
# Local Government Energy Audit Report

## Board Office

## March 12, 2019

*Prepared for:*

Newton Board of Education
57 Trinity Street
Newton, NJ 07860

*Prepared by:*

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# Disclaimer

The goal of this audit report is to identify potential energy efficiency opportunities, help prioritize specific measures for implementation, and provide information about financial incentives that may be available. 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 Energy Services (TRC) reviewed the energy conservation measures and estimates of energy savings were reviewed 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 installation costs on our experience at similar facilities, pricing from local contractors and vendors, and/or cost estimates from RS Means. We encourage the owner of the facility is encouraged to independently confirm these cost estimates and to obtain multiple estimates when considering measure installations. Actual installation costs can vary widely based on individual measures and conditions. TRC and NJBPU do not guarantee installed cost estimates and shall in no event be held liable should actual installed costs vary from estimates.

The New Jersey Clean Energy Program (NJCEP) incentive values provided in this report are estimates based on program information available at the time of the report. Incentive levels are not guaranteed. The NJBPU reserves the right to extend, modify, or terminate programs without prior notice. Please review all available 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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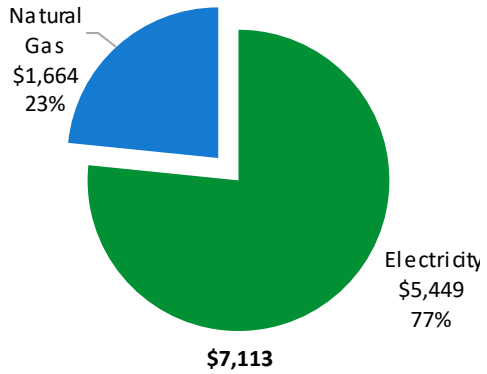
# 1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for the Newton Board Office. 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 Energy Services (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 help protect our environment by reducing statewide energy consumption.

## BUILDING PERFORMANCE REPORT

| | | |
|---|---|---|
| Annual Utilities | Costs: $7,113<br>Electricity:<br>40,512 kWh<br>Natural Gas:<br>1,711 Therms |  |
| ENERGY STAR® Benchmarking Score | 45<br>*(1-100 scale)* | This building performs at or below the national average. This report contains suggestions about how to improve building performance and reduce energy costs. |

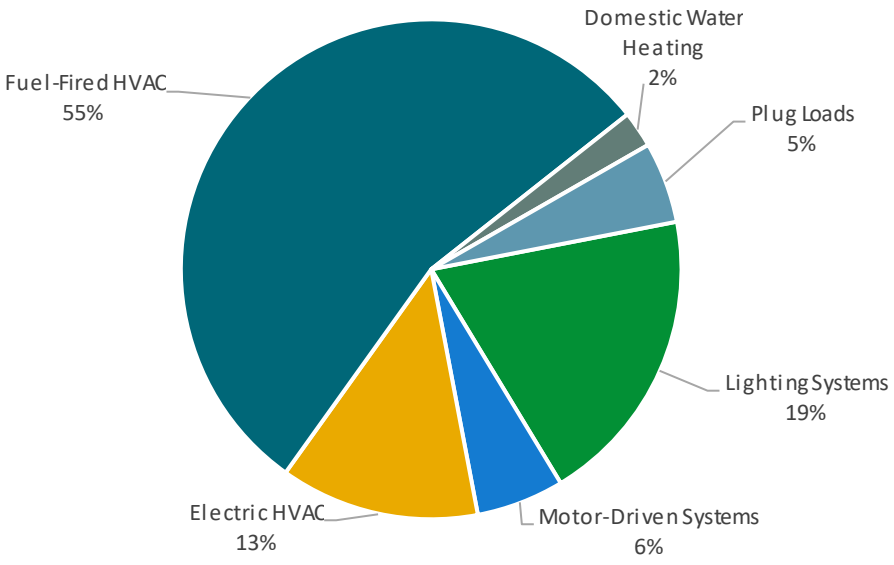


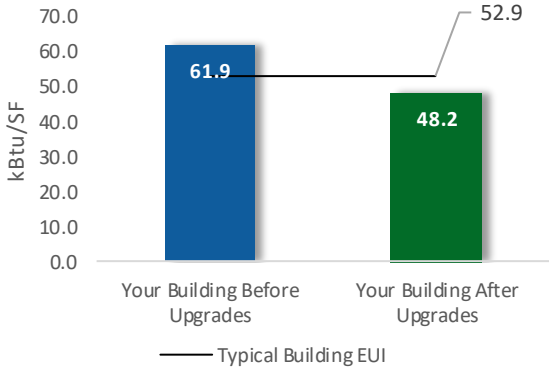

*Figure 1 - Energy Use by System*

## POTENTIAL IMPROVEMENTS

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

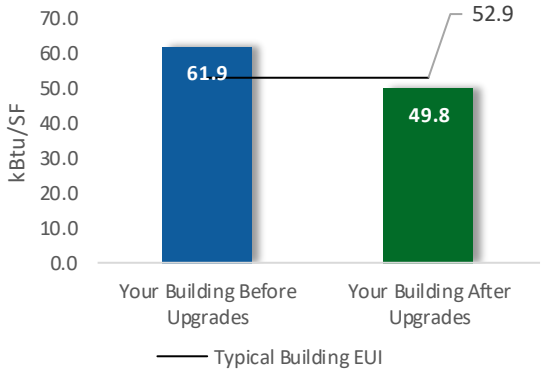
### Scenario 1: Full Package (all evaluated measures)

| | |
|---|---|
| Installation Cost | $13,016 |
| Potential Rebates & Incentives[1] | $2,251 |
| Annual Cost Savings | $1,888 |
| Annual Energy Savings | Electricity: 12,097 kWh<br>Natural Gas: 269 Therms |
| Greenhouse Gas Emission Savings | 8 Tons |
| Simple Payback | 5.7 Years |
| Site Energy Savings (all utilities) | 22% |




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

| | |
|---|---|
| Installation Cost | $11,175 |
| Potential Rebates & Incentives | $2,251 |
| Annual Cost Savings | $1,812 |
| Annual Energy Savings | Electricity: 12,097 kWh<br>Natural Gas: 191 Therms |
| Greenhouse Gas Emission Savings | 7 Tons |
| Simple Payback | 4.9 Years |
| Site Energy Savings (all utilities) | 20% |




### On-site Generation Potential

| | |
|---|---|
| Photovoltaic | None |
| Combined Heat and Power | None |

[1] Incentives are based on current SmartStart Prescriptive incentives. Other program incentives 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 | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Lifetime Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($)* | Estimated Net Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | **9,504** | **4.5** | **-2** | **$1,260** | **$18,905** | **$7,937** | **$1,666** | **$6,271** | **5.0** | **9,353** |
| ECM 1 | Install LED Fixtures | 626 | 0.1 | 0 | $84 | $1,264 | $966 | $100 | $866 | 10.3 | 631 |
| ECM 2 | Retrofit Fixtures with LED Lamps | 8,878 | 4.4 | -2 | $1,176 | $17,641 | $6,971 | $1,566 | $5,405 | 4.6 | 8,722 |
| **Lighting Control Measures** | | **1,867** | **0.9** | **0** | **$247** | **$1,979** | **$2,946** | **$585** | **$2,361** | **9.5** | **1,834** |
| ECM 3 | Install Occupancy Sensor Lighting Controls | 1,663 | 0.8 | 0 | $220 | $1,763 | $2,546 | $315 | $2,231 | 10.1 | 1,634 |
| ECM 4 | Install High/Low Lighting Controls | 204 | 0.1 | 0 | $27 | $216 | $400 | $270 | $130 | 4.8 | 200 |
| **Gas Heating (HVAC/Process) Replacement** | | **0** | **0.0** | **8** | **$76** | **$1,140** | **$1,841** | **$0** | **$1,841** | **24.2** | **915** |
| | Install High Efficiency Unit Heaters | 0 | 0.0 | 8 | $76 | $1,140 | $1,841 | $0 | $1,841 | 24.2 | 915 |
| **HVAC System Improvements** | | **0** | **0.0** | **21** | **$207** | **$2,278** | **$264** | **$0** | **$264** | **1.3** | **2,494** |
| ECM 5 | Install Pipe Insulation | 0 | 0.0 | 21 | $207 | $2,278 | $264 | $0 | $264 | 1.3 | 2,494 |
| **Domestic Water Heating Upgrade** | | **726** | **0.0** | **0** | **$98** | **$977** | **$29** | **$0** | **$29** | **0.3** | **731** |
| ECM 6 | Install Low-Flow DHW Devices | 726 | 0.0 | 0 | $98 | $977 | $29 | $0 | $29 | 0.3 | 731 |
| **TOTALS** | | **12,097** | **5.4** | **27** | **$1,888** | **$25,279** | **$13,016** | **$2,251** | **$10,765** | **5.7** | **15,328** |

* - All incentives presented in this table are based on NJ SmartStart equipment incentives and assume proposed equipment meets minimum performance criteria for that pro
** - Simple Payback Period is based on net measure costs (i.e. after incentives).

