.0 | 0 | \$40 | \$30 | \$0 | \$30 | 0.7 | 239 |
| ECM 6 | Install Low-Flow DHW Devices | 237 | 0.0 | 0 | \$40 | \$30 | \$0 | \$30 | 0.7 | 239 |

ECM 6: 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 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 ₂ e Emissions Reduction (lbs) |
|------------------------|---|-------------------------------|--------------------------|-----------------------------|---------------------------------|-------------------------|---------------------------|-----------------------------|-------------------------------|---|
| Custom Measures | | 739 | 0.0 | 0 | \$125 | \$2,100 | \$0 | \$2,100 | 16.8 | 744 |
| ECM 7 | Replace Electric Water Heater with Heat Pump Water Heater | 739 | 0.0 | 0 | \$125 | \$2,100 | \$0 | \$2,100 | 16.8 | 744 |

ECM 7: Replace Electric Water Heater with Heat Pump Water Heater

Replace the existing electric water heater with a heat pump water heater (HPWH).

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

HPWH reject cold air. As such, they need to be installed in an unconditioned space of about 750 cubic feet with good ventilation. Ideal locations are garages, large enclosed, unconditioned storage areas, or areas with excess heat such as a furnace or boiler room.⁵ The HPWH will also produce condensate so accommodations for draining the condensate need to be provided.

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

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

Affected Units: basement DHW tank

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

4.6 Measures for Future Consideration

There are additional opportunities for improvement that NJ DEP Monmouth Battlefield SP 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.

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

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

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

Upgrade to a Heat Pump System

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

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

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

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

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

5 ENERGY EFFICIENT BEST PRACTICES

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

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

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

Energy Tracking with ENERGY STAR Portfolio Manager



You've heard it before—you cannot manage what you do not measure. ENERGY STAR Portfolio Manager is an online tool that you can use to measure and track energy and water consumption, as well as greenhouse gas emissions⁶. Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

Weatherization

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

Doors and Windows

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

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.

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

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.

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.

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.

Water Heater Maintenance

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

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

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

Procurement Strategies

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

6 WATER BEST PRACTICES

Getting Started



The commercial and institutional sector is the second largest consumer of publicly supplied water in the United States, accounting for 17% of the withdrawals from public water supplies⁷. In New Jersey, excluding water used for power generation, approximately 80% of total water use was attributed to potable supply during the period of 2009 to 2018. Water withdrawals for potable supply have not changed noticeably during the period from 1990 to 2018⁸.

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

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

For more information regarding water conservation or additional details regarding the practices shown below go to the EPA's WaterSense website⁹ or download a copy of EPA's "WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities"¹⁰ to get ideas for creating a water management plan and best practices for a wide range of water using systems.

Leak Detection and Repair

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

Toilets and Urinals

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

⁷ Estimated from analyzing data in: [Solley, Wayne B., et al, "Estimated Use of Water in the United States in 1995", U.S Geological Survey Circular 1200, \(1998\)](#)

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

⁹ <https://www.epa.gov/watersense>

¹⁰ <https://www.epa.gov/watersense/watersense-work-0>

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

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

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

Faucets and Showerheads

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

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

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

7 ON-SITE GENERATION

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

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

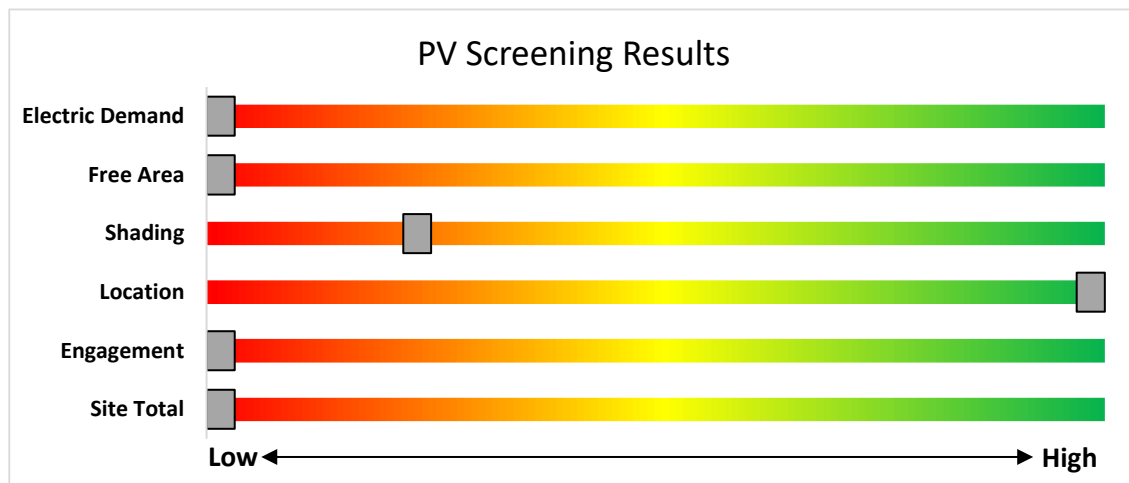
7.1 Solar Photovoltaic

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

A preliminary screening based on the facility's electric demand, size and location of free area, and shading elements shows that the facility has no potential for installing a PV array.

