Local Government Energy Audit Report

Woodbine State Police Barracks

November 11, 2020

Prepared for:

Borough of Woodbine

809 Franklin Street

Woodbine, New Jersey 08270

Prepared by:

TRC

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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 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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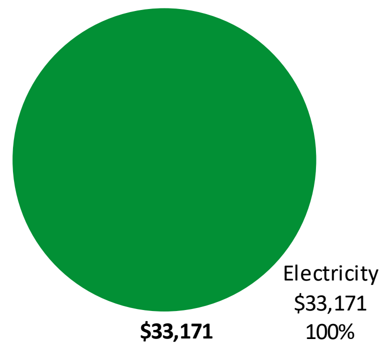
1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Woodbine State Police Barracks. 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: $33,171 Electricity: 208,800 kWh	
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.

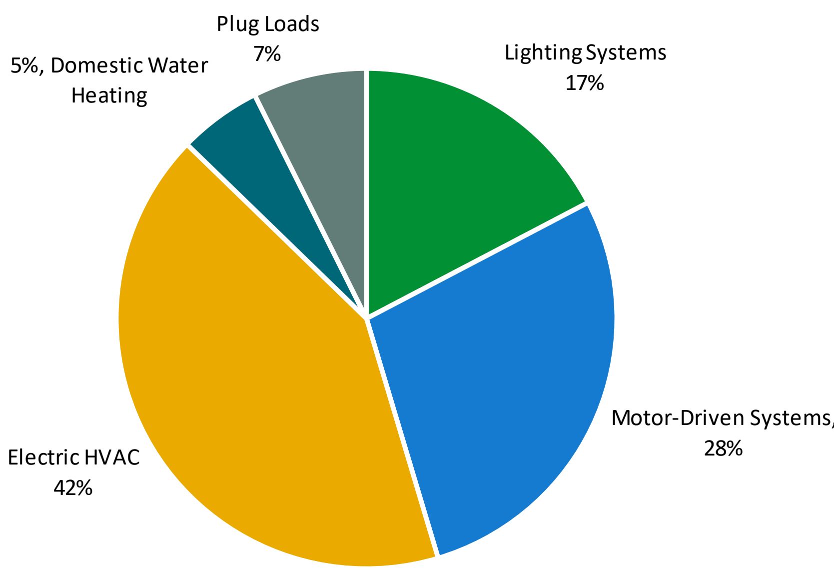


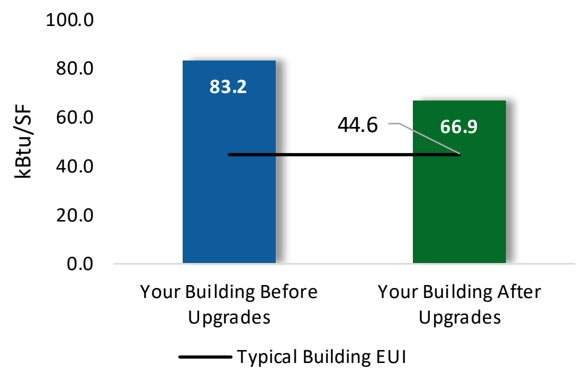
Figure 1 - Energy Use by System

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.

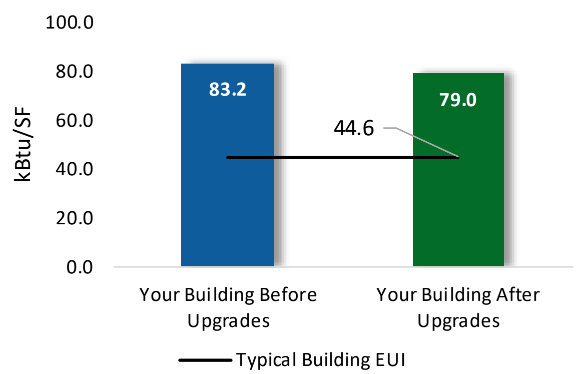
Scenario 1: Full Package (all evaluated measures)

Installation Cost	$154,547
Potential Rebates & Incentives[1]	$9,389
Annual Cost Savings	$6,518
Annual Energy Savings	Electricity: 41,027 kWh
Greenhouse Gas Emission Savings	21 Tons
Simple Payback	22.3 Years
Site Energy Savings (all utilities)	20%



Scenario 2: Cost Effective Package[2]

Installation Cost	$3,569
Potential Rebates & Incentives	$1,482
Annual Cost Savings	$1,675
Annual Energy Savings	Electricity: 10,541 kWh
Greenhouse Gas Emission Savings	5 Tons
Simple Payback	1.2 Years
Site Energy Savings (all utilities)	5%



On-site Generation Potential

Photovoltaic	None
Combined Heat and Power	None

[1] Incentives are based on current SmartStart Prescriptive incentives. Other program incentives may apply.

[2] A cost-effective measure is defined as one where the simple payback does not exceed two-thirds of the expected proposed equipment useful life. Simple payback is based on the net measure cost after potential incentives.

#	Energy Conservation Measure	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			**567**	**0.1**	**0**	**$90**	**$252**	**$40**	**$212**	**2.4**	**571**
ECM 1	Retrofit Fixtures with LED Lamps	Yes	567	0.1	0	$90	$252	$40	$212	2.4	571
Lighting Control Measures			**5,917**	**0.8**	**0**	**$940**	**$2,835**	**$1,220**	**$1,615**	**1.7**	**5,958**
ECM 2	Install Occupancy Sensor Lighting Controls	Yes	4,013	0.6	0	$638	$2,160	$560	$1,600	2.5	4,041
ECM 3	Install High/Low Lighting Controls	Yes	1,904	0.2	0	$302	$675	$660	$15	0.0	1,917
Variable Frequency Drive (VFD) Measures			**26,642**	**3.8**	**0**	**$4,232**	**$50,471**	**$2,050**	**$48,421**	**11.4**	**26,828**
ECM 4	Install VFDs on Constant Volume (CV) Fans	No	21,674	2.9	0	$3,443	$40,559	$1,500	$39,059	11.3	21,825
ECM 5	Install VFDs on Heating Water Pumps	No	4,533	0.9	0	$720	$6,522	$400	$6,122	8.5	4,565
ECM 6	Install VFDs on Cooling Tower Fans	No	435	0.0	0	$69	$3,391	$150	$3,241	46.9	438
Electric Unitary HVAC Measures			**3,844**	**1.3**	**0**	**$611**	**$100,506**	**$5,858**	**$94,649**	**155.0**	**3,871**
ECM 7	Install High Efficiency Heat Pumps	No	3,844	1.3	0	$611	$100,506	$5,858	$94,649	155.0	3,871
Domestic Water Heating Upgrade			**834**	**0.0**	**0**	**$133**	**$22**	**$22**	**$0**	**0.0**	**840**
ECM 8	Install Low-Flow DHW Devices	Yes	834	0.0	0	$133	$22	$22	$0	0.0	840
Food Service & Refrigeration Measures			**3,224**	**0.4**	**0**	**$512**	**$460**	**$200**	**$260**	**0.5**	**3,246**
ECM 9	Vending Machine Control	Yes	3,224	0.4	0	$512	$460	$200	$260	0.5	3,246
TOTALS (COST EFFECTIVE MEASURES)			**10,541**	**1.3**	**0**	**$1,675**	**$3,569**	**$1,482**	**$2,087**	**1.2**	**10,615**
TOTALS (ALL MEASURES)			**41,027**	**6.3**	**0**	**$6,518**	**$154,547**	**$9,389**	**$145,157**	**22.3**	**41,313**

