Local Government Energy Audit Report

Madison Public Safety Complex

March 12, 2020

Prepared for:

Borough of Madison
62 King's Road
Madison, NJ Madison

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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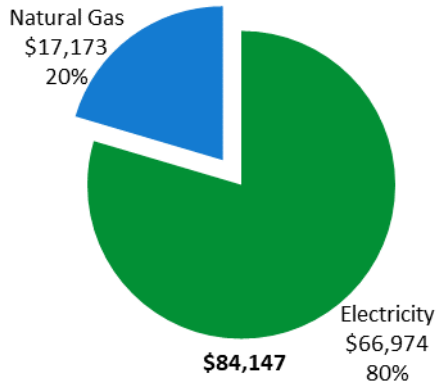
1 EXECUTIVE SUMMARY

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

BUILDING PERFORMANCE REPORT

Annual Utilities	Costs: $84,147 Electricity: 492,300 kWh Natural Gas: 18,905 Therms	
ENERGY STAR® Benchmarking Score	N/A *(1-100 scale)*	A standard energy use benchmark is not available for this facility type. This report contains suggestions about how to improve building performance and reduce energy costs.

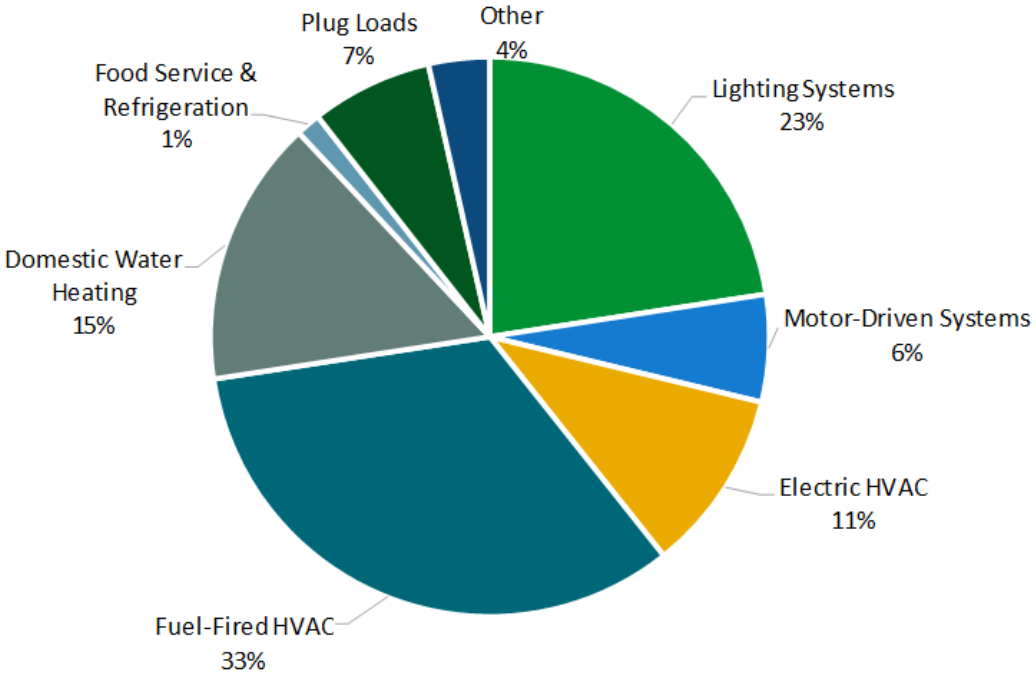


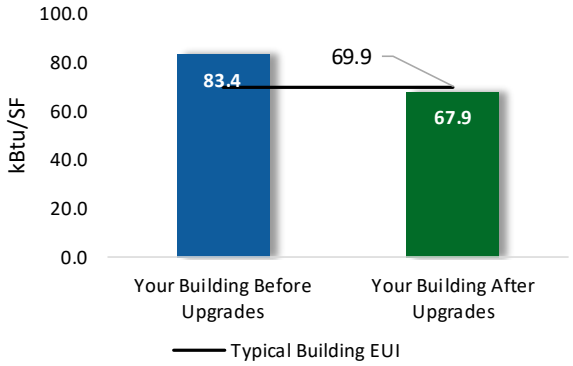
Figure 1 - Energy Use by System

POTENTIAL IMPROVEMENTS

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

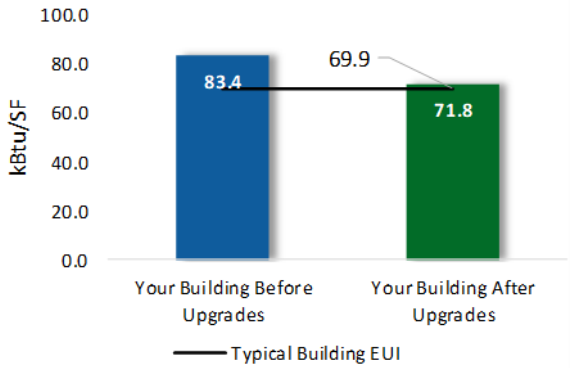
Scenario 1: Full Package (all evaluated measures)

Installation Cost	$182,344
Potential Rebates & Incentives[1]	$0
Annual Cost Savings	$25,576
Annual Energy Savings	Electricity: 185,929 kWh Natural Gas: 276 Therms
Greenhouse Gas Emission Savings	95 Tons
Simple Payback	7.1 Years
Site Energy Savings (all utilities)	19%



Scenario 2: Cost Effective Package[2]

Installation Cost	$44,411
Potential Rebates & Incentives	$0
Annual Cost Savings	$20,668
Annual Energy Savings	Electricity: 153,884 kWh
Greenhouse Gas Emission Savings	76 Tons
Simple Payback	2.1 Years
Site Energy Savings (all utilities)	14%



On-site Generation Potential

Photovoltaic	High
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			**133,079**	**13.7**	**-26**	**$17,865**	**$29,271**	**$0**	**$29,271**	**1.6**	**130,919**
ECM 1	Install LED Fixtures	Yes	8,753	0.0	0	$1,191	$11,200	$0	$11,200	9.4	8,814
ECM 2	Retrofit Fixtures with LED Lamps	Yes	124,326	13.7	-26	$16,674	$18,071	$0	$18,071	1.1	122,104
Lighting Control Measures			**14,045**	**1.3**	**-3**	**$1,884**	**$7,285**	**$0**	**$7,285**	**3.9**	**13,793**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	11,360	1.1	-2	$1,524	$5,710	$0	$5,710	3.7	11,156
ECM 4	Install High/Low Lighting Controls	Yes	2,685	0.3	-1	$360	$1,575	$0	$1,575	4.4	2,637
Variable Frequency Drive (VFD) Measures			**6,547**	**0.6**	**18**	**$1,053**	**$13,259**	**$0**	**$13,259**	**12.6**	**8,689**
ECM 5	Install VFDs on Heating Water Pumps	Yes	5,148	0.6	0	$700	$7,625	$0	$7,625	10.9	5,184
ECM 6	Install VFDs on Kitchen Hood Fan Motors	No	1,399	0.0	18	$353	$5,634	$0	$5,634	16.0	3,505
Electric Unitary HVAC Measures			**25,440**	**10.1**	**0**	**$3,461**	**$113,620**	**$0**	**$113,620**	**32.8**	**25,618**
ECM 7	Install High Efficiency Air Conditioning Units	No	25,440	10.1	0	$3,461	$113,620	$0	$113,620	32.8	25,618
Food Service & Refrigeration Measures			**1,612**	**0.2**	**0**	**$219**	**$230**	**$0**	**$230**	**1.0**	**1,623**
ECM 8	Vending Machine Control	Yes	1,612	0.2	0	$219	$230	$0	$230	1.0	1,623
Custom Measures			**5,207**	**0.0**	**39**	**$1,063**	**$18,679**	**$0**	**$18,679**	**17.6**	**9,815**
ECM 9	Retro-Commissioning Study	No	5,207	0.0	39	$1,063	$18,679	$0	$18,679	17.6	9,815
TOTALS (COST EFFECTIVE MEASURES)			**153,884**	**15.8**	**-29**	**$20,668**	**$44,411**	**$0**	**$44,411**	**2.1**	**151,519**
TOTALS (ALL MEASURES)			**185,929**	**26.0**	**28**	**$25,545**	**$182,344**	**$0**	**$182,344**	**7.1**	**190,457**

* - 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 Fixtures with LED Lamps		X	
ECM 3	Install Occupancy Sensor Lighting Controls		X	
ECM 4	Install High/Low Lighting Controls		X	
ECM 5	Install VFDs on Heating Water Pumps		X	
ECM 6	Install VFDs on Kitchen Hood Fan Motors		X	
ECM 7	Install High Efficiency Air Conditioning Units		X	
ECM 8	Vending Machine Control		X	
ECM 9	Retro-Commissioning Study			

Figure 3 – Funding Options

New Jersey's Clean Energy Programs At-A-Glance

	SmartStart Flexibility to install at your own pace	**Direct Install** Turnkey installation	**Pay for Performance** 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. Average peak demand should be below 200 kW. Not suitable for significant building shell issues.	Mid to large size facilities looking to implement as many measures as possible at one time. 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. 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 Madison Public Safety Complex. This report provides information on how your facility uses energy, identifies energy conservation measures (ECMs) that can reduce your energy use, and provides information and assistance to help you implement the ECMs. 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 6, 2019, TRC performed an energy audit at Madison Public Safety Complex 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.