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

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



Photovoltaic Screening

Successor Solar Incentive Program (SuSI)

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

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

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

7.2 Combined Heat and Power

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

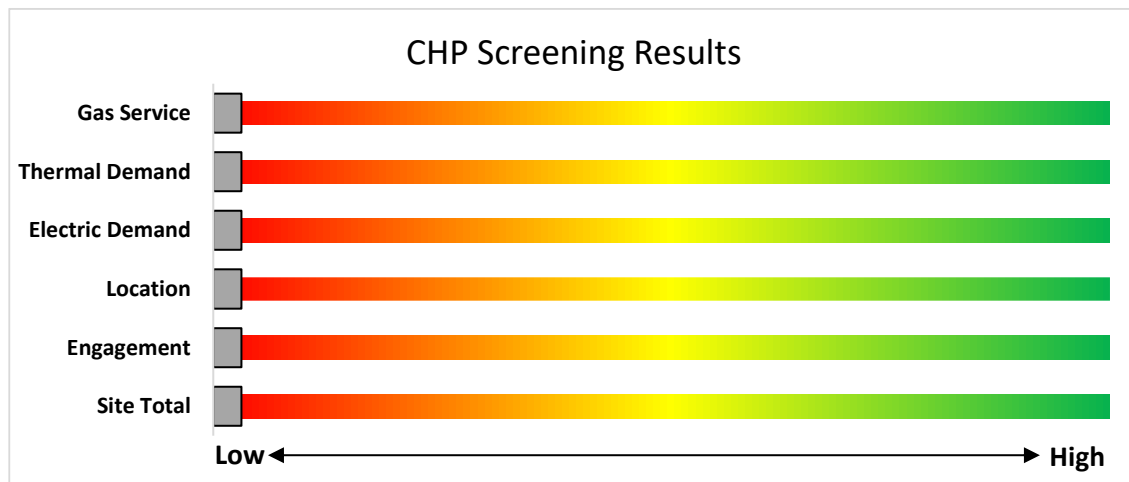
CHP systems typically produce a portion of the electric power used on-site, with the balance of electric power needs supplied by the local utility company. The heat is used to supplement (or replace) existing boilers and provide space heating and/or domestic hot water heating. Waste heat can also be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

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

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

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

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



Combined Heat and Power Screening

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

8 ELECTRIC VEHICLES

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

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

8.1 EV Charging

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

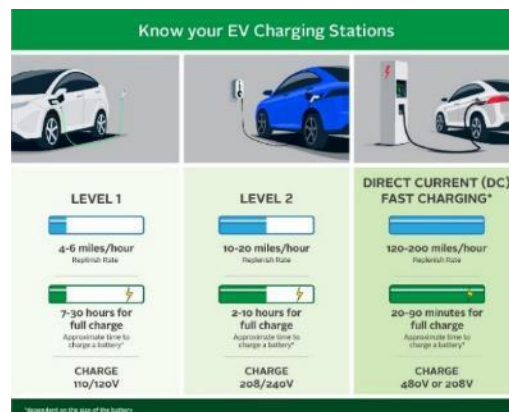
EV charging comes in three main types. For this assessment, the screening considers addition of Level 2 charging, which is most common at workplaces and other public locations. Depending on the site type and usage, other levels of charging power may be more appropriate.

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

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

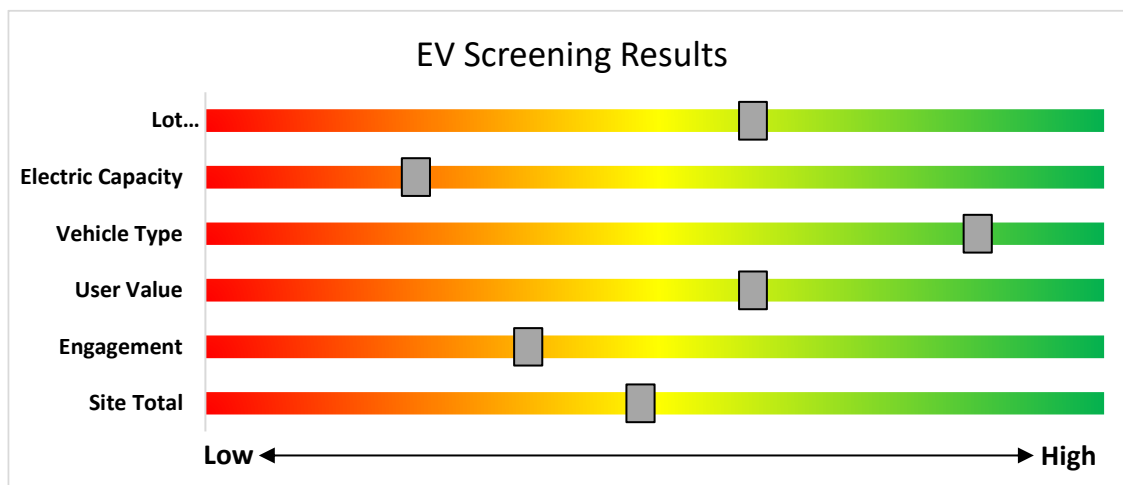
The type and size of the parking area impact the costs and feasibility of adding EV charging. Parking structure installations can be less costly than surface lot installations as power may be readily available, and equipment and wiring can be surface mounted. Parking lot installations often require trenching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

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



Other factors to consider when planning for EV charging at a facility include who the intended users are, how long they park vehicles at the site, and whether they will need to pay for the electricity they use. Adding EV charging may have a negative financial impact due to increased electric demand charges.