*Figure 2 – Evaluated Energy Improvements*

## 1.1 Planning Your Project

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

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

### Pick Your Installation Approach

New Jersey 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.

The potential ECMs identified for this building likely qualify for multiple incentive and funding programs. Based on current program rules and requirements, your measures are likely to qualify for the following programs:

| Energy Conservation Measure | | SmartStart | Direct Install | Pay For Performance |
|---|---|---|---|---|
| ECM 1 | Install LED Fixtures | X | X | |
| ECM 2 | Retrofit Fixtures with LED Lamps | X | X | |
| ECM 3 | Install Occupancy Sensor Lighting Controls | X | X | |
| ECM 4 | Install High/Low Lighting Controls | X | X | |
| ECM 5 | Install Pipe Insulation | | X | |
| ECM 6 | Install Low-Flow Domestic Hot Water Devices | | X | |

*Figure 3 – Funding Options*

## New Jersey Clean Energy Programs At-A-Glance

| | **SmartStart**<br>Flexibility to install at your own pace | **Direct Install**<br>Turnkey installation | **Pay for Performance**<br>Whole building upgrades |
|---|---|---|---|
| **Who should use it?** | Buildings installing individual measures or small group of measures. | Small to mid-size facilities that can bundle multiple measures together.<br>Peak demand should be below 200 kW.<br>Not suitable for significant building shell issues. | Mid to large size facilities looking to implement as many measures as possible at one time.<br>Peak demand should be over 200 kW. |
| **How does it work?** | Use in-house staff or your preferred contractor. | Pre-approved contractors pass savings along to you via reduced material and labor costs. | Whole-building approach to energy upgrades designed to reduce energy use by at least 15%. The more you save, the higher the incentives. |
| **What are the Incentives?** | Fixed incentives for specific energy efficiency measures. | Incentives pay up to 70% of eligible costs, up to $125,000 per project.<br>You pay the remaining 30% directly to the contractor. | Up to 25% of installation cost, calculated based on level of energy savings per square foot. |
| **How do I participate?** | Submit an application for the specific equipment to be installed. | Contact a participating contractor in your region. | Contact a pre-qualified Partner to develop your Energy Reduction Plan and set your energy savings targets. |

Take the next step by visiting **www.njcleanenergy.com** for program details, applications, and to contact a qualified contractor.

### *Individual Measures with SmartStart*

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 SmartStart 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 is required for some SmartStart incentives, so only after receiving pre-approval should you proceed with ECM installation.

### *Turnkey Installation with Direct Install*

The Direct Install program provides turnkey installation of multiple measures through an authorized network of participating contractors. This program can provide substantially higher incentives than SmartStart, up to 70% of the cost of selected measures. Direct Install contractors will assess and verify individual measure eligibility, and, in most cases, they perform the installation work. The Direct Install program is available to sites with an average peak demand of less than 200 kW.

### *Whole Building Approach with Pay for Performance*

Pay for Performance can be a good option for medium to large sized facilities to achieve deep energy savings. Pay for Performance 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. Many facilities pursuing an Energy Savings Improvement Program (ESIP) loan also use this program. Pay for Performance works for larger customers with a peak demand over 200 kW. The minimum installed scope of work must include at least two unique measures resulting in at least 15% energy savings, where lighting cannot make up the majority of the savings.

## More Options from Around the State

### *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 & Power (CHP)*

The CHP program provides incentives for combined heat and power (aka 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.

### *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 their 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.

# 2 EXISTING CONDITIONS

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for the Newton Board Office. 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. This report also contains valuable information on financial incentives from New Jersey's Clean Energy Program (NJCEP) for implementing ECMs.

TRC Energy Services (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 November 6, 2018, TRC performed an energy audit at the Newton Board Office located in Newton, NJ. TRC met with Joseph Vankirk to review the facility operations and help focus our investigation on specific energy-using systems.

The Newton Board Office is a two-story, 5,000 square foot building built in 1974. Spaces include: offices, break room, kitchen, conference rooms, restrooms, corridors and a basement mechanical space.

During the site audit we noticed uninsulated heating hot water pipes. This accounts for heat loss. The piping would require 2-inch-thick pipe insulation.

## 2.2 Building Occupancy

The facility is occupied year-round by staff during normal business hours. Typical weekday occupancy is eight staff people. There are no weekend activities.

| Building Name | Weekday/Weekend | Operating Schedule |
|---|---|---|
| Board Office | Weekday | 8:00 AM - 4:00 PM |
| | Weekend | Closed |

*Figure 4 - Building Occupancy Schedule*

## 2.3 Building Envelope

Building walls are made of bricks over structural steel. The roof is made of asphalt shingles in a curved barrel structure. The roof encloses conditioned space.

Front side of the windows are double pane glazed and have wood frames with a thermal break, whereas back side of windows are original single pane inefficient windows with no thermal insulation. The glass-to-frame seals are in fair condition. Operable window weather seals are in good condition, showing little evidence of excessive wear. Exterior doors have aluminum and wood frames and are in good condition with undamaged door seals.

Windows typically occupy about 15% to 20% of the surface area of the walls. Single pane windows can significantly add to heating and cooling costs (15% to 25% per the US DOE). Single pane windows are responsible for the loss of more heat per square foot of area in winter and gain more heat in summer than any other surface of a building envelope. TRC observed that most of the windows at Newton High School are inefficient single pane windows. Replacing these with double pane low e-glass windows can have a significant impact on your heating and cooling energy costs.

Double paned windows have two sheets of glass in a window frame instead of just one in a single pane. Between the glass panes is a small space filled with insulating gas to provide additional insulation. Double-paned windows are often as much as 40%-50% more efficient than traditional single-pane windows.

*Image 1 Building Exterior*

*Image 2 Building Roof*

*Image 3 Building Rooftop*

*Image 4 Exterior Door*

## 2.4 Lighting Systems

The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps and 32-Watt U-bend fluorescent T8 lamps. Additionally, there are some incandescent and LED general purpose lamps. Typically, T8 fluorescent lamps use electronic ballasts.

Fixture types include 2, 3, and 4-lamp, 4 and 8-foot long linear fixtures and 2-foot fixtures with U-bend tube lamps.

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

*Image 5 Mech Room Lighting*

*Image 6 Conference Room Lighting*

*Image 7 8 ft long T8 Fixtures*

*Image 8 Conference Room Lighting*

Lighting fixtures in offices are controlled by occupancy sensors and the remainder fixtures are controlled by wall switches.

*Image 9 Exterior Lighting*

*Image 10 LED Exterior Fixture*

*Image 11 Exterior Fixture Mount*

*Image 12 HPS Fixture*

Exterior fixtures include wall packs with 150-Watt high pressure sodium lamps and 26-Watt LED wall mounted area fixtures. Exterior fixtures are controlled by a time clock or photocell, depending on the fixture.

## 2.5 Air Handling Systems

**Packaged Units**

Basement offices and the conference room are served by a 5-ton 11.20 EER Lennox packaged air conditioning (AC) unit, controlled by room thermostats.

*Image 13 Packaged AC*

*Image 14 Split system AC*


*Image 15 Packaged AC Nameplate*


*Image 16 Split system AC Nameplate*

Refer to Appendix A for detailed information about each unit.

## Air Conditioners

The main conference room is served by a Lennox split system air conditioning (AC) unit with a cooling capacity of 7.5 tons and efficiency of 11.20 EER. The unit is in good condition. A 12,000 Btu General Electric window AC unit with an efficiency rating of 10.80 EER serves the facility office.

The offices are heated by Markel wall-mounted electric unit heaters and a TPI ceiling mounted electric unit heater.

*Image 17 Unit Heater in Basement*

*Image 18 Electric Heater in Facility Office*

*Image 19 Window AC in Facility Office*

*Image 20 Wall Mounted Heater*

## 2.6 Heating Hot Water Systems

One Slant Fin 152 MBh non-condensing hot water boiler serves the heating load requirement of most of the building area. The burner is non- modulating with a nominal efficiency of 83%. The boiler is configured in a manual control scheme. Installed in 2007, the boiler is in good condition. There is a service contract in place.

