# Local Government Energy Audit Report

## Hartley Dodge Memorial

March 12, 2020

*Prepared for:*

Borough of Madison
50 King's Road
Madison, NJ 07940

*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 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. Cost estimates include material and labor pricing associated with installation of primary recommended equipment only. Cost estimates do not include demolition or removal of hazardous waste. We encourage the owner of the facility 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.

New Jersey's 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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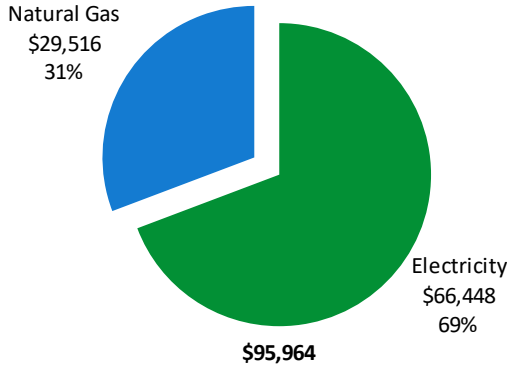
# 1 EXECUTIVE SUMMARY

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

## BUILDING PERFORMANCE REPORT

| | | |
|---|---|---|
| Annual Utilities | Costs: $95,964<br><br>Electricity:<br>464,400 kWh<br><br>Natural Gas:<br>32,230 Therms |  |
| ENERGY STAR® Benchmarking Score | 27<br>*(1-100 scale)* | This building performs below the national average. This report contains suggestions about how to improve building performance and reduce energy costs. |

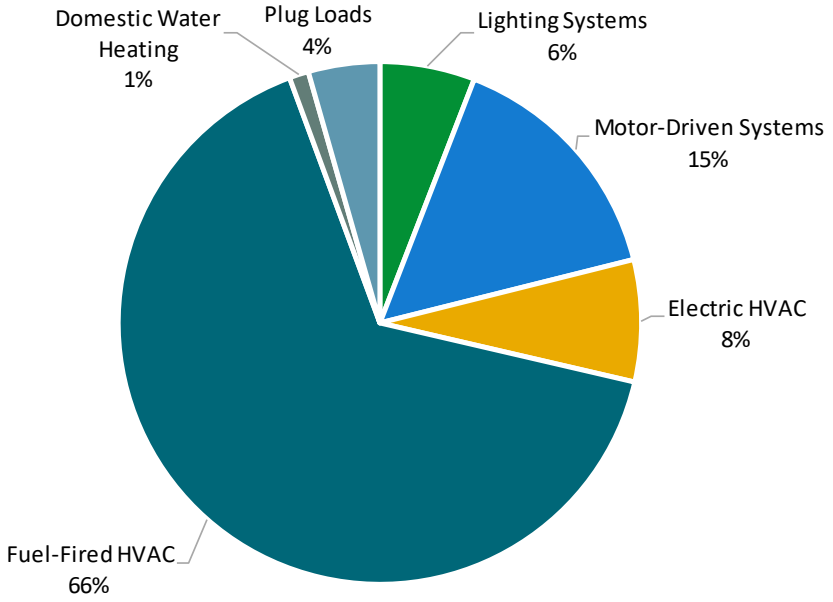


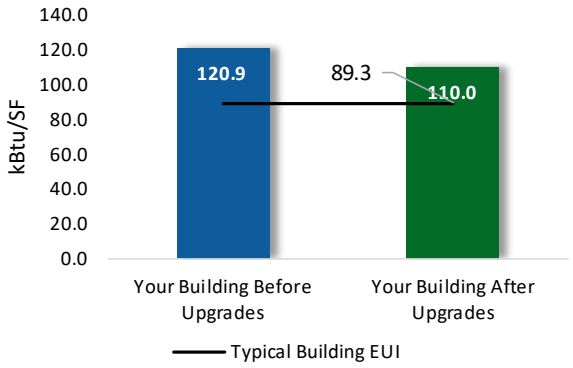

*Figure 1 - Energy Use by System*

## 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.

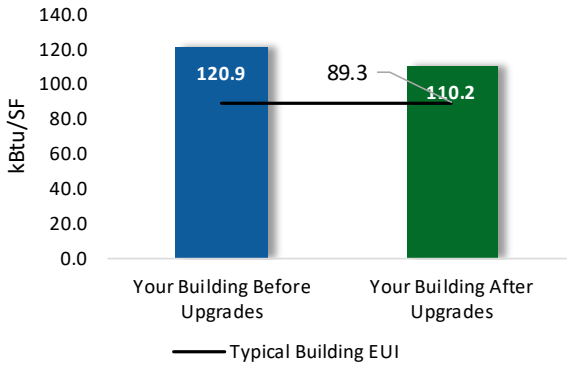
### Scenario 1: Full Package (all evaluated measures)

| | |
|---|---|
| Installation Cost | $88,173 |
| Potential Rebates & Incentives[1] | $120 |
| Annual Cost Savings | $13,766 |
| Annual Energy Savings | Electricity: 87,619 kWh<br>Natural Gas: 1,342 Therms |
| Greenhouse Gas Emission Savings | 52 Tons |
| Simple Payback | 6.4 Years |
| Site Energy Savings (all utilities) | 9% |




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

| | |
|---|---|
| Installation Cost | $80,090 |
| Potential Rebates & Incentives | $120 |
| Annual Cost Savings | $13,407 |
| Annual Energy Savings | Electricity: 85,104 kWh<br>Natural Gas: 1,343 Therms |
| Greenhouse Gas Emission Savings | 51 Tons |
| Simple Payback | 6.0 Years |
| Site Energy Savings (all utilities) | 9% |




### On-site Generation Potential

| | |
|---|---|
| Photovoltaic | Low |
| 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 | Cost Effective? | 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** | | | **43,632** | **13.2** | **-7** | **$6,177** | **$32,975** | **$0** | **$32,975** | **5.3** | **43,098** |
| ECM 1 | Install LED Fixtures | Yes | 12,462 | 1.2 | -1 | $1,777 | $16,714 | $0 | $16,714 | 9.4 | 12,474 |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | Yes | 1,757 | 1.1 | 0 | $248 | $1,520 | $0 | $1,520 | 6.1 | 1,727 |
| ECM 3 | Retrofit Fixtures with LED Lamps | Yes | 29,412 | 10.9 | -6 | $4,152 | $14,741 | $0 | $14,741 | 3.6 | 28,898 |
| **Lighting Control Measures** | | | **4,696** | **1.6** | **-1** | **$663** | **$8,796** | **$0** | **$8,796** | **13.3** | **4,614** |
| ECM 4 | Install Occupancy Sensor Lighting Controls | Yes | 4,289 | 1.5 | -1 | $606 | $7,446 | $0 | $7,446 | 12.3 | 4,214 |
| ECM 5 | Install High/Low Lighting Controls | No | 406 | 0.1 | 0 | $57 | $1,350 | $0 | $1,350 | 23.5 | 399 |
| **Variable Frequency Drive (VFD) Measures** | | | **24,422** | **6.5** | **0** | **$3,494** | **$29,427** | **$0** | **$29,427** | **8.4** | **24,593** |
| ECM 6 | Install VFD on Variable Air Volume (VAV) Fans | Yes | 24,422 | 6.5 | 0 | $3,494 | $29,427 | $0 | $29,427 | 8.4 | 24,593 |
| **Electric Unitary HVAC Measures** | | | **2,109** | **0.7** | **0** | **$302** | **$6,733** | **$0** | **$6,733** | **22.3** | **2,124** |
| ECM 7 | Install High Efficiency Air Conditioning Units | No | 2,109 | 0.7 | 0 | $302 | $6,733 | $0 | $6,733 | 22.3 | 2,124 |
| **HVAC System Improvements** | | | **0** | **0.0** | **7** | **$65** | **$126** | **$48** | **$78** | **1.2** | **829** |
| ECM 8 | Install Pipe Insulation | Yes | 0 | 0.0 | 7 | $65 | $126 | $48 | $78 | 1.2 | 829 |
| **Domestic Water Heating Upgrade** | | | **0** | **0.0** | **9** | **$87** | **$72** | **$72** | **$0** | **0.0** | **1,111** |
| ECM 9 | Install Low-Flow DHW Devices | Yes | 0 | 0.0 | 9 | $87 | $72 | $72 | $0 | 0.0 | 1,111 |
| **Custom Measures** | | | **12,761** | **0.0** | **126** | **$2,978** | **$10,044** | **$0** | **$10,044** | **3.4** | **27,575** |
| ECM 10 | Retro-Commissioning Study | Yes | 12,761 | 0.0 | 126 | $2,978 | $10,044 | $0 | $10,044 | 3.4 | 27,575 |
| **TOTALS (COST EFFECTIVE MEASURES)** | | | **85,104** | **21.2** | **134** | **$13,407** | **$80,090** | **$120** | **$79,970** | **6.0** | **101,420** |
| **TOTALS (ALL MEASURES)** | | | **87,619** | **22.0** | **134** | **$13,766** | **$88,173** | **$120** | **$88,053** | **6.4** | **103,943** |

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

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

*Figure 2 – Evaluated Energy Improvements*

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

## 1.1 Planning Your Project

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

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

### Pick Your Installation Approach

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

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 | |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | | X | |
| ECM 3 | Retrofit Fixtures with LED Lamps | | X | |
| ECM 4 | Install Occupancy Sensor Lighting Controls | | X | |
| ECM 5 | Install High/Low Lighting Controls | | X | |
| ECM 6 | Install VFD on Variable Air Volume (VAV) Fans | | X | |
| ECM 7 | Install High Efficiency Air Conditioning Units | | X | |
| ECM 8 | Install Pipe Insulation | X | X | |
| ECM 9 | Install Low-Flow DHW Devices | X | X | |
| ECM 10 | Retro-Commissioning Study | | X | |

*Figure 3 – Funding Options*

## New Jersey's 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>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.

*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 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 Hartley Dodge Memorial. 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 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.

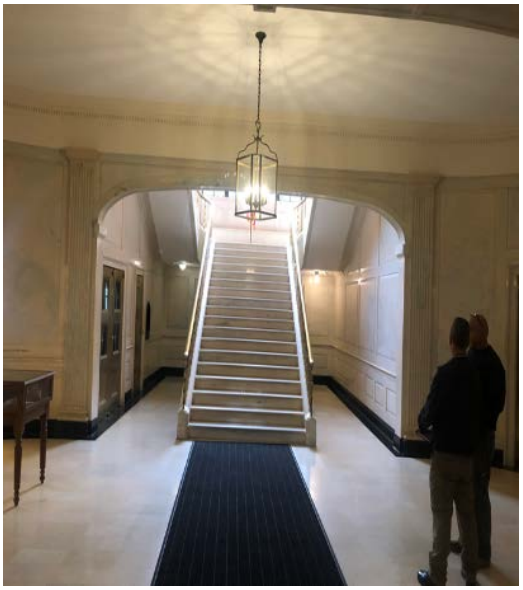
## 2.1 Site Overview

On November 5, 2019, TRC performed an energy audit at Hartley Dodge Memorial located in Madison, New Jersey. TRC met with Bob Duffy to review the facility operations and help focus our investigation on specific energy-using systems.

Hartley Dodge Memorial is a 3-story, 39,756 square foot building built in 1933. The building serves as the Brough of Madison Town Hall and houses many of its administrative services. The building also used to house the Fire and Police Departments. The Hartley Dodge Memorial building is listed on the National Registry of Historic Places. Spaces include: offices, storage rooms, basement spaces, an attic (housing mechanical equipment), municipal court, cells, lobbies, conference rooms, council and committee rooms, mail room, restrooms, garages, hallways, and a boiler room.

Recent improvements include: Over the last ten years the facility has replaced the boilers and installed a new water-cooled chiller, air handling units and a Trane building management system. There has also been a partial interior and exterior lighting retrofit.

The site is interested installing a small dedicated hot water boiler to meet the summer reheat load. The facility has issues balancing the heating load because of leakage in the ductwork.



*Court Room & Lobby Stairwell*

## 2.2 Building Occupancy

The facility is occupied year-round, Monday to Friday. The typical weekday occupancy schedule is presented in the table below.

| Building Name | Weekday/Weekend | Operating Schedule |
|---|---|---|
| Harthley Dodge Memorial - Offices | Weekday | 7:30 AM - 5:00 PM |
| | Weekend | Closed |

*Figure 4 - Building Occupancy Schedule*

## 2.3 Building Envelope

The building is constructed of granite, limestone, and marble, it boasts six colossal fluted Doric columns and an octagonal cupola. The walls are in good condition. The building has a pitched roof presumably covered with clay tiles. It has a conditioned attic space that houses mechanical equipment. The aging windows are single paned and have metal frames. They are in poor condition, showing evidence of wear. Exterior doors are constructed of metal and are in fair condition. There are several rollup doors that were used by the Fire and Police Departments. Overall, the building appears to be in acceptable aging condition.

*Building's Facades*

*Roof & Walls*

*Windows*

*Exterior & Rollup Doors*

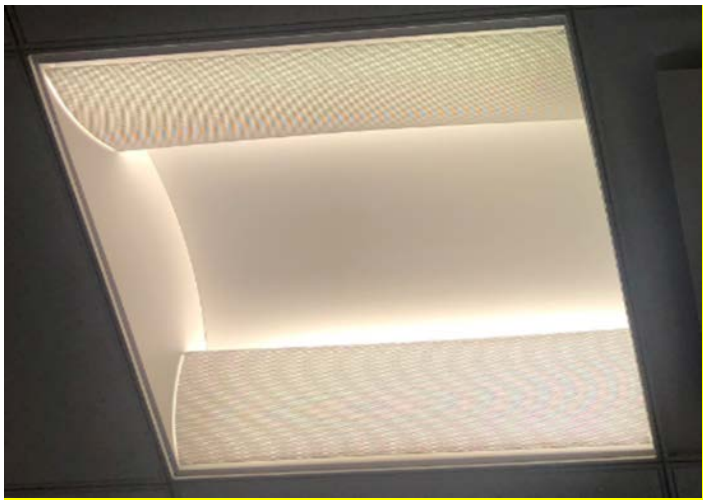
## 2.4 Lighting Systems

The primary interior lighting system includes a mixture of linear fluorescent T5, T8 lamps and LED general purpose lamps. Additionally, there are a lesser quantity of compact fluorescent lamps (CFL), linear fluorescent T12 lamps and incandescent lamps. Linear fluorescent fixture types include 2-lamp, 4-foot long troffer, recessed, and surface mounted fixtures, as well as 2-foot fixtures with U-bend linear tube lamps.