* - 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	Retrofit Fixtures with LED Lamps	X	X	
ECM 2	Install Occupancy Sensor Lighting Controls	X	X	
ECM 3	Install High/Low Lighting Controls	X	X	
ECM 4	Install VFDs on Constant Volume (CV) Fans	X	X	
ECM 5	Install VFDs on Heating Water Pumps	X	X	
ECM 6	Install VFDs on Cooling Tower Fans	X	X	
ECM 7	Install High Efficiency Heat Pumps	X	X	
ECM 8	Install Low-Flow DHW Devices	X	X	
ECM 9	Vending Machine Control	X	X	

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 Woodbine State Police Barracks. 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 July 29, 2020, TRC performed an energy audit at Woodbine State Police Barracks located in Woodbine, New Jersey. TRC met with Jim Gurdgiel to review the facility operations and help focus our investigation on specific energy-using systems.

The Woodbine State Police Barracks is a two-story, 8,558 square foot building built in 1978 and was renovated in 2001. Spaces include administrative offices, an interrogation room, holding cells, a records room, a squad room, a basement workout room and mechanical space, locker rooms, and restrooms.

The Borough staff has reported that the facility is operating at a reduced efficiency level compared to other borough buildings and has expressed a great interest in recommendations that can mitigate the building operation efficiency issue. We note that elevated usage as compared to other buildings is at least partially due to the continuous operation of the facility in response to operational requirements.

The building heating, ventilation, and air conditioning (HVAC) and the domestic hot water systems are 100 percent electric. The facility has recently replaced interior and exterior lights to LED fixtures.

2.2 Building Occupancy

The facility is occupied year-round, 24/7. During a typical day, the facility is occupied by approximately 25 staff. It should be noted that the energy and economic analysis for this building is based on the use of the building during the utility billing period, and results will vary based on changes to building use patterns.

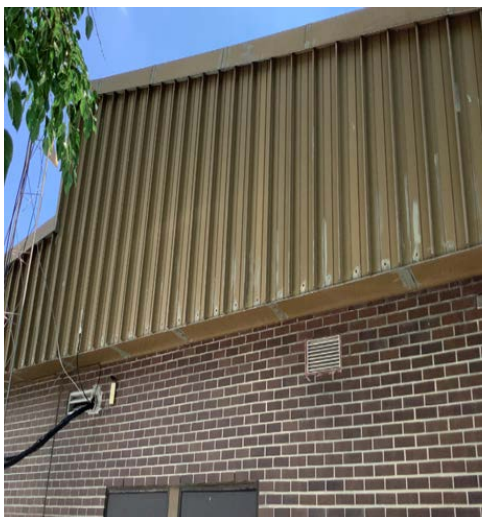
Building Name	Weekday/Weekend	Operating Schedule
Woodbine State Police Barracks	Weekday	24/7
	Weekend	24/7

Figure 4 - Building Occupancy Schedule

2.3 Building Envelope

The walls are made of concrete masonry units with a brick veneer and gypsum drywall interior finish. Steel trusses support a gable roof with a metal deck covered with a standing seam metal roofing system that appears in fair condition. The roof encloses unconditioned space and the thermal barrier is between this space and the conditioned space bellow. Typically, windows are double paned, clear glass with aluminum frames. The glass-to-frame seals are in good condition. Blinds are utilized through the facility for occupant comfort. Exterior doors have aluminum frames. The main entrance door is in good condition, while the exit doors appear in fair condition.

Building Walls & Roof



Building Walls & Windows

Exterior Doors

2.4 Lighting Systems

The interior lighting system uses LED fixtures and LED linear tubes. Light fixtures are mostly 2' x 4' recessed or surfaced mounted. Light fixtures are in good condition. All exit signs are LED units. There are three 2-lamp, 26-Watt compact fluorescent lamps in the foyer and one in the women' locker room.

Interior lighting levels were generally sufficient. Lighting in spaces are controlled with occupancy sensors and switches.

Exterior lighting is mostly provided by wall, recessed, and pole mounted with LED lamps that are controlled by a timeclock.


LED Exit Sign, Compact Fluorescent lamps & Occupancy Sensor


Linear LED Tubes

LED Fixtures

Exterior Fixtures

2.5 Heating and Cooling Systems

The Woodbine Police Barrack is conditioned by a water source heat pump (WSHP) system. There are 14 WSHP units located in the plenum. They vary in heating capacity from 14.6 to 68 MBh and from 0.98 to 4.92 tons in cooling capacity. The Climate Master water source heat pumps were installed in 2004 and are nearing the end of their useful service life. They provide heating and cooling to various spaces.

An Evapco open loop cooling tower, located outside the building on grade, operates in a dedicated loop with a plate and frame heat exchanger. The cooling tower fan is pitched to a remote 1.5 hp constant speed motor located in the basement mechanical space. Both the cooling tower and heat exchanger were manufactured in 2002, and the tower appears in just fair condition because of corrosion.

A Precision, 80 kW electric hot water boiler is used to warm the loop back up to a certain setpoint. During the heating periods, heat pumps will heat the space and cool the loop. In the cooling periods, the cooling tower is required to reject the heat energy from the condenser water loop. The electric boiler was manufactured in 2002 and appears to be one the largest consumers of electricity in the building. There are two 2 hp WSHP recirculation pumps and a 0.33 hp hot water pump. They run at constant speed.

The WSHP are controlled via programmable thermostats located in the zones. Staff has reported that the HVAC controls is maintained by a Johnson Controls Metasys that provides control over the pumps, room setpoints, heat pump temperature, and boiler setpoint. We did not have access to the system and do not know the current status of the system.

Supplemental heating in the locker rooms and restrooms is provided by electricity resistance heaters that are controlled by local thermostats.

Water Source Heat Pump

Programmable Thermostat

Electric Hot Water Boiler & Cooling Tower

Heat Exchanger & Basin

WSHP Circulation Pump

2.6 Domestic Hot Water

Hot water for the building is produced with an 80-gallon 18 kW Bradford White electric storage tank water heater located in the mechanical room. The domestic hot water pipes are insulated, and the insulation is in good condition.