The boiler loop is configured in a constant flow primary distribution with three 1/8 hp Taco constant speed hot water circulation pumps operating with a manual control scheme. The boiler provides hot water to cast iron radiators and unit heaters throughout the building.

One gas fired 63 MBh Modine unit heater serves basement offices with 78% efficiency. The unit heater is old and in need of replacement.

There is approximately 5 feet of 1-inch hot water pipe, 10 feet of 1.5-inch heating hot water pipe and 15 feet of 2-inch hot water pipe with no insulation that should be insulated with 2-inch thick insulation. Hot water is supplied at 182°F.

*Image 21 Hot Water Boiler*

*Image 22 Circulation Pumps*

*Image 23 Hot Water Pipes Without Insulation*


*Image 24 Boiler Nameplate*

## 2.7 Domestic Hot Water

Hot water is produced with a 50-gallon 4.5 kW electric A.O. Smith storage water heater. At the time of the site visit, the domestic water heater was set at 121°F. The domestic hot water pipes are partially insulated, and the insulation is in fair condition.

*Image 25 Hot Water Heater*


*Image 26 Hot Water Heater Nameplate*

*Image 27 DHW Pipes Without Insulation*

*Image 28 Pipes Without Insulation*

## 2.8 Plug Loads

The utility bill analysis indicates that plug loads consume approximately 5% of total building energy use. This is slightly higher than a typical building.

You may wish to consider paying attention to minimizing your plug load usage. This report makes suggestions for ECMs in this area as well as Energy Efficient Best Practices.

There are approximately 11 computer work stations throughout the facility. Plug loads throughout the building include general kitchen and office equipment.

There are four residential style refrigerators throughout the building that are used to store lunches of staff and cold beverages. These vary in condition and efficiency.

*Image 29 Copy Machine*

*Image 30 Small Refrigerator*

*Image 31 Kitchen Equipment*

*Image 32 Copy Room Equipment*

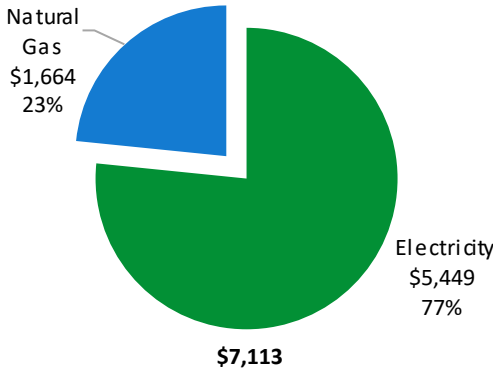
## 2.9 Water-Using Systems

There are two restrooms with toilets, urinals, and sinks. Faucet flow rates are at 2.5 gallons per minute (gpm) or higher. Toilets are rated at 2.5 gallons per flush (gpf) and urinals are rated at 2 gpf.

# 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 | 40,512 kWh | $5,449 |
| Natural Gas | 1,711 Therms | $1,664 |
| **Total** | | **$7,113** |




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

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

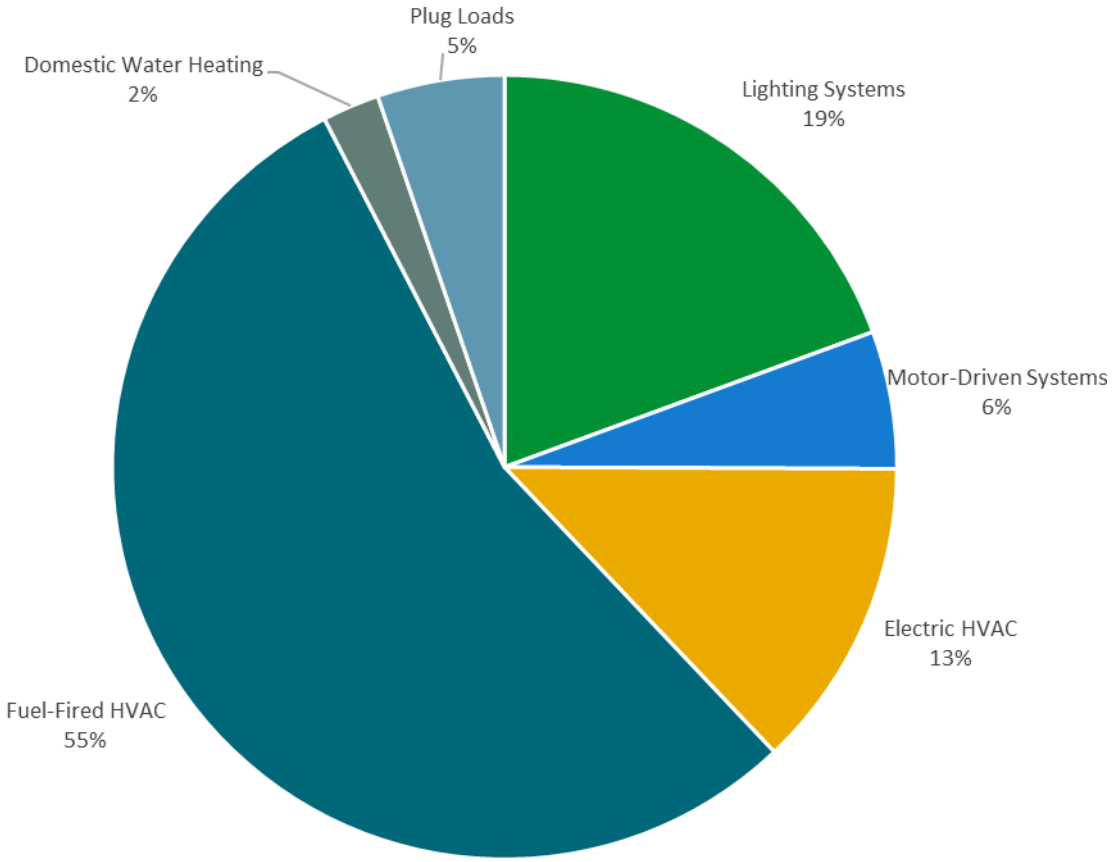
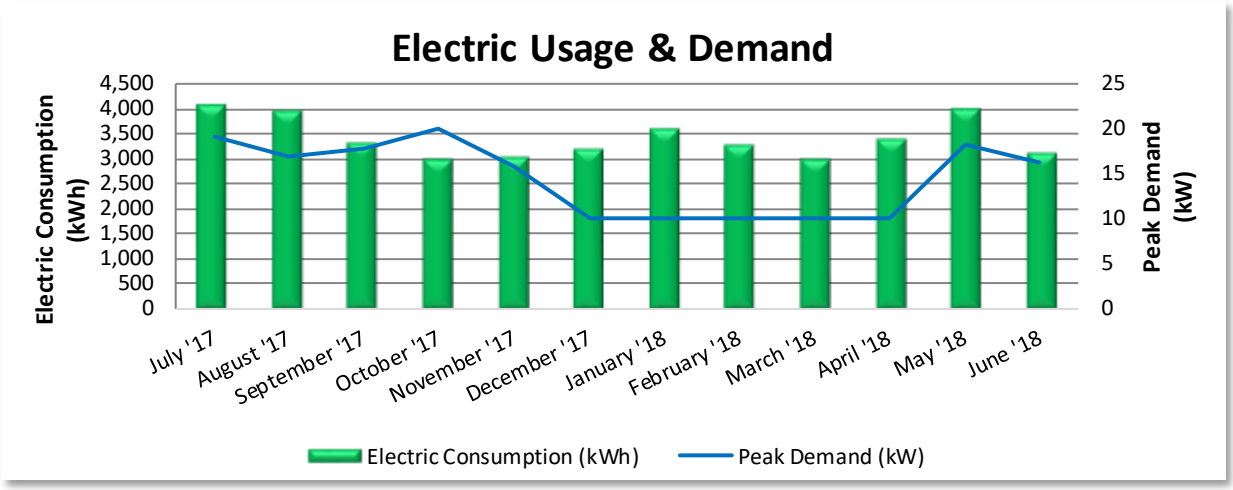



*Figure 5 - Energy Balance*

## 3.1 Electricity

JCP&L delivers electricity under rate class Monthly General Service Secondary, with electric production provided by South Jersey Energy, a third-party supplier.