The old Police Department Garage and one of the storage rooms use 2-lamp, 8-foot long linear fluorescent T12 lamps. Most of the offices, lunch room and the copy room are lit with linear fluorescent T5 lamps. Fluorescent T8 fixtures are found in spaces such as the attic, basement, storage rooms, server room and boiler room, the court room, lobbies, council room and committee rooms. Trustee's conference room and some restrooms are illuminated with LED screw in lamps including some LED candelabra lamps. Most fixtures are in good condition and interior lighting levels were generally sufficient. Interior light fixtures are controlled either by occupancy sensors or wall switches.

The exterior lights include wall and recessed mounted metal halide fixtures with 100 Watt and 400-Watt lamps. There are eight LED fixture illuminating the ramp areas. Additionally, there are several pole and wall mounted LED fixtures. Exterior fixtures are controlled with a timer.

Many fixtures, both interior and exterior, are decorative in nature.



*31-Watt 4 PIN CFL Lamps*

*Linear T5 Fixtures*

*Linear T8 Lamps*

*LED Tubes*

*LED Candelabra Lamps*

*CFL Screw In Lamps*


*LED Exit Sign, Occupancy Sensor & Wall Switches*

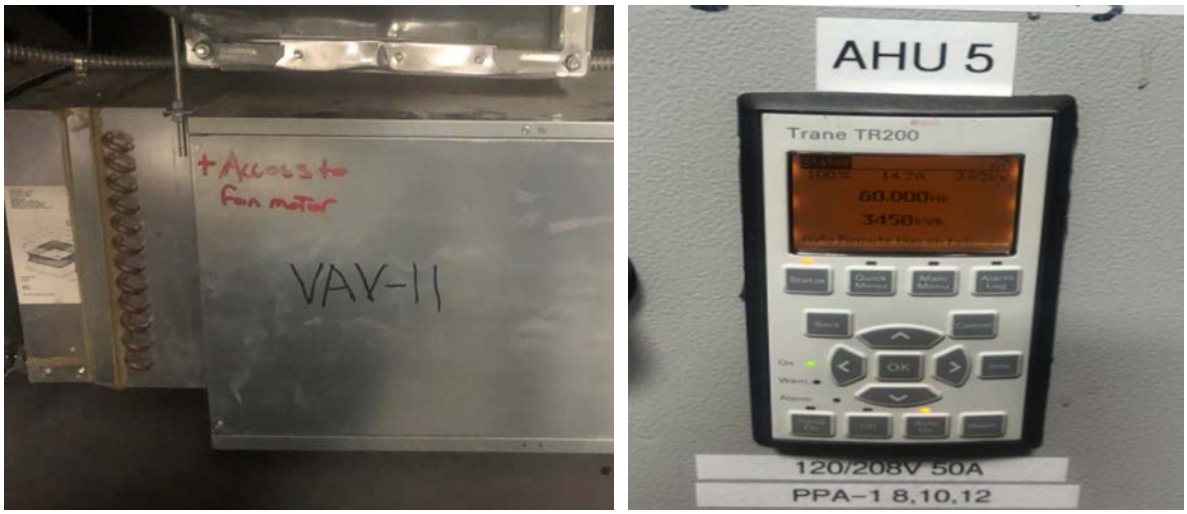
*Exterior LED Fixtures*

## 2.5 Air Distribution System - Air Handling Units (AHUs)

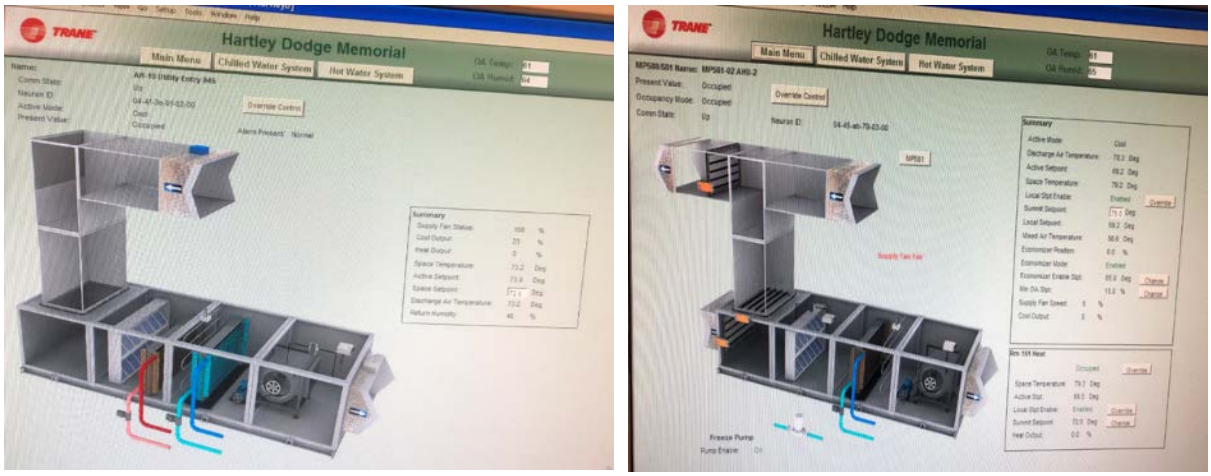
A total of 11 Trane AHUs are located in the attic and the basement, providing heating and cooling to the various spaces. Heating hot water is provided through a heat exchanger from the two steam boilers, and chilled water from the water-cooled chiller. Some AHUs (AHU-1, -2) only have chilled water coils. AHU-5, -6, and -7 are variable volume air volume (VAV) system with variable frequency drive (VFD) driven supply and return fan motors. The remaining AHUs are all constant air volume (CAV) systems. Supply fan motor horse power ranges from 0.3 hp to 7.5 hp. Supply fans are all in good working condition.

Conditioned air is distributed through concealed ductwork to variable air volume (VAV) terminals where it is distributed through the supply air registers in each common area and tenant space. There are approximately 31 VAV boxes. Space temperature set points for occupied and unoccupied are respectively 72°F and 68°F. The AHUs are controlled by the Trane energy management system (EMS). They are all in good condition.

*AHUs*




*VAV Box & VFD*




*EMS - AHUs*

## Direct Expansion Air Conditioning System (DX)

The direct expansion (DX) system for the facility consists of three split system air conditioners serving the mail room, server, and elevator room. They are respectively 1-, 2- and 1.5-ton units that are near the end of their useful life and have been evaluated for replacement. They are controlled with programmable thermostats.


*Mitsubishi Split System AC Serving the Mail Room*


*EMI Split System AC serving the Server Room & Programmable Thermostat*

## 2.6 Heating Steam Systems

The building space heating is served by two Weil McLain, 1,700 MBh steam boilers that were installed five years ago. The burners are non-modulating with 0.5 hp constant speed fan motors. The boilers are configured in an automated lead/lag control scheme. Both boilers are required under high load condition. There are two 0.5 hp boiler feed water pumps and two 0.3 hp condensate pumps.

A 2-pipe steam distribution system directly serves the building heating terminals. Based on the boiler control panel, steam is supplied at 2.6 psi to radiators for space heating.

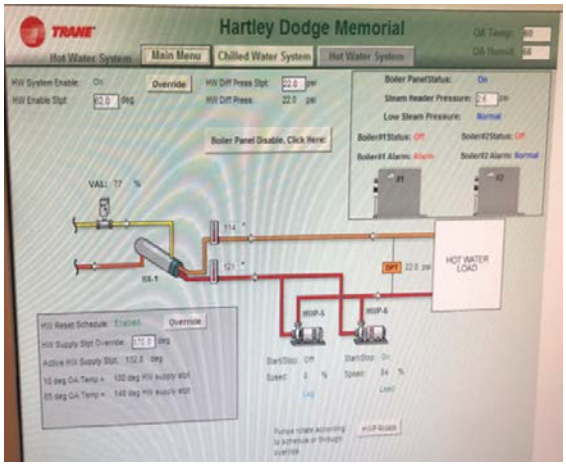
The boilers also produce heating hot water using a heat exchanger located in the boiler room. Heating hot water is supplied to AHUs, hydronic unit heaters, baseboards, and fan coil units (FCU). Hot water is distributed using two 5 hp variable speed hot water pumps (P5, P6) that run in automated lead/lag scheme. The hydronic system is a 2-pipe heating only system.

Based on the EMS, hot water is supplied at 180°F when the outside air temperature is 10°F, and the setpoint is adjusted linearly to 140°F when the outside air is above 65°F. Both the hot water and steam heating systems are controlled via the Trane EMS.


*Steam Boilers & Radiator*

*Boiler Feed Water Pumps & Condensate Pumps*


*Hot Water Pump & VFDs*



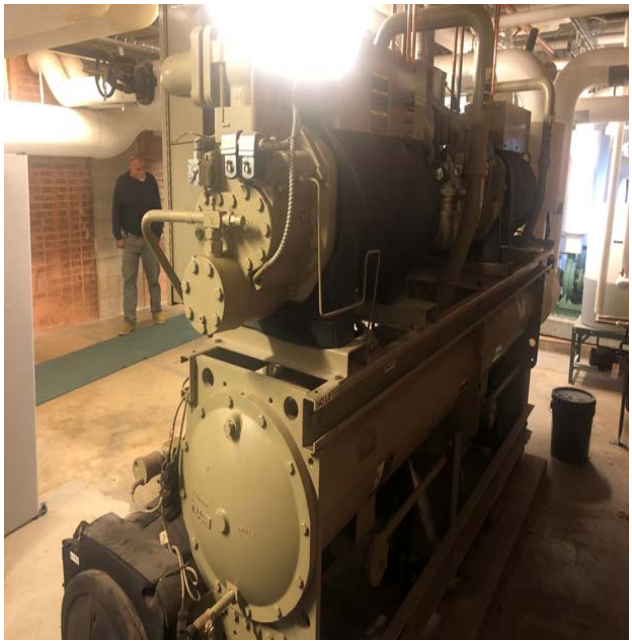

*Hot Water Loop & Fan Coil Unit*

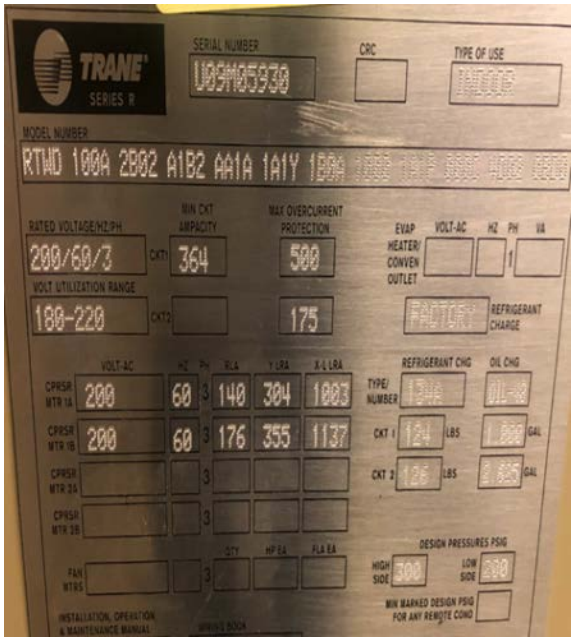
## 2.7 Chilled Water System

Chilled water is produced using a Trane helical-rotary variable speed liquid chiller. The chiller is configured in a primary- secondary distribution loop with two 10 hp constant flow primary pumps (P1, P2) and two 7.5 hp variable flow secondary pumps (P3, P4). The pumps run in automated lead/lad scheme.

The chilled water supply temperature is reset based on outside air temperature. Chilled water is distributed at 42°F when the outside air temperature is above 60°F and the setpoint is reset to 50°F when the outside air is below 55°F. The chiller plant is locked out when the outside air temperature is below 45°F. Chilled water is supplied to AHUs located in the attic and basement. The chilled water system is controlled via the Trane EMS. The chiller is in good condition.

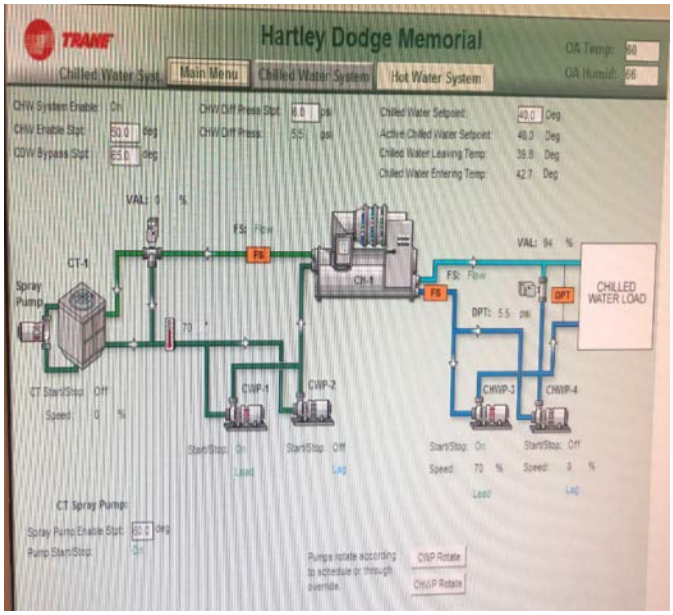
The condenser water system consists of one-cell cooling tower. The tower has a 30 hp variable speed fan motor and one 1.5 hp constant speed spray pump. The cooling tower is in good condition.