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



EV Charger Screening

Electric Vehicle Programs Available

New Jersey is leading the way on electric vehicle (EV) adoption on the East Coast. There are several programs designed to encourage EV adoption in New Jersey, which is crucial to reaching a 100% clean energy future.

NJCEP offers a variety of EV programs for vehicles, charging stations, and fleets. Certain EV charging stations that receive electric utility service from Atlantic City Electric Company (ACE), Public Service Electric and Gas Company (PSE&G) or Jersey Central Power and Light (JCP&L), may be eligible for additional electric vehicle charging incentives directly from the utility. Projects may be eligible for both the incentives offered by this BPU program and incentives offered by ACE, PSE&G or JCP&L, up to 90% of the combined charger purchase and installation costs. Please check ACE, PSE&G or JCP&L program eligibility requirements before purchasing EV charging equipment, as additional conditions on types of eligible chargers may apply for utility incentives.

EV Charging incentive information is available from Atlantic City Electric, PSE&G and JCP&L. For more information and to keep up to date on all EV programs please visit <https://www.njcleanenergy.com/commercial-industrial/programs/electric-vehicle-programs>.

9 PROJECT FUNDING AND INCENTIVES

Ready to improve your building's performance? New Jersey's Clean Energy Programs and Utility Energy Efficiency Programs can help. Pick the program that works best for you. This section provides an overview of currently available incentive programs in New Jersey.

NJBPU and NJCEP Administered Programs



- New Construction (residential, commercial, industrial, government)
 - Large Energy Users
 - Energy Savings Improvement Program (financing)
 - State Facilities Initiative*
 - Local Government Energy Audits
 - Combined Heat & Power & Fuel Cells
- *State facilities are also eligible for utility programs

Utility Administered Programs



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

9.1 New Jersey's Clean Energy Program

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

Large Energy Users

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

Incentives

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

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

How to Participate

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

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

Combined Heat and Power

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

Incentives¹¹

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

¹¹

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

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

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

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

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



How to Participate

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

Successor Solar Incentive Program (SuSI)

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

Administratively Determined Incentive (ADI) Program

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

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

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

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

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

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

Competitive Solar Incentive (CSI) Program

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

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

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

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

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

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

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

Energy Savings Improvement Program

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

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

How to Participate

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

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

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

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

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

Demand Response (DR) Energy Aggregator

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

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

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

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

The first step toward participation in a DR program is to contact a curtailment service provider. A list of these providers is available on the website of the independent system operator, PJM, and it includes contact information for each company, as well as the states where they have active business¹². PJM also posts training materials for program members interested in specific rules and requirements regarding DR activity along with a variety of other DR program information¹³.

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

¹² <http://www.pjm.com/markets-and-operations/demand-response.aspx>.

¹³ <http://www.pjm.com/training/training-events.aspx>.