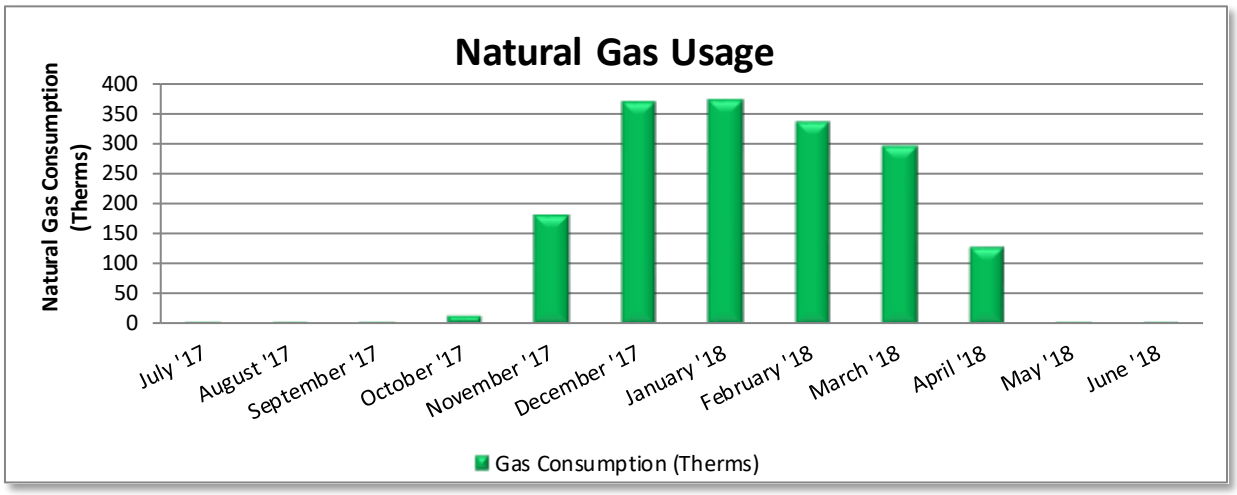

| Electric Billing Data | | | | | |
|---|---|---|---|---|---|
| **Period Ending** | **Days in Period** | **Electric Usage (kWh)** | **Demand (kW)** | **Demand Cost** | **Total Electric Cost** |
| 7/25/17 | 29 | 4,055 | 19 | $144 | $503 |
| 8/24/17 | 30 | 3,918 | 17 | $50 | $750 |
| 9/24/17 | 31 | 3,297 | 18 | $56 | $365 |
| 10/24/17 | 30 | 2,964 | 20 | $33 | $364 |
| 11/23/17 | 30 | 2,994 | 16 | $38 | $389 |
| 12/24/17 | 31 | 3,183 | 10 | $33 | $392 |
| 1/24/18 | 31 | 3,554 | 10 | $32 | $425 |
| 2/23/18 | 30 | 3,261 | 10 | $32 | $626 |
| 3/25/18 | 30 | 2,977 | 10 | $32 | $364 |
| 4/25/18 | 31 | 3,354 | 10 | $31 | $411 |
| 5/29/18 | 34 | 3,983 | 18 | $51 | $481 |
| 6/27/18 | 29 | 3,083 | 16 | $42 | $393 |
| **Totals** | **366** | **40,623** | **20** | **$574** | **$5,464** |
| **Annual** | **365** | **40,512** | **20** | **$572** | **$5,449** |

Notes:

- Peak demand of 20 kW occurred in October 2017.
- The average electric cost over the past 12 months was $0.135/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.

## 3.2 Natural Gas

Elizabethtown Gas delivers natural gas under rate class General Service.




| Gas Billing Data | | | |
|---|---|---|---|
| **Period Ending** | **Days in Period** | **Natural Gas Usage (Therms)** | **Natural Gas Cost** |
| 8/4/17 | 30 | 4 | $44 |
| 9/4/17 | 31 | 4 | $44 |
| 10/5/17 | 31 | 4 | $44 |
| 11/4/17 | 30 | 16 | $51 |
| 12/5/17 | 31 | 183 | $158 |
| 1/5/18 | 31 | 368 | $320 |
| 2/4/18 | 30 | 371 | $313 |
| 3/6/18 | 30 | 335 | $286 |
| 4/5/18 | 30 | 294 | $242 |
| 5/6/18 | 31 | 127 | $115 |
| 6/4/18 | 29 | 6 | $26 |
| 7/6/18 | 32 | 4 | $25 |
| **Totals** | **366** | **1,716** | **$1,668** |
| **Annual** | **365** | **1,711** | **$1,664** |

Notes:

- The average gas cost for the past 12 months is $0.972/therm, which is the blended rate used throughout the analysis.

## 3.3 Benchmarking

Your building was benchmarked using the United States Environmental Protection Agency's (EPA) *Portfolio Manager®* software. Benchmarking compares your building's energy use to that of similar buildings across the county, 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.

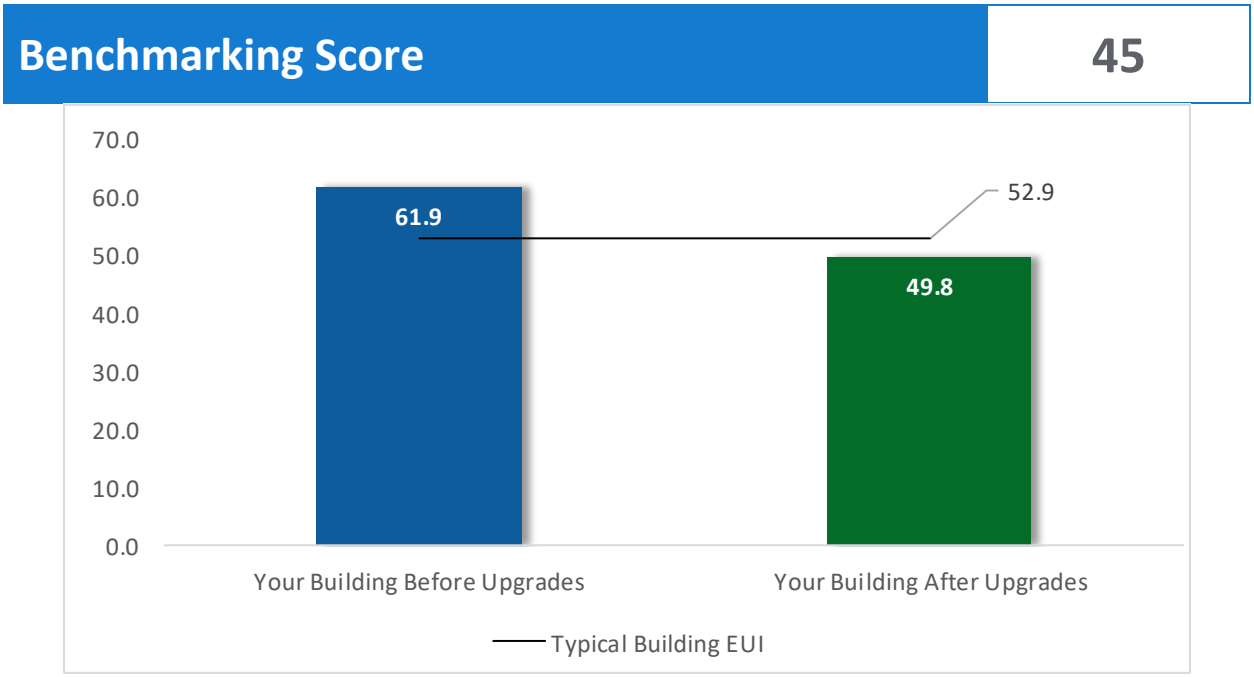



*Figure 6 - Energy Use Intensity Comparison*

This building performs at, or below the national average. This report contains suggestions about how to improve building performance and reduce energy costs.

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. A number of factors can cause as building to vary from the "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.

## Tracking Your Energy Performance

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

**We have created a Portfolio Manager® account for your facility and we 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]

[3] https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1.

# 4 Energy Conservation Measures

The goal of this audit report is to identify and evaluate potential energy efficiency improvements, provide information about the cost effectiveness of those improvements, and recognize potential financial incentives from NJBPU. Most energy conservation measures have received preliminary analysis of feasibility which identifies expected ranges of savings and costs. 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 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 are based on the current NJCEP prescriptive SmartStart program. A higher level of investigation may be necessary to support any SmartStart Custom, Pay for Performance, or Direct Install incentive applications. Some measures and proposed upgrades may be eligible for higher incentives than those shown below through other NJCEP programs described in a following section of this report.

**Appendix A: Equipment Inventory & Recommendations** provides a detailed list of the locations and recommended upgrades for each energy conservation measure.