*100 Ton Helical-Rotary Trane Liquid Chiller*

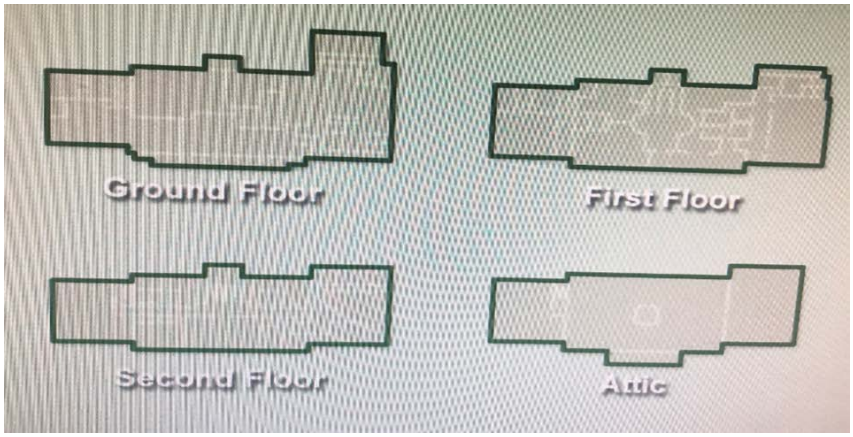

*Primary/Secondary Pumps & VFDs*



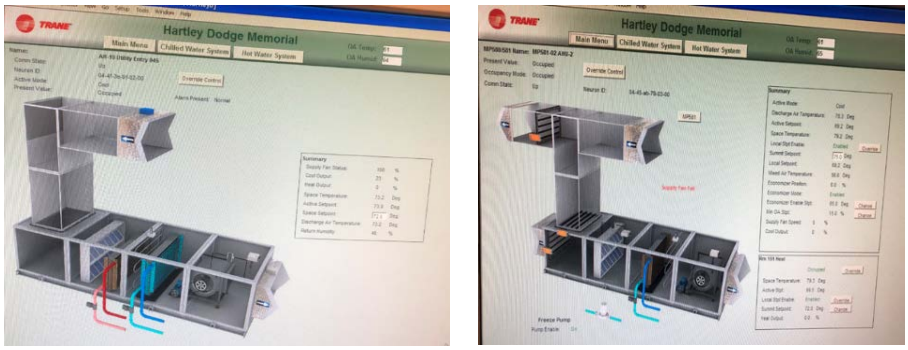

*Cooling Tower & Chilled Water EMS Loop*

## 2.8 Building Energy Management Systems (EMS)

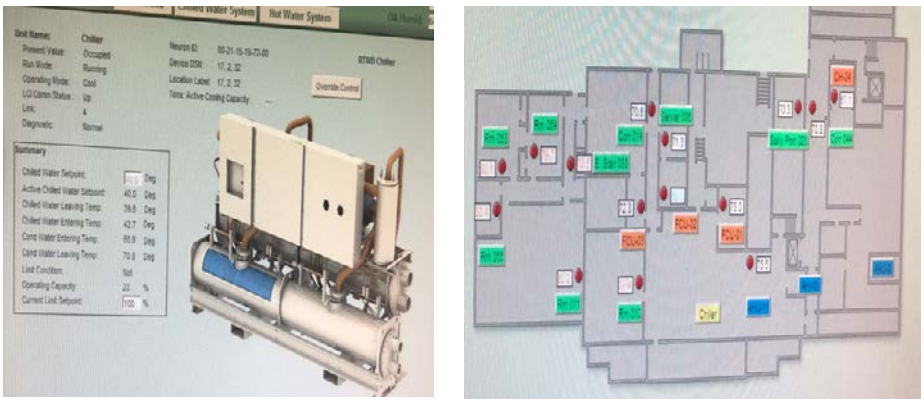
A Trane EMS controls the HVAC equipment, boilers, chiller, air handlers, VAV boxes, and fan coils. The EMS provides equipment scheduling control and monitors and controls space temperatures, supply air temperatures, humidity, heating water loop temperatures and chilled water loop temperatures. The EMS is ten years old; system operation would benefit from retro-commissioning.




*EMS Building's Floors*




*EMS - Air Distribution Systems*



*EMS - Chiller Plant & Ground Floor Diagram*

## 2.9 Domestic Hot Water

Hot water is produced with a 50 gallon 100 MBh 96% efficient gas-fired condensing storage water heater. At the time of the site visit, the domestic water heater supply water temperature was set at 120°F. The water heater is in good condition. The domestic hot water pipes are partially insulated.


*Gas-Fired Condensing Storage Tank Hot Water Heater*

## 2.10 Plug Load & Vending Machines

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

There are approximately 47 computer work stations throughout the facility. Plug loads throughout the building include general café and office equipment such as copy machines, desktop printers, water cooler, small refrigerators, coffee machines, and microwaves. The building also houses the main server for the Borough.

*Typical Plug Load*

## 2.11 Water-Using Systems

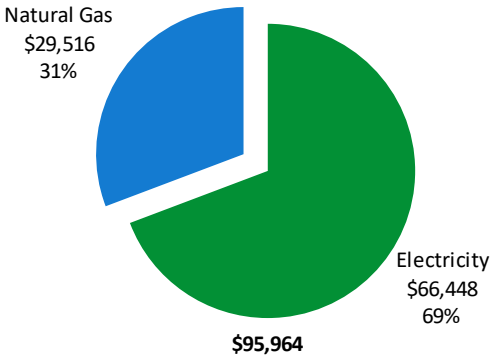
There are several restrooms with toilets, urinals, and sinks. Faucet flow rates are at 2.5 gallons per minute (gpm) or higher. Toilets are rated at 2.5 gallons per flush (gpf) and urinals are rated at 2.5 gpf. There is a restroom with shower and showerhead which is rated as low flow.

*Typical Sink & Urinals*

# 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 | 464,400 kWh | $66,448 |
| Natural Gas | 32,230 Therms | $29,516 |
| **Total** | | **$95,964** |




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.

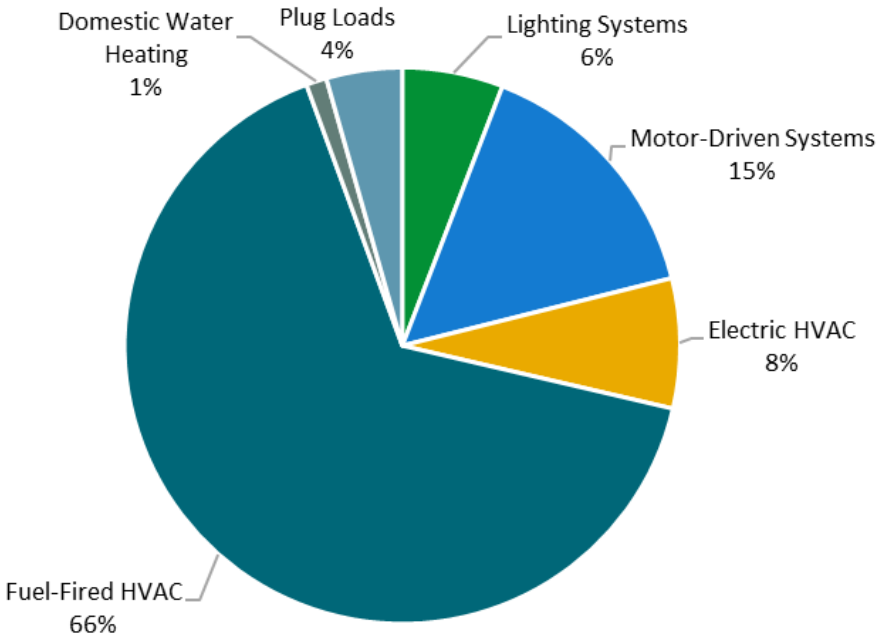
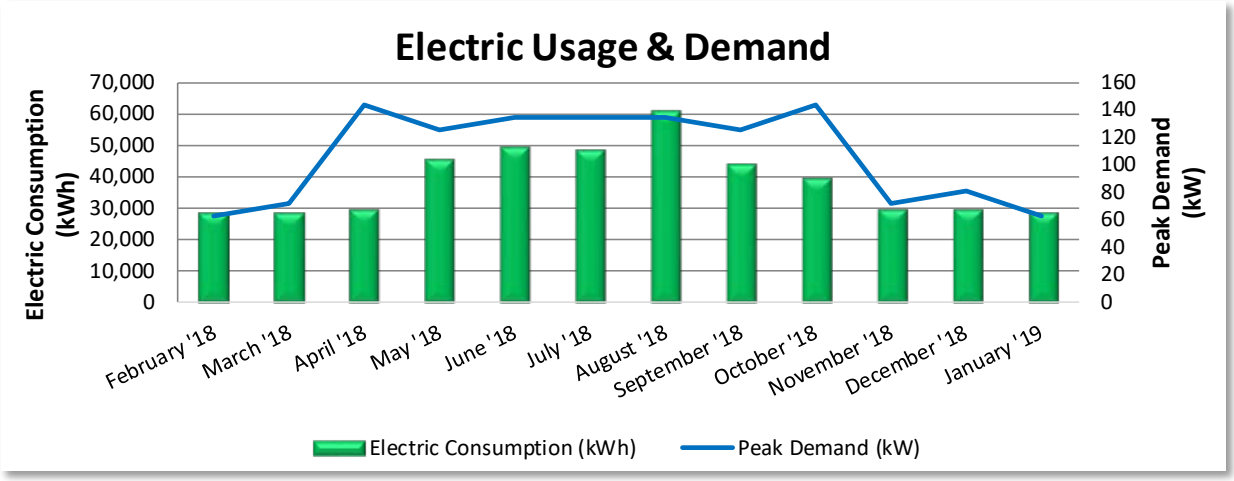



*Figure 5 - Energy Balance*

## 3.1 Electricity

Borough of Madison delivers electricity under rate class Basic Generation Service.



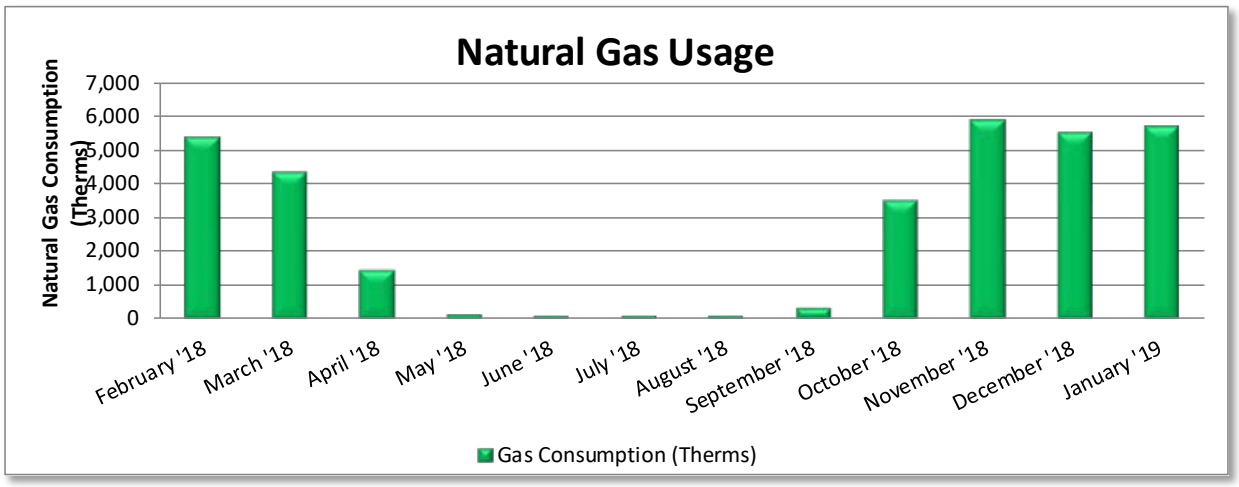

| Electric Billing Data | | | | | |
|---|---|---|---|---|---|
| Period Ending | Days in Period | Electric Usage (kWh) | Demand (kW) | Demand Cost | Total Electric Cost |
| 3/6/18 | 31 | 28,800 | 63 | $839 | $4,001 |
| 4/4/18 | 30 | 28,800 | 72 | $959 | $4,121 |
| 5/3/18 | 31 | 29,700 | 144 | $1,917 | $5,178 |
| 6/5/18 | 30 | 45,900 | 126 | $1,678 | $6,701 |
| 7/6/18 | 31 | 49,500 | 135 | $1,797 | $7,283 |
| 8/6/18 | 31 | 48,600 | 135 | $1,797 | $7,043 |
| 9/5/18 | 30 | 61,200 | 135 | $1,797 | $6,730 |
| 10/4/18 | 31 | 44,100 | 126 | $1,678 | $6,576 |
| 11/5/18 | 30 | 39,600 | 144 | $1,917 | $6,255 |
| 12/5/18 | 31 | 29,700 | 72 | $959 | $4,219 |
| 1/3/19 | 31 | 29,700 | 81 | $1,078 | $4,339 |
| 2/15/19 | 28 | 28,800 | 63 | $839 | $4,001 |
| **Totals** | **365** | **464,400** | **144** | **$17,255** | **$66,448** |
| **Annual** | **365** | **464,400** | **144** | **$17,255** | **$66,448** |

Notes:

- Peak demand of 144 kW occurred in April '18.
- Average demand over the past 12 months was 108 kW.
- The average electric cost over the past 12 months was $0.143/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.

## 3.2 Natural Gas

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




| Gas Billing Data | | | |
|---|---|---|---|
| **Period Ending** | **Days in Period** | **Natural Gas Usage (Therms)** | **Natural Gas Cost** |
| 3/6/18 | 31 | 5,338 | $5,037 |
| 4/4/18 | 30 | 4,310 | $2,673 |
| 5/3/18 | 31 | 1,448 | $975 |
| 6/5/18 | 30 | 100 | $168 |
| 7/6/18 | 31 | 67 | $149 |
| 8/6/18 | 31 | 81 | $157 |
| 9/5/18 | 30 | 93 | $164 |
| 10/4/18 | 31 | 291 | $289 |
| 11/5/18 | 30 | 3,466 | $3,567 |
| 12/5/18 | 31 | 5,861 | $5,842 |
| 1/3/19 | 31 | 5,481 | $5,346 |
| 2/15/19 | 28 | 5,696 | $5,148 |
| **Totals** | **365** | **32,230** | **$29,516** |
| **Annual** | **365** | **32,230** | **$29,516** |

Notes:

- The average gas cost for the past 12 months is $0.916/therm, which is the blended rate used throughout the analysis.