9.2 Utility Energy Efficiency Programs

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

Prescriptive and Custom

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

Equipment Examples

Lighting

Lighting Controls

HVAC Equipment

Refrigeration

Gas Heating

Gas Cooling

Commercial Kitchen Equipment

Food Service Equipment

Variable Frequency Drives

Electronically Commutate Motors

Variable Frequency Drives

Plug Loads Controls

Washers and Dryers

Agricultural

Water Heating

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

Direct Install

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

Incentives

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

How to Participate

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

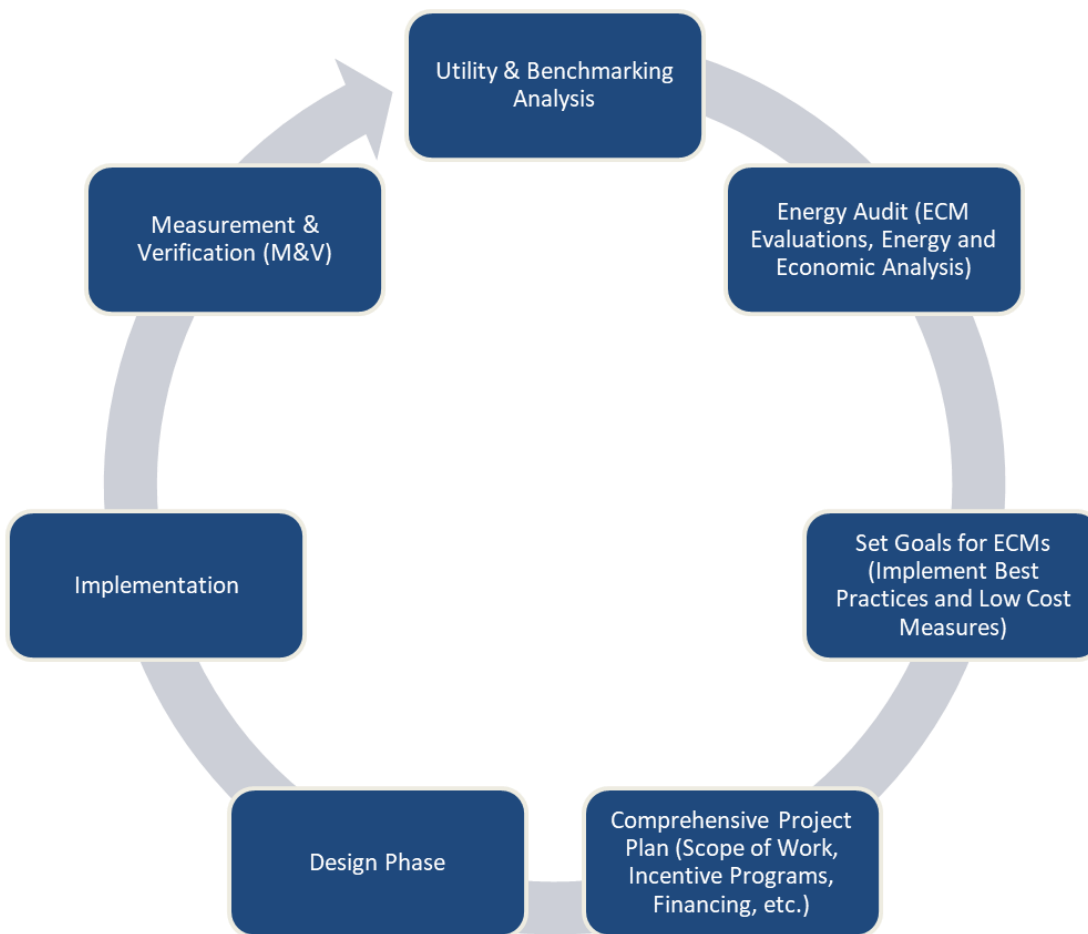
Engineered Solutions

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

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

10 PROJECT DEVELOPMENT

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



Project Development Cycle

11 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

11.1 Retail Electric Supply Options

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

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

A list of licensed third-party electric suppliers is available at the NJBPU website¹⁴.

11.2 Retail Natural Gas Supply Options

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

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

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

A list of licensed third-party natural gas suppliers is available at the NJBPU website¹⁵.