Electric Storage Tank Water Heater

2.7 Plug Load & Vending Machines

There are approximately 18 computer workstations throughout the facility. Plug loads throughout the building include coffee machines, microwaves, printers, a scanner/copier, dehumidifiers, a water cooler, and a residential style refrigerator.

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 two refrigerated vending machines in the building.

Scanner/Copier & Water Cooler

Residential Style Refrigerator & Vending Machine

2.8 Water-Using Systems

There are three restrooms with toilets, urinals, and sinks. Some faucet flow rates are at 2.2 gallons per minute (gpm) or higher. Toilets and urinals vary in rated gallons per flush (gpf). There is a restroom with shower, and the showerhead is rated as low flow.

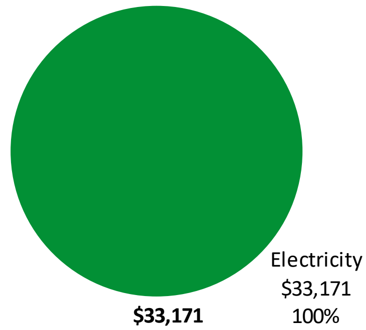

Restroom Sinks

Showerhead

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	208,800 kWh	$33,171
Total		$33,171



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.

An LGEA report was previously conducted for this site. A comparison table between the site energy usage from the 2010 legacy report and the current energy usage is provided below.

Years	Elec Usage (kWh/yr)	Average Demand (kW)	Elec Costs ($)	Average Rate ($/kWh
2010	228,640	28.9	36,540	0.160
2020	205,800	28	33,171	0.159
Percentage	**-10%**	**-3%**	**-9%**	**-1%**

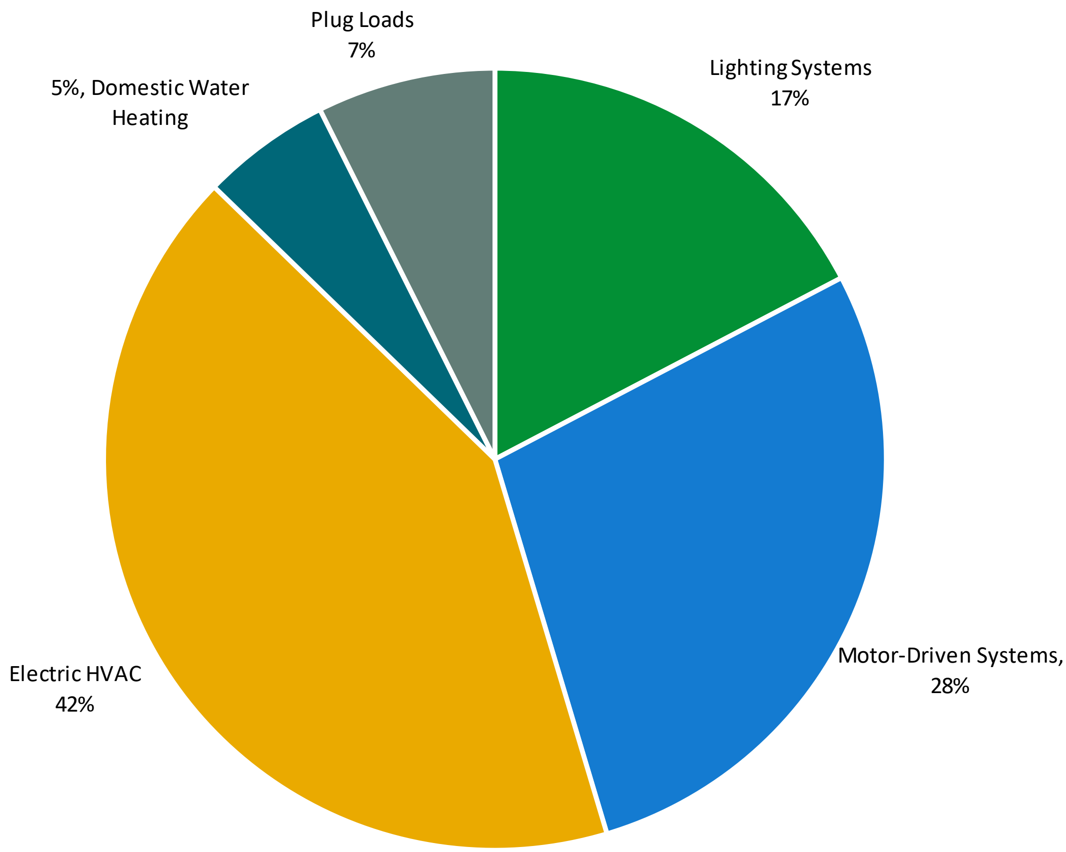
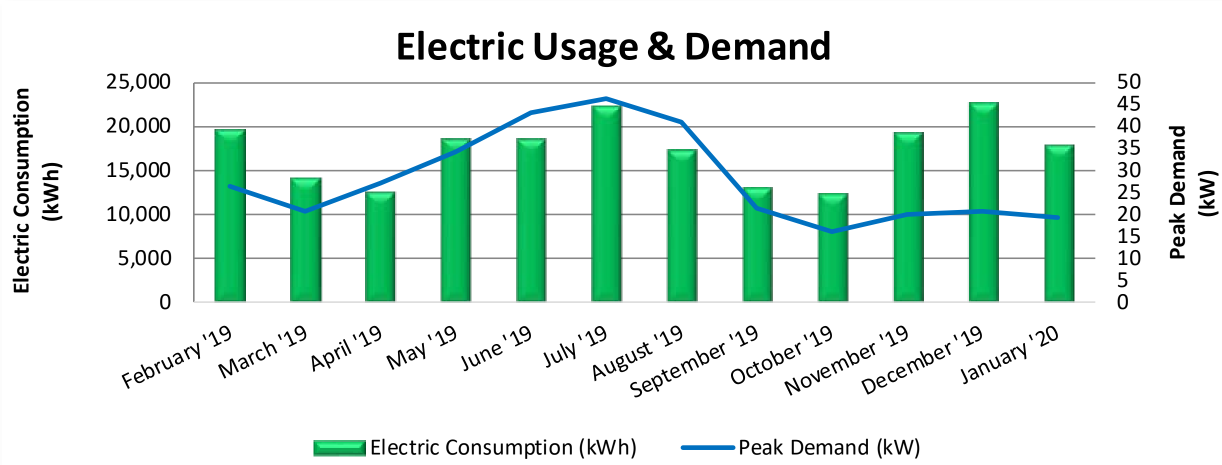


Figure 5 - Energy Balance

3.1 Electricity

Atlantic City Electric delivers electricity under rate class Monthly General Service Secondary.



Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
3/11/19	31	19,680	26	$109	$2,850
4/9/19	29	14,160	21	$90	$2,096
5/9/19	30	12,560	27	$134	$2,016
6/12/19	34	18,640	34	$206	$3,046
7/11/19	29	18,640	43	$246	$3,142
8/12/19	32	22,400	46	$292	$3,781
9/12/19	31	17,440	41	$255	$2,948
10/9/19	27	13,040	22	$113	$2,087
11/8/19	30	12,480	16	$81	$1,951
12/9/19	31	19,280	20	$108	$2,990
1/13/20	35	22,640	21	$127	$3,511
2/8/20	26	17,840	19	$86	$2,752
Totals	**365**	**208,800**	**46**	**$1,848**	**$33,171**
Annual	**365**	**208,800**	**46**	**$1,848**	**$33,171**

Notes:

- Peak demand of 46 kW occurred in August '19.
- Average demand over the past 12 months was 28 kW.
- The average electric cost over the past 12 months was $0.159/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 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.

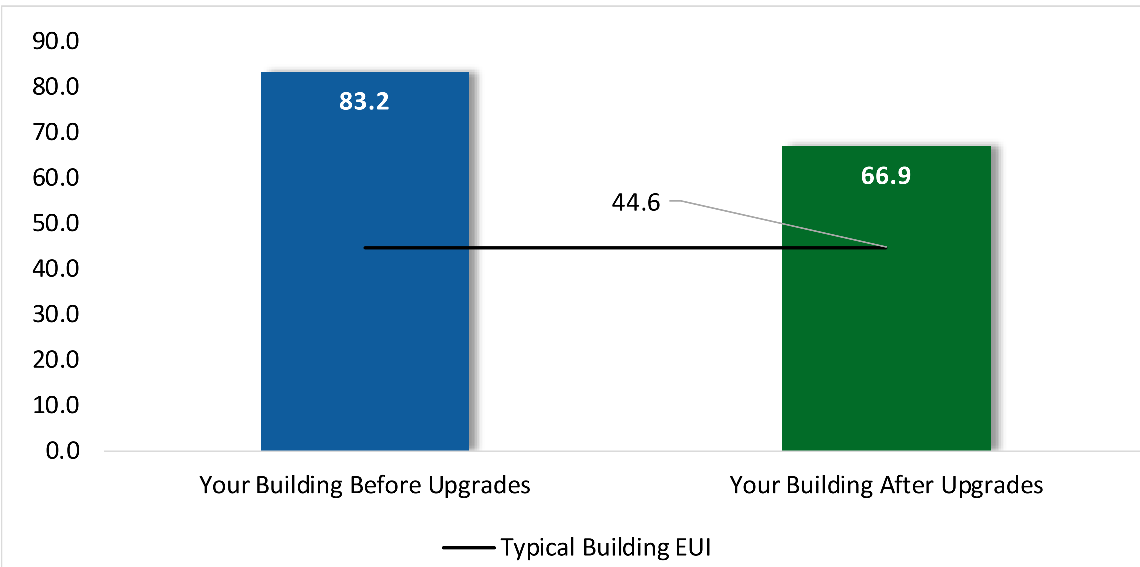


Figure 6 - Energy Use Intensity Comparison[3]

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			**567**	**0.1**	**0**	**$90**	**$252**	**$40**	**$212**	**2.4**	**571**
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ECM 2	Install Occupancy Sensor Lighting Controls	Yes	4,013	0.6	0	$638	$2,160	$560	$1,600	2.5	4,041
ECM 3	Install High/Low Lighting Controls	Yes	1,904	0.2	0	$302	$675	$660	$15	0.0	1,917
Variable Frequency Drive (VFD) Measures			**26,642**	**3.8**	**0**	**$4,232**	**$50,471**	**$2,050**	**$48,421**	**11.4**	**26,828**
ECM 4	Install VFDs on Constant Volume (CV) Fans	No	21,674	2.9	0	$3,443	$40,559	$1,500	$39,059	11.3	21,825
ECM 5	Install VFDs on Heating Water Pumps	No	4,533	0.9	0	$720	$6,522	$400	$6,122	8.5	4,565
ECM 6	Install VFDs on Cooling Tower Fans	No	435	0.0	0	$69	$3,391	$150	$3,241	46.9	438
Electric Unitary HVAC Measures			**3,844**	**1.3**	**0**	**$611**	**$100,506**	**$5,858**	**$94,649**	**155.0**	**3,871**
ECM 7	Install High Efficiency Heat Pumps	No	3,844	1.3	0	$611	$100,506	$5,858	$94,649	155.0	3,871
Domestic Water Heating Upgrade			**834**	**0.0**	**0**	**$133**	**$22**	**$22**	**$0**	**0.0**	**840**
ECM 8	Install Low-Flow DHW Devices	Yes	834	0.0	0	$133	$22	$22	$0	0.0	840
Food Service & Refrigeration Measures			**3,224**	**0.4**	**0**	**$512**	**$460**	**$200**	**$260**	**0.5**	**3,246**
ECM 9	Vending Machine Control	Yes	3,224	0.4	0	$512	$460	$200	$260	0.5	3,246
TOTALS			**41,027**	**6.3**	**0**	**$6,518**	**$154,547**	**$9,389**	**$145,157**	**22.3**	**41,313**

* - 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		**567**	**0.1**	**0**	**$90**	**$252**	**$40**	**$212**	**2.4**	**571**
ECM 1	Retrofit Fixtures with LED Lamps	567	0.1	0	$90	$252	$40	$212	2.4	571
Lighting Control Measures		**5,917**	**0.8**	**0**	**$940**	**$2,835**	**$1,220**	**$1,615**	**1.7**	**5,958**
ECM 2	Install Occupancy Sensor Lighting Controls	4,013	0.6	0	$638	$2,160	$560	$1,600	2.5	4,041
ECM 3	Install High/Low Lighting Controls	1,904	0.2	0	$302	$675	$660	$15	0.0	1,917
Domestic Water Heating Upgrade		**834**	**0.0**	**0**	**$133**	**$22**	**$22**	**$0**	**0.0**	**840**
ECM 8	Install Low-Flow DHW Devices	834	0.0	0	$133	$22	$22	$0	0.0	840
Food Service & Refrigeration Measures		**3,224**	**0.4**	**0**	**$512**	**$460**	**$200**	**$260**	**0.5**	**3,246**
ECM 9	Vending Machine Control	3,224	0.4	0	$512	$460	$200	$260	0.5	3,246
TOTALS		**10,541**	**1.3**	**0**	**$1,675**	**$3,569**	**$1,482**	**$2,087**	**1.2**	**10,615**

* - 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		**567**	**0.1**	**0**	**$90**	**$252**	**$40**	**$212**	**2.4**	**571**
ECM 1	Retrofit Fixtures with LED Lamps	567	0.1	0	$90	$252	$40	$212	2.4	571

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: Retrofit Fixtures with LED Lamps

Replace compact fluorescent 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: foyer, main entrance, and women's locker room.