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($)* | Estimated Net Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | **9,504** | **4.5** | **-2** | **$1,260** | **$7,937** | **$1,666** | **$6,271** | **5.0** | **9,353** |
| ECM 1 | Install LED Fixtures | 626 | 0.1 | 0 | $84 | $966 | $100 | $866 | 10.3 | 631 |
| ECM 2 | Retrofit Fixtures with LED Lamps | 8,878 | 4.4 | -2 | $1,176 | $6,971 | $1,566 | $5,405 | 4.6 | 8,722 |
| **Lighting Control Measures** | | **1,867** | **0.9** | **0** | **$247** | **$2,946** | **$585** | **$2,361** | **9.5** | **1,834** |
| ECM 3 | Install Occupancy Sensor Lighting Controls | 1,663 | 0.8 | 0 | $220 | $2,546 | $315 | $2,231 | 10.1 | 1,634 |
| ECM 4 | Install High/Low Lighting Controls | 204 | 0.1 | 0 | $27 | $400 | $270 | $130 | 4.8 | 200 |
| **Gas Heating (HVAC/Process) Replacement** | | **0** | **0.0** | **8** | **$76** | **$1,841** | **$0** | **$1,841** | **24.2** | **915** |
| | Install High Efficiency Unit Heaters | 0 | 0.0 | 8 | $76 | $1,841 | $0 | $1,841 | 24.2 | 915 |
| **HVAC System Improvements** | | **0** | **0.0** | **21** | **$207** | **$264** | **$0** | **$264** | **1.3** | **2,494** |
| ECM 5 | Install Pipe Insulation | 0 | 0.0 | 21 | $207 | $264 | $0 | $264 | 1.3 | 2,494 |
| **Domestic Water Heating Upgrade** | | **726** | **0.0** | **0** | **$98** | **$29** | **$0** | **$29** | **0.3** | **731** |
| ECM 6 | Install Low-Flow DHW Devices | 726 | 0.0 | 0 | $98 | $29 | $0 | $29 | 0.3 | 731 |
| **TOTALS** | | **12,097** | **5.4** | **27** | **$1,888** | **$13,016** | **$2,251** | **$10,765** | **5.7** | **15,328** |

* - All incentives presented in this table are based on NJ SmartStart equipment incentives and assume proposed equipment meets minimum performance criteria

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

*Figure 7 – All Evaluated ECMs*

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($)* | Estimated Net Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | **9,504** | **4.5** | **-2** | **$1,260** | **$7,937** | **$1,666** | **$6,271** | **5.0** | **9,353** |
| ECM 1 | Install LED Fixtures | 626 | 0.1 | 0 | $84 | $966 | $100 | $866 | 10.3 | 631 |
| ECM 2 | Retrofit Fixtures with LED Lamps | 8,878 | 4.4 | -2 | $1,176 | $6,971 | $1,566 | $5,405 | 4.6 | 8,722 |
| **Lighting Control Measures** | | **1,867** | **0.9** | **0** | **$247** | **$2,946** | **$585** | **$2,361** | **9.5** | **1,834** |
| ECM 3 | Install Occupancy Sensor Lighting Controls | 1,663 | 0.8 | 0 | $220 | $2,546 | $315 | $2,231 | 10.1 | 1,634 |
| ECM 4 | Install High/Low Lighting Controls | 204 | 0.1 | 0 | $27 | $400 | $270 | $130 | 4.8 | 200 |
| **HVAC System Improvements** | | **0** | **0.0** | **21** | **$207** | **$264** | **$0** | **$264** | **1.3** | **2,494** |
| ECM 5 | Install Pipe Insulation | 0 | 0.0 | 21 | $207 | $264 | $0 | $264 | 1.3 | 2,494 |
| **Domestic Water Heating Upgrade** | | **726** | **0.0** | **0** | **$98** | **$29** | **$0** | **$29** | **0.3** | **731** |
| ECM 6 | Install Low-Flow DHW Devices | 726 | 0.0 | 0 | $98 | $29 | $0 | $29 | 0.3 | 731 |
| **TOTALS** | | **12,097** | **5.4** | **19** | **$1,812** | **$11,175** | **$2,251** | **$8,924** | **4.9** | **14,413** |

* - All incentives presented in this table are based on NJ SmartStart equipment incentives and assume proposed equipment meets minimum performance criteria

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

*Figure 8 – Cost Effective ECMs*

## 4.1 Lighting

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($)* | Estimated Net Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | **9,504** | **4.5** | **-2** | **$1,260** | **$7,937** | **$1,666** | **$6,271** | **5.0** | **9,353** |
| ECM 1 | Install LED Fixtures | 626 | 0.1 | 0 | $84 | $966 | $100 | $866 | 10.3 | 631 |
| ECM 2 | Retrofit Fixtures with LED Lamps | 8,878 | 4.4 | -2 | $1,176 | $6,971 | $1,566 | $5,405 | 4.6 | 8,722 |

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 are proposed, we suggest converting all a specific lighting type (e.g. linear fluorescent) to LED lamps to minimize the number of lamp types in use at the facility, which should help reduce future maintenance costs.

### ECM 1: Install LED Fixtures

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

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

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

**Affected building areas:** exterior fixtures

### ECM 2: Retrofit Fixtures with LED Lamps

Replace linear and U-bend T8 fluorescent and incandescent lamps with LED lamps. Many LED tubes are direct replacements for existing fluorescent tubes and can be installed while leaving the fluorescent fixture ballast in place. LED lamps can be used in existing fixtures as a direct replacement for most other lighting technologies.

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:** offices, restrooms, conference rooms, corridors, vestibule

## 4.2 Lighting Controls

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($)* | Estimated Net Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Control Measures** | | **1,867** | **0.9** | **0** | **$247** | **$2,946** | **$585** | **$2,361** | **9.5** | **1,834** |
| ECM 3 | Install Occupancy Sensor Lighting Controls | 1,663 | 0.8 | 0 | $220 | $2,546 | $315 | $2,231 | 10.1 | 1,634 |
| ECM 4 | Install High/Low Lighting Controls | 204 | 0.1 | 0 | $27 | $400 | $270 | $130 | 4.8 | 200 |

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

### ECM 3: Install Occupancy Sensor Lighting Controls

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

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

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

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

**Affected building areas:** offices, conference rooms, restrooms, and storage rooms

### ECM 4: Install High/Low Lighting Controls

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

Lighting fixtures with these controls operate at default low levels when the area is unoccupied to provide minimal lighting to meet security or safety requirements. 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.

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

**Affected building areas**: first floor hallway

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 an occupant approaches.

## 4.3 Gas-Fired Heating

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($)* | Estimated Net Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Gas Heating (HVAC/Process) Replacement** | | **0** | **0.0** | **8** | **$76** | **$1,841** | **$0** | **$1,841** | **24.2** | **915** |
| | Install High Efficiency Unit Heaters | 0 | 0.0 | 8 | $76 | $1,841 | $0 | $1,841 | 24.2 | 915 |

### Install High Efficiency Unit Heaters

We evaluated replacing the existing standard gas-fired unit heater with a high efficiency gas-fired unit heater. Improved combustion technology and heat exchanger design optimize the heat recovery from the combustion gases which can significantly improve unit heater efficiency. Savings result from improved system efficiency.

Note: these units produce acidic condensate that requires proper drainage.

Replacing the existing gas fired unit heater has a long payback based on energy savings and may not be justifiable based simply on energy considerations. However, the unit heater has reached the end of normal useful life. Typically, the marginal cost of purchasing high efficiency unit heaters can be justified by the marginal savings from the improved efficiency. When the unit heater is eventually replaced, consider purchasing a heater that exceeds the minimum efficiency required by building codes.

## 4.4 HVAC

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($)* | Estimated Net Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **HVAC System Improvements** | | **0** | **0.0** | **21** | **$207** | **$264** | **$0** | **$264** | **1.3** | **2,494** |
| ECM 5 | Install Pipe Insulation | 0 | 0.0 | 21 | $207 | $264 | $0 | $264 | 1.3 | 2,494 |

### ECM 4: Install Pipe Insulation

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

## 4.5 Domestic Water Heating

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($)* | Estimated Net Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Domestic Water Heating Upgrade** | | **726** | **0.0** | **0** | **$98** | **$29** | **$0** | **$29** | **0.3** | **731** |
| ECM 6 | Install Low-Flow DHW Devices | 726 | 0.0 | 0 | $98 | $29 | $0 | $29 | 0.3 | 731 |

### ECM 5: 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. [Pre-rinse spray valves (PRSVs) — often used in commercial and institutional kitchens — remove food waste from dishes prior to dishwashing.]