## 3.3 Benchmarking

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

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

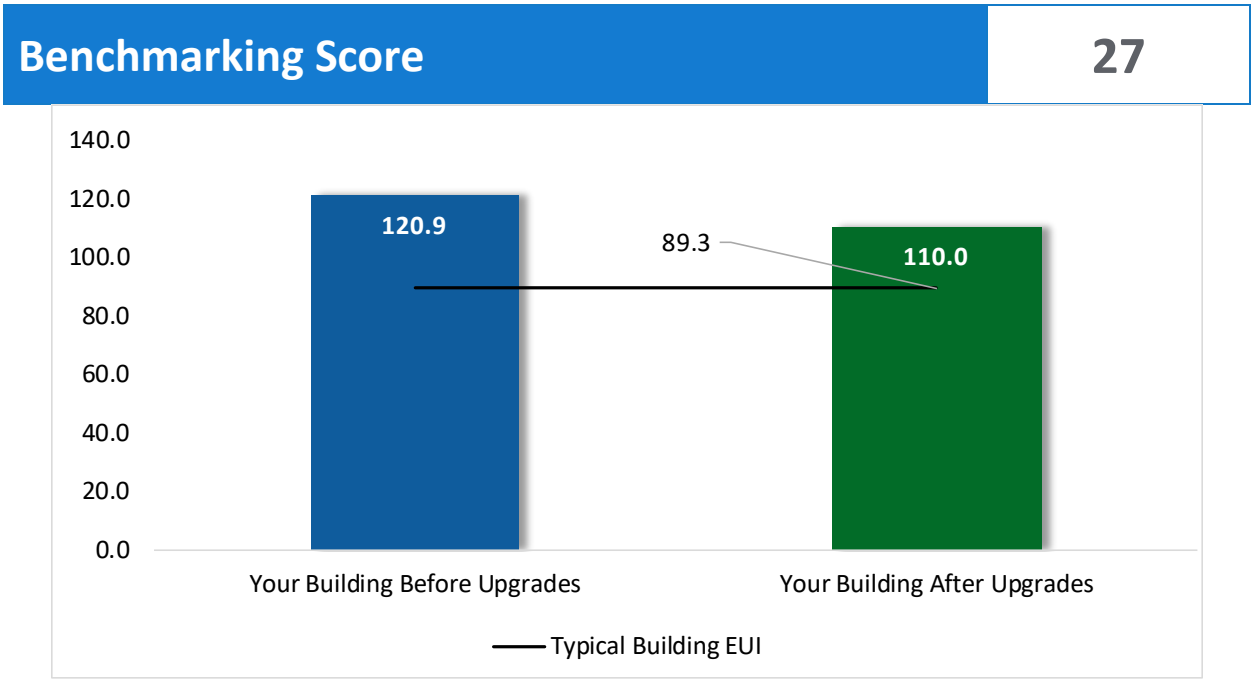



*Figure 6 - Energy Use Intensity Comparison*[3]

This building performs 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 a 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.

[3] Based on all evaluated ECMs

## Tracking Your Energy Performance

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

**We have created a Portfolio Manager® account for your facility and 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[4].

[4] 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's Clean Energy Program Protocols to Measure Resource Savings*, which is approved by the NJBPU. Further analysis or investigation may be required to calculate more precise savings based on specific circumstances.

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

Financial incentives 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.

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

| # | Energy Conservation Measure | Cost Effective? | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($)* | Estimated Net Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | | **43,632** | **13.2** | **-7** | **$6,177** | **$32,975** | **$0** | **$32,975** | **5.3** | **43,098** |
| ECM 1 | Install LED Fixtures | Yes | 12,462 | 1.2 | -1 | $1,777 | $16,714 | $0 | $16,714 | 9.4 | 12,474 |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | Yes | 1,757 | 1.1 | 0 | $248 | $1,520 | $0 | $1,520 | 6.1 | 1,727 |
| ECM 3 | Retrofit Fixtures with LED Lamps | Yes | 29,412 | 10.9 | -6 | $4,152 | $14,741 | $0 | $14,741 | 3.6 | 28,898 |
| **Lighting Control Measures** | | | **4,696** | **1.6** | **-1** | **$663** | **$8,796** | **$0** | **$8,796** | **13.3** | **4,614** |
| ECM 4 | Install Occupancy Sensor Lighting Controls | Yes | 4,289 | 1.5 | -1 | $606 | $7,446 | $0 | $7,446 | 12.3 | 4,214 |
| ECM 5 | Install High/Low Lighting Controls | No | 406 | 0.1 | 0 | $57 | $1,350 | $0 | $1,350 | 23.5 | 399 |
| **Variable Frequency Drive (VFD) Measures** | | | **24,422** | **6.5** | **0** | **$3,494** | **$29,427** | **$0** | **$29,427** | **8.4** | **24,593** |
| ECM 6 | Install VFD on Variable Air Volume (VAV) Fans | Yes | 24,422 | 6.5 | 0 | $3,494 | $29,427 | $0 | $29,427 | 8.4 | 24,593 |
| **Electric Unitary HVAC Measures** | | | **2,109** | **0.7** | **0** | **$302** | **$6,733** | **$0** | **$6,733** | **22.3** | **2,124** |
| ECM 7 | Install High Efficiency Air Conditioning Units | No | 2,109 | 0.7 | 0 | $302 | $6,733 | $0 | $6,733 | 22.3 | 2,124 |
| **HVAC System Improvements** | | | **0** | **0.0** | **7** | **$65** | **$126** | **$48** | **$78** | **1.2** | **829** |
| ECM 8 | Install Pipe Insulation | Yes | 0 | 0.0 | 7 | $65 | $126 | $48 | $78 | 1.2 | 829 |
| **Domestic Water Heating Upgrade** | | | **0** | **0.0** | **9** | **$87** | **$72** | **$72** | **$0** | **0.0** | **1,111** |
| ECM 9 | Install Low-Flow DHW Devices | Yes | 0 | 0.0 | 9 | $87 | $72 | $72 | $0 | 0.0 | 1,111 |
| **Custom Measures** | | | **12,761** | **0.0** | **126** | **$2,978** | **$10,044** | **$0** | **$10,044** | **3.4** | **27,575** |
| ECM 10 | Retro-Commissioning Study | Yes | 12,761 | 0.0 | 126 | $2,978 | $10,044 | $0 | $10,044 | 3.4 | 27,575 |
| **TOTALS (COST EFFECTIVE MEASURES)** | | | **85,104** | **21.2** | **134** | **$13,407** | **$80,090** | **$120** | **$79,970** | **6.0** | **101,420** |
| **TOTALS (ALL MEASURES)** | | | **87,619** | **22.0** | **134** | **$13,766** | **$88,173** | **$120** | **$88,053** | **6.4** | **103,943** |

*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** | | **43,632** | **13.2** | **-7** | **$6,177** | **$32,975** | **$0** | **$32,975** | **5.3** | **43,098** |
| ECM 1 | Install LED Fixtures | 12,462 | 1.2 | -1 | $1,777 | $16,714 | $0 | $16,714 | 9.4 | 12,474 |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | 1,757 | 1.1 | 0 | $248 | $1,520 | $0 | $1,520 | 6.1 | 1,727 |
| ECM 3 | Retrofit Fixtures with LED Lamps | 29,412 | 10.9 | -6 | $4,152 | $14,741 | $0 | $14,741 | 3.6 | 28,898 |
| **Lighting Control Measures** | | **4,289** | **1.5** | **-1** | **$606** | **$7,446** | **$0** | **$7,446** | **12.3** | **4,214** |
| ECM 4 | Install Occupancy Sensor Lighting Controls | 4,289 | 1.5 | -1 | $606 | $7,446 | $0 | $7,446 | 12.3 | 4,214 |
| **Variable Frequency Drive (VFD) Measures** | | **24,422** | **6.5** | **0** | **$3,494** | **$29,427** | **$0** | **$29,427** | **8.4** | **24,593** |
| ECM 6 | Install VFD on Variable Air Volume (VAV) Fans | 24,422 | 6.5 | 0 | $3,494 | $29,427 | $0 | $29,427 | 8.4 | 24,593 |
| **HVAC System Improvements** | | **0** | **0.0** | **7** | **$65** | **$126** | **$48** | **$78** | **1.2** | **829** |
| ECM 8 | Install Pipe Insulation | 0 | 0.0 | 7 | $65 | $126 | $48 | $78 | 1.2 | 829 |
| **Domestic Water Heating Upgrade** | | **0** | **0.0** | **9** | **$87** | **$72** | **$72** | **$0** | **0.0** | **1,111** |
| ECM 9 | Install Low-Flow DHW Devices | 0 | 0.0 | 9 | $87 | $72 | $72 | $0 | 0.0 | 1,111 |
| **Custom Measures** | | **12,761** | **0.0** | **126** | **$2,978** | **$10,044** | **$0** | **$10,044** | **3.4** | **27,575** |
| ECM 10 | Retro-Commissioning Study | 12,761 | 0.0 | 126 | $2,978 | $10,044 | $0 | $10,044 | 3.4 | 27,575 |
| **TOTALS** | | **85,104** | **21.2** | **134** | **$13,407** | **$80,090** | **$120** | **$79,970** | **6.0** | **101,420** |

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

** - 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** | | **43,632** | **13.2** | **-7** | **$6,177** | **$32,975** | **$0** | **$32,975** | **5.3** | **43,098** |
| ECM 1 | Install LED Fixtures | 12,462 | 1.2 | -1 | $1,777 | $16,714 | $0 | $16,714 | 9.4 | 12,474 |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | 1,757 | 1.1 | 0 | $248 | $1,520 | $0 | $1,520 | 6.1 | 1,727 |
| ECM 3 | Retrofit Fixtures with LED Lamps | 29,412 | 10.9 | -6 | $4,152 | $14,741 | $0 | $14,741 | 3.6 | 28,898 |

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

### ECM 1: Install LED Fixtures

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

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

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

**Affected building areas:** exterior fixtures.

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

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

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

**Affected building areas**: all areas with fluorescent fixtures with T12 tubes (garages, storage room, closet).

## ECM 3: Retrofit Fixtures with LED Lamps

Replace fluorescent T5, T8, CFLs 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:** all areas with fluorescent fixture(T5, T8 tubes, CFLs,) and incandescent lamps.

## 4.2 Lighting Controls

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($)* | Estimated Net Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Control Measures** | | **4,696** | **1.6** | **-1** | **$663** | **$8,796** | **$0** | **$8,796** | **13.3** | **4,614** |
| ECM 4 | Install Occupancy Sensor Lighting Controls | 4,289 | 1.5 | -1 | $606 | $7,446 | $0 | $7,446 | 12.3 | 4,214 |
| ECM 5 | Install High/Low Lighting Controls | 406 | 0.1 | 0 | $57 | $1,350 | $0 | $1,350 | 23.5 | 399 |

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

### ECM 4: Install Occupancy Sensor Lighting Controls

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

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

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

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

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

### ECM 5: Install High/Low Lighting Controls

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

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

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

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

**Affected building areas**: hallways and stairwells.

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 Variable Frequency Drives (VFD)

| # | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Variable Frequency Drive (VFD) Measures** | | **24,422** | **6.5** | **0** | **$3,494** | **$29,427** | **$0** | **$29,427** | **8.4** | **24,593** |
| ECM 6 | Install VFD on Variable Air Volume (VAV) Fans | 24,422 | 6.5 | 0 | $3,494 | $29,427 | $0 | $29,427 | 8.4 | 24,593 |

Variable frequency drives control motors for fans, pumps, and process equipment based on the actual output required of the driven equipment. Energy savings result from more efficient control of motor energy usage when equipment operates at partial load. The magnitude of energy savings depends on the estimated amount of time that the motor would operate at partial load. For equipment with proposed VFDs, we have included replacing the controlled motor with a new inverter duty rated motor to conservatively account for the cost of an inverter duty rated motor.

### ECM 6: Install VFD on Variable Air Volume (VAV) Fans

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

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

**Affected air handlers**: all constant air volume AHUs.

## 4.4 Electric Unitary 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Electric Unitary HVAC Measures** | | **2,109** | **0.7** | **0** | **$302** | **$6,733** | **$0** | **$6,733** | **22.3** | **2,124** |
| ECM 7 | Install High Efficiency Air Conditioning Units | 2,109 | 0.7 | 0 | $302 | $6,733 | $0 | $6,733 | 22.3 | 2,124 |

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

### ECM 7: Install High Efficiency Air Conditioning Units

We have evaluated replacing standard efficiency split system air conditioning units with high efficiency split system air conditioning units. The magnitude of energy savings for this measure depends on the relative efficiency of the older unit versus the new high efficiency unit, the average cooling load, and the estimated annual operating hours.

**Affected units:** the three split system ACs.

## 4.5 HVAC Improvements

| # | 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** | **7** | **$65** | **$126** | **$48** | **$78** | **1.2** | **829** |
| ECM 8 | Install Pipe Insulation | 0 | 0.0 | 7 | $65 | $126 | $48 | $78 | 1.2 | 829 |

### ECM 8: Install Pipe Insulation

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

## 4.6 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** | | **0** | **0.0** | **9** | **$87** | **$72** | **$72** | **$0** | **0.0** | **1,111** |
| ECM 9 | Install Low-Flow DHW Devices | 0 | 0.0 | 9 | $87 | $72 | $72 | $0 | 0.0 | 1,111 |

### ECM 9: 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 |

Low-flow devices reduce the overall water flow from the fixture, while still providing adequate pressure for washing. Additional cost savings may result from reduced water usage.