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		**5,917**	**0.8**	**0**	**$940**	**$2,835**	**$1,220**	**$1,615**	**1.7**	**5,958**
ECM 2	Install Occupancy Sensor Lighting Controls	4,013	0.6	0	$638	$2,160	$560	$1,600	2.5	4,041
ECM 3	Install High/Low Lighting Controls	1,904	0.2	0	$302	$675	$660	$15	0.0	1,917

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 2: 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: squad room, sergeant desk, records room, fingerprinting room, workout room, community policing room, and detective office.

ECM 3: Install High/Low Lighting Controls

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

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

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

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

Affected building areas: hallways and foyer.

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		**26,642**	**3.8**	**0**	**$4,232**	**$50,471**	**$2,050**	**$48,421**	**11.4**	**26,828**
ECM 4	Install VFDs on Constant Volume (CV) Fans	21,674	2.9	0	$3,443	$40,559	$1,500	$39,059	11.3	21,825
ECM 5	Install VFDs on Heating Water Pumps	4,533	0.9	0	$720	$6,522	$400	$6,122	8.5	4,565
ECM 6	Install VFDs on Cooling Tower Fans	435	0.0	0	$69	$3,391	$150	$3,241	46.9	438

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 4: Install VFDs on Constant Volume (CV) Fans

We have evaluated installing VFDs to control constant volume fan motor speeds. This converts a constant-volume, single-zone air handling system into a variable-air-volume (VAV) system. A separate VFD is usually required to control the return fan motor or dedicated exhaust fan motor, if the air handler has one.

Zone thermostats signal the VFD to adjust fan speed to maintain the appropriate temperature in the zone, while maintaining a constant supply air temperature.

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

Affected Units: water source heat pumps supply fan motors.

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: 2 hp recirculation pumps.

ECM 6: Install VFDs on Cooling Tower Fans

We have evaluated installing a VFD to control the cooling tower fan motor. The VFD will allow the cooling tower fan to operate at the minimum speed necessary to maintain the temperature of the condenser water returning to the chiller.

Energy savings result from reducing fan speed (and power) when there is a reduced load on the chiller and outside air wet bulb temperatures are depressed. The magnitude of energy savings is based on the estimated amount of time that the system will operate at reduced load.

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		**3,844**	**1.3**	**0**	**$611**	**$100,506**	**$5,858**	**$94,649**	**155.0**	**3,871**
ECM 7	Install High Efficiency Heat Pumps	3,844	1.3	0	$611	$100,506	$5,858	$94,649	155.0	3,871

Replacing the WSHP has a long payback period and may not be justifiable based simply on energy considerations. However, most of the units 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 WSHP are eventually replaced, consider purchasing equipment that exceeds the minimum efficiency required by building codes.

ECM 7: Install High Efficiency Heat Pumps

We have evaluated replacing standard efficiency water source heat pumps that are nearing their useful life service with high efficiency water source heat pumps. A higher EER or SEER rating indicates a more efficient cooling system and a higher HSPF rating indicates more efficient heating mode. 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 heating and cooling loads, and the estimated annual operating hours.

Affected units: all 14 ClimateMaster WSHP.

4.5 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**834**	**0.0**	**0**	**$133**	**$22**	**$22**	**$0**	**0.0**	**840**
ECM 8	Install Low-Flow DHW Devices	834	0.0	0	$133	$22	$22	$0	0.0	840

ECM 8: Install Low-Flow DHW Devices

Install low-flow devices to reduce overall hot water demand. The following low flow devices are recommended to reduce hot water usage:

Device	Flow Rate
Faucet aerators (lavatory)	0.5 gpm

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

4.6 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		**3,224**	**0.4**	**0**	**$512**	**$460**	**$200**	**$260**	**0.5**	**3,246**
ECM 9	Vending Machine Control	3,224	0.4	0	$512	$460	$200	$260	0.5	3,246

ECM 9: 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.

4.7 Measures for Future Consideration

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

Borough of Woodbine may wish to consider implementing comprehensive, largescale and/or complex system wide projects, these measures may be pursued during development of a future energy savings plan. We recommend that you work with your energy service company (ESCO) and/or design team to:

- evaluate these measures further
- develop firm costs
- determine measure savings
- prepare detailed implementation plans.

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

Installation of an Energy Management System

Most larger facilities have some type of energy management system (EMS) which provides for centralized, remote control and monitoring of HVAC equipment and sometimes lighting or other building systems. An EMS utilizes a system of temperature and pressure sensors that obtain feedback about field conditions and provide signals to control systems that adjust HVAC system operation for optimal functioning. Thirty years ago, most control systems were pneumatic systems driven by compressed air, with pneumatic thermostats and air driven actuators for valves and dampers. Pneumatics controls have largely been replaced by direct digital control (DDC) systems, but many pneumatic systems remain. Contemporary DDC systems afford tighter controls and enhanced monitoring and trending capabilities as compared to the older systems.

Often smaller facilities are not equipped with central controls. For many small sites, it has been less costly to install distributed local controls, such as programmable thermostats and timeclocks, rather than centralized DDC. Local controls do a reasonably good job of scheduling equipment and maintaining operating conditions by relying on controls integral to HVAC units, such as logic for compressor staging, to manage the equipment operating algorithms.

Even for smaller sites, inefficiencies arise when temperature sensors and thermostat schedules are not maintained, when there are separate systems for heating and cooling, and especially when equipment is added, or the facility is reconfigured or repurposed.

Based on our survey, it appears that the installation of an EMS at your site could increase the efficiency of your building HVAC system operation.

A controls upgrade would enable automated equipment “start” and “stop” times, temperature setpoints, lockouts and deadbands to be programmed remotely using a graphic interface. Controls can be configured to optimize ventilation and outside air intake by adjusting economizer position, damper function and fan speed. Existing chilled and hot water distribution system controls are typically “tied in”, including associated pumps and valves. Coordinated control of HVAC systems is dependent on a network of sensors and status points. A comprehensive building control system provides monitoring and control for all HVAC systems so operators can adjust system programming for optimal comfort and energy savings.

It is recommended that an HVAC engineer or contractor who specializes in energy management systems be contacted for a detailed evaluation and implementation costs. For the purposes of this report, the potential energy savings and measure costs were estimated based on industry standards and previous project experience. Further analysis should be conducted for the feasibility of this measure. This is not an investment grade analysis nor should be used as a basis for design and construction.

VRF Systems

Variable refrigerant flow (VRF) systems use direct expansion (DX) heat pumps to transport heat between an outdoor condensing unit and a network of indoor evaporators, located near or within the conditioned space, through refrigerant piping installed in the building. Attributes that distinguish VRF from other DX system types are:

- multiple indoor units connected to a common outdoor unit
- scalability
- variable capacity
- distributed control
- simultaneous heating and cooling capability.

VRF provides flexibility by allowing for many different indoor units (with different capacities and configurations), individual zone control, the unique ability to offer simultaneous heating and cooling in separate zones on a common refrigerant circuit, and heat recovery from one zone to another. VRF systems are equipped with at least one variable-speed and/or variable-capacity compressor.