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

¹⁵ www.state.nj.us/bpu/commercial/shopping.html

APPENDIX A: EQUIPMENT INVENTORY & RECOMMENDATIONS

Lighting Inventory & Recommendations

| Location | Existing Conditions | | | | | | Proposed Conditions | | | | | | Energy Impact & Financial Analysis | | | | | | | | |
|---|---------------------|--|----------------|-------------|-------------------|------------------------|---------------------|------------------------|---------------|------------------|---------------------------------------|------------------|------------------------------------|------------------------|-----------------------|--------------------------|----------------------------|----------------------------------|-------------------------|------------------|---------------------------------------|
| | 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 |
| Alpyane Office - Cobb House | 1 | LED Lamps: (5) 7W B13 Screw-In Lamps | Wall Switch | S | 35 | 2,900 | | None | No | 1 | LED Lamps: (5) 7W B13 Screw-In Lamps | Wall Switch | 35 | 2,900 | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |
| Basement - Cobb House | 2 | Compact Fluorescent: (1) 26W A19 Screw-In Lamp | Wall Switch | S | 26 | 1,500 | 2 | Relamp | No | 2 | LED Lamps: A19 Lamps | Wall Switch | 19 | 1,500 | 0.0 | 23 | 0 | \$4 | \$40 | \$0 | 10.9 |
| Basement - Cobb House | 5 | Incandescent: (1) 60W A19 Screw-In Lamp | Wall Switch | S | 60 | 1,500 | 2 | Relamp | No | 5 | LED Lamps: A19 Lamps | Wall Switch | 9 | 1,500 | 0.2 | 413 | 0 | \$67 | \$100 | \$10 | 1.3 |
| Basement - Cobb House | 9 | Linear Fluorescent - T12: 8' T12 (75W) - 2L | Wall Switch | S | 158 | 1,500 | 1 | Relamp & Reballast | No | 9 | LED - Linear Tubes: (2) 8' Lamps | Wall Switch | 72 | 1,500 | 0.7 | 1,254 | -1 | \$203 | \$1,170 | \$180 | 4.9 |
| Basement - Cobb House | 1 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | S | 88 | 1,500 | 1 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 1,500 | 0.1 | 96 | 0 | \$16 | \$70 | \$10 | 3.9 |
| Corridor Second Floor - Cobb House | 1 | Incandescent: (1) 60W A19 Screw-In Lamp | Wall Switch | S | 60 | 2,900 | 2 | Relamp | No | 1 | LED Lamps: A19 Lamps | Wall Switch | 9 | 2,900 | 0.0 | 160 | 0 | \$26 | \$20 | \$0 | 0.8 |
| Corridor Second Floor - Cobb House | 2 | LED Lamps: (2) 10W A19 Screw-In Lamps | Wall Switch | S | 20 | 2,900 | 4 | None | Yes | 2 | LED Lamps: (2) 10W A19 Screw-In Lamps | High/Low Control | 20 | 2,001 | 0.0 | 39 | 0 | \$6 | \$230 | \$70 | 25.4 |
| Corridor to Kitchen - Cobb House | 1 | LED Lamps: (1) 10W A19 Screw-In Lamp | Wall Switch | S | 10 | 2,900 | | None | No | 1 | LED Lamps: (1) 10W A19 Screw-In Lamp | Wall Switch | 10 | 2,900 | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |
| Ed's Office - Cobb House | 1 | LED Lamps: (5) 7W B13 Screw-In Lamps | Wall Switch | S | 35 | 2,900 | | None | No | 1 | LED Lamps: (5) 7W B13 Screw-In Lamps | Wall Switch | 35 | 2,900 | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |
| Exterior Socket - Cobb House | 1 | LED Lamps: (1) 10W A19 Screw-In Lamp | Wall Switch | | 10 | 3,000 | | None | No | 1 | LED Lamps: (1) 10W A19 Screw-In Lamp | Wall Switch | 10 | 3,000 | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |
| Exterior Socket - Cobb House | 2 | LED Lamps: (2) 10W A19 Screw-In Lamps | Timedlock | | 20 | 4,380 | | None | No | 2 | LED Lamps: (2) 10W A19 Screw-In Lamps | Timedlock | 20 | 4,380 | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |
| Exterior Wall Sconce - Cobb House | 1 | LED - Fixtures: Wall Sconces | Photocell | | 15 | 4,380 | | None | No | 1 | LED - Fixtures: Wall Sconces | Photocell | 15 | 4,380 | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |
| First Floor Storage - Cobb House | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Wall Switch | S | 114 | 1,500 | 2 | Relamp | No | 1 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | 58 | 1,500 | 0.0 | 91 | 0 | \$15 | \$70 | \$20 | 3.4 |
| Front Foyer - Cobb House | 1 | Compact Fluorescent: (1) 26W A19 Screw-In Lamp | Wall Switch | S | 26 | 1,500 | 2 | Relamp | No | 1 | LED Lamps: A19 Lamps | Wall Switch | 19 | 1,500 | 0.0 | 11 | 0 | \$2 | \$20 | \$0 | 10.9 |
| Front Foyer - Cobb House | 1 | Incandescent: (1) 60W A19 Screw-In Lamp | Wall Switch | S | 60 | 1,500 | 2 | Relamp | No | 1 | LED Lamps: A19 Lamps | Wall Switch | 9 | 1,500 | 0.0 | 83 | 0 | \$13 | \$20 | \$0 | 1.5 |
| J.Adam Office - Cobb House | 1 | LED Lamps: (5) 7W B13 Screw-In Lamps | Wall Switch | S | 35 | 2,900 | | None | No | 1 | LED Lamps: (5) 7W B13 Screw-In Lamps | Wall Switch | 35 | 2,900 | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |
| Kitchen - Cobb House | 1 | LED Lamps: (2) 10W A19 Screw-In Lamps | Wall Switch | S | 20 | 2,900 | | None | No | 1 | LED Lamps: (2) 10W A19 Screw-In Lamps | Wall Switch | 20 | 2,900 | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |
| Kitchen - Cobb House | 8 | LED - Fixtures: Linear Strip | Wall Switch | S | 10 | 2,900 | | None | No | 8 | LED - Fixtures: Linear Strip | Wall Switch | 10 | 2,900 | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |
| Kitchen Restroom - Cobb House | 1 | Incandescent: (1) 60W A19 Screw-In Lamp | Wall Switch | S | 60 | 1,500 | 2 | Relamp | No | 1 | LED Lamps: A19 Lamps | Wall Switch | 9 | 1,500 | 0.0 | 83 | 0 | \$13 | \$20 | \$0 | 1.5 |
| Kitchen Restroom - Cobb House | 1 | LED Lamps: (1) 10W A19 Screw-In Lamps | Wall Switch | S | 10 | 1,500 | | None | No | 1 | LED Lamps: (1) 10W A19 Screw-In Lamps | Wall Switch | 10 | 1,500 | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |
| Nick's Office - Cobb House | 1 | LED Lamps: (1) 10W A19 Screw-In Lamp | Wall Switch | S | 10 | 2,900 | | None | No | 1 | LED Lamps: (1) 10W A19 Screw-In Lamp | Wall Switch | 10 | 2,900 | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |
| Second Floor Book Storage - Cobb House | 1 | Compact Fluorescent: (1) 26W A19 Screw-In Lamp | Wall Switch | S | 26 | 1,500 | 2 | Relamp | No | 1 | LED Lamps: A19 Lamps | Wall Switch | 19 | 1,500 | 0.0 | 11 | 0 | \$2 | \$20 | \$0 | 10.9 |
| Second Floor Conference Room - Cobb House | 3 | LED - Fixtures: Ambient 2x2 Fixture | Wall Switch | S | 32 | 1,500 | 3 | None | Yes | 3 | LED - Fixtures: Ambient 2x2 Fixture | Occupancy Sensor | 32 | 1,035 | 0.0 | 48 | 0 | \$8 | \$270 | \$40 | 29.4 |
| Second Floor Office Bill White - Cobb House | 1 | Incandescent: (5) 60W A19 Screw-In Lamps | Wall Switch | S | 300 | 2,900 | 2, 3 | Relamp | Yes | 1 | LED Lamps: A19 Lamps | Occupancy Sensor | 45 | 2,001 | 0.2 | 842 | 0 | \$137 | \$360 | \$50 | 2.3 |
| Second Floor Office Brian McDowell - Cobb House | 1 | Compact Fluorescent: (1) 26W A19 Screw-In Lamp | Wall Switch | S | 26 | 2,900 | 2 | Relamp | No | 1 | LED Lamps: A19 Lamps | Wall Switch | 19 | 2,900 | 0.0 | 22 | 0 | \$4 | \$20 | \$0 | 5.6 |