## 4.7 Custom Measures

| # | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Custom Measures** | | **12,761** | **0.0** | **126** | **$2,978** | **$10,044** | **$0** | **$10,044** | **3.4** | **27,575** |
| ECM 10 | Retro-Commissioning Study | 12,761 | 0.0 | 126 | $2,978 | $10,044 | $0 | $10,044 | 3.4 | 27,575 |

**ECM 10: Retro-Commissioning Study**

Due to the complexity of today's HVAC systems and controls a thorough analysis and rebalance of heating, ventilation, and cooling systems should periodically be conducted. There are indications at this site that systems may be not be operating correctly or as efficiently as they could be. One important tool available to building operators to ensure proper system operation is retro-commissioning.

Retro-commissioning is a common practice recommended by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) to be implemented every few years. We recommend that you contact a reputable engineering firm that specializes in energy control systems and retro-commissioning. Ask them to propose a scope of work and an outline of the procedures and processes to be implemented, including a schedule and the roles of all responsible parties.

Once goals and responsibilities are established, the objective of the investigation process is to understand how the building is currently operating, identify the issues, and determine the most cost-effective way to improve performance. The retro-commissioning agent will review building documentation, interview building occupants, and inspect and test the equipment. Information is then compiled into a report and shared with facility staff, who will select which recommendations to implement after reviewing the findings.

The implementation phase puts the selected processes into place. Typical measures may include sensor calibration, equipment schedule changes, damper linkage repair and similar relatively low-cost adjustments -- although more expensive sophisticated programming and building control system upgrades may be warranted. Approved measures may be implemented by the agent, the building staff, or by subcontractors. Typically, a combination of these individuals makes up the retro-commissioning team.

After the approved measures are implemented, the team will verify that the changes are working as expected. Baseline and post-case measurements will allow building staff to monitor equipment and ensure that the benefits are maintained.

A high-level evaluation of potential savings and costs is provided for demonstration purposes only. It is a screening evaluation for the potential in HVAC Control Improvements. Based on industry standards and previous project experience, the potential energy savings may be up to 15% of existing HVAC energy use. The average cost of retro-commissioning studies and control improvements is $0.30 per square foot. Actual savings and costs will need to be outlined by the specific contractor engaged to perform the study. For the purposes of this report, we have conservatively estimated savings to be 4% of the HVAC energy consumption baseline.

## 4.8 Measures for Future Consideration

There are additional opportunities for improvement that the Borough of Madison may wish to consider. These potential upgrades typically require further analysis, involve substantial capital investment and/or include significant system reconfiguration. These measures are therefore beyond the scope of this energy audit. These measures are described here to support a whole building approach to energy efficiency and sustainability.

The Borough of Madison may wish to consider the Energy Savings Improvement Program (ESIP). With interest in implementing comprehensive, largescale and/or complex system wide projects, these measures may be pursued during development of a future energy savings plan. We recommend that you work with your energy service company (ESCO) and/or design team to evaluate these measures further, develop firm costs, savings estimates and detailed implementation plans. Other modernization or capital improvement funds may be leveraged for these types of refurbishments. As you plan for capital upgrades, be sure to consider the energy impact of the building systems and controls being specified.

### Dedicated Summer Boiler Installation

The largest consumer of energy in this building is associated with the heating mechanical equipment. Due to the boiler plant serving the reheat coils and space heating needs of the facility, a boiler must operate year-round at light load conditions which results in an overall poor "cycle" efficiency. A potential solution includes the installation of a dedicated boiler which would operate to meet the heating needs during the summer months, eliminating the need for the heating boiler during this period.

This action will increase the efficiency of the boiler plant operation and therefore significantly reduce fuel consumption. The summer boiler must be sized to meet the requirements of the reheat system. This will allow for the mitigation of short cycling and cycling losses in the system. The system will include the boiler, a new heat exchanger, blending valve and additional gas and water piping and electrical connections. We recommend that an HVAC contractor who specializes in boiler systems be contacted for a detailed evaluation and implementation costs.

### Duct Sealing

Duct leakage in commercial buildings can account for five to twenty-five percent of the supply airflow. In the case of rooftop air handlers, duct leakage can occur to the outside of the building wasting conditioned air. Check ductwork for leakage. Distribution system losses are dependent on air system temperature, the size of the distribution system, and the level of insulation of the ductwork. Significant energy savings can be achieved when insulation has not been well maintained. When the insulation is missing or worn, the system efficiency can be significantly reduced. This measure saves energy by reducing heat transfer in the distribution system. Eliminating duct leaks can improve ventilation system performance and reduce heating and cooling system operation.

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

## Weatherization

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

## Doors and Windows

Close exterior doors and windows in heated and cooled areas. Leaving doors and windows open leads to a loss of heat during the winter and chilled air during the summer. Reducing air changes per hour (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.

[5] 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. Adjust exterior lighting time clock controls seasonally as needed to match your lighting requirements.

## Motor Maintenance

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

## 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.

## Chiller Maintenance

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

## AC System Evaporator/Condenser Coil Cleaning

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

## HVAC Filter Cleaning and Replacement

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

## Boiler Maintenance

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

## Water Heater Maintenance

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

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

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

## Computer Power Management Software

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

## Water Conservation


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

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

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

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

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

## Procurement Strategies

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

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

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

# 6 On-site Generation

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

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

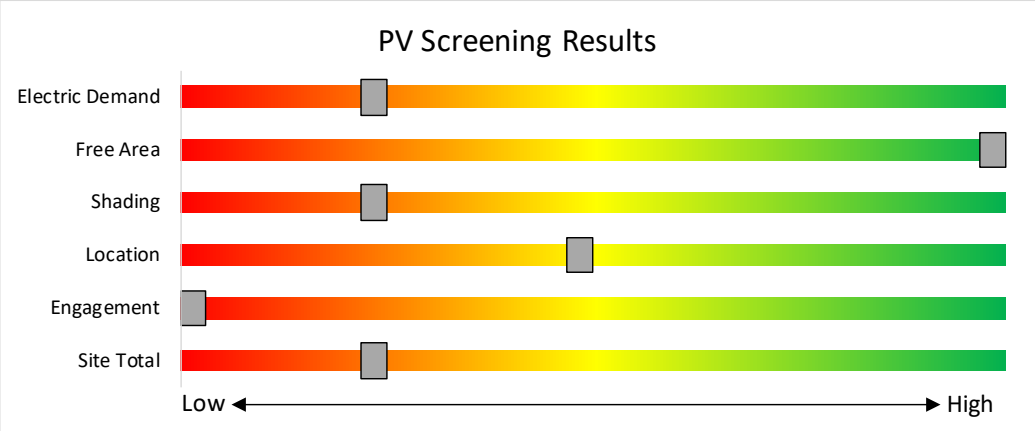
## 6.1 Solar Photovoltaic

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

A preliminary screening based on the facility's electric demand, size and location of free area, and shading elements shows that the facility has low potential for installing a PV array.

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

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




| | | |
|---|---|---|
| **Potential** | Low | |
| **System Potential** | 107 | kW DC STC |
| **Electric Generation** | 80,512 | kWh/yr |
| **Displaced Cost** | $11,520 | /yr |
| **Installed Cost** | $306,000 | |

*Figure 9 - Photovoltaic Screening*

**Solar Renewable Energy Certificate (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.

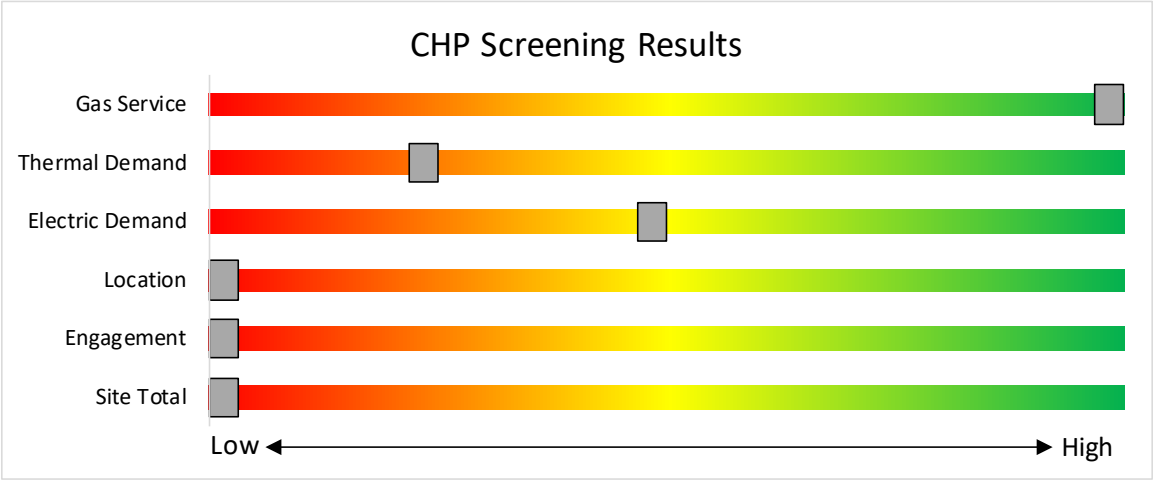
CHP systems typically produce a portion of the electric power used on-site, with the balance of electric power needs supplied by the local utility company. The heat is used to supplement (or replace) existing boilers and provide space heating and/or domestic hot water heating. Waste heat can also be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




| | | |
|---|---|---|
| **Potential** | None | |
| **System Type** | None | |
| **System Potential** | 10 | kW |
| **Electric Generation** | 106,028 | kWh/yr |
| **Thermal Generation** | 2,079,780 | MBtu/yr |
| **Displaced Cost** | $7,027 | /yr |
| **Installed Cost** | $50,000 | |

*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's 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 New Jersey's 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 efficient 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.

**The evaluated electric measures do not qualify for incentive under SmartStart as the site does not pay the system benefit charge (SBC).**

## 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 Pay for Performance - Existing Buildings

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 that results in at least 15% source energy savings, and lighting cannot make up the majority of the savings. P4P is a generally a good option for medium-to-large sized facilities looking to implement as many measures as possible under a single project to achieve deep energy savings. This program has an added benefit of addressing measures that may not qualify for other programs. Many facilities pursuing an Energy Savings Improvement Program loan also use this program.

Based on the site building and utility data provided, the facility does not meet the requirements of the current P4P program.

**Incentives**

Incentives are based on estimated and achieved energy savings ranging from $0.18-$0.22/kWh and $1.80-$2.50/therm, capped at the lesser of 50% total project cost, or $1 million per electric account and $1 million per natural gas account, per fiscal year, not to exceed $2 million per project. An incentive of $0.15/square foot is also available to offset the cost of developing the Energy Reduction Plan (see below) contingent on the project moving forward with measure installation.

**How to Participate**

Contact one of the pre-approved consultants and contractors ("Partners"). Under direct contract to you, they will help further evaluate the measures identified in this report through development of the energy reduction plan), assist you in implementing selected measures, and verify actual savings one year after the installation. Your Partner will also help you apply for incentives.

Approval of the final scope of work is required by the program prior to installation. Installation can be done by the contractor of your choice (some P4P Partners are also contractors) or by internal staff, but the Partner remains involved throughout construction to ensure compliance with the program requirements.

Detailed program descriptions, instructions for applying, applications and list of Partners can be found at: www.njcleanenergy.com/P4P.

## 7.4 Combined Heat and Power

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

**Incentives**

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

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

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

**How to Participate**

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

## 7.5 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.*

## 7.6 SREC Registration Program

The SREC (Solar Renewable Energy Certificate) Registration Program (SRP) is used to register the intent to install solar projects in New Jersey. Rebates are not available for solar projects, but owners of solar projects *must* register their projects prior to the start of construction to establish the project's eligibility to earn SRECs. Registration of the intent to participate in New Jersey's solar marketplace provides market participants with information about the pipeline of anticipated new solar capacity and insight into future SREC pricing.

After the registration is accepted, construction is complete, and final paperwork has been submitted and is deemed complete, the project is issued a New Jersey certification number, which enables it to generate New Jersey SRECs. SREC's are generated once the solar project has been authorized to be energized by the Electric Distribution Company (EDC).

Each time a solar installation generates 1,000 kilowatt-hours (kWh) of electricity, an SREC is earned. Solar project owners report the energy production to the SREC Tracking System. This reporting allows SREC's to be placed in the customer's electronic account. SRECs can then be sold on the SREC Tracking System, providing revenue for the first 15 years of the project's life.

Electricity suppliers, the primary purchasers of SRECs, are required to pay a Solar Alternative Compliance Payment (SACP) if they do not meet the requirements of New Jersey's Solar Renewable Portfolio Standard. Purchasing SRECs can help them meet those requirements. As SRECs are traded in a competitive market, the price may vary significantly. The actual price of an SREC during a trading period fluctuates depending on supply and demand.

Information about the SRP can be found at: www.njcleanenergy.com/srec.