Madison Public Safety Complex is a 2-story, 42,829 square foot building built in 2006. The building houses the Borough Police and Fire Departments. Spaces include: offices, locker rooms, shower rooms, lobbies, interview and processing rooms, work room, basement space, laundry room, storage room, fire truck garage, day room, kitchen and restrooms.

Lighting is provided by a combination of LED tubes, fluorescent T8 and compact fluorescent lamps. The rooftop units are original to the building. They have reached their useful life and are due for an upgrade. The building uses hot water supplied from four condensing boilers for heating. The facility has a diesel emergency backup generator and two hydraulic passenger elevators.

2.2 Building Occupancy

The facility operates continuously. Typical weekday occupancy is 20 staff.

Building Name	Weekday/Weekend	Operating Schedule
Madison Safety Complex	Weekday	12:00 AM - 12:00 AM
	Weekend	12:00 AM - 12:00 AM

Figure 4 - Building Occupancy Schedule

2.3 Building Envelope

The building walls of the complex are concrete block over structural steel. The building has a combination of a flat roof covered with a white membrane and a pitched roof covered with a metal standing seam. The pitched roof has an attic above the conditioned space. The RTUs and exhaust fans are located on the flat roof. The roofs are in good condition. The complex is highly insulated. The windows are double paned and mainly fixed with metal frames. There are some glass panel store front type windows. The glass-to-frame seals are in good condition. The entrance doors are fully glass with aluminum frames. Exit doors are made of metal. Door seals are in good condition. Overall, the building envelope is in good condition.

Building Walls

Entrance Doors

Flat & Pitched Roofs

Metal Frames Windows

Rollup Doors

2.4 Lighting Systems

The interior lighting system uses a combination of 32-Watt linear fluorescent T8 lamps and LED tubes. There are also several compact fluorescent lamps (CFLs), fluorescent T5 high output lamps, and incandescent lamps. Fluorescent T8 fixture types include 1- or 2-lamp, 2- or 4-foot long troffer, recessed, and surface mounted fixtures as well as 2-foot fixtures with U-bend tube lamps. Spaces such as the garage, green team room, storage rooms, firehouse basement, workout room, stairwell, rooms 126 and 103, are lit with LED tubes. Room 132 uses fluorescent T5 high output lamps. Most fixtures are in good condition and interior lighting levels were generally sufficient.

Lighting fixtures in spaces are controlled either with occupancy sensors or wall switches. The sensors are either wall or ceiling mounted depending on the area that is being controlled. Exit signs throughout the building are LED fixtures.

Exterior lighting system consists of five 2-lamp, 13-Watt CFLs, and six 100-Watt metal halide fixtures, which are all wall mounted. There are five 150 Watt metal halide pole mounted fixtures and one LED spot luminaire. Exterior lights are controlled with photocells and a timer.

2-Lamp, 2-Foot Long T8 Fixture

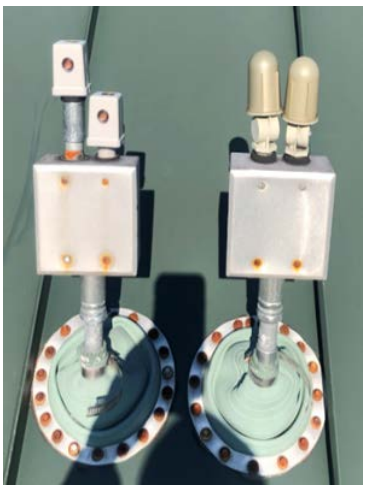
2-Lamp, 4-Foot Long T8 Troffer

U-Bend T8 Fixture

LED Tubes Fixtures

Ceiling Mounted Occupancy Sensor

Compact Fluorescent Lamp in Recessed Can



Metal Halide Fixture & Photocells

2.5 Air Handling Systems

Direct Expansion Air Conditioning System (DX)

Three Trane rooftop units (RTUs) with direct expansion (DX) coils serve the first and second floor of the complex and are original to the building. RTU 1 and RTU 2 are 27.5 ton, while RTU 3 is a 10-ton unit. They are variable air volume (VAV) systems with variable frequency drives (VFD) that control the 7.5 hp and 5 hp supply fan motors. The RTUs are equipped with economizers. Air distribution is provided to supply air registers by ductwork concealed above the ceiling. Cooled air is distributed through ducts to variable air volume (VAV) terminals concealed above the ceilings in each common area. There are approximately 30 VAV boxes. The RTUs have reached their useful life and have been evaluated for replacement. The units are controlled via the Siemens energy management system (EMS).

Cooling is provided in the server room by two 3-ton Mitsubishi split air conditioners (ACs). The units are in good condition and are controlled with programmable thermostats.

The dispatch room is served by a Trane air handling unit (AHU 4) with cooling coils connected to an exterior 2-ton condensing unit that is in fair condition and has been evaluated for replacement. The unit is controlled via the EMS.

Trane RTUs

Programmable Thermostat

3-ton Mitsubishi Split ACs

Trane AHU and Condensing Unit

2.6 Heating Hot Water System

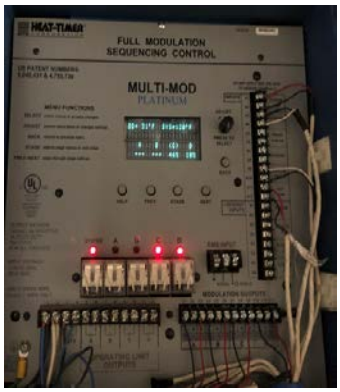
Four P-K Mach 275 MBh condensing hot water boilers serve the building heating load. The burners are fully modulating with a nominal efficiency of 91.6%. The boilers are configured in an automated lead-lag control scheme. Two or three boilers are required under high load conditions. One boiler is required in the summer months for the VAV reheat system. The boilers are in good condition. A Multi-Mod heat-timer is used to control the ON/OFF and the modulation of each stage to maintain precise set point control using PID type control logic. The heat-timer is connected to the Siemens EMS that controls the hot water loop.

Two 3 hp based-mounted constant speed circulating pumps provide hot water to each temperature-controlled space by a two-pipe-distribution system. The hot water supplies the baseboard heaters, cabinets heaters, and VAV terminal units.

The complex heating and cooling temperature set point is between 70°F - 71°F. During the November site survey, a snapshot view of the EMS indicated that hot water was being supplied at 122°F while the hot water return temperature was registering 120°F.

Heating in the fire truck garage area is provided by a 290 MBh Reznor warm air unit heater with a combustion efficiency of 83%. It is in good condition and is controlled by a local thermostat.