To match the building's load profiles, energy is transferred from one indoor space to another through the refrigerant line, and only one energy source is necessary to provide both heating and cooling. VRF systems also operate efficiently at part load because of the compressor's variable capacity control. VRF systems are ideal for applications with varying loads or where zoning is required. Some other advantages of VRF systems include consistent comfort, quiet operation, energy efficiency, installation flexibility, zoned heating and cooling, state-of-the-art controls and reliability.

VRF systems are more expensive that conventional heat pump systems, however, the higher initial cost can be offset by improved cooling efficiency during part load operation; a SEER (cooling) rating of 18.0 is not uncommon for small packaged VRF-equipped heat pumps, significantly higher than required to receive a Tier 2 SmartStart Incentive.

When you are replacing packaged HVAC equipment, we recommend a comprehensive approach. Work with your contractor or design engineer to make sure your systems are sized and zoned according to current space configurations and occupancy. Select high efficiency equipment and controls that match your heating and cooling needs. Commission the system and controls to ensure proper operation, comfort, ventilation, and energy use.

Utilize the natural gas service in the building

The site has reported that the natural gas service is now available for the Police Barracks. The facility should explore other less costly ways of heating and cooling the building. For example, you can replace the 18 kW domestic hot water heater with a better, efficient gas-fired storage tank water heater.

5 ENERGY EFFICIENT BEST PRACTICES

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

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

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

Energy Tracking with ENERGY STAR® Portfolio Manager®

You've heard it before - you can't manage what you don't measure. ENERGY STAR® Portfolio Manager® is an online tool that you can use to measure and track energy and water consumption, as well as greenhouse gas emissions[5] . Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

Weatherization

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

Doors and Windows

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

Window Treatments/Coverings

Use high-reflectivity films or cover windows with shades or shutters to reduce solar heat gain and reduce the load on cooling and heating systems. Older, single pane windows and east or west-facing windows are

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

especially prone to solar heat gain. In addition, use shades or shutters at night during cold weather to reduce heat loss.

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.

Fans to Reduce Cooling Load

Install ceiling fans to supplement your cooling system. Thermostat settings can typically be increased by 4°F with no change in overall occupant comfort due to the wind chill effect of moving air.

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.

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.

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.

Optimize HVAC Equipment Schedules

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

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

Water Heater Maintenance

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

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

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

Water Conservation

Installing dual flush or low-flow toilets and low-flow/waterless urinals are ways to reduce water use. The EPA WaterSense® ratings for urinals is 0.5 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.

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

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

6 On-site Generation

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

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

6.1 Solar Photovoltaic

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

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

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

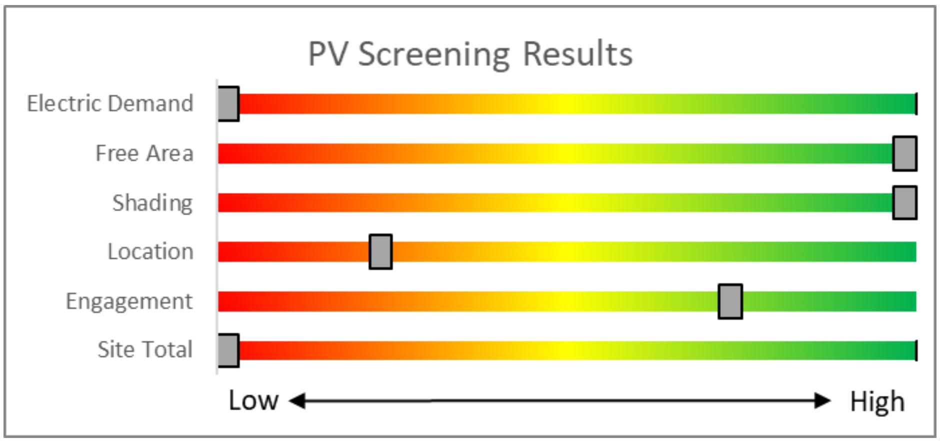

Figure 9 - Photovoltaic Screening

Transition Incentive (TI) Program

The TI program is a bridge between the Legacy SREC Program and a to-be determined Successor Incentive Program. The program 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 TRECs (Transition Incentive Renewable Energy Certificates). The Transition Incentive is structured as a factorized renewable energy certificate. The factors allow the TI Program to provide differentiated financial incentives for different types of solar installation.

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:

Transition Incentive (TI) Program: https://www.njcleanenergy.com/renewable-energy/programs/transition-incentive-program

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

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.

<u>Equipment with Prescriptive Incentives Currently Available</u>:

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

Incentives

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

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

How to Participate

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

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

7.2 Direct Install

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

Incentives

The program pays up to 70% of the total installed cost of eligible measures, up to $125,000 per project. Each entity is limited to incentives up to $250,000 per fiscal year.

How to Participate

To participate in Direct Install, you will need to contact the participating contractor assigned to the region of the state where your facility is located. A complete list of Direct Install program partners is provided on the Direct Install website linked below. The contractor will be paid the measure incentives directly by the program, which will pass on to you in the form of reduced material and implementation costs. This means up to 70% of eligible costs are covered by the program, subject to program caps and eligibility, while the remaining 30% of the cost is paid to the contractor by the customer.

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

7.3 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 Transition Incentive (TI) Program

The TI program is a bridge between the Legacy SREC Program and a to-be determined Successor Incentive Program. The program 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 TRECs (Transition Incentive Renewable Energy Certificates). The Transition Incentive is structured as a factorized renewable energy certificate. The factors allow the TI Program to provide differentiated financial incentives for different types of solar installations. NJBPU calculates the value of a Transition Renewable Energy Certificate (TREC) by multiplying the base compensation rate ($152/MWh) by the project's assigned factor (i.e. $152 x 0.85 = $129.20/MWh). The TREC factors are defined based on the chart below:

Project Type	Factor
Subsection (t): landfill, brownfield, areas of historic fill	1.00
Grid supply (Subsection (r)) rooftop	1.00
Net metered non-residential rooftop and carport	1.00
Community solar	0.85
Grid supply (Subsection (r)) ground mount	0.60
Net metered residential ground mount	0.60
Net metered residential rooftop and carport	0.60
Net metered non-residential ground mount	0.60

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 TRECs.

Eligible projects may generate TRECs for 15 years following the commencement of commercial operations (also referred to as the "Transition Incentive Qualification Life"). After 15 years, projects may be eligible for a New Jersey Class I REC.

TRECs will be used by the identified compliance entities to satisfy a compliance obligation tied to a new Transition Incentive Renewable Portfolio Standard ("Tl-RPS"), which will exist in parallel with, and completely separate from, the existing Solar RPS for Legacy SRECs. The Tl-RPS is a carve-out of the current Class I RPS requirement. The creation of TRECs is based upon metered generation supplied to PJM-EIS General Attribute Tracking System ("GATS") by the owners of eligible facilities or their agents. GATS would create one TREC for each MWh of energy produced from a qualified facility.