# 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 |
| Attic - East Wing | 8 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,470 | 3, 4 | Relamp | Yes | 8 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,704 | 0.3 | 913 | 0 | $129 | $562 | $0 | 4.4 |
| Attic - East Wing | 1 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | S | 88 | 2,470 | 2, 4 | Relamp & Reballast | Yes | 1 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,704 | 0.1 | 185 | 0 | $26 | $69 | $0 | 2.6 |
| Attic - East Wing | 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 |
| Attic - Center Wing | 3 | LED - Fixtures: Ambient 2x4 Fixture | Occupancy Sensor | S | 50 | 1,820 | | None | No | 3 | LED - Fixtures: Ambient 2x4 Fixture | Occupancy Sensor | 50 | 1,820 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Attic - Center Wing | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | S | 29 | 1,820 | | None | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,820 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Attic - Center Wing | 49 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | S | 32 | 1,820 | 3 | Relamp | No | 49 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,820 | 0.8 | 1,717 | 0 | $242 | $895 | $0 | 3.7 |
| Attic - Center Wing | 4 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 4 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Attic - Center Wing | 8 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 1,820 | 3 | Relamp | No | 8 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,820 | 0.2 | 529 | 0 | $75 | $292 | $0 | 3.9 |
| Attic - West Wing | 9 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 1,820 | 3 | Relamp | No | 9 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,820 | 0.3 | 595 | 0 | $84 | $329 | $0 | 3.9 |
| Attic - West Wing | 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 |
| Attic - Stairwell | 2 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | S | 88 | 3,120 | 2, 5 | Relamp & Reballast | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | High/Low Control | 29 | 2,153 | 0.1 | 467 | 0 | $66 | $363 | $0 | 5.5 |
| Attic - Stairwell | 2 | LED Lamps: Screw in | Wall Switch | S | 9 | 3,120 | | None | No | 2 | LED Lamps: Screw in | Wall Switch | 9 | 3,120 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Attic - Stairwell | 3 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 3 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Attic - Stairwell | 2 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | S | 29 | 3,120 | 5 | None | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | High/Low Control | 29 | 2,153 | 0.0 | 62 | 0 | $9 | $0 | $0 | 0.0 |
| Attic - Stairwell | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 3,120 | 3, 5 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | High/Low Control | 29 | 2,153 | 0.1 | 288 | 0 | $41 | $298 | $0 | 7.3 |
| Boiler Room | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,470 | 3, 4 | Relamp | Yes | 12 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,704 | 0.5 | 1,369 | 0 | $193 | $978 | $0 | 5.1 |
| Basement - Restroom | 1 | LED Lamps: Screw in | Wall Switch | S | 9 | 2,470 | | None | No | 1 | LED Lamps: Screw in | Wall Switch | 9 | 2,470 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Basement - Hallway | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 3,120 | 3, 5 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | High/Low Control | 29 | 2,153 | 0.1 | 288 | 0 | $41 | $298 | $0 | 7.3 |
| Basement - Hallway | 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 |
| Basement - Hallway | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 2,210 | 3 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,210 | 0.0 | 80 | 0 | $11 | $37 | $0 | 3.2 |
| Closet | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 1,040 | 3 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 1,040 | 0.0 | 38 | 0 | $5 | $37 | $0 | 6.9 |
| Basement | 15 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 3,120 | 3, 4 | Relamp | Yes | 15 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,153 | 0.6 | 2,162 | 0 | $305 | $1,088 | $0 | 3.6 |
| Basement | 2 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 2 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Mail Room | 4 | U-Bend Fluorescent - T8: U T8 (32W) - 2L | Wall Switch | S | 62 | 2,470 | 3, 4 | Relamp | Yes | 4 | LED - Linear Tubes: (2) U-Lamp | Occupancy Sensor | 33 | 1,704 | 0.1 | 426 | 0 | $60 | $560 | $0 | 9.3 |
| Storage Room1 | 3 | Linear Fluorescent - T12: 8' T12 (75W) - 2L | Wall Switch | S | 158 | 1,040 | 2, 4 | Relamp & Reballast | Yes | 3 | LED - Linear Tubes: (2) 8' Lamps | Occupancy Sensor | 72 | 718 | 0.3 | 372 | 0 | $52 | $656 | $0 | 12.5 |

| | 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 |
| Storage Room1 | 1 | Incandescent: Screw in | Wall Switch | S | 65 | 1,040 | 3, 4 | Relamp | Yes | 1 | LED Lamps: LED Screw in | Occupancy Sensor | 10 | 718 | 0.1 | 66 | 0 | $9 | $17 | $0 | 1.8 |
| Storage Room2 | 6 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 6 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Storage Room2 | 8 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 1,040 | 3 | Relamp | No | 8 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,040 | 0.2 | 302 | 0 | $43 | $292 | $0 | 6.9 |
| Storage Room3 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 1,040 | 3, 4 | Relamp | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 718 | 0.2 | 192 | 0 | $27 | $416 | $0 | 15.3 |
| Restroom | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,470 | 3 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 2,470 | 0.0 | 90 | 0 | $13 | $37 | $0 | 2.9 |
| Garage | 4 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | S | 88 | 1,040 | 2, 4 | Relamp & Reballast | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 718 | 0.3 | 311 | 0 | $44 | $545 | $0 | 12.4 |
| IT Hallway | 3 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 2,080 | 3 | Relamp | No | 3 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,080 | 0.1 | 227 | 0 | $32 | $110 | $0 | 3.4 |
| IT Hallway | 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 |
| Janitorial Office | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 2,210 | 3 | Relamp | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,210 | 0.1 | 160 | 0 | $23 | $73 | $0 | 3.2 |
| IT Office | 2 | U-Bend Fluorescent - T8: U T8 (32W) - 2L | Occupancy Sensor | S | 62 | 2,210 | 3 | Relamp | No | 2 | LED - Linear Tubes: (2) U-Lamp | Occupancy Sensor | 33 | 2,210 | 0.1 | 141 | 0 | $20 | $145 | $0 | 7.3 |
| Server Room | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 2,210 | 3 | Relamp | No | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,210 | 0.1 | 321 | 0 | $45 | $146 | $0 | 3.2 |
| AHU Room | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,470 | 3 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 2,470 | 0.0 | 90 | 0 | $13 | $37 | $0 | 2.9 |
| West Wing Basement | 9 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 2,210 | 3 | Relamp | No | 9 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,210 | 0.3 | 722 | 0 | $102 | $329 | $0 | 3.2 |
| West Wing Basement | 1 | Exit Signs: LED - 2 W Lamp | None | | 6 | 1,820 | | None | No | 1 | Exit Signs: LED - 2 W Lamp | None | 6 | 1,820 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| West Wing Basement | 8 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,470 | 3, 4 | Relamp | Yes | 8 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,704 | 0.3 | 913 | 0 | $129 | $562 | $0 | 4.4 |
| Elevator Room1 | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 1,040 | 3 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 1,040 | 0.0 | 38 | 0 | $5 | $37 | $0 | 6.9 |
| Telephone Room | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,470 | 3, 4 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,704 | 0.1 | 228 | 0 | $32 | $189 | $0 | 5.9 |
| Generator Room | 3 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 1,040 | 3, 4 | Relamp | Yes | 3 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 718 | 0.1 | 144 | 0 | $20 | $380 | $0 | 18.7 |
| Elevator Room2 | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 1,040 | 3 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 1,040 | 0.0 | 38 | 0 | $5 | $37 | $0 | 6.9 |
| Elevator - Basement | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 2,210 | 3 | Relamp | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,210 | 0.1 | 160 | 0 | $23 | $73 | $0 | 3.2 |
| Elevator - Basement | 2 | Exit Signs: LED - 2 W Lamp | None | | 6 | 1,820 | | None | No | 2 | Exit Signs: LED - 2 W Lamp | None | 6 | 1,820 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Old PD Garage | 4 | Linear Fluorescent - T12: 8' T12 (75W) - 2L | Wall Switch | S | 158 | 1,300 | 2, 4 | Relamp & Reballast | Yes | 4 | LED - Linear Tubes: (2) 8' Lamps | Occupancy Sensor | 72 | 897 | 0.4 | 620 | 0 | $87 | $785 | $0 | 9.0 |
| Hallway | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 3,120 | 3, 5 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | High/Low Control | 29 | 2,153 | 0.1 | 288 | 0 | $41 | $298 | $0 | 7.3 |
| Hallway | 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 |
| West Wing Stairwell | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 3,120 | 3, 5 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | High/Low Control | 29 | 2,153 | 0.1 | 288 | 0 | $41 | $298 | $0 | 7.3 |

| | 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 |
| West Wing Stairwell | 5 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 5 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| West Wing Stairwell | 4 | LED Lamps: Screw in | Wall Switch | S | 9 | 3,120 | | None | No | 4 | LED Lamps: Screw in | Wall Switch | 9 | 3,120 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Court Room | 6 | LED Lamps: Screw in | Wall Switch | S | 10 | 3,120 | 4 | None | Yes | 6 | LED Lamps: Screw in | Occupancy Sensor | 10 | 2,153 | 0.0 | 64 | 0 | $9 | $0 | $0 | 0.0 |
| Court Room | 66 | Compact Fluorescent: 4-pin | Wall Switch | S | 42 | 3,120 | 3, 4 | Relamp | Yes | 66 | LED Lamps: (1) 18.5W Plug-In Lamp | Occupancy Sensor | 19 | 2,153 | 1.8 | 6,622 | -1 | $935 | $3,285 | $0 | 3.5 |
| Court Room | 3 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 3 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Cell | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Wall Switch | S | 32 | 8,760 | 3 | Relamp | No | 1 | LED - Linear Tubes: (1) 4' Lamp | Wall Switch | 15 | 8,760 | 0.0 | 169 | 0 | $24 | $18 | $0 | 0.8 |
| Cell | 2 | LED Lamps: Screw in | Wall Switch | S | 9 | 8,760 | | None | No | 2 | LED Lamps: Screw in | Wall Switch | 9 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Cell | 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 |
| Judge Chamber | 4 | (2) 26 W CFL Plug-in Lamps: 4-pin | Wall Switch | S | 62 | 2,470 | 1, 4 | Fixture Replacement | Yes | 4 | LED - Fixtures: Ambient 2x2 Fixture | Occupancy Sensor | 40 | 1,704 | 0.1 | 374 | 0 | $53 | $1,070 | $0 | 20.3 |
| Restroom | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,470 | 3 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 2,470 | 0.0 | 90 | 0 | $13 | $37 | $0 | 2.9 |
| Storage Room | 2 | (2) 26 W CFL Plug-in Lamps: 4-pin | Wall Switch | S | 62 | 1,040 | 1, 4 | Fixture Replacement | Yes | 2 | LED - Fixtures: Ambient 2x2 Fixture | Occupancy Sensor | 40 | 718 | 0.1 | 79 | 0 | $11 | $516 | $0 | 46.5 |
| Court Lobby | 10 | LED Lamps: Screw in | Wall Switch | S | 9 | 3,120 | | None | No | 10 | LED Lamps: Screw in | Wall Switch | 9 | 3,120 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Court Lobby | 2 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 2 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Court Entrance | 2 | LED Lamps: Screw in | Wall Switch | S | 9 | 3,120 | | None | No | 2 | LED Lamps: Screw in | Wall Switch | 9 | 3,120 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Court Entrance | 3 | Compact Fluorescent: 4-pin | Wall Switch | S | 42 | 3,120 | 3, 4 | Relamp | Yes | 3 | LED Lamps: (1) 18.5W Plug-In Lamp | Occupancy Sensor | 19 | 2,153 | 0.1 | 301 | 0 | $42 | $346 | $0 | 8.1 |
| Court Entrance | 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 |
| Men Restroom | 2 | LED Lamps: Screw in | Wall Switch | S | 9 | 2,470 | | None | No | 2 | LED Lamps: Screw in | Wall Switch | 9 | 2,470 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Men Restroom | 2 | LED - Linear Tubes: (1) 4' Lamp | Wall Switch | S | 15 | 2,470 | | None | No | 2 | LED - Linear Tubes: (1) 4' Lamp | Wall Switch | 15 | 2,470 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Conference Room1 | 2 | (2) 26 W CFL Plug-in Lamps: 4-pin | Occupancy Sensor | S | 62 | 2,210 | 1 | Fixture Replacement | No | 2 | LED - Fixtures: Ambient 2x2 Fixture | Occupancy Sensor | 40 | 2,210 | 0.0 | 107 | 0 | $15 | $400 | $0 | 26.5 |
| Conference Room2 | 2 | (2) 26 W CFL Plug-in Lamps: 4-pin | Occupancy Sensor | S | 62 | 2,210 | 1 | Fixture Replacement | No | 2 | LED - Fixtures: Ambient 2x2 Fixture | Occupancy Sensor | 40 | 2,210 | 0.0 | 107 | 0 | $15 | $400 | $0 | 26.5 |
| Ladies Restroom | 2 | LED Lamps: Screw in | Wall Switch | S | 9 | 2,470 | | None | No | 2 | LED Lamps: Screw in | Wall Switch | 9 | 2,470 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Ladies Restroom | 2 | LED - Linear Tubes: (1) 4' Lamp | Wall Switch | S | 15 | 2,470 | | None | No | 2 | LED - Linear Tubes: (1) 4' Lamp | Wall Switch | 15 | 2,470 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Hallway | 4 | LED Lamps: Screw in | Wall Switch | S | 9 | 3,120 | 5 | None | Yes | 4 | LED Lamps: Screw in | High/Low Control | 9 | 2,153 | 0.0 | 36 | 0 | $5 | $225 | $0 | 44.1 |
| Hallway | 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 |
| Main Entrance | 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 |