Hot Water Boilers



Heat-Timer

3 hp Circulating Hot Water Pumps

Cabinet Heaters

Reznor Unit Heater

Local Thermostat

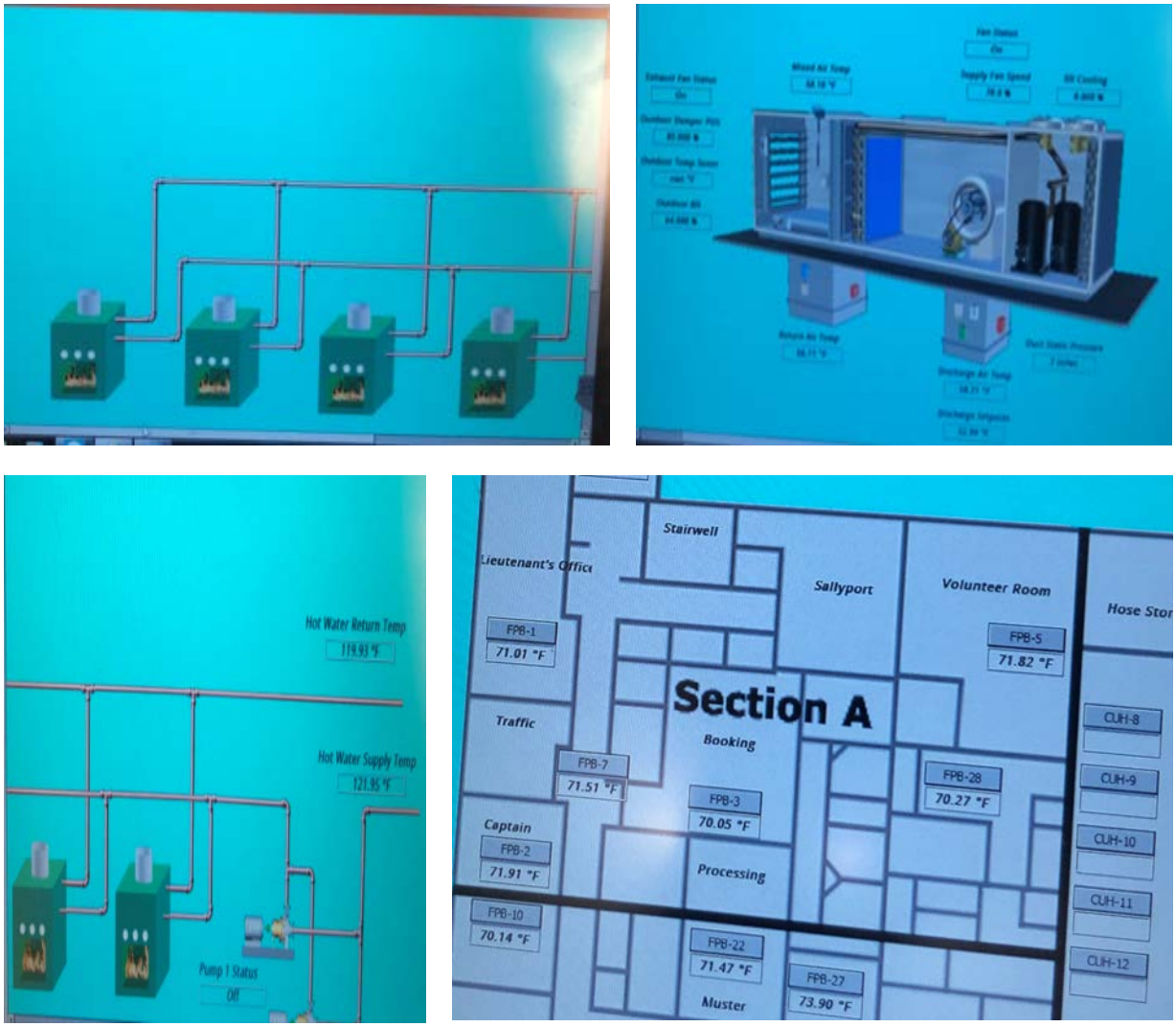
2.7 Exhaust Air System

Air is exhausted from the facility via roof mounted and indoor exhaust fans. The attic floor has a 0.5 hp indoor exhaust fan and there are two kitchen hood exhaust fans. The exhaust fans are controlled via the EMS.

Kitchen Hood & Exhaust Fan

2.8 Building Energy Management Systems (EMS)

A Siemens EMS controls the RTUs, boilers, exhaust fans, and the diesel backup power generator. The EMS provides equipment scheduling control and monitors and controls space temperatures, supply air temperatures, humidity, heating water loop temperatures.



Siemens EMS

2.9 Domestic Hot Water

Hot water is produced with a 125 gallon 565 MBh gas-fired storage water heater with an efficiency of 94%.

At the time of the site visit, the domestic water heater was set at 125°F. Two 0.3 hp circulation pumps distribute water to end uses. The domestic hot water pipes are insulated, and the insulation is in good condition.

Domestic Hot Water Heater & Circulating Pump

2.10 Food Service and Refrigeration Equipment

The complex has a small kitchen that is used by the firefighters. It has a gas-fired oven and a standup Beverage Air refrigerator.

Gas-Fired Oven

Standup Refrigerator

2.11 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 27 computer work stations throughout the facility. Plug loads throughout the building include general café and office equipment.

There are four residential style refrigerators throughout the building. There is one central vacuum used by the firefighters and the main server of the Borough safety department.

There is refrigerated beverage vending machine located in the lunch room that is not equipped with occupancy-based control.

Ice Maker

Copy Machine

2.12 Water-Using Systems

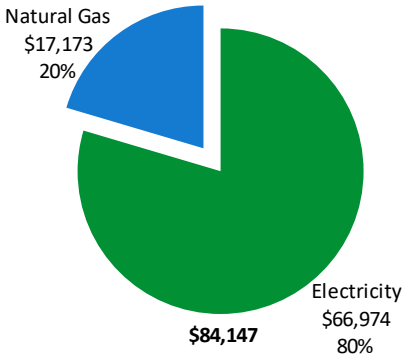
There are several restrooms with toilets, urinals, and sinks. Faucet flow and toilets all have low flow devices.

Typical Sinks

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	492,300 kWh	$66,974
Natural Gas	18,905 Therms	$17,173
Total		**$84,147**



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.

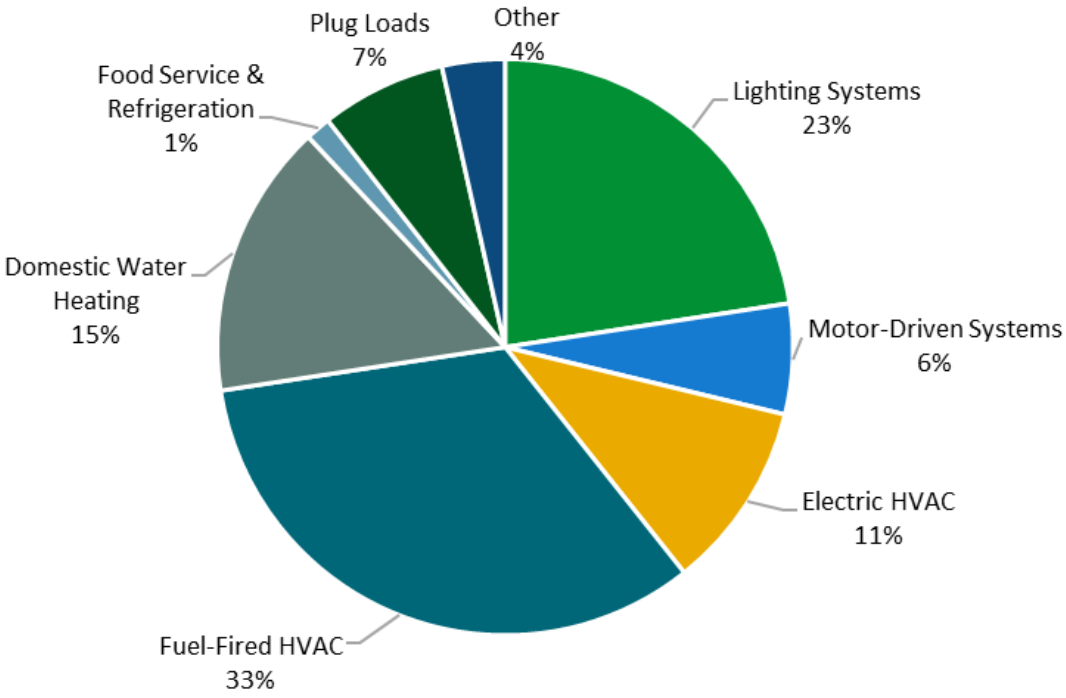
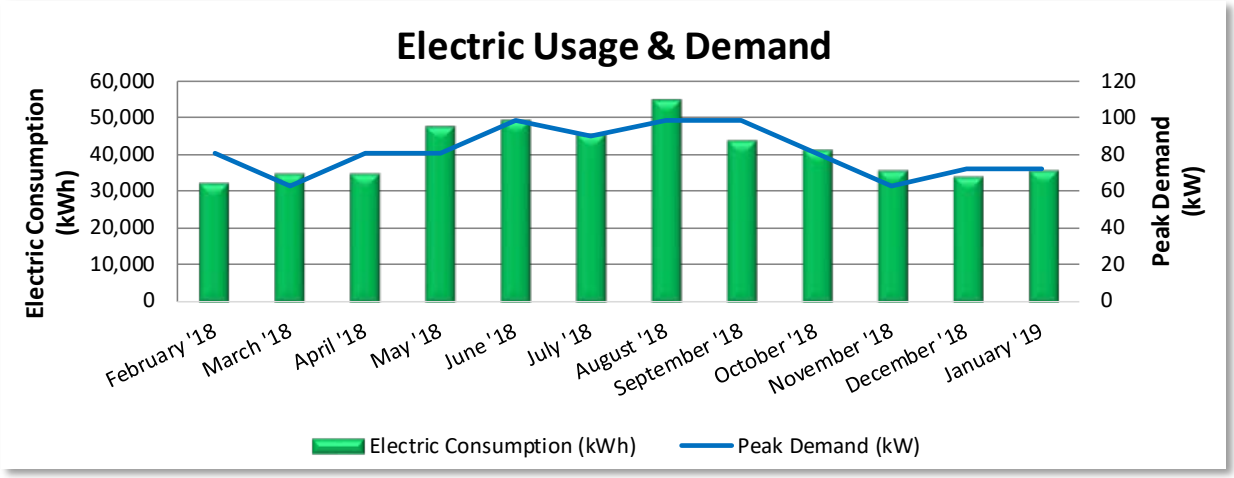