Additional cost savings may result from reduced water usage.

# 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. 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 can't manage what you don't measure. ENERGY STAR® Portfolio Manager® is an online tool that you can use to measure and track energy and water consumption, as well as greenhouse gas emissions.[4] Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

## 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.

## 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 (ACH) can lead to increased occupant comfort as well as heating and cooling savings, especially when combined with proper HVAC controls and adequate ventilation.

## Window Treatments/Coverings

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

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

## Lighting Maintenance

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

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

## Lighting Controls

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

## Thermostat Schedules and Temperature Resets

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

## Boiler Maintenance

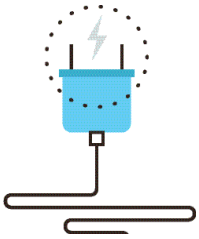
Many boiler problems develop slowly over time, so regular inspection and maintenance is essential to keeping the heating system running efficiently and preventing expensive repairs. Annual tune-ups should include a combustion analysis to analyze the exhaust from the boilers and to ensure the boiler is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

## Water Heater Maintenance

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

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

## Plug Load Controls



Reducing plug loads is a common way to decrease your electrical use. Limiting the energy use of plug loads can include increasing occupant awareness, removing under-used equipment, installing hardware controls, and using software controls. Consider enabling the most aggressive power settings on existing devices or install load sensing or occupancy sensing (advanced) power strips.[5] Your local utility may offer incentives or rebates for this equipment.

## Water Conservation

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

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

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

If the facility has detached buildings with a master water meter for the entire campus, check for unnatural wet areas in the lawn or water seeping in the foundation at water pipe penetrations through the foundation. Periodically check overnight meter readings when the facility is unoccupied, and there is no other scheduled water usage.

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

## Procurement Strategies

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

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

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

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

# 6 On-site Generation

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

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

## 6.1 Solar Photovoltaic

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

This facility appears to not 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 flat or south-facing rooftop or other unshaded space on which to place the PV panels.

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

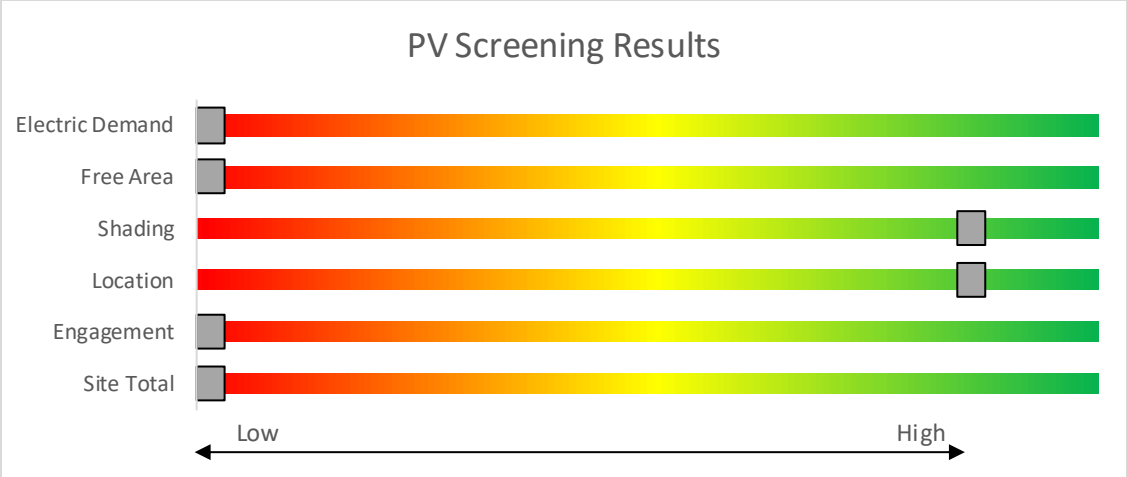



*Figure 9 - Photovoltaic Screening*

**Solar Renewable Energy Credit (SREC) Registration Program (SRP)**

Rebates are not available for solar projects, but owners of solar projects MUST register their projects in the SREC Registration Program before starting construction. Once your PV system is up and running, you periodically earn credits, which can then be sold on the open market for up to 15 years.

If you are considering installing solar photovoltaics on your building, visit www.njcleanenergy.com/srec for more information about the SREC Registration Program.

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:

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

## 6.2 Combined Heat and Power

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

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

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

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

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

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

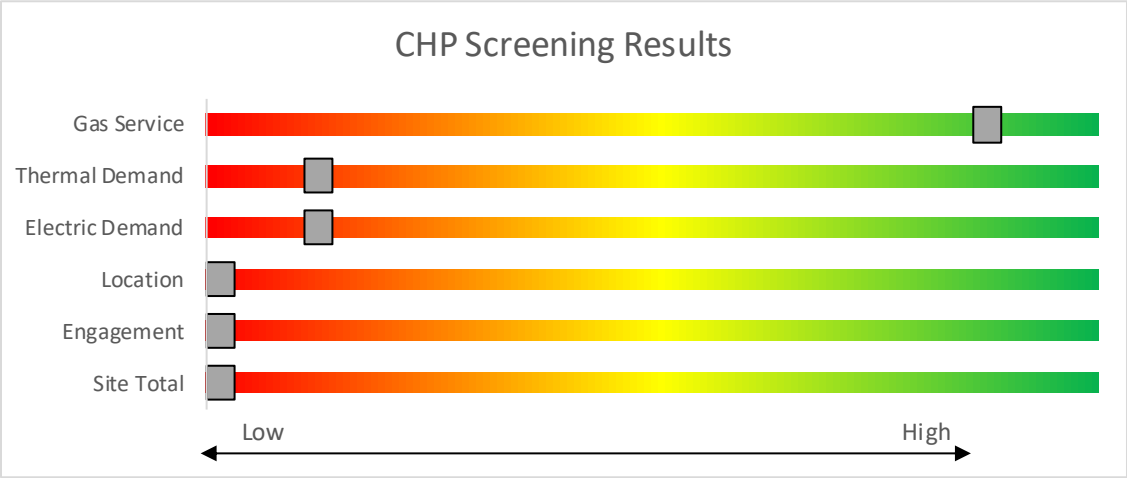



*Figure 10 - Combined Heat and Power Screening*

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/.

# 7 PROJECT FUNDING AND INCENTIVES

Ready to improve your building's performance? New Jersey Clean Energy Programs can help. Pick the program that works best for you. Incentive programs that may apply to this facility are identified in the Executive Summary. This section provides an overview of currently available in New Jersey Clean Energy Programs.

| | **SmartStart**<br>*Flexibility to install at your own pace* | **Direct Install**<br>*Turnkey installation* | **Pay for Performance**<br>*Whole building upgrades* |
|---|---|---|---|
| **Who should use it?** | Buildings installing individual measures or small group of measures. | Small to mid-size facilities that can bundle multiple measures together.<br>Average peak demand should be below 200 kW.<br>Not suitable for significant building shell issues. | Mid to large size facilities looking to implement as many measures as possible at one time.<br>Peak demand should be over 200 kW. |
| **How does it work?** | Use in-house staff or your preferred contractor. | Pre-approved contractors pass savings along to you via reduced material and labor costs. | Whole-building approach to energy upgrades designed to reduce energy use by at least 15%. The more you save, the higher the incentives. |
| **What are the Incentives?** | Fixed incentives for specific energy efficiency measures. | Incentives pay up to 70% of eligible costs, up to $125,000 per project.<br>You pay the remaining 30% directly to the contractor. | Up to 25% of installation cost, calculated based on level of energy savings per square foot. |
| **How do I participate?** | Submit an application for the specific equipment to be installed. | Contact a participating contractor in your region. | Contact a pre-qualified Partner to develop your Energy Reduction Plan and set your energy savings targets. |
| Take the next step by visiting **www.njcleanenergy.com** for program details, applications, and to contact a qualified contractor. | | | |

## 7.1 SmartStart

SmartStart 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.

SmartStart routinely adds, removes, or modifies incentives from year-to-year for various energy efficiency equipment based on market trends and new technologies.

**Equipment with Prescriptive Incentives Currently Available:**

*Electric Chillers*
*Electric Unitary HVAC*
*Gas Cooling*
*Gas Heating*
*Gas Water Heating*
*Ground Source Heat Pumps*
*Lighting*
*Lighting Controls*
*Refrigeration Doors*
*Refrigeration Controls*
*Refrigerator/Freezer Motors*
*Food Service Equipment*
*Variable Frequency Drives*

**Incentives**

The SmartStart Prescriptive program provides fixed incentives for specific energy efficiency measures. Prescriptive incentives vary by equipment type.