| | 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 |
| Main Entrance | 4 | LED Lamps: LED Candelabra | Wall Switch | S | 4 | 8,760 | | None | No | 4 | LED Lamps: LED Candelabra | Wall Switch | 4 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Main Lobby | 8 | LED Lamps: LED Candelabra | Wall Switch | S | 4 | 8,760 | | None | No | 8 | LED Lamps: LED Candelabra | Wall Switch | 4 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Main Lobby | 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 |
| Violation Office | 17 | Linear Fluorescent - T5: 4' T5 (28W) - 2L | Occupancy Sensor | S | 60 | 2,210 | 3 | Relamp | No | 17 | LED - Linear Tubes: (2) 4' T5 (14.5W) Lamps | Occupancy Sensor | 30 | 2,210 | 0.5 | 1,240 | 0 | $175 | $970 | $0 | 5.5 |
| Violation Office | 2 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 2 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Fined Collection Office | 9 | Linear Fluorescent - T5: 4' T5 (28W) - 2L | Occupancy Sensor | S | 60 | 2,210 | 3 | Relamp | No | 9 | LED - Linear Tubes: (2) 4' T5 (14.5W) Lamps | Occupancy Sensor | 30 | 2,210 | 0.3 | 656 | 0 | $93 | $514 | $0 | 5.5 |
| Clerk Office | 18 | Linear Fluorescent - T5: 4' T5 (28W) - 2L | Occupancy Sensor | S | 60 | 2,210 | 3 | Relamp | No | 18 | LED - Linear Tubes: (2) 4' T5 (14.5W) Lamps | Occupancy Sensor | 30 | 2,210 | 0.5 | 1,313 | 0 | $185 | $1,027 | $0 | 5.5 |
| Clerk Office | 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 |
| Copy Room | 2 | Linear Fluorescent - T5: 4' T5 (28W) - 2L | Occupancy Sensor | S | 60 | 2,210 | 3 | Relamp | No | 2 | LED - Linear Tubes: (2) 4' T5 (14.5W) Lamps | Occupancy Sensor | 30 | 2,210 | 0.1 | 146 | 0 | $21 | $114 | $0 | 5.5 |
| Office | 4 | Linear Fluorescent - T5: 4' T5 (28W) - 2L | Occupancy Sensor | S | 60 | 2,210 | 3 | Relamp | No | 4 | LED - Linear Tubes: (2) 4' T5 (14.5W) Lamps | Occupancy Sensor | 30 | 2,210 | 0.1 | 292 | 0 | $41 | $228 | $0 | 5.5 |
| Closet | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 1,040 | 3 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 1,040 | 0.0 | 38 | 0 | $5 | $37 | $0 | 6.9 |
| Closet | 1 | Compact Fluorescent: Screw in | Wall Switch | S | 23 | 1,040 | 3 | Relamp | No | 1 | LED Lamps: LED Screw in | Wall Switch | 16 | 1,040 | 0.0 | 8 | 0 | $1 | $17 | $0 | 15.2 |
| Tax Collection Office | 15 | Linear Fluorescent - T5: 4' T5 (28W) - 2L | Occupancy Sensor | S | 60 | 2,210 | 3 | Relamp | No | 15 | LED - Linear Tubes: (2) 4' T5 (14.5W) Lamps | Occupancy Sensor | 30 | 2,210 | 0.4 | 1,094 | 0 | $154 | $856 | $0 | 5.5 |
| Tax Collection Office | 2 | Compact Fluorescent: 4-pin | Occupancy Sensor | S | 42 | 2,210 | 3 | Relamp | No | 2 | LED Lamps: (1) 18.5W Plug-In Lamp | Occupancy Sensor | 19 | 2,210 | 0.0 | 114 | 0 | $16 | $50 | $0 | 3.1 |
| Closet | 1 | Compact Fluorescent: Screw in | Wall Switch | S | 23 | 1,040 | 3 | Relamp | No | 1 | LED Lamps: LED Screw in | Wall Switch | 16 | 1,040 | 0.0 | 8 | 0 | $1 | $17 | $0 | 15.2 |
| Office | 4 | (2) 26 W CFL Plug-in Lamps: 4-pin | Occupancy Sensor | S | 62 | 2,210 | 1 | Fixture Replacement | No | 4 | LED - Fixtures: Ambient 2x2 Fixture | Occupancy Sensor | 40 | 2,210 | 0.1 | 214 | 0 | $30 | $800 | $0 | 26.5 |
| File Room | 2 | Linear Fluorescent - T5: 4' T5 (28W) - 2L | Wall Switch | S | 60 | 2,470 | 3, 4 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' T5 (14.5W) Lamps | Occupancy Sensor | 30 | 1,704 | 0.1 | 214 | 0 | $30 | $230 | $0 | 7.6 |
| Tax Collection Office | 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 |
| Closet | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Wall Switch | S | 32 | 1,040 | 3 | Relamp | No | 1 | LED - Linear Tubes: (1) 4' Lamp | Wall Switch | 15 | 1,040 | 0.0 | 20 | 0 | $3 | $18 | $0 | 6.5 |
| Janitorial Closet | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Wall Switch | S | 32 | 1,040 | 3 | Relamp | No | 1 | LED - Linear Tubes: (1) 4' Lamp | Wall Switch | 15 | 1,040 | 0.0 | 20 | 0 | $3 | $18 | $0 | 6.5 |
| Men Restroom | 2 | Incandescent: Screw in | Wall Switch | S | 65 | 2,470 | 3, 4 | Relamp | Yes | 2 | LED Lamps: LED Screw in | Occupancy Sensor | 10 | 1,704 | 0.1 | 316 | 0 | $45 | $150 | $0 | 3.4 |
| Women Restroom | 1 | Incandescent: Screw in | Wall Switch | S | 65 | 2,470 | 3 | Relamp | No | 1 | LED Lamps: LED Screw in | Wall Switch | 10 | 2,470 | 0.1 | 149 | 0 | $21 | $17 | $0 | 0.8 |
| Women Restroom | 1 | LED Lamps: Screw in | Wall Switch | S | 9 | 2,470 | | None | No | 1 | LED Lamps: Screw in | Wall Switch | 9 | 2,470 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Stair - Boiler Room | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | S | 29 | 3,120 | | None | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 3,120 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| 2nd Floor Lobby | 8 | LED Lamps: LED Candelabra | Wall Switch | S | 4 | 8,760 | | None | No | 8 | LED Lamps: LED Candelabra | Wall Switch | 4 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

| | Existing Conditions | | | | | | Proposed Conditions | | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Fixture Quantity | Fixture Description | Control System | Light Level | Watts per Fixture | Annual Operating Hours | ECM # | Fixture Recommendation | Add Controls? | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| 2nd Floor Lobby | 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 |
| 2nd Floor Hallway | 4 | LED Lamps: LED Candelabra | Wall Switch | S | 4 | 8,760 | | None | No | 4 | LED Lamps: LED Candelabra | Wall Switch | 4 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| 2nd Floor Hallway | 2 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 2 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Women Restroom | 1 | Incandescent: Screw in | Occupancy Sensor | S | 65 | 1,820 | 3 | Relamp | No | 1 | LED Lamps: LED Screw in | Occupancy Sensor | 10 | 1,820 | 0.1 | 110 | 0 | $16 | $17 | $0 | 1.1 |
| Administration Office | 4 | (2) 26 W CFL Plug-in Lamps: 4-pin | Occupancy Sensor | S | 62 | 1,820 | 1 | Fixture Replacement | No | 4 | LED - Fixtures: Ambient 2x2 Fixture | Occupancy Sensor | 40 | 1,820 | 0.1 | 176 | 0 | $25 | $800 | $0 | 32.2 |
| Closet | 1 | Compact Fluorescent: Screw in | Wall Switch | S | 23 | 1,040 | 3 | Relamp | No | 1 | LED Lamps: LED Screw in | Wall Switch | 16 | 1,040 | 0.0 | 8 | 0 | $1 | $17 | $0 | 15.2 |
| Office | 4 | (2) 26 W CFL Plug-in Lamps: 4-pin | Occupancy Sensor | S | 62 | 2,210 | 1 | Fixture Replacement | No | 4 | LED - Fixtures: Ambient 2x2 Fixture | Occupancy Sensor | 40 | 2,210 | 0.1 | 214 | 0 | $30 | $800 | $0 | 26.5 |
| Trustees Conference Room | 32 | LED Lamps: Screw in | Wall Switch | O | 10 | 2,470 | 4 | None | Yes | 32 | LED Lamps: Screw in | Occupancy Sensor | 10 | 1,704 | 0.1 | 270 | 0 | $38 | $270 | $0 | 7.1 |
| Trustees Conference Room | 1 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 1 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Closet | 1 | Compact Fluorescent: Screw in | Wall Switch | S | 23 | 1,040 | 3 | Relamp | No | 1 | LED Lamps: LED Screw in | Wall Switch | 16 | 1,040 | 0.0 | 8 | 0 | $1 | $17 | $0 | 15.2 |
| Janitorial Closet | 1 | Compact Fluorescent: Screw in | Wall Switch | S | 23 | 1,040 | 3 | Relamp | No | 1 | LED Lamps: LED Screw in | Wall Switch | 16 | 1,040 | 0.0 | 8 | 0 | $1 | $17 | $0 | 15.2 |
| Stair - West Wing | 4 | LED Lamps: Screw in | Wall Switch | S | 9 | 3,640 | | None | No | 4 | LED Lamps: Screw in | Wall Switch | 9 | 3,640 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Stair - West Wing | 2 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 2 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Restroom | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Wall Switch | S | 114 | 2,470 | 3, 4 | Relamp | Yes | 1 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 1,704 | 0.1 | 201 | 0 | $28 | $189 | $0 | 6.7 |
| Lunch Room | 3 | Linear Fluorescent - T5: 4' T5 (28W) - 2L | Wall Switch | S | 60 | 2,470 | 3, 4 | Relamp | Yes | 3 | LED - Linear Tubes: (2) 4' T5 (14.5W) Lamps | Occupancy Sensor | 30 | 1,704 | 0.1 | 320 | 0 | $45 | $441 | $0 | 9.8 |
| Lunch Room | 1 | Compact Fluorescent: Screw in | Wall Switch | S | 23 | 2,470 | 3, 4 | Relamp | Yes | 1 | LED Lamps: LED Screw in | Occupancy Sensor | 16 | 1,704 | 0.0 | 32 | 0 | $5 | $17 | $0 | 3.8 |
| Lunch Room | 1 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 1 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Closet | 1 | Incandescent: Screw in | Wall Switch | S | 65 | 1,040 | 3 | Relamp | No | 1 | LED Lamps: LED Screw in | Wall Switch | 10 | 1,040 | 0.1 | 63 | 0 | $9 | $17 | $0 | 1.9 |
| 2nd Floor West Wing Hallway | 2 | LED Lamps: Screw in | Occupancy Sensor | S | 9 | 2,210 | | None | No | 2 | LED Lamps: Screw in | Occupancy Sensor | 9 | 2,210 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| 2nd Floor West Wing Hallway | 4 | Compact Fluorescent: 4-pin | Occupancy Sensor | S | 42 | 2,210 | 3 | Relamp | No | 4 | LED Lamps: (1) 18.5W Plug-In Lamp | Occupancy Sensor | 19 | 2,210 | 0.1 | 229 | 0 | $32 | $101 | $0 | 3.1 |
| 2nd Floor West Wing Hallway | 2 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 2 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| HR Office | 5 | (2) 26 W CFL Plug-in Lamps: 4-pin | Occupancy Sensor | S | 62 | 2,210 | 1 | Fixture Replacement | No | 5 | LED - Fixtures: Ambient 2x2 Fixture | Occupancy Sensor | 40 | 2,210 | 0.1 | 267 | 0 | $38 | $1,000 | $0 | 26.5 |
| HR Office | 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 |
| Office | 4 | (2) 26 W CFL Plug-in Lamps: 4-pin | Occupancy Sensor | S | 62 | 2,210 | 1 | Fixture Replacement | No | 4 | LED - Fixtures: Ambient 2x2 Fixture | Occupancy Sensor | 40 | 2,210 | 0.1 | 214 | 0 | $30 | $800 | $0 | 26.5 |
| Finance Dept | 19 | Linear Fluorescent - T5: 4' T5 (28W) - 2L | Occupancy Sensor | S | 60 | 2,210 | 3 | Relamp | No | 19 | LED - Linear Tubes: (2) 4' T5 (14.5W) Lamps | Occupancy Sensor | 30 | 2,210 | 0.5 | 1,386 | 0 | $196 | $1,084 | $0 | 5.5 |