Figure 5 - Energy Balance

3.1 Electricity

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



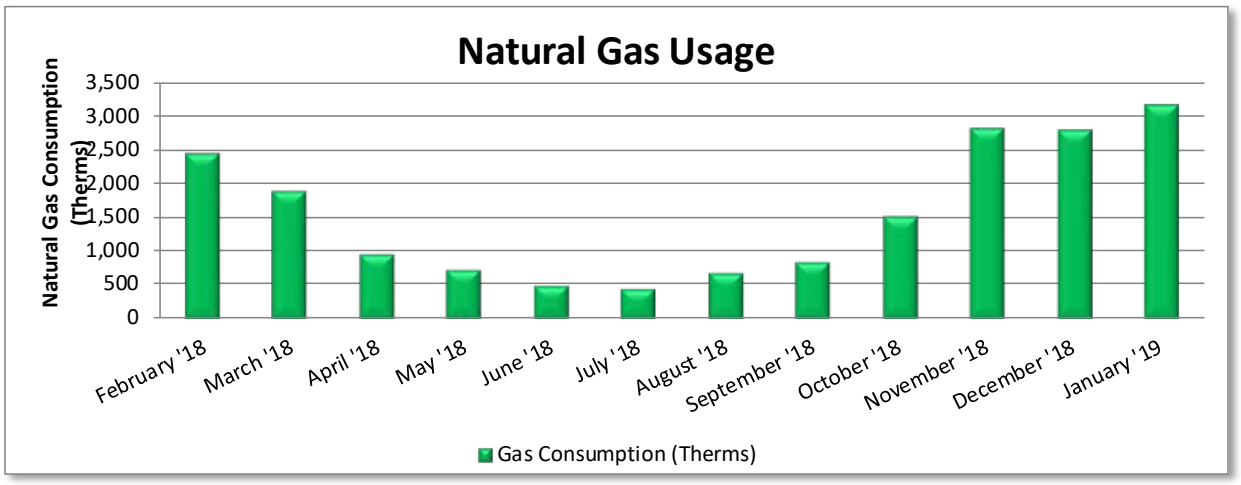
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
3/5/18	31	32,400	81	$1,078	$4,633
4/4/18	30	35,100	63	$839	$4,687
5/3/18	31	35,100	81	$1,078	$4,927
6/5/18	30	47,700	81	$1,078	$6,297
7/6/18	31	49,500	99	$1,318	$6,733
8/3/18	31	45,900	90	$1,198	$6,221
9/5/18	30	54,900	99	$1,318	$7,320
10/4/18	31	44,100	99	$1,318	$6,145
11/5/18	30	41,400	81	$1,078	$5,612
12/5/18	31	36,000	63	$839	$4,785
1/3/19	31	34,200	72	$959	$4,709
2/6/19	28	36,000	72	$959	$4,905
Totals	**365**	**492,300**	**99**	**$13,061**	**$66,974**
Annual	**365**	**492,300**	**99**	**$13,061**	**$66,974**

Notes:

- Peak demand of 99 kW occurred in June '18.
- Average demand over the past 12 months was 82 kW.
- The average electric cost over the past 12 months was $0.136/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**
3/5/18	31	2,469	$2,426
4/4/18	30	1,899	$1,240
5/3/18	31	969	$688
6/5/18	30	741	$562
7/6/18	31	489	$413
8/3/18	31	445	$383
9/5/18	30	690	$532
10/4/18	31	838	$632
11/5/18	30	1,528	$1,670
12/5/18	31	2,841	$2,878
1/3/19	31	2,810	$2,826
2/6/19	28	3,186	$2,923
Totals	**365**	**18,905**	**$17,173**
Annual	**365**	**18,905**	**$17,173**

Notes:

- The average gas cost for the past 12 months is $0.908/therm, which is the blended rate used throughout the analysis.
- Some of the summer gas use can be attributed to the VAV reheat system

3.3 Benchmarking

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

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

Benchmarking Score	**N/A**

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

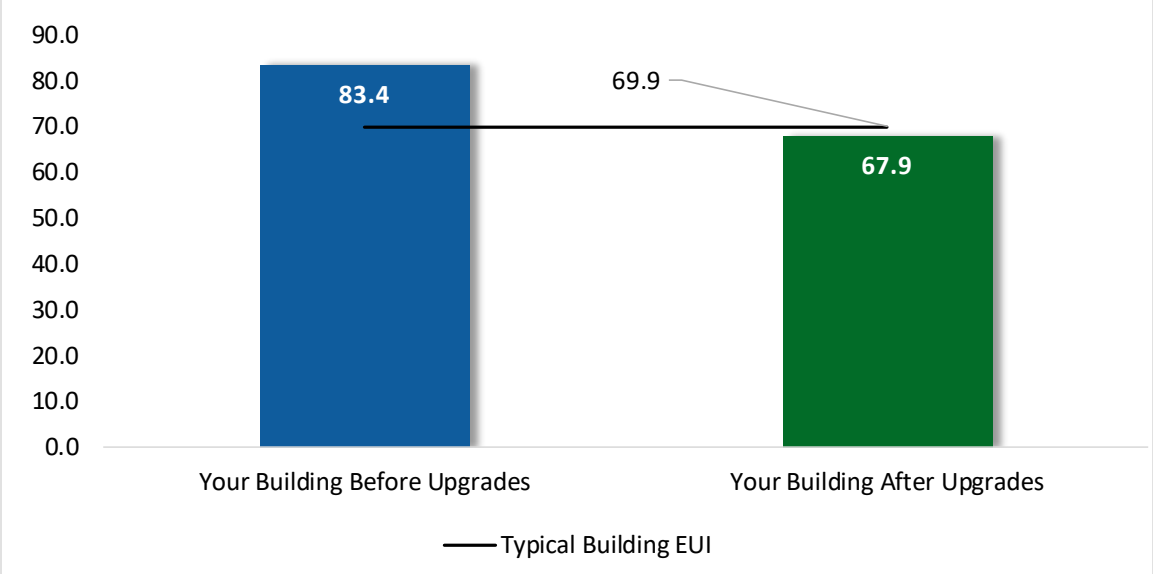


Figure 6 - Energy Use Intensity Comparison[3]

Energy use intensity (EUI) measures energy consumption per square foot and is the standard metric for comparing buildings' energy performance. A lower EUI means better performance and less energy consumed. 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			**133,079**	**13.7**	**-26**	**$17,865**	**$29,271**	**$0**	**$29,271**	**1.6**	**130,919**
ECM 1	Install LED Fixtures	Yes	8,753	0.0	0	$1,191	$11,200	$0	$11,200	9.4	8,814
ECM 2	Retrofit Fixtures with LED Lamps	Yes	124,326	13.7	-26	$16,674	$18,071	$0	$18,071	1.1	122,104
Lighting Control Measures			**14,045**	**1.3**	**-3**	**$1,884**	**$7,285**	**$0**	**$7,285**	**3.9**	**13,793**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	11,360	1.1	-2	$1,524	$5,710	$0	$5,710	3.7	11,156
ECM 4	Install High/Low Lighting Controls	Yes	2,685	0.3	-1	$360	$1,575	$0	$1,575	4.4	2,637
Variable Frequency Drive (VFD) Measures			**6,547**	**0.6**	**18**	**$1,053**	**$13,259**	**$0**	**$13,259**	**12.6**	**8,689**
ECM 5	Install VFDs on Heating Water Pumps	Yes	5,148	0.6	0	$700	$7,625	$0	$7,625	10.9	5,184
ECM 6	Install VFDs on Kitchen Hood Fan Motors	No	1,399	0.0	18	$353	$5,634	$0	$5,634	16.0	3,505
Electric Unitary HVAC Measures			**25,440**	**10.1**	**0**	**$3,461**	**$113,620**	**$0**	**$113,620**	**32.8**	**25,618**
ECM 7	Install High Efficiency Air Conditioning Units	No	25,440	10.1	0	$3,461	$113,620	$0	$113,620	32.8	25,618
Food Service & Refrigeration Measures			**1,612**	**0.2**	**0**	**$219**	**$230**	**$0**	**$230**	**1.0**	**1,623**
ECM 8	Vending Machine Control	Yes	1,612	0.2	0	$219	$230	$0	$230	1.0	1,623
Custom Measures			**5,207**	**0.0**	**39**	**$1,063**	**$18,679**	**$0**	**$18,679**	**17.6**	**9,815**
ECM 9	Retro-Commissioning Study	No	5,207	0.0	39	$1,063	$18,679	$0	$18,679	17.6	9,815
TOTALS			**185,929**	**26.0**	**28**	**$25,545**	**$182,344**	**$0**	**$182,344**	**7.1**	**190,457**

* - 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 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		**133,079**	**13.7**	**-26**	**$17,865**	**$29,271**	**$0**	**$29,271**	**1.6**	**130,919**
ECM 1	Install LED Fixtures	8,753	0.0	0	$1,191	$11,200	$0	$11,200	9.4	8,814
ECM 2	Retrofit Fixtures with LED Lamps	124,326	13.7	-26	$16,674	$18,071	$0	$18,071	1.1	122,104
Lighting Control Measures		**14,045**	**1.3**	**-3**	**$1,884**	**$7,285**	**$0**	**$7,285**	**3.9**	**13,793**
ECM 3	Install Occupancy Sensor Lighting Controls	11,360	1.1	-2	$1,524	$5,710	$0	$5,710	3.7	11,156
ECM 4	Install High/Low Lighting Controls	2,685	0.3	-1	$360	$1,575	$0	$1,575	4.4	2,637
Variable Frequency Drive (VFD) Measures		**6,547**	**0.6**	**18**	**$1,053**	**$13,259**	**$0**	**$13,259**	**12.6**	**8,689**
ECM 5	Install VFDs on Heating Water Pumps	5,148	0.6	0	$700	$7,625	$0	$7,625	10.9	5,184
ECM 6	Install VFDs on Kitchen Hood Fan Motors	1,399	0.0	18	$353	$5,634	$0	$5,634	16.0	3,505
Food Service & Refrigeration Measures		**1,612**	**0.2**	**0**	**$219**	**$230**	**$0**	**$230**	**1.0**	**1,623**
ECM 8	Vending Machine Control	1,612	0.2	0	$219	$230	$0	$230	1.0	1,623
TOTALS		**155,283**	**15.8**	**-11**	**$21,021**	**$50,045**	**$0**	**$50,045**	**2.4**	**155,024**

* - 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		**133,079**	**13.7**	**-26**	**$17,865**	**$29,271**	**$0**	**$29,271**	**1.6**	**130,919**
ECM 1	Install LED Fixtures	8,753	0.0	0	$1,191	$11,200	$0	$11,200	9.4	8,814
ECM 2	Retrofit Fixtures with LED Lamps	124,326	13.7	-26	$16,674	$18,071	$0	$18,071	1.1	122,104

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 fixtures.