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

Solar projects help the State of New Jersey reach renewable energy goals outlined in the state's Energy Master Plan. The Transition Incentive Program online portal is now open to new applications effective May 1, 2020. There are instructions on "How and When to Transfer my SRP Registration to the Transition Incentive Program". If you are considering installing solar photovoltaics on your building, visit the following link for more information:

https://www.njcleanenergy.com/renewable-energy/programs/transition-incentive-program

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
Basement Mechanical 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
Basement Mechanical Room	4	LED - Fixtures: (2) 4-Foot LED Strip	Wall Switch	S	42	5,678		None	No	4	LED - Fixtures: (2) 4-Foot LED Strip	Wall Switch	42	5,678	0.0	0	0	$0	$0	$0	0.0
Basement Workout Room	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
Basement Workout Room	15	LED - Fixtures: 2x4 LED Recessed Fixture	Wall Switch	S	43	5,242	2	None	Yes	15	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	43	3,617	0.2	975	0	$155	$270	$70	1.3
Community Policing Room	4	LED - Fixtures: 2x4 LED Recessed Fixture	Wall Switch	S	43	3,931	2	None	Yes	4	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	43	2,713	0.0	195	0	$31	$270	$70	6.5
Detective Office	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Detective Office	9	LED - Fixtures: 2x4 LED Recessed Fixture	Wall Switch	S	43	6,552	2	None	Yes	9	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	43	4,521	0.1	731	0	$116	$270	$70	1.7
Elevator Flag Light	1	LED - Fixtures: 85W High Bay LED Fixture	Timeclock		85	4,380		None	No	1	LED - Fixtures: 85W High Bay LED Fixture	Timeclock	85	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior Main Entrance	4	LED - Linear Tubes: (2) 4' Lamps	Timeclock		29	4,380		None	No	4	LED - Linear Tubes: (2) 4' Lamps	Timeclock	29	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior Pole Light	6	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Timeclock		135	4,380		None	No	6	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Timeclock	135	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior Wall Pack	6	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock		45	4,380		None	No	6	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	45	4,380	0.0	0	0	$0	$0	$0	0.0
Fingerprint Room	4	LED - Fixtures: 2x4 LED Recessed Fixture	Wall Switch	S	43	3,931	2	None	Yes	4	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	43	2,713	0.0	195	0	$31	$270	$70	6.5
Foyer	3	Compact Fluorescent: (2) 26W 4-pin Lamps	Wall Switch	S	52	8,736	1, 3	Relamp	Yes	3	LED Lamps: 4-pin LED Lamps	High/Low Control	37	6,028	0.1	645	0	$102	$376	$234	1.4
Hallway East	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
Hallway East	9	LED - Fixtures: 2x4 LED Recessed Fixture	Wall Switch	S	43	8,736	3	None	Yes	9	LED - Fixtures: 2x4 LED Recessed Fixture	High/Low Control	43	6,028	0.1	975	0	$155	$225	$225	0.0
Hallway West	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
Hallway West	6	LED - Fixtures: 2x4 LED Recessed Fixture	Wall Switch	S	43	8,736	3	None	Yes	6	LED - Fixtures: 2x4 LED Recessed Fixture	High/Low Control	43	6,028	0.1	650	0	$103	$225	$225	0.0
Holding Cell	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	7,426		None	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	7,426	0.0	0	0	$0	$0	$0	0.0
Holding Cell 2	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	7,426		None	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	7,426	0.0	0	0	$0	$0	$0	0.0
Inter Interview Room	2	LED - Fixtures: 2x4 LED Recessed Fixture	Wall Switch	S	43	3,931		None	No	2	LED - Fixtures: 2x4 LED Recessed Fixture	Wall Switch	43	3,931	0.0	0	0	$0	$0	$0	0.0
Inter Room	4	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	S	43	6,028		None	No	4	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	43	6,028	0.0	0	0	$0	$0	$0	0.0
Kitchen	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
Kitchen	2	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	S	43	3,918		None	No	2	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	43	3,918	0.0	0	0	$0	$0	$0	0.0
Main Entrance	1	Compact Fluorescent: (2) 26W 4-pin Lamps	None		52	8,736	1	Relamp	No	1	LED Lamps: 4-pin LED Lamps	None	37	8,736	0.0	122	0	$19	$50	$8	2.2
Main Entrance	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Mens Locker Room	8	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	S	43	3,918		None	No	8	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	43	3,918	0.0	0	0	$0	$0	$0	0.0
Mens Locker Room - Restroom	2	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	S	43	3,918		None	No	2	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	43	3,918	0.0	0	0	$0	$0	$0	0.0
Mens Locker Room - Shower Room	2	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	S	43	3,918		None	No	2	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	43	3,918	0.0	0	0	$0	$0	$0	0.0
Office - Assistant Commender	4	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	S	43	3,918		None	No	4	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	43	3,918	0.0	0	0	$0	$0	$0	0.0
Office - Commender	4	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	S	43	3,918		None	No	4	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	43	3,918	0.0	0	0	$0	$0	$0	0.0
Record Room	3	LED - Fixtures: 2x4 LED Recessed Fixture	Wall Switch	S	43	4,805	2	None	Yes	3	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	43	3,315	0.0	179	0	$28	$270	$70	7.0
Restroom	1	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	S	43	3,918		None	No	1	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	43	3,918	0.0	0	0	$0	$0	$0	0.0
Restroom	1	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	S	43	3,918		None	No	1	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	43	3,918	0.0	0	0	$0	$0	$0	0.0
Restroom - Unisex	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	S	44	3,931		None	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	3,931	0.0	0	0	$0	$0	$0	0.0
Sergeant Desk	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
Sergeant Desk	6	LED - Fixtures: 2x4 LED Recessed Fixture	Wall Switch	S	43	6,552	2	None	Yes	6	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	43	4,521	0.1	487	0	$77	$270	$70	2.6
Squad Room	24	LED - Fixtures: 23W Canopy LED Fixtures	Wall Switch	S	23	7,862	2	None	Yes	24	LED - Fixtures: 23W Canopy LED Fixtures	Occupancy Sensor	23	5,425	0.2	1,251	0	$199	$540	$140	2.0
Stairs 1	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Stairs	1	LED - Fixtures: 15W Canopy LED Fixture	Wall Switch	S	30	8,736		None	No	1	LED - Fixtures: 15W Canopy LED Fixture	Wall Switch	30	8,736	0.0	0	0	$0	$0	$0	0.0
Stairs	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	8,736		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,736	0.0	0	0	$0	$0	$0	0.0
Women's Locker Room	1	Compact Fluorescent: (2) 26W 4-pin Lamps	Wall Switch	S	52	5,678	1	Relamp	No	1	LED Lamps: 4-pin LED Lamps	Wall Switch	37	5,678	0.0	79	0	$13	$50	$8	3.4
Women's Locker Room	4	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	S	43	3,918		None	No	4	LED - Fixtures: 2x4 LED Recessed Fixture	Occupancy Sensor	43	3,918	0.0	0	0	$0	$0	$0	0.0