| Location | Existing Conditions | | | | | | Proposed Conditions | | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---------------------|--|----------------|-------------|-------------------|------------------------|---------------------|------------------------|---------------|------------------|---|------------------|-------------------|------------------------|------------------------------------|--------------------------|----------------------------|----------------------------------|-------------------------|------------------|---------------------------------------|
| | 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 |
| Second Floor Office Jason Freeborn - Cobb House | 2 | Linear Fluorescent - T5: 4' T5 (28W) - 4L | Wall Switch | S | 120 | 2,900 | 2, 3 | Relamp | Yes | 2 | LED - Linear Tubes: (4) 4' T5 (14.5W) Lamps | Occupancy Sensor | 60 | 2,001 | 0.1 | 492 | 0 | \$80 | \$340 | \$60 | 3.5 |
| Second Floor Office Larry Tutella - Cobb House | 1 | Compact Fluorescent: (1) 26W A19 Screw-In Lamp | Wall Switch | S | 26 | 2,900 | 2 | Relamp | No | 1 | LED Lamps: A19 Lamps | Wall Switch | 19 | 2,900 | 0.0 | 22 | 0 | \$4 | \$20 | \$0 | 5.6 |
| Second Floor Office Larry Tutella - Cobb House | 3 | Incandescent: (1) 60W A19 Screw-In Lamp | Wall Switch | S | 60 | 2,900 | 2, 3 | Relamp | Yes | 3 | LED Lamps: A19 Lamps | Occupancy Sensor | 9 | 2,001 | 0.1 | 505 | 0 | \$82 | \$330 | \$40 | 3.5 |
| Second Floor Office Larry Tutella - Cobb House | 1 | LED Lamps: (1) 10W A19 Screw-In Lamp | Wall Switch | S | 10 | 2,900 | | None | No | 1 | LED Lamps: (1) 10W A19 Screw-In Lamp | Wall Switch | 10 | 2,900 | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |
| Second Floor Restroom - Cobb House | 1 | Compact Fluorescent: (1) 26W A19 Screw-In Lamp | Wall Switch | S | 26 | 1,500 | 2 | Relamp | No | 1 | LED Lamps: A19 Lamps | Wall Switch | 19 | 1,500 | 0.0 | 11 | 0 | \$2 | \$20 | \$0 | 10.9 |
| Second Floor Restroom - Cobb House | 2 | LED Lamps: (1) 10W A19 Screw-In Lamps | Wall Switch | S | 10 | 1,500 | 3 | None | Yes | 2 | LED Lamps: (1) 10W A19 Screw-In Lamps | Occupancy Sensor | 10 | 1,035 | 0.0 | 10 | 0 | \$2 | \$120 | \$20 | 61.4 |

Motor Inventory & Recommendations

| Location | Area(s)/System(s) Served | Existing Conditions | | | | | | | | | Proposed Conditions | | | | | Energy Impact & Financial Analysis | | | | | | |
|------------------------------------|--------------------------|---------------------|-------------------|--------------|----------------------|--------------|--------------|-------|-----------------------|------------------------|---------------------|---------------------------------|----------------------|---------------|----------------|------------------------------------|--------------------------|----------------------------|----------------------------------|-------------------------|------------------|---------------------------------------|
| | | 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 |
| Kitchen - Cobb House | Kitchen Exhaust Fan | 1 | Exhaust Fan | 0.30 | 65.0% | No | | | W | 500 | | No | 65.0% | No | | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |
| Kitchen Restroom - Cobb House | Restroom Exhaust Fan | 1 | Exhaust Fan | 0.30 | 65.0% | No | | | W | 1,500 | | No | 65.0% | No | | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |
| Second Floor Restroom - Cobb House | Restroom Exhaust Fan | 1 | Exhaust Fan | 0.30 | 65.0% | No | | | W | 1,000 | | No | 65.0% | No | | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |

Packaged HVAC Inventory & Recommendations

| Location | Area(s)/System(s) Served | Existing Conditions | | | | | | | | | Proposed Conditions | | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|--------------------------|---------------------|--------------------------|----------------------------------|---------------------------------|---|-------------------------|--------------|------------|-----------------------|---------------------|---------------------------------|-----------------|-------------|----------------------------------|---------------------------------|---|-------------------------|------------------------------------|--------------------------|----------------------------|----------------------------------|-------------------------|------------------|---------------------------------------|
| | | 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 |
| Second Floor Office Bill White - Cobb House | Electric Resistance Heat | 1 | Electric Resistance Heat | | 5.10 | | 1 COP | DeLonghi | EW7507EBL | W | | No | | | | | | | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |
| Second Floor Office Brian McDowell - Cobb House | Electric Resistance Heat | 1 | Electric Resistance Heat | | 5.10 | | 1 COP | DeLonghi | EW7507EBL | W | | No | | | | | | | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |
| Second Floor Office Jason Freeborn - Cobb House | Electric Resistance Heat | 1 | Electric Resistance Heat | | 5.10 | | 1 COP | DeLonghi | EW7507EBL | W | | No | | | | | | | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |
| Second Floor Office Larry Tutella - Cobb House | Electric Resistance Heat | 1 | Electric Resistance Heat | | 5.10 | | 1 COP | DeLonghi | EW7507EBL | W | | No | | | | | | | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |
| Exterior HVAC - Cobb House | Air Source Heat Pump | 5 | Packaged Air-Source HP | 2.00 | 24.00 | 18.00 | 9.5 HSPF | Fujitsu | AOU24RLXFZ | W | | No | | | | | | | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |

Space Heating Boiler Inventory & Recommendations

| Location | Area(s)/System(s) Served | Existing Conditions | | | | | | Proposed Conditions | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|-----------------------|--------------------------|---------------------|---------------------------------|--------------------------------|--------------|-------|-----------------------|---------------------|---------------------------------|-----------------|---------------------------------|--------------------------------|--------------------|--------------------------|------------------------------------|--------------------------|----------------------------|----------------------------------|-------------------------|------------------|---------------------------------------|
| | | 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 |
| Basement - Cobb House | HHW Propane Boiler | 1 | Non-Condensing Hot Water Boiler | 200 | Weil Mclain | | B | 5 | Yes | 1 | Non-Condensing Hot Water Boiler | 200 | 85.00% | AFUE | 0.0 | 0 | 13 | \$237 | \$10,200 | \$400 | 41.4 |

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 |
| Basement - Cobb House | DHW Tank | 1 | Storage Tank Water Heater (≤ 50 Gal) | | | W | | No | | | | | | 0.0 | 0 | 0 | \$0 | \$0 | \$0 | 0.0 |

Low-Flow Device Recommendations

| | | Recommendation Inputs | | | | Energy Impact & Financial Analysis | | | | | | |
|------------------------------------|-------|-----------------------|---------------------------|--------------------------|--------------------------|------------------------------------|--------------------------|----------------------------|----------------------------------|-------------------------|------------------|---------------------------------------|
| Location | ECM # | Device Quantity | Device Type | Existing Flow Rate (gpm) | Proposed Flow Rate (gpm) | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Estimated M&L Cost (\$) | Total Incentives | Simple Payback w/ Incentives in Years |
| Kitchen - Cobb House | 6 | 1 | Faucet Aerator (Kitchen) | 1.80 | 1.50 | 0.0 | 25 | 0 | \$4 | \$10 | \$0 | 2.4 |
| Kitchen Restroom - Cobb House | 6 | 1 | Faucet Aerator (Lavatory) | 1.80 | 0.50 | 0.0 | 106 | 0 | \$18 | \$10 | \$0 | 0.6 |
| Second Floor Restroom - Cobb House | 6 | 1 | Faucet Aerator (Lavatory) | 1.80 | 0.50 | 0.0 | 106 | 0 | \$18 | \$10 | \$0 | 0.6 |

Plug Load Inventory

| | | Existing Conditions | | | | |
|------------|----------|----------------------------|-----------------|-------------------------|--------------|-------|
| Location | Quantity | Equipment Description | Energy Rate (W) | ENERGY STAR Qualified ? | Manufacturer | Model |
| Cobb House | 1 | Coffee Machine | 900 | No | | |
| Cobb House | 1 | Fan | 40 | No | | |
| Cobb House | 7 | Laptop | 45 | No | | |
| Cobb House | 1 | Microwave | 1,000 | No | | |
| Cobb House | 1 | Electric Stove Top | 1,200 | No | | |
| Cobb House | 1 | Small Fan | 10 | No | | |
| Cobb House | 1 | Speaker System | 30 | No | | |
| Cobb House | 2 | Paper Shredder | 360 | No | | |
| Cobb House | 3 | Printer (Medium/Small) | 350 | No | | |
| Cobb House | 1 | Printer/Copier (Large) | 600 | No | | |
| Cobb House | 1 | Refrigerator (Residential) | 400 | No | | |
| Cobb House | 1 | Television | 75 | No | | |
| Cobb House | 1 | Toaster | 1,000 | No | | |
| Cobb House | 1 | Toaster Oven | 1,200 | No | | |

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 or less than 30 gal.

| Existing Conditions | | | | | | Proposed Conditions | | | | Energy Impact & Financial Analysis | | | | | | | | | | |
|-------------------------------------|--------------------------|-------------------|-----------|------------------------------|------------------------------|------------------------|-----|------------------------------|---------------------|------------------------------------|--------------------------|----------------------------|----------------------------------|-------------------------|-----------------|---------------------|------------------|----------------|---------------------------------|--------------------------------|
| Description | Area(s)/System(s) Served | SF of Area Served | Fuel Type | Input Capacity per Unit (kW) | Tank Capacity per Unit (Gal) | Description | COP | Tank Capacity per Unit (Gal) | Estimated Unit Cost | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Estimated M&L Cost (\$) | Base Incentives | Enhanced Incentives | Total Incentives | Total Net Cost | Payback w/o Incentives in Years | Payback w/ Incentives in Years |
| Storage Tank Water Heater (≤50 Gal) | DHW Tank - Cobb House | 2,000 | Electric | 4.5 | 30.0 | Heat Pump Water Heater | 2.5 | 30 | \$2,091.00 | 0.00 | 739 | 0 | \$125 | \$2,100 | \$0 | \$0 | \$0 | \$2,100 | 16.80 | 16.80 |
| | | | Electric | | | | | | | | | | | | | | | | | |
| | | | Electric | | | | | | | | | | | | | | | | | |

APPENDIX B: ENERGY STAR STATEMENT OF ENERGY PERFORMANCE

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

NJCEP uses the EPA's ENERGY STAR Portfolio Manager system to generate baseline energy usage results and comparable building EUIs. Portfolio Manager is specifically designed for benchmarking energy consumption within a building. Due to the building type, NJCEP is unable to provide an ENERGY STAR Statement of Energy Performance (SEP) for this facility. However, EUI scores are still provided and allow the facility to track their progress as ECMs are implemented. Utility bills have been entered into Portfolio Manager for this facility. We encourage you to keep the utility bills updated monthly within Portfolio Manager for energy and cost savings purposes.