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

Affected building areas: exterior fixtures.

ECM 2: Retrofit Fixtures with LED Lamps

Replace fluorescent T8, compact fluorescent lamps (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 fixtures with 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		**14,045**	**1.3**	**-3**	**$1,884**	**$7,285**	**$0**	**$7,285**	**3.9**	**13,793**
ECM 3	Install Occupancy Sensor Lighting Controls	11,360	1.1	-2	$1,524	$5,710	$0	$5,710	3.7	11,156
ECM 4	Install High/Low Lighting Controls	2,685	0.3	-1	$360	$1,575	$0	$1,575	4.4	2,637

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

ECM 3: Install Occupancy Sensor Lighting Controls

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

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

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

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

Affected building areas: offices, day room, laundry, volunteer rooms, conference rooms, restrooms, and storage rooms.

ECM 4: Install High/Low Lighting Controls

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

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

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		**6,547**	**0.6**	**18**	**$1,053**	**$13,259**	**$0**	**$13,259**	**12.6**	**8,689**
ECM 5	Install VFDs on Heating Water Pumps	5,148	0.6	0	$700	$7,625	$0	$7,625	10.9	5,184
ECM 6	Install VFDs on Kitchen Hood Fan Motors	1,399	0.0	18	$353	$5,634	$0	$5,634	16.0	3,505

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 5: Install VFDs on Heating Water Pumps

Install variable frequency drives (VFD) to control heating water pumps. Two-way valves must serve the hot water coils and the hot water loop must have a differential pressure sensor installed. If three-way valves or a bypass leg are used in the hot water distribution they will need to be modified when this measure is implemented. As the hot water valves close, the differential pressure increases and the VFD modulates the pump speed to maintain a differential pressure setpoint.

Energy savings result from reducing pump motor speed (and power) as hot water valves close. The magnitude of energy savings is based on the estimated amount of time that the system will operate at reduced load.

Affected pumps: 3 hp hot water pumps.

ECM 6: Install VFDs on Kitchen Hood Fan Motors

We have evaluated installing VFDs and sensors to control the kitchen hood fan motors. The air flow of the hoods is varied based on two key inputs: temperature and smoke/cooking fumes. The VFD controls the amount of exhaust (and kitchen make-up air) based on temperature—the lower the temperature the lower the flow. If the optic sensor is triggered by smoke or cooking fumes, the speed of the fan ramps up to 100%.

Energy savings result from reducing the hood fan speed (and power) when conditions allow for reduced air flow.

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		**25,440**	**10.1**	**0**	**$3,461**	**$113,620**	**$0**	**$113,620**	**32.8**	**25,618**
ECM 7	Install High Efficiency Air Conditioning Units	25,440	10.1	0	$3,461	$113,620	$0	$113,620	32.8	25,618

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 units 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 packaged air conditioning units and a condensing AC with high efficiency packaged air conditioning units and a condensing AC. 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.

4.5 Food Service & Refrigeration Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Food Service & Refrigeration Measures		**1,612**	**0.2**	**0**	**$219**	**$230**	**$0**	**$230**	**1.0**	**1,623**
ECM 8	Vending Machine Control	1,612	0.2	0	$219	$230	$0	$230	1.0	1,623

ECM 8: Vending Machine Control

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

4.6 Custom Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Custom Measures		**5,433**	**0.0**	**39**	**$1,094**	**$18,679**	**$0**	**$18,679**	**17.1**	**10,043**
ECM 9	Retro-Commissioning Study	5,433	0.0	39	$1,094	$18,679	$0	$18,679	17.1	10,043

ECM 9: 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 3% of the HVAC energy consumption baseline.

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.

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.

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

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.

Economizer Maintenance

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

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

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.

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.

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.

Furnace Maintenance

Preventative maintenance can extend the life of the system, maintain energy efficiency, and ensure safe operation. Following the manufacturer's instructions, a yearly tune-up should: check for gas / carbon monoxide leaks; change the air and fuel filters; check components for cracks, corrosion, dirt, or debris build-up; ensure the ignition system is working properly; test and adjust operation and safety controls; inspect electrical connections; and lubricate motors and bearings.

Water Heater Maintenance

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

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

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

Compressed Air System Maintenance

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

- Inspection, cleaning, and replacement of inlet filter cartridges
- Cleaning of drain traps
- Daily inspection of lubricant levels to reduce unwanted friction
- Inspection of belt condition and tension
- Check for leaks and adjust loose connections
- Overall system cleaning

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

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.

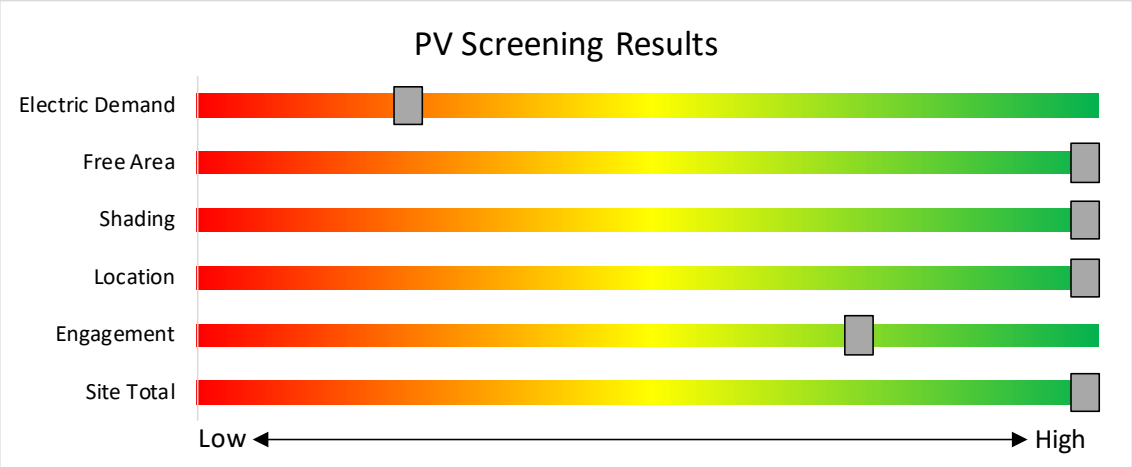
6.1 Solar Photovoltaic

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 high potential for installing a PV array.

The amount of free area, ease of installation (location), and the lack of shading elements contribute to the high potential. A PV array located on the roof may be feasible. If you are interested in pursuing the installation of PV, we recommend conducting a full feasibility study.

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	High	
System Potential	80	kW DC STC
Electric Generation	95,310	kWh/yr
Displaced Cost	$12,970	/yr
Installed Cost	$208,000	

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.

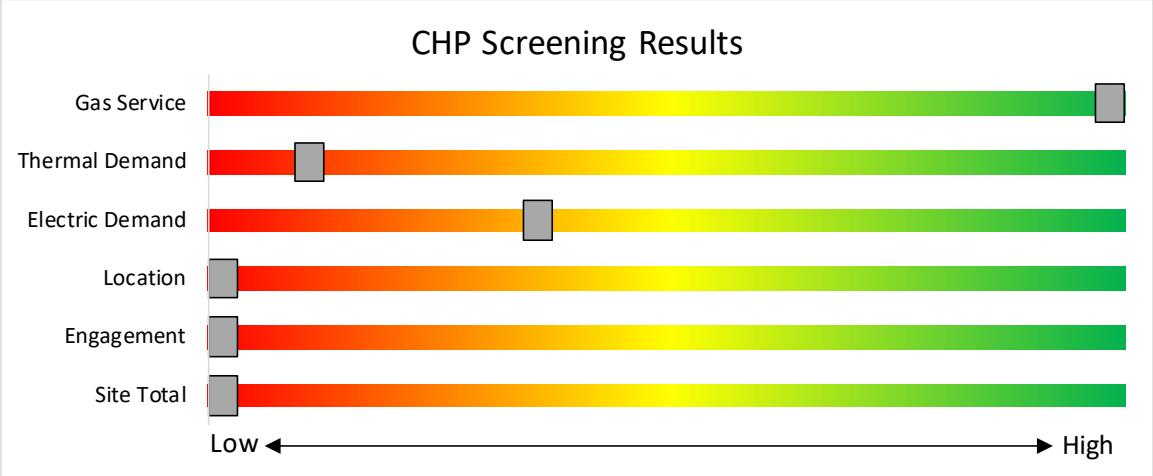
CHP systems typically produce a portion of the electric power used on-site, with the balance of electric power needs supplied by the local utility company. The heat is used to supplement (or replace) existing boilers and provide space heating and/or domestic hot water heating. Waste heat can also be 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	49,574	kWh/yr
Thermal Generation	1,168,530	MBtu/yr
Displaced Cost	$3,509	/yr
Installed Cost	$27,000	