SmartStart Custom provides incentives for more unique or specialized technologies or systems that are not addressed through prescriptive incentives. Custom incentives are calculated at $0.16/kWh and $1.60/therm based on estimated annual savings. Incentives are capped at 50% of the total installed incremental project cost, or a project cost buy down to a one-year payback (whichever is less). Program incentives are capped at $500,000 per electric account and $500,000 per natural gas account, per fiscal year.

**How to Participate**

Submit an application for the specific equipment to be installed. Many applications are designed as rebates, although others require application approval prior to installation. You can work with your preferred contractor or use internal staff to install measures.

Visit www.njcleanenergy.com/SSB for a detailed program description, instructions for applying, and applications.

## 7.2 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 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, up to $125,000 per project. Each entity is limited to incentives up to $250,000 per fiscal year.

**How to Participate**

To participate in Direct Install, you will need to contact the participating contractor assigned to the region of the state where your facility is located. A complete list of Direct Install program partners is provided on the Direct Install website linked below. 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 program, subject to program caps and eligibility, while the remaining 30% of the cost is paid to the contractor by the customer.

Detailed program descriptions and applications can be found at: www.njcleanenergy.com/DI.

## 7.3 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 in to contracts to help finance building energy upgrades. Annual payments are lower than the savings projected from the 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 (ESP) 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.*

# 8 Energy Purchasing and Procurement Strategies

## 8.1 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. So, though you may choose a different company from which to buy your electric power, responsibility for your facility's interconnection to the grid and repair to local power distribution will still reside with the traditional utility company serving your region.

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

A list of licensed third-party electric suppliers is available at the NJBPU website.[8]

## 8.2 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 that fluctuate monthly. The utility provides basic gas supply service (BGSS) to customers who choose not to buy from a third-party supplier for natural gas commodity.

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

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

A list of licensed third-party natural gas suppliers is available at the NJBPU website.[9]

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

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

# APPENDIX A: EQUIPMENT INVENTORY & RECOMMENDATIONS

## Lighting Inventory & Recommendations

| | Existing Conditions | | | | | | Proposed Conditions | | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Fixture Quantity | Fixture Description | Control System | Light Level | Watts per Fixture | Annual Operating Hours | ECM # | Fixture Recommendation | Add Controls? | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Mechanical Room | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 1,872 | 2 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 1,872 | 0.0 | 68 | 0 | $9 | $37 | $10 | 2.9 |
| Mechanical Room | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Wall Switch | S | 114 | 1,872 | 2 | Relamp | No | 2 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | 58 | 1,872 | 0.1 | 231 | 0 | $31 | $146 | $40 | 3.5 |
| Mechanical Room | 4 | Linear Fluorescent - T8: 8' T8 (59W) - 2L | Wall Switch | S | 110 | 1,872 | 2 | Relamp | No | 4 | LED - Linear Tubes: (2) 8' Lamps | Wall Switch | 72 | 1,872 | 0.1 | 313 | 0 | $41 | $354 | $80 | 6.6 |
| Conference Room | 7 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | S | 93 | 1,872 | 2, 3 | Relamp | Yes | 7 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,292 | 0.4 | 908 | 0 | $120 | $653 | $140 | 4.3 |
| Storage | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 1,872 | 2, 3 | Relamp | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,292 | 0.2 | 346 | 0 | $46 | $262 | $40 | 4.8 |
| Copy Area | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 1,872 | 2 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 1,872 | 0.0 | 68 | 0 | $9 | $37 | $10 | 2.9 |
| Women | 3 | U-Bend Fluorescent - T8: U T8 (32W) - 2L | Wall Switch | S | 62 | 1,872 | 2, 3 | Relamp | Yes | 3 | LED - Linear Tubes: (2) U-Lamp | Occupancy Sensor | 33 | 1,292 | 0.1 | 242 | 0 | $32 | $487 | $65 | 13.2 |
| Women | 1 | Incandescent: Bulbs (25W) - 3L | Wall Switch | S | 75 | 1,872 | 2 | Relamp | No | 1 | LED Screw-In Lamps: LED Bulb - 3L | Wall Switch | 9 | 1,872 | 0.1 | 136 | 0 | $18 | $52 | $3 | 2.7 |
| Men | 3 | U-Bend Fluorescent - T8: U T8 (32W) - 2L | Wall Switch | S | 62 | 1,872 | 2, 3 | Relamp | Yes | 3 | LED - Linear Tubes: (2) U-Lamp | Occupancy Sensor | 33 | 1,292 | 0.1 | 242 | 0 | $32 | $487 | $65 | 13.2 |
| Men | 1 | Incandescent: Bulbs (25W) - 3L | Wall Switch | S | 75 | 1,872 | 2 | Relamp | No | 1 | LED Screw-In Lamps: LED Bulb - 3L | Wall Switch | 9 | 1,872 | 0.1 | 136 | 0 | $18 | $52 | $3 | 2.7 |
| Office | 9 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Wall Switch | S | 114 | 1,872 | 2, 3 | Relamp | Yes | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 1,292 | 0.6 | 1,371 | 0 | $182 | $927 | $215 | 3.9 |
| Office 2 | 8 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Wall Switch | S | 114 | 1,872 | 2, 3 | Relamp | Yes | 8 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 1,292 | 0.6 | 1,219 | 0 | $161 | $854 | $195 | 4.1 |
| Office 2 | 1 | LED - Fixtures: Ceiling Mount | Wall Switch | S | 13 | 1,872 | | None | No | 1 | LED - Fixtures: Ceiling Mount | Wall Switch | 13 | 1,872 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Office 3 | 8 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 1,872 | 2, 3 | Relamp | Yes | 8 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,292 | 0.3 | 692 | 0 | $92 | $562 | $115 | 4.9 |
| Exterior | 1 | High-Pressure Sodium: (1) 150W Lamp | Photocell | | 188 | 4,380 | 1 | Fixture Replacement | No | 1 | LED - Fixtures: Outdoor Wall-Mounted Area Fixture | Photocell | 45 | 4,380 | 0.1 | 626 | 0 | $84 | $966 | $100 | 10.3 |
| Exterior | 2 | LED - Fixtures: Outdoor Wall-Mounted Area Fixture | Photocell | | 26 | 4,380 | | None | No | 2 | LED - Fixtures: Outdoor Wall-Mounted Area Fixture | Photocell | 26 | 4,380 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Basement | 1 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 1 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| 1st Floor Hall | 7 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 1,872 | 2, 4 | Relamp | Yes | 7 | LED - Linear Tubes: (2) 4' Lamps | High/Low Control | 29 | 1,292 | 0.3 | 605 | 0 | $80 | $456 | $270 | 2.3 |
| 1st Floor Hall | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Wall Switch | S | 114 | 1,872 | 2, 4 | Relamp | Yes | 2 | LED - Linear Tubes: (4) 4' Lamps | High/Low Control | 58 | 1,292 | 0.1 | 305 | 0 | $40 | $346 | $110 | 5.8 |
| Roof deck | 2 | Linear Fluorescent - T8: 8' T8 (59W) - 2L | Wall Switch | S | 110 | 1,872 | 2, 3 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 8' Lamps | Occupancy Sensor | 72 | 1,292 | 0.1 | 248 | 0 | $33 | $447 | $75 | 11.3 |
| Roof deck | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Wall Switch | S | 32 | 1,872 | 2 | Relamp | No | 1 | LED - Linear Tubes: (1) 4' Lamp | Wall Switch | 15 | 1,872 | 0.0 | 36 | 0 | $5 | $18 | $5 | 2.8 |
| Office 4 | 8 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 1,292 | 2 | Relamp | No | 8 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 1,292 | 0.4 | 637 | 0 | $84 | $584 | $160 | 5.0 |
| Office 5 | 3 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 1,292 | 2 | Relamp | No | 3 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 1,292 | 0.2 | 239 | 0 | $32 | $219 | $60 | 5.0 |
| Conference Room 1st Fl | 4 | U-Bend Fluorescent - T8: U T8 (32W) - 2L | Wall Switch | S | 62 | 1,872 | 2, 3 | Relamp | Yes | 4 | LED - Linear Tubes: (2) U-Lamp | Occupancy Sensor | 33 | 1,292 | 0.1 | 323 | 0 | $43 | $560 | $75 | 11.3 |
| Office 6 | 2 | U-Bend Fluorescent - T8: U T8 (32W) - 2L | Occupancy Sensor | S | 62 | 1,292 | 2 | Relamp | No | 2 | LED - Linear Tubes: (2) U-Lamp | Occupancy Sensor | 33 | 1,292 | 0.1 | 82 | 0 | $11 | $145 | $20 | 11.4 |