Motor Inventory & Recommendations

		Existing Conditions							Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Basement Mechanical Room	Cooling Tower	1	Cooling Tower Fan	1.5	86.5%	No	W	2,745	6	No	86.5%	Yes	1	0.0	435	0	$69	$3,391	$150	46.9
Basement Mechanical Room	Heating System	1	Heating Hot Water Pump	0.3	60.0%	No	W	3,504		No	60.0%	No		0.0	0	0	$0	$0	$0	0.0
Basement Mechanical Room	Sump Pump	2	Other	0.5	70.0%	No	W	915		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Basement Mechanical Room	Cooling System	2	Water-Source Heat Pump Circulation Pump	2.0	86.5%	No	W	3,504	5	No	86.5%	Yes	2	0.9	4,533	0	$720	$6,522	$400	8.5
Plenum	WSHP Supply Motor	5	Supply Fan	0.8	70.0%	No	W	7,008	4	No	81.1%	Yes	5	1.3	10,211	0	$1,622	$14,399	$500	8.6
Plenum	WSHP Supply Motor	2	Supply Fan	1.0	84.0%	No	W	7,008	4	No	85.5%	Yes	2	0.6	4,213	0	$669	$6,566	$300	9.4
Plenum	WSHP Supply Motor	7	Supply Fan	0.3	60.0%	No	W	7,008	4	No	73.4%	Yes	7	0.9	7,249	0	$1,152	$19,595	$700	16.4

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
Mens Locker Room	Mens Locker Room	1	Electric Resistance Heat		6.82	W		No							0.0	0	0	$0	$0	$0	0.0
Mens Locker Room - Restroom	Mens Locker Room - Restroom	1	Electric Resistance Heat		6.82	W		No							0.0	0	0	$0	$0	$0	0.0
Mens Locker Room - Shower Room	Mens Locker Room - Shower Room	1	Electric Resistance Heat		6.82	W		No							0.0	0	0	$0	$0	$0	0.0
Women's Locker Room	Women's Locker Room	1	Electric Resistance Heat		6.82	W		No							0.0	0	0	$0	$0	$0	0.0
Basement Mechanical Room	Basement Mechanical Room	1	Electric Resistance Heat		17.06	W		No							0.0	0	0	$0	$0	$0	0.0
Detective Office	Detective Office	1	Window AC	0.83		W		No							0.0	0	0	$0	$0	$0	0.0
Plenum	Various Zones	5	Water Source HP	3.33	46.70	W	7	Yes	5	Water Source HP	3.33	46.70	14.00	4.80	0.5	1,683	0	$267	$46,327	$2,700	163.1
Plenum	Various Zones	1	Water Source HP	1.18	16.80	W	7	Yes	1	Water Source HP	1.18	16.80	14.00	4.80	0.0	65	0	$10	$3,266	$190	299.6
Plenum	Various Zones	1	Water Source HP	2.38	33.30	W	7	Yes	1	Water Source HP	2.38	33.30	14.00	4.80	0.1	188	0	$30	$6,602	$385	207.7
Plenum	Various Zones	1	Water Source HP	1.58	22.30	W	7	Yes	1	Water Source HP	1.58	22.30	14.00	4.80	0.1	225	0	$36	$4,378	$255	115.5
Plenum	Various Zones	1	Water Source HP	2.38	33.30	W	7	Yes	1	Water Source HP	2.38	33.30	14.00	4.80	0.1	188	0	$30	$6,602	$385	207.7
Plenum	Various Zones	1	Water Source HP	0.98	14.60	W	7	Yes	1	Water Source HP	0.98	14.60	14.00	4.80	0.0	131	0	$21	$2,733	$159	123.8
Plenum	Various Zones	1	Water Source HP	1.18	16.80	W	7	Yes	1	Water Source HP	1.18	16.80	14.00	4.80	0.0	65	0	$10	$3,266	$190	299.6
Plenum	Various Zones	1	Water Source HP	4.92	68.00	W	7	Yes	1	Water Source HP	4.92	68.00	14.00	4.80	0.2	604	0	$96	$13,666	$797	134.2
Plenum	Various Zones	1	Water Source HP	4.92	68.00	W	7	Yes	1	Water Source HP	4.92	68.00	14.00	4.80	0.3	695	0	$110	$13,666	$797	116.6
Basement Mechanical Room	Heating System	1	Electric Resistance Heat		272.96	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
Basement Mechanical Spsce	Domestic Hot Water	1	Storage Tank Water Heater (> 50 Gal)	W		No						0.0	0	0	$0	$0	$0	0.0

Low-Flow Device Recommendations

	Recommedation Inputs					Energy Impact & Financial Analysis						
Location	ECM #	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Restrooms	8	3	Faucet Aerator (Lavatory)	2.20	0.50	0.0	834	0	$133	$22	$22	0.0

Plug Load Inventory

	Existing Conditions			
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
State Police Barracks	5	Coffee Machine	400	
State Police Barracks	3	Dehumidifier	85	
State Police Barracks	18	Desktop	120	
State Police Barracks	2	Microwave	1,000	
State Police Barracks	9	Printer (Medium/Small)	112	
State Police Barracks	1	Refrigerator (Large)	224	
State Police Barracks	2	Scanner/Fax Machine	600	
State Police Barracks	2	Television	124	
State Police Barracks	1	Toaster	500	
State Police Barracks	5	Water Cooler	192	
State Police Barracks	1	Electric Oven	1,500	

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
Fingerprint Room	1	Refrigerated	9	Yes	0.2	1,612	0	$256	$230	$100	0.5
Hallway West	1	Refrigerated	9	Yes	0.2	1,612	0	$256	$230	$100	0.5

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]

Woodbine State Police Barracks

Primary Property Type: Police Station
Gross Floor Area (ft²): 8,558
Built: 1978

For Year Ending: January 31, 2020
Date Generated: July 02, 2020

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
Woodbine State Police Barracks 809 Franklin Street Woodbine, New Jersey 08270	Borough of Woodbine 501 Washington Avenue Woodbine, NJ 08270 (609) 861-2153	William Pikolycky 501 Washington Avenue Woodbine, NJ 08270 (609) 861-2153 mayor@boroughofwoodbine.net

Property ID: 11619606

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
84.6 kBtu/ft²

Annual Energy by Fuel

Electric - Grid (kBtu)	723,686 (100%)

Source EUI
236.8 kBtu/ft²

National Median Comparison

National Median Site EUI (kBtu/ft²)	44.6
National Median Source EUI (kBtu/ft²)	124.9
% Diff from National Median Source EUI	90%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	73

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.
TREC	*Transition Incentive Renewable Energy Certificate:* a factorized renewable energy certificate 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.