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 *Flexibility to install at your own pace*	**Direct Install** *Turnkey installation*	**Pay for Performance** *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. Average peak demand should be below 200 kW. Not suitable for significant building shell issues.	Mid to large size facilities looking to implement as many measures as possible at one time. 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. 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 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 Floor	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,736	2	Relamp	No	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.1	1,557	0	$209	$183	$0	0.9
Attic Floor	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
Penthouse	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	6,028		None	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	6,028	0.0	0	0	$0	$0	$0	0.0
Garage	7	LED - Linear Tubes: (1) 4' Lamp	None	S	15	8,760		None	No	7	LED - Linear Tubes: (1) 4' Lamp	None	15	8,760	0.0	0	0	$0	$0	$0	0.0
Garage	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	8,736		None	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.0	0	0	$0	$0	$0	0.0
Campoem Room	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	6,028		None	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	6,028	0.0	0	0	$0	$0	$0	0.0
Greenteam Room	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	8,736		None	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.0	0	0	$0	$0	$0	0.0
Garage	67	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	8,736		None	No	67	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.0	0	0	$0	$0	$0	0.0
Garage	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
Storage 1	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	8,736	3	None	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	6,028	0.0	339	0	$45	$116	$0	2.5
Storage 2	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	8,736		None	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.0	0	0	$0	$0	$0	0.0
Storage 3	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	8,736		None	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.0	0	0	$0	$0	$0	0.0
Day Room	10	Compact Fluorescent: (2) 32W Plug-In Lamps	Wall Switch	S	64	8,736	2, 3	Relamp	Yes	10	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.4	4,580	-1	$614	$774	$0	1.3
Day Room	15	Incandescent: (1) 65W Screw-in Lamp	Wall Switch	S	65	8,736	2, 3	Relamp	Yes	15	LED Lamps: (1) 10.5W Plug-In Lamp	Occupancy Sensor	11	6,028	0.8	8,174	-2	$1,096	$798	$0	0.7
Day 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
Day Room Kitchen	2	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	8,736		None	No	2	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	8,736	0.0	0	0	$0	$0	$0	0.0
Room 137	4	Compact Fluorescent: (2) 32W Plug-In Lamps	Wall Switch	S	64	8,736	2, 3	Relamp	Yes	4	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.2	1,832	0	$246	$472	$0	1.9
Room 137	2	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	8,736	3	None	Yes	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	6,028	0.0	85	0	$11	$116	$0	10.2
Storage	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	6,028		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	6,028	0.0	0	0	$0	$0	$0	0.0
Garage Lobby	3	Compact Fluorescent: (2) 32W Plug-In Lamps	Wall Switch	S	64	8,736	2, 4	Relamp	Yes	3	LED Lamps: LED Plug-in Lamp	High/Low Control	22	6,028	0.1	1,374	0	$184	$376	$0	2.0
Garage 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
Laundry Room	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	8,736	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	6,028	0.1	1,481	0	$199	$560	$0	2.8
Laundry Room	4	Compact Fluorescent: (2) 32W Plug-In Lamps	Wall Switch	S	64	8,736	2, 3	Relamp	Yes	4	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.2	1,832	0	$246	$202	$0	0.8
Shower Room	1	Compact Fluorescent: (2) 26W Screw-In Lamps	Wall Switch	S	52	8,736	2	Relamp	No	1	LED Lamps: LED Screw in Lamp	Wall Switch	18	8,736	0.0	319	0	$43	$34	$0	0.8
Women Restroom	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	8,736	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	8,736	0.0	274	0	$37	$72	$0	2.0

	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
Men Restroom	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Occupancy Sensor	S	62	6,028	2	Relamp	No	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	6,028	0.1	378	0	$51	$145	$0	2.9
Men Restroom	3	Compact Fluorescent: (2) 26W Plug-In Lamps	Occupancy Sensor	S	52	6,028	2	Relamp	No	3	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	18	6,028	0.1	660	0	$89	$151	$0	1.7
Janitorial	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,736	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.0	311	0	$42	$37	$0	0.9
Volunteer Room	12	Compact Fluorescent: (2) 32W Plug-In Lamp	Wall Switch	S	64	8,736	2, 3	Relamp	Yes	12	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.5	5,496	-1	$737	$875	$0	1.2
Volunteer Room	9	Incandescent: (1) 65W Screw-in Lamp	Wall Switch	S	65	8,736	2, 3	Relamp	Yes	9	LED Lamps: (1) 10.5W Plug-In Lamp	Occupancy Sensor	11	6,028	0.5	4,904	-1	$658	$425	$0	0.6
Volunteer Room	6	Compact Fluorescent: (2) 26W Screw-In Lamps	Wall Switch	S	52	8,736	2, 3	Relamp	Yes	6	LED Lamps: LED Screw in Lamp	Occupancy Sensor	18	6,028	0.2	2,233	0	$299	$477	$0	1.6
Storage Room	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	8,736	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	6,028	0.1	740	0	$99	$261	$0	2.6
Stair Basement	3	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	8,736		None	No	3	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	8,736	0.0	0	0	$0	$0	$0	0.0
Firehouse Basement	17	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	8,736		None	No	17	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.0	0	0	$0	$0	$0	0.0
Firehouse Basement	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
Firehouse Basement	6	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	8,736	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	6,028	0.2	2,221	0	$298	$705	$0	2.4
Room 008	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,736	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.0	311	0	$42	$37	$0	0.9
Room 009	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,736	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.0	311	0	$42	$37	$0	0.9
Workout Room	8	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	8,736	3	None	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	6,028	0.1	679	0	$91	$270	$0	3.0
Server Room	12	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	8,736	2, 3	Relamp	Yes	12	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	6,028	0.4	4,442	-1	$596	$1,140	$0	1.9
Hallway	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	8,736	4	None	Yes	3	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	6,028	0.0	254	0	$34	$225	$0	6.6
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
Storage	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	8,736		None	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.0	0	0	$0	$0	$0	0.0
Room 010	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	8,736		None	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.0	0	0	$0	$0	$0	0.0
Storage Room	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	8,736	3	None	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	6,028	0.0	424	0	$57	$270	$0	4.7
Stairwell	7	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	8,736		None	No	7	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	8,736	0.0	0	0	$0	$0	$0	0.0
Stairwell	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
1st Floor PD	18	Compact Fluorescent: (2) 32W Plug-In Lamps	None	S	64	8,760	2, 3	Relamp	Yes	18	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,044	0.8	8,267	-2	$1,109	$1,448	$0	1.3
1st Floor PD	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
1st Floor PD	3	Compact Fluorescent: (2) 26W Screw-In Lamps	Wall Switch	S	52	8,736	2, 3	Relamp	Yes	3	LED Lamps: LED Screw in Lamp	Occupancy Sensor	18	6,028	0.1	1,116	0	$150	$103	$0	0.7