| | Existing Conditions | | | | | | Proposed Conditions | | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Fixture Quantity | Fixture Description | Control System | Light Level | Watts per Fixture | Annual Operating Hours | ECM # | Fixture Recommendation | Add Controls? | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Office 7 | 4 | U-Bend Fluorescent - T8: U T8 (32W) - 2L | Occupancy Sensor | S | 62 | 1,292 | 2 | Relamp | No | 4 | LED - Linear Tubes: (2) U-Lamp | Occupancy Sensor | 33 | 1,292 | 0.1 | 165 | 0 | $22 | $290 | $40 | 11.4 |
| Office 8 | 4 | U-Bend Fluorescent - T8: U T8 (32W) - 2L | Occupancy Sensor | S | 62 | 1,292 | 2 | Relamp | No | 4 | LED - Linear Tubes: (2) U-Lamp | Occupancy Sensor | 33 | 1,292 | 0.1 | 165 | 0 | $22 | $290 | $40 | 11.4 |
| Office 9 | 9 | U-Bend Fluorescent - T8: U T8 (32W) - 2L | Occupancy Sensor | S | 62 | 1,292 | 2 | Relamp | No | 9 | LED - Linear Tubes: (2) U-Lamp | Occupancy Sensor | 33 | 1,292 | 0.2 | 371 | 0 | $49 | $652 | $90 | 11.4 |
| Main Conference Room | 17 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 1,872 | 2, 3 | Relamp | Yes | 17 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,292 | 0.7 | 1,470 | 0 | $195 | $891 | $205 | 3.5 |
| Vestibule | 1 | U-Bend Fluorescent - T8: U T8 (32W) - 2L | Wall Switch | S | 62 | 1,872 | 2 | Relamp | No | 1 | LED - Linear Tubes: (2) U-Lamp | Wall Switch | 33 | 1,872 | 0.0 | 60 | 0 | $8 | $72 | $10 | 7.9 |
| Vestibule | 1 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 1 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Sign Light | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 1,872 | 2 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 1,872 | 0.0 | 68 | 0 | $9 | $37 | $10 | 2.9 |
| Exterior | 1 | LED - Fixtures: Bulb (9W) - 1L | Timeclock | | 9 | 2,080 | | None | No | 1 | LED - Fixtures: Bulb (9W) - 1L | Timeclock | 9 | 2,080 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

## Motor Inventory & Recommendations

| | | Existing Conditions | | | | | | | Proposed Conditions | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | Motor Quantity | Motor Application | HP Per Motor | Full Load Efficiency | VFD Control? | 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 | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Mechanical Room | Boiler | 3 | Heating Hot Water Pump | 0.1 | 60.0% | No | W | 1,200 | | No | 60.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| 1st Floor Closet | 1st Floor Conf Room | 1 | Supply Fan | 2.0 | 86.5% | No | W | 2,400 | | No | 86.5% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Closet | Basement | 1 | Supply Fan | 1.0 | 85.5% | No | W | 2,400 | | No | 85.5% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

## Electric HVAC Inventory & Recommendations

| | | Existing Conditions | | | | | Proposed Conditions | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | System Quantity | System Type | Cooling Capacity per Unit (Tons) | Heating Capacity per Unit (MBh) | 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/EER) | Heating Mode Efficiency (COP) | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| 1st Floor Closet | 1st Floor Conf Room | 1 | Split-System AC | 7.50 | | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Closet | Basement | 1 | Packaged AC | 5.00 | | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facility Office | Facility Office | 1 | Electric Resistance Heat | | 19.10 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facility Office | Facility Office | 1 | Window AC | 1.00 | | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| 1st Floor | Offices | 2 | Electric Resistance Heat | | 6.82 | B | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

## Fuel Heating Inventory & Recommendations

| | | Existing Conditions | | | | Proposed Conditions | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | System Quantity | System Type | Output Capacity per Unit (MBh) | 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 | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Mechanical Room | Offices | 1 | Non-Condensing Hot Water Boiler | 152.00 | W | | No | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Basement Hallway | Offices | 1 | Warm Air Unit Heater | 63.00 | B | NR | Yes | 1 | Warm Air Unit Heater | 63.00 | 93.00% | Et | 0.0 | 0 | 8 | $76 | $1,841 | $0 | 24.2 |

## Pipe Insulation Recommendations

| | | Recommendation Inputs | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Affected | ECM # | Length of Uninsulated Pipe (ft) | Pipe Diameter (in) | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Mechanical Room | Domestic & HHW System | 5 | 5 | 1.00 | 0.0 | 0 | 2 | $23 | $44 | $0 | 1.9 |
| Mechanical Room | Domestic & HHW System | 5 | 10 | 1.50 | 0.0 | 0 | 7 | $65 | $88 | $0 | 1.4 |
| Mechanical Room | Domestic & HHW System | 5 | 15 | 2.00 | 0.0 | 0 | 12 | $119 | $132 | $0 | 1.1 |

## DHW Inventory & Recommendations

| | | Existing Conditions | | | Proposed Conditions | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | System Quantity | System Type | 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 | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Mechanical Room | Restrooms | 1 | Storage Tank Water Heater (≤ 50 Gal) | W | | No | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

## Low-Flow Device Recommendations

| | Recommedation Inputs | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | ECM # | Device Quantity | Device Type | Existing Flow Rate (gpm) | Proposed Flow Rate (gpm) | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Restrooms | 6 | 2 | Faucet Aerator (Lavatory) | 2.50 | 0.50 | 0.0 | 393 | 0 | $53 | $14 | $0 | 0.3 |
| Restrooms | 6 | 2 | Faucet Aerator (Lavatory) | 2.20 | 0.50 | 0.0 | 334 | 0 | $45 | $14 | $0 | 0.3 |

## Plug Load Inventory

| | Existing Conditions | | | |
|---|---|---|---|---|
| Location | Quantity | Equipment Description | Energy Rate (W) | ENERGY STAR Qualified? |
| Conf Room | 1 | Projectors | 120.0 | Yes |
| Offices | 6 | Small Printer | 46.0 | Yes |
| Conf Room | 5 | Medium Printer | 55.0 | No |
| Copy room | 2 | Copy Machine | 600.0 | Yes |
| Kitchen | 1 | Refrigerator | 255.0 | No |
| Office | 3 | Mini Refrigerator | 145.0 | No |
| Office | 11 | Computers | 120.0 | No |
| Kitchen | 3 | Microwave | 800.0 | No |
| Kitchen | 3 | Coffee Maker | 300.0 | No |
| Offices | 3 | Paper Shredder | 46.0 | Yes |
| Kitchen | 1 | Toaster Oven | 550.0 | No |
| Kitchen | 1 | Toaster | 300.0 | No |

# APPENDIX B: ENERGY STAR® STATEMENT OF ENERGY PERFORMANCE

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

LEARN MORE AT energystar.gov

## ENERGY STAR® Statement of Energy Performance

**45**

ENERGY STAR® Score[1]

### Board Office

**Primary Property Type:** Office
**Gross Floor Area (ft²):** 5,000
**Built:** 1974

**For Year Ending:** May 31, 2018
**Date Generated:** December 03, 2018

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

### Property & Contact Information

| Property Address | Property Owner | Primary Contact |
|---|---|---|
| Board Office<br>57 Trinity Street<br>Newton, New Jersey 07860 | _____<br>.<br>(___)___-_____ | ____ _____<br>.<br>(___)___-_____<br>_____ |

**Property ID:** 6622862

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

**Site EUI**
62.1 kBtu/ft²

**Source EUI**
113.9 kBtu/ft²

**Annual Energy by Fuel**

| | |
|---|---|
| Electric - Grid (kBtu) | 139,079 (45%) |
| Natural Gas (kBtu) | 171,590 (55%) |

**National Median Comparison**

| | |
|---|---|
| National Median Site EUI (kBtu/ft²) | 58.3 |
| National Median Source EUI (kBtu/ft²) | 107 |
| % Diff from National Median Source EUI | 6% |

**Annual Emissions**

| | |
|---|---|
| Greenhouse Gas Emissions (Metric Tons CO2e/year) | 23 |

### Signature & Stamp of Verifying Professional

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

Signature: _____ Date: _____

**Licensed Professional**

____ _____
,
(___)___-_____
_____

**Professional Engineer Stamp (if applicable)**

# APPENDIX C: GLOSSARY

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

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

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