| | 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 |
| Finance Dept | 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 |
| Copy Room | 2 | Linear Fluorescent - T5: 4' T5 (28W) - 2L | Occupancy Sensor | S | 60 | 2,210 | 3 | Relamp | No | 2 | LED - Linear Tubes: (2) 4' T5 (14.5W) Lamps | Occupancy Sensor | 30 | 2,210 | 0.1 | 146 | 0 | $21 | $114 | $0 | 5.5 |
| Closet | 1 | Incandescent: Screw in | Wall Switch | S | 65 | 1,040 | 3 | Relamp | No | 1 | LED Lamps: LED Screw in | Wall Switch | 10 | 1,040 | 0.1 | 63 | 0 | $9 | $17 | $0 | 1.9 |
| CFO Office | 4 | (2) 26 W CFL Plug-in Lamps: 4-pin | Occupancy Sensor | S | 62 | 2,210 | 1 | Fixture Replacement | No | 4 | LED - Fixtures: Ambient 2x2 Fixture | Occupancy Sensor | 40 | 2,210 | 0.1 | 214 | 0 | $30 | $800 | $0 | 26.5 |
| Elevator Lobby | 2 | Compact Fluorescent: 4-pin | Wall Switch | S | 42 | 2,470 | 3 | Relamp | No | 2 | LED Lamps: (1) 18.5W Plug-In Lamp | Wall Switch | 19 | 2,470 | 0.0 | 128 | 0 | $18 | $50 | $0 | 2.8 |
| Downtown Manager Office | 4 | (2) 26 W CFL Plug-in Lamps: 4-pin | Occupancy Sensor | S | 62 | 2,210 | 1 | Fixture Replacement | No | 4 | LED - Fixtures: Ambient 2x2 Fixture | Occupancy Sensor | 40 | 2,210 | 0.1 | 214 | 0 | $30 | $800 | $0 | 26.5 |
| Downtown Manager Office | 3 | LED Lamps: LED Candelabra | Occupancy Sensor | S | 4 | 2,210 | | None | No | 3 | LED Lamps: LED Candelabra | Occupancy Sensor | 4 | 2,210 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Downtown Manager Office | 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 |
| Downtown Manager Office | 8 | Halogen Incandescent: PAR 38 | Wall Switch | S | 90 | 2,470 | 3, 4 | Relamp | Yes | 8 | LED Lamps: LED Screw in | Occupancy Sensor | 14 | 1,704 | 0.6 | 1,754 | 0 | $248 | $242 | $0 | 1.0 |
| Council Room | 22 | LED Lamps: LED Candelabra | Wall Switch | S | 4 | 2,470 | 4 | None | Yes | 22 | LED Lamps: LED Candelabra | Occupancy Sensor | 4 | 1,704 | 0.0 | 65 | 0 | $9 | $0 | $0 | 0.0 |
| Council Room | 4 | LED Lamps: Screw in | Wall Switch | S | 10 | 2,470 | 4 | None | Yes | 4 | LED Lamps: Screw in | Occupancy Sensor | 10 | 1,704 | 0.0 | 34 | 0 | $5 | $0 | $0 | 0.0 |
| Council Room | 7 | LED Lamps: Screw in | Wall Switch | S | 19 | 2,470 | 4 | None | Yes | 7 | LED Lamps: Screw in | Occupancy Sensor | 19 | 1,704 | 0.0 | 112 | 0 | $16 | $270 | $0 | 17.1 |
| Committee Room | 8 | LED Lamps: Screw in | Occupancy Sensor | S | 10 | 2,210 | | None | No | 8 | LED Lamps: Screw in | Occupancy Sensor | 10 | 2,210 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Committee Room | 16 | Compact Fluorescent: 4-pin | Wall Switch | S | 42 | 2,470 | 3, 4 | Relamp | Yes | 16 | LED Lamps: (1) 18.5W Plug-In Lamp | Occupancy Sensor | 19 | 1,704 | 0.4 | 1,271 | 0 | $179 | $944 | $0 | 5.3 |
| Committee Room | 1 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 1 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| closet1 | 2 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | S | 88 | 1,040 | 2, 4 | Relamp & Reballast | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 718 | 0.1 | 156 | 0 | $22 | $254 | $0 | 11.5 |
| closet2 | 1 | Incandescent: Screw in | Wall Switch | S | 65 | 1,040 | 3 | Relamp | No | 1 | LED Lamps: LED Screw in | Wall Switch | 10 | 1,040 | 0.1 | 63 | 0 | $9 | $17 | $0 | 1.9 |
| 2nd Floor - East Wing Hallway | 3 | LED Lamps: Screw in | Occupancy Sensor | S | 9 | 2,210 | | None | No | 3 | LED Lamps: Screw in | Occupancy Sensor | 9 | 2,210 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| 2nd Floor - East Wing Hallway | 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 |
| Construction Dept | 19 | Linear Fluorescent - T5: 4' T5 (28W) - 2L | Occupancy Sensor | S | 60 | 2,210 | 3 | Relamp | No | 19 | LED - Linear Tubes: (2) 4' T5 (14.5W) Lamps | Occupancy Sensor | 30 | 2,210 | 0.5 | 1,386 | 0 | $196 | $1,084 | $0 | 5.5 |
| Construction Dept | 2 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 2 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Office | 4 | (2) 26 W CFL Plug-in Lamps: 4-pin | Occupancy Sensor | S | 62 | 2,210 | 1 | Fixture Replacement | No | 4 | LED - Fixtures: Ambient 2x2 Fixture | Occupancy Sensor | 40 | 2,210 | 0.1 | 214 | 0 | $30 | $800 | $0 | 26.5 |
| Office | 2 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 2 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Land Use Dept | 4 | (2) 26 W CFL Plug-in Lamps: 4-pin | Occupancy Sensor | S | 62 | 2,210 | 1 | Fixture Replacement | No | 4 | LED - Fixtures: Ambient 2x2 Fixture | Occupancy Sensor | 40 | 2,210 | 0.1 | 214 | 0 | $30 | $800 | $0 | 26.5 |
| Land Use Dept | 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 |

## 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 |
| East Wing Attic Floor | AHU1 - Building Dept | 1 | Supply Fan | 3.0 | 82.5% | No | W | 3,391 | 6 | No | 89.5% | Yes | 1 | 1.0 | 3,935 | 0 | $563 | $3,812 | $0 | 6.8 |
| Center Attic Floor | AHU5 - Meeting Rm & Land Use | 1 | Supply Fan | 7.5 | 91.7% | Yes | W | 3,391 | | No | 91.7% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Center Attic Floor | AHU4 - | 1 | Supply Fan | 3.0 | 82.5% | No | W | 3,391 | 6 | No | 89.5% | Yes | 1 | 1.0 | 3,935 | 0 | $563 | $3,812 | $0 | 6.8 |
| Center Attic Floor | AHU9 | 1 | Supply Fan | 1.0 | 78.5% | No | W | 3,391 | 6 | No | 85.5% | Yes | 1 | 0.3 | 1,387 | 0 | $198 | $3,283 | $0 | 16.5 |
| Center Attic Floor | Return Fan (AHUs) - RF1 | 1 | Return Fan | 5.0 | 87.5% | Yes | W | 2,745 | | No | 87.5% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| West Wing Attic Floor | AHU6 | 1 | Supply Fan | 1.5 | 78.5% | Yes | W | 3,391 | | No | 78.5% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| West Wing Attic Floor | AHU6 | 1 | Return Fan | 1.0 | 78.5% | Yes | W | 3,391 | | No | 78.5% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| West Wing Attic Floor | AHU7 | 1 | Supply Fan | 2.0 | 78.5% | Yes | W | 3,391 | | No | 78.5% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| West Wing Attic Floor | AHU7 | 1 | Return Fan | 1.0 | 78.5% | Yes | W | 3,391 | | No | 78.5% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Boiler Room | Air Combustion | 2 | Combustion Air Fan | 0.5 | 70.0% | No | W | 2,745 | | No | 70.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Boiler Room | Boiler Feed Water | 2 | Boiler Feed Water Pump | 0.5 | 70.0% | No | W | 1,373 | | No | 70.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Boiler Room | Heating System | 2 | Heating Hot Water Pump | 5.0 | 90.2% | Yes | W | 2,745 | | No | 90.2% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Boiler Room | Condensate | 2 | Condensate Pump | 0.3 | 65.0% | No | W | 2,745 | | No | 65.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Boiler Room | Sump Pump | 2 | Other | 0.3 | 65.0% | No | W | 824 | | No | 65.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Basement | AHU11 | 1 | Supply Fan | 1.0 | 78.5% | No | W | 3,391 | 6 | No | 85.5% | Yes | 1 | 0.3 | 1,387 | 0 | $198 | $3,283 | $0 | 16.5 |
| Basement | Cooling System | 2 | Chilled Water Pump | 10.0 | 91.5% | No | W | 1,696 | | No | 91.5% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Basement | Cooling System | 2 | Chilled Water Pump | 7.5 | 91.7% | Yes | W | 1,696 | | No | 91.7% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Basement | Exhaust Air | 1 | Exhaust Fan | 0.5 | 70.0% | No | W | 2,745 | | No | 70.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Basement | AHU10 | 1 | Supply Fan | 1.0 | 78.5% | No | W | 2,745 | 6 | No | 85.5% | Yes | 1 | 0.3 | 1,122 | 0 | $161 | $3,283 | $0 | 20.4 |
| Elevator Room1 | Elevator | 1 | Other | 25.0 | 75.5% | No | W | 146 | | No | 75.5% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

| | | Existing Conditions | | | | | | | Proposed Conditions | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | Motor Quantity | Motor Application | HP Per Motor | Full Load Efficiency | VFD Control? | 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 |
| basement - West | AHU8 | 1 | Supply Fan | 7.5 | 91.7% | No | W | 3,391 | 6 | No | 91.7% | Yes | 1 | 2.1 | 7,759 | 0 | $1,110 | $4,761 | $0 | 4.3 |
| Elevator Room2 | Elevator | 1 | Other | 5.0 | 70.0% | No | W | 146 | | No | 70.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Ground Floor | Cooling Tower | 1 | Cooling Tower Fan | 30.0 | 93.6% | Yes | W | 3,391 | | No | 93.6% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Ground Floor | Spray Pump | 1 | Other | 1.5 | 85.5% | No | W | 3,391 | | No | 85.5% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Facility | VAV Boxes | 31 | Supply Fan | 0.3 | 65.0% | No | W | 3,391 | | No | 65.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Attic Floor | AHU2 | 1 | Supply Fan | 3.0 | 82.5% | No | W | 2,745 | 6 | No | 89.5% | Yes | 1 | 1.0 | 3,186 | 0 | $456 | $3,812 | $0 | 8.4 |
| Attic Floor | AHU3 | 1 | Supply Fan | 1.5 | 78.5% | No | W | 2,745 | 6 | No | 86.5% | Yes | 1 | 0.5 | 1,712 | 0 | $245 | $3,380 | $0 | 13.8 |

## 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 |
| Mail Room | Main Room | 1 | Split-System AC | 1.00 | | B | 7 | Yes | 1 | Split-System AC | 1.00 | | 14.00 | | 0.2 | 469 | 0 | $67 | $1,496 | $0 | 22.3 |
| Ground Floor | Server Rooom | 1 | Split-System AC | 2.00 | | B | 7 | Yes | 1 | Split-System AC | 2.00 | | 14.00 | | 0.3 | 937 | 0 | $134 | $2,992 | $0 | 22.3 |
| Ground Floor | Elevator Room | 1 | Split-System AC | 1.50 | | B | 7 | Yes | 1 | Split-System AC | 1.50 | | 14.00 | | 0.2 | 703 | 0 | $101 | $2,244 | $0 | 22.3 |

## Electric Chiller Inventory & Recommendations

| | | Existing Conditions | | | | Proposed Conditions | | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | Chiller Quantity | System Type | Cooling Capacity per Unit (Tons) | Remaining Useful Life | ECM # | Install High Efficiency Chillers? | Chiller Quantity | System Type | Constant/ Variable Speed | Cooling Capacity (Tons) | Full Load Efficiency (kW/Ton) | IPLV Efficiency (kW/Ton) | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Basement | Cooling System | 1 | Water-Cooled Screw Chiller | 100.00 | W | | 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 |
| Boiler Room | Heating System | 2 | Forced Draft Steam Boiler | 1,700 | W | | No | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

## Pipe Insulation Recommendations

| | | Recommendation Inputs | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Affected | ECM # | Length of Uninsulated Pipe (ft) | Pipe Diameter (in) | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Boiler Room | Domestic Hot Water | 8 | 12 | 1.00 | 0.0 | 0 | 7 | $65 | $126 | $48 | 1.2 |

## 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 |
| Boiler Room | Domestic Hot Water System | 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 |
| Facility | 9 | 10 | Faucet Aerator (Lavatory) | 2.20 | 0.50 | 0.0 | 0 | 9 | $87 | $72 | $72 | 0.0 |

## Plug Load Inventory

| | Existing Conditions | | | |
|---|---|---|---|---|
| Location | Quantity | Equipment Description | Energy Rate (W) | ENERGY STAR Qualified? |
| Hartley Memorial Hall | 10 | Copy Machine | 650 | YES |
| Hartley Memorial Hall | 47 | Desktop Computer | 120 | YES |
| Hartley Memorial Hall | 4 | Coffee Machine | 550 | No |
| Hartley Memorial Hall | 5 | Small Fridge | 124 | YES |
| Hartley Memorial Hall | 6 | Microwave | 1,000 | No |
| Hartley Memorial Hall | 2 | Refrigerator | 224 | YES |
| Hartley Memorial Hall | 7 | Water Cooler | 92 | YES |
| Hartley Memorial Hall | 14 | Printer | 78 | YES |
| Hartley Memorial Hall | 1 | Server | 5,000 | No |

## Custom (High Level) Measure Analysis

Retro-Commissioning Study

| | | | | | |
|---|---|---|---|---|---|
| Building Square Footage | 36,000 | | Fuel Utility Rate | $9.158 | MMBtu |
| Percent of Conditioned Area Impacted | 93% | | Blended Electric Utility Rate | $0.143 | kWh |

| Existing Conditions | | | | | | Proposed Conditions | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Description | Area(s)/System(s) Served | Remaining Useful Life | Total HVAC Motor Usage kWh | Total HVAC Electric Usage kWh | Total HVAC Fuel Usage MMBtu | Description | % Savings HVAC Motor Usage kWh | % Savings HVAC Electric Usage kWh | % Savings HVAC Fuel Usage MMBtu | Estimated Cost per Sqft | 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 |
| HVAC Controls Not Currently Optimized | HVAC Equipment & Systems | N | 213,328 | 105,703 | 3,144 | Retro-Commissioning Study | 4% | 4% | 4% | $0.30 | 0.00 | 12,761 | 126 | $2,978 | $10,044 | $0 | 3.37 |

# 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.

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## ENERGY STAR® Statement of Energy Performance

**27**

ENERGY STAR® Score[1]

### Hartley Dodge Memorial Building

**Primary Property Type:** Office
**Gross Floor Area (ft²):** 39,756
**Built:** 1933

**For Year Ending:** January 31, 2019
**Date Generated:** August 29, 2019

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 |
|---|---|---|
| Hartley Dodge Memorial Building<br>50 Kings Road<br>Madison, New Jersey 07940 | Borough of Madison<br>50 Kings Road<br>Madison, NJ 07940<br>(973) 593-3042 | Peter Fried<br>38 Morris Place<br>Madison, NJ 07940<br>(973) 699-1915<br>peter_fried@yahoo.com |

**Property ID:** 6894135

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

**Site EUI**
120.1 kBtu/ft²

**Source EUI**
195.2 kBtu/ft²

| Annual Energy by Fuel | |
|---|---|
| Electric - Grid (kBtu) | 1,570,585 (33%) |
| Natural Gas (kBtu) | 3,202,227 (67%) |

| National Median Comparison | |
|---|---|
| National Median Site EUI (kBtu/ft²) | 89.3 |
| National Median Source EUI (kBtu/ft²) | 145.2 |
| % Diff from National Median Source EUI | 34% |
| **Annual Emissions** | |
| Greenhouse Gas Emissions (Metric Tons CO2e/year) | 329 |

#### 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* |

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

| | |
|---|---|
| **SEER** | *Seasonal energy efficiency ratio:* a measure of efficiency in terms of annual cooling energy provided divided by total electric input. |
| **SEP** | *Statement of energy performance:* a summary document from the ENERGY STAR® Portfolio Manager®. |
| **Simple Payback** | The amount of time needed to recoup the funds expended in an investment or to reach the break-even point between investment and savings. |
| **SREC** | *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. |