	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
PD Back Entrance	1	Compact Fluorescent: (2) 32W Plug-In Lamps	None	S	64	8,760	2	Relamp	No	1	LED Lamps: LED Plug-in Lamp	None	22	8,760	0.0	394	0	$53	$50	$0	1.0
PD Back 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
Room113B	4	Compact Fluorescent: (2) 32W Plug-In Lamps	Occupancy Sensor	S	64	6,028	2	Relamp	No	4	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.1	1,083	0	$145	$202	$0	1.4
Room 115 Men Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 1L	Occupancy Sensor	S	22	6,028	2	Relamp	No	1	LED - Linear Tubes: (1) 2' Lamp	Occupancy Sensor	9	6,028	0.0	88	0	$12	$16	$0	1.4
Room 117 Women Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 1L	Occupancy Sensor	S	22	6,028	2	Relamp	No	1	LED - Linear Tubes: (1) 2' Lamp	Occupancy Sensor	9	6,028	0.0	88	0	$12	$16	$0	1.4
Room 116 Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,736	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.0	311	0	$42	$37	$0	0.9
Room 113A	6	Compact Fluorescent: (2) 32W Plug-In Lamps	Occupancy Sensor	S	64	6,028	2	Relamp	No	6	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.2	1,625	0	$218	$303	$0	1.4
Room 118	1	Compact Fluorescent: (2) 32W Plug-In Lamps	Wall Switch	S	64	8,736	2	Relamp	No	1	LED Lamps: LED Plug-in Lamp	Wall Switch	22	8,736	0.0	392	0	$53	$50	$0	1.0
Room 111	5	Compact Fluorescent: (2) 32W Plug-In Lamps	Occupancy Sensor	S	64	6,028	2	Relamp	No	5	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.2	1,354	0	$182	$252	$0	1.4
Room 110	6	Compact Fluorescent: (2) 32W Plug-In Lamps	Occupancy Sensor	S	64	6,028	2	Relamp	No	6	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.2	1,625	0	$218	$303	$0	1.4
Room 109	6	Compact Fluorescent: (2) 32W Plug-In Lamps	Occupancy Sensor	S	64	6,028	2	Relamp	No	6	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.2	1,625	0	$218	$303	$0	1.4
Room 109	2	LED Lamps: (1) 9W Screw-in Lamp	Wall Switch	S	9	8,736		None	No	2	LED Lamps: (1) 9W Screw-in Lamp	Wall Switch	9	8,736	0.0	0	0	$0	$0	$0	0.0
Interview Room	3	Compact Fluorescent: (2) 32W Plug-In Lamps	Wall Switch	S	64	8,736	2, 3	Relamp	Yes	3	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.1	1,374	0	$184	$421	$0	2.3
Room 123	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,736	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.0	311	0	$42	$37	$0	0.9
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 1L	Occupancy Sensor	S	22	6,028	2	Relamp	No	1	LED - Linear Tubes: (1) 2' Lamp	Occupancy Sensor	9	6,028	0.0	88	0	$12	$16	$0	1.4
Room 124	2	Compact Fluorescent: (2) 32W Plug-In Lamps	Occupancy Sensor	S	64	6,028	2	Relamp	No	2	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.1	542	0	$73	$101	$0	1.4
Room 125	6	Compact Fluorescent: (2) 32W Plug-In Lamps	Occupancy Sensor	S	64	6,028	2	Relamp	No	6	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.2	1,625	0	$218	$303	$0	1.4
Processing Room	4	Compact Fluorescent: (2) 32W Plug-In Lamps	Occupancy Sensor	S	64	6,028	2	Relamp	No	4	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.1	1,083	0	$145	$202	$0	1.4
Booking Room	10	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Occupancy Sensor	S	62	6,028	2	Relamp	No	10	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	6,028	0.3	1,888	0	$253	$725	$0	2.9
DWI Room	4	Compact Fluorescent: (2) 32W Plug-In Lamps	Occupancy Sensor	S	64	6,028	2	Relamp	No	4	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.1	1,083	0	$145	$202	$0	1.4
Interview Room	2	Compact Fluorescent: (2) 32W Plug-In Lamps	Wall Switch	S	64	8,736	2, 3	Relamp	Yes	2	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.1	916	0	$123	$217	$0	1.8
Cells	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,736	2	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.2	1,868	0	$251	$219	$0	0.9
Room 126	11	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	8,736	3	None	Yes	11	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	6,028	0.1	933	0	$125	$270	$0	2.2
Room 127	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	6,028	2	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	6,028	0.1	430	0	$58	$73	$0	1.3
Room 132	18	Linear Fluorescent - T5HO: 4' T5HO (54W) - 2L	Occupancy Sensor	S	117	6,028	2	Relamp	No	18	LED - Linear Tubes: (2) 4' T5 (14.5W) Lamps	Occupancy Sensor	30	6,028	1.4	10,195	-2	$1,367	$1,027	$0	0.8

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Room 103	8	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	8,736	3	None	Yes	8	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	6,028	0.0	398	0	$53	$270	$0	5.1
Dispatch Support	2	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	8,736		None	No	2	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	8,736	0.0	0	0	$0	$0	$0	0.0
Main Lobby	13	LED Lamps: (2) 8.5W Plug-In Lamps	Occupancy Sensor	S	17	6,028		None	No	13	LED Lamps: (2) 8.5W Plug-In Lamps	Occupancy Sensor	17	6,028	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
Main Lobby	7	Compact Fluorescent: (2) 26W Screw-In Lamps	Occupancy Sensor	S	52	6,028	2	Relamp	No	7	LED Lamps: LED Screw in Lamp	Occupancy Sensor	18	6,028	0.2	1,540	0	$207	$241	$0	1.2
Hallway	3	LED Lamps: (2) 8.5W Plug-In Lamps	Occupancy Sensor	S	17	6,028		None	No	3	LED Lamps: (2) 8.5W Plug-In Lamps	Occupancy Sensor	17	6,028	0.0	0	0	$0	$0	$0	0.0
Hallway	19	Compact Fluorescent: (2) 26W Screw-In Lamps	Occupancy Sensor	S	52	6,028	2	Relamp	No	19	LED Lamps: LED Screw in Lamp	Occupancy Sensor	18	6,028	0.6	4,181	-1	$561	$655	$0	1.2
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
Room 104	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Occupancy Sensor	S	62	6,028	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	6,028	0.0	189	0	$25	$72	$0	2.9
Room 228	8	Compact Fluorescent: (2) 32W Plug-In Lamps	Wall Switch	S	64	8,736	2, 3	Relamp	Yes	8	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.3	3,664	-1	$491	$674	$0	1.4
Room 228	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
Room 234	4	Compact Fluorescent: (2) 32W Plug-In Lamps	Occupancy Sensor	S	64	6,028	2	Relamp	No	4	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.1	1,083	0	$145	$202	$0	1.4
Room 234	4	Incandescent: (1) 65W Screw-in Lamp	Wall Switch	S	65	8,736	2, 3	Relamp	Yes	4	LED Lamps: (1) 10.5W Plug-In Lamp	Occupancy Sensor	11	6,028	0.2	2,180	0	$292	$69	$0	0.2
Closet	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Occupancy Sensor	S	62	6,028	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	6,028	0.0	189	0	$25	$72	$0	2.9
Men Restroom	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Occupancy Sensor	S	62	6,028	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	6,028	0.0	189	0	$25	$72	$0	2.9
Men Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	6,028	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	6,028	0.0	215	0	$29	$37	$0	1.3
Women Restroom	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	8,736	2	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	8,736	0.0	274	0	$37	$72	$0	2.0
Women Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	8,736	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.0	311	0	$42	$37	$0	0.9
Conference Room	6	Compact Fluorescent: (2) 32W Plug-In Lamps	Occupancy Sensor	S	64	6,028	2	Relamp	No	6	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.2	1,625	0	$218	$303	$0	1.4
Lunch Room	6	Compact Fluorescent: (2) 32W Plug-In Lamps	Occupancy Sensor	S	64	6,028	2	Relamp	No	6	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.2	1,625	0	$218	$303	$0	1.4
Men Locker Room	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Occupancy Sensor	S	62	6,028	2	Relamp	No	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	6,028	0.1	378	0	$51	$145	$0	2.9
Men Locker Room	6	Compact Fluorescent: (2) 26W Screw-In Lamps	Occupancy Sensor	S	52	6,028	2	Relamp	No	6	LED Lamps: LED Screw in Lamp	Occupancy Sensor	18	6,028	0.2	1,320	0	$177	$207	$0	1.2
Men Locker Room	14	Compact Fluorescent: (2) 32W Plug-In Lamps	Occupancy Sensor	S	64	6,028	2	Relamp	No	14	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.5	3,791	-1	$508	$706	$0	1.4
Shower Room	2	Incandescent: (1) 65W Screw-in Lamp	Wall Switch	S	65	8,736	2, 3	Relamp	Yes	2	LED Lamps: (1) 10.5W Plug-In Lamp	Occupancy Sensor	11	6,028	0.1	1,090	0	$146	$150	$0	1.0
Shower 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