ENERGY STAR® Statement of Energy Performance

LEARN MORE AT energystar.gov

N/A

ENERGY STAR® Score¹

MBSP - Cobb House

Primary Property Type: Other - Public Services
 Gross Floor Area (ft²): 8,085
 Built: 1871

For Year Ending: February 28, 2023
 Date Generated: January 21, 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 MBSP - Cobb House 333 Freehold / Englishtown Road Manalapan, New Jersey 07726 | Property Owner State of New Jersey 428 East State Street Trenton, NJ 08625 (609) 940-4129 | Primary Contact New Jersey Board of Public Utilities State Energy Services 44 South Clinton Ave Trenton, NJ 08625 6096339666 BPU.EnergyServices@bpu.nj.gov | |
| Property ID: 28034805 | | | |

| Energy Consumption and Energy Use Intensity (EUI) | | | |
|---|---|--|--|
| Site EUI 38.5 kBtu/ft ² | Annual Energy by Fuel Electric - Grid (kBtu) 80,546 (26%) Propane (kBtu) 231,058 (74%) | National Median Comparison National Median Site EUI (kBtu/ft ²) 60.6 National Median Source EUI (kBtu/ft ²) 89.3 % Diff from National Median Source EUI -36% | |
| Source EUI 56.8 kBtu/ft ² | Annual Emissions Total (Location-Based) GHG Emissions (Metric Tons CO ₂ e/year) 22 | | |

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 | <i>British thermal unit</i> : 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 | <i>Combined heat and power</i> . Also referred to as cogeneration. |
| COP | <i>Coefficient of performance</i> : 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 | <i>Demand control ventilation</i> : a control strategy to limit the amount of outside air introduced to the conditioned space based on actual occupancy need. |
| US DOE | <i>United States Department of Energy</i> |
| EC Motor | <i>Electronically commutated motor</i> |
| ECM | <i>Energy conservation measure</i> |
| EER | <i>Energy efficiency ratio</i> : a measure of efficiency in terms of cooling energy provided divided by electric input. |
| EUI | <i>Energy Use Intensity</i> : 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 | <i>United States Environmental Protection Agency</i> |
| Generation | The process of generating electric power from sources of primary energy (e.g., natural gas, the sun, oil). |
| GHG | <i>Greenhouse gas</i> 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 | <i>Gallons per flush</i> |

| | |
|------------------|---|
| gpm | <i>Gallon per minute</i> |
| HID | <i>High intensity discharge</i> : high-output lighting lamps such as high-pressure sodium, metal halide, and mercury vapor. |
| hp | <i>Horsepower</i> |
| HPS | <i>High-pressure sodium</i> : a type of HID lamp. |
| HSPF | <i>Heating seasonal performance factor</i> : a measure of efficiency typically applied to heat pumps. Heating energy provided divided by seasonal energy input. |
| HVAC | <i>Heating, ventilating, and air conditioning</i> |
| IHP 2014 | US DOE Integral Horsepower rule. The current ruling regarding required electric motor efficiency. |
| IPLV | <i>Integrated part load value</i> : a measure of the part load efficiency usually applied to chillers. |
| kBtu | One thousand British thermal units |
| kW | <i>Kilowatt</i> : equal to 1,000 Watts. |
| kWh | <i>Kilowatt-hour</i> : 1,000 Watts of power expended over one hour. |
| LED | <i>Light emitting diode</i> : a high-efficiency source of light with a long lamp life. |
| LGEA | <i>Local Government Energy Audit</i> |
| Load | The total power a building or system is using at any given time. |
| Measure | A single activity, or installation of a single type of equipment, that is implemented in a building system to reduce total energy consumption. |
| MH | <i>Metal halide</i> : a type of HID lamp. |
| MBh | <i>Thousand Btu per hour</i> |
| MBtu | <i>One thousand British thermal units</i> |
| MMBtu | <i>One million British thermal units</i> |
| MV | <i>Mercury Vapor</i> : a type of HID lamp. |
| NJBPU | <i>New Jersey Board of Public Utilities</i> |
| NJCEP | <i>New Jersey's Clean Energy Program</i> : 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 | <i>Photovoltaic</i> : refers to an electronic device capable of converting incident light directly into electricity (direct current). |

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| SEER | <i>Seasonal energy efficiency ratio</i> : a measure of efficiency in terms of annual cooling energy provided divided by total electric input. |
| SEP | <i>Statement of energy performance</i> : 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) | <i>Solar renewable energy credit</i> : 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 | <i>Variable air volume</i> |
| VFD | <i>Variable frequency drive</i> : 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. |