	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 PD Hallway	14	Compact Fluorescent: (2) 32W Plug-In Lamps	Wall Switch	S	64	8,736	2, 4	Relamp	Yes	14	LED Lamps: LED Plug-in Lamp	High/Low Control	22	6,028	0.6	6,412	-1	$860	$1,156	$0	1.3
2nd Floor PD 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
Room 213	12	Compact Fluorescent: (2) 32W Plug-In Lamps	Wall Switch	S	64	8,736	2, 3	Relamp	Yes	12	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.5	5,496	-1	$737	$875	$0	1.2
Room 214	3	Compact Fluorescent: (2) 32W Plug-In Lamps	Occupancy Sensor	S	64	6,028	2	Relamp	No	3	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.1	812	0	$109	$151	$0	1.4
Room 215	6	Compact Fluorescent: (2) 32W Plug-In Lamps	Occupancy Sensor	S	64	6,028	2	Relamp	No	6	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.2	1,625	0	$218	$303	$0	1.4
Men Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Occupancy Sensor	S	33	6,028	2	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	6,028	0.0	104	0	$14	$33	$0	2.3
Women Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Occupancy Sensor	S	33	6,028	2	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	6,028	0.0	104	0	$14	$33	$0	2.3
Janitorial	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	6,028	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	6,028	0.0	215	0	$29	$37	$0	1.3
Room 220	15	Compact Fluorescent: (2) 32W Plug-In Lamps	Occupancy Sensor	S	64	6,028	2	Relamp	No	15	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.6	4,062	-1	$545	$757	$0	1.4
Room 218	2	Compact Fluorescent: (2) 32W Plug-In Lamps	Occupancy Sensor	S	64	6,028	2	Relamp	No	2	LED Lamps: LED Plug-in Lamp	Occupancy Sensor	22	6,028	0.1	542	0	$73	$101	$0	1.4
Women Locker Room	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Occupancy Sensor	S	62	6,028	2	Relamp	No	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	6,028	0.1	755	0	$101	$290	$0	2.9
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Occupancy Sensor	S	33	6,028	2	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	6,028	0.0	104	0	$14	$33	$0	2.3
Wall Pack	5	Compact Fluorescent: (2) 13W Plug-In Lamps	Photocell		26	4,380	2	Relamp	No	5	LED Lamps: LED Plug-in Lamp	Photocell	9	4,380	0.0	370	0	$50	$252	$0	5.0
Wall Pack	6	Metal Halide: (1) 100W Lamp	Photocell		128	4,380	1	Fixture Replacement	No	6	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	38	4,380	0.0	2,355	0	$320	$4,800	$0	15.0
Pole Light	5	Metal Halide: (1) 150W Lamp	Photocell		190	4,380	1	Fixture Replacement	No	5	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Photocell	57	4,380	0.0	2,913	0	$396	$4,000	$0	10.1
Up Light	1	LED - Fixtures: Architectural Flood/Spot Luminaire	Photocell		75	4,380		None	No	1	LED - Fixtures: Architectural Flood/Spot Luminaire	Photocell	75	4,380	0.0	0	0	$0	$0	$0	0.0
Wall Pack	3	Metal Halide: (1) 150W Lamp	Wall Switch		190	8,736	1	Fixture Replacement	No	3	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	57	8,736	0.0	3,486	0	$474	$2,400	$0	5.1
Main Stariwell	21	Compact Fluorescent: (2) 26W Screw-In Lamps	Wall Switch	S	52	8,736	2, 4	Relamp	Yes	21	LED Lamps: LED Screw in Lamp	High/Low Control	18	6,028	0.7	7,815	-2	$1,048	$1,398	$0	1.3
Main Stariwell	4	LED Lamps: (2) 8.5W Plug-In Lamps	Wall Switch	S	17	8,736	4	None	Yes	4	LED Lamps: (2) 8.5W Plug-In Lamps	High/Low Control	17	6,028	0.0	199	0	$27	$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
Roof	Restroom	1	Exhaust Fan	0.2	65.0%	No	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Kitchen	1	Kitchen Hood Exhaust Fan	0.5	70.0%	No	W	2,100	6	No	78.2%	Yes	1	0.0	846	9	$196	$2,848	$0	14.5
Roof	Kitchen	1	Kitchen Hood Exhaust Fan	0.3	65.0%	No	W	2,100	6	No	69.5%	Yes	1	0.0	552	9	$156	$2,786	$0	17.8
Roof	Restroom	1	Exhaust Fan	0.5	70.0%	No	W	2,745		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	Restroom	1	Exhaust Fan	0.3	65.0%	No	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Attic Floor	Attic Floor	1	Exhaust Fan	0.5	70.0%	No	W	2,745		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Pent House	Heating System	2	Heating Hot Water Pump	3.0	89.5%	No	W	2,745	5	No	89.5%	Yes	2	0.6	5,148	0	$700	$7,625	$0	10.9
Pent House	Air Combustion	1	Combustion Air Fan	0.3	55.0%	No	W	2,745		No	55.0%	No		0.0	0	0	$0	$0	$0	0.0
Pent House	Domestic Hot Water	2	Heating Hot Water Pump	0.3	55.0%	No	W	2,745		No	55.0%	No		0.0	0	0	$0	$0	$0	0.0
Compressor Room	Air Compressor	1	Air Compressor	5.0	84.5%	No	W	2,500		No	84.5%	No		0.0	0	0	$0	$0	$0	0.0
Storage Rooms	Storage Rooms	2	Exhaust Fan	0.3	65.0%	No	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Garage	Rollup Doors	6	Other	1.0	82.0%	No	W	730		No	82.0%	No		0.0	0	0	$0	$0	$0	0.0
Room 008	Dispatch room	1	Other	0.3	65.0%	No	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Room 009	Elevators	2	Other	25.0	70.0%	No	W	146		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Storage Room	Sum Pump	2	Other	0.3	65.0%	No	W	548		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	RTU1,2	2	Supply Fan	7.5	89.5%	Yes	W	2,100		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	RTU3	1	Supply Fan	5.0	86.5%	Yes	W	2,100		No	86.5%	No		0.0	0	0	$0	$0	$0	0.0
Room 008	AHU Dispatch room	1	Supply Fan	0.3	65.0%	Yes	W	2,100		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	RTU1,2	2	Exhaust Fan	1.0	84.0%	No	W	2,100		No	84.0%	No		0.0	0	0	$0	$0	$0	0.0
Facility	Facility	5	Supply Fan	0.3	65.0%	No	W	2,100		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0

Electric HVAC Inventory & Recommendations

		Existing Conditions					Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/EER)	Heating Mode Efficiency (COP)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Roof	Dispatch Room	1	Split-System AC	2.00		B	7	Yes	1	Split-System AC	2.00		14.00		0.3	719	0	$98	$2,992	$0	30.6
Roof	Server Room	2	Split-System AC	3.00		W		No							0.0	0	0	$0	$0	$0	0.0
Roof	RTU2 - Second Floor	1	Packaged AC	27.50		B	7	Yes	1	Packaged AC	27.50		12.00		4.2	10,459	0	$1,423	$46,403	$0	32.6
Roof	RTU1- First Floor	1	Packaged AC	27.50		B	7	Yes	1	Packaged AC	27.50		12.00		4.2	10,459	0	$1,423	$46,403	$0	32.6
Roof	RTU1- First & Second Floor	1	Packaged AC	10.00		B	7	Yes	1	Packaged AC	10.00		12.00		1.5	3,803	0	$517	$17,821	$0	34.4

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
Pent House	Heating System	4	Condensing Hot Water Boiler	275	W		No						0.0	0	0	$0	$0	$0	0.0
Garage	Garage	1	Furnace	291	W		No						0.0	0	0	$0	$0	$0	0.0
Facility	Washer/Dryer	2	Other	100	W		No						0.0	0	0	$0	$0	$0	0.0

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
Pent House	Domestic Hot Water System	1	Storage Tank Water Heater (> 50 Gal)	W		No						0.0	0	0	$0	$0	$0	0.0

Commercial Refrigerator/Freezer Inventory & Recommendations

	Existing Conditions			Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Refrigerator/ Freezer Type	ENERGY STAR Qualified?	ECM #	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Lunch Room	1	Stand-Up Refrigerator, Solid Door (31 - 50 cu. ft.)	Yes		No	0.0	0	0	$0	$0	$0	0.0

Cooking Equipment Inventory & Recommendations

	Existing Conditions			Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Equipment Type	High Efficiency Equipement?	ECM #	Install High Efficiency Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Gas Combination Oven/Steam Cooker (<15 Pans)	Yes		No	0.0	0	0	$0	$0	$0	0.0

Plug Load Inventory

	Existing Conditions		
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
Facility	1	Icemachine	2,500	Yes
Facility	5	Water Cooler	92	Yes
Facility	18	Wall Tys	124	Yes
Facility	4	Refrigerator	224	Yes
Facility	8	Coffee Machine	500	No
Facility	6	Microwave	1,000	No
Facility	3	Copy Machine	600	Yes
Facility	27	Desktop Computer	120	Yes
Facility	1	Electric Washing Machine	1,200	No
Facility	4	Toaster	300	No
Facility	5	Printer	45	Yes
Facility	2	Small Printer	55	Yes
Facility	1	Central Vacuum	2,000	No
Facility	1	Server	5,000	No

Vending Machine Inventory & Recommendations

	Existing Conditions		Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Vending Machine Type	ECM #	Install Controls?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Lunch Room	1	Refrigerated	8	Yes	0.2	1,612	0	$219	$230	$0	1.0

Custom (High Level) Measure Analysis

Retro-Commissioning Study

Building Square Footage	40,000		Fuel Utility Rate	$9.084	MMBtu
Percent of Conditioned Area Impacted	93%		Blended Electric Utility Rate	$0.136	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	B	64,199	116,901	1,302	Retro-Commissioning Study	3%	3%	3%	$0.50	0.00	5,433	39	$1,094	$18,679	$0	17.08

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

N/A

ENERGY STAR® Score[1]

Madison Public Safety Complex (Police & Fire)

Primary Property Type: Fire Station
Gross Floor Area (ft²): 37,526
Built: 2005

For Year Ending: January 31, 2019
Date Generated: December 30, 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
Madison Public Safety Complex (Police & Fire) 62 Kings Road Madison, New Jersey 07940	Borough of Madison 50 Kings Road Madison, NJ 07940 (973) 593-3042	Peter Fried 38 Morris Place Madison, NJ 07940 (973) 699-1915 peter_fried@yahoo.com

Property ID: 6894403

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
96.9 kBtu/ft²

Source EUI
179 kBtu/ft²

Annual Energy by Fuel	
Electric - Grid (kBtu)	1,658,051 (46%)
Natural Gas (kBtu)	1,976,600 (54%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	67.6
National Median Source EUI (kBtu/ft²)	124.9
% Diff from National Median Source EUI	43%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	273

Signature & Stamp of Verifying Professional

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

LP Signature: _____ Date: _____

Licensed Professional

____ _____
,
(____)____-_____
_____

Professional Engineer or Registered Architect Stamp (if applicable)

APPENDIX C: GLOSSARY

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

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

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