Local Government Energy Audit Report

Park Department Maintenance

November 17, 2021

Prepared for:

City of Trenton
Cadwalader Park
Trenton, NJ 08618

Prepared by:

TRC
900 Route 9 North
Woodbridge, NJ 07095

Disclaimer

The goal of this audit report is to identify potential energy efficiency opportunities and help prioritize specific measures for implementation. Most energy conservation measures have received preliminary analysis of feasibility that identifies expected ranges of savings and costs. This level of analysis is usually considered sufficient to establish a basis for further discussion and to help prioritize energy measures.

TRC reviewed the energy conservation measures and estimates of energy savings for technical accuracy. Actual, achieved energy savings depend on behavioral factors and other uncontrollable variables and, therefore, estimates of final energy savings are not guaranteed. TRC and the New Jersey Board of Public Utilities (NJBPU) shall in no event be liable should the actual energy savings vary.

TRC bases estimated material and labor costs primarily on RS Means cost manuals as well as on our experience at similar facilities. This approach is based on standard cost estimating manuals and is vendor neutral. Cost estimates include material and labor pricing associated with one for one equipment replacements. Cost estimates do not include demolition or removal of hazardous waste. The actual implementation costs for energy savings projects are anticipated to be significantly higher based on the specific conditions at your site(s). We strongly recommend that you work with your design engineer or contractor to develop actual project costs for your specific scope of work for the installation of high efficiency equipment. We encourage you to obtain multiple estimates when considering measure installations. Actual installation costs can vary widely based on selected products and installers. TRC and NJBPU do not guarantee cost estimates and shall in no event be held liable should actual installed costs vary from these material and labor estimates.

Incentive values provided in this report are estimated based of previously run state efficiency programs. Incentive levels are not guaranteed. The NJBPU reserves the right to extend, modify, or terminate programs without prior notice. Please review all available utility program incentives and eligibility requirements prior to selecting and installing any energy conservation measures.

The customer and their respective contractor(s) are responsible to implement energy conservation measures in complete conformance with all applicable local, state, and federal requirements.

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Energy Efficiency Incentive & Rebate Transition

For the purposes of your LGEA, estimated incentives and rebates are included as placeholders for planning purposes. New Jersey utilities are rolling out their own energy efficiency programs, which your project may be eligible for depending on individual measures, quantities, and size of the building.

In 2018, Governor Murphy signed into law the landmark legislation known as the Clean Energy Act. The law called for a significant overhaul of New Jersey's clean energy systems by building sustainable infrastructure in order to fight climate change and reduce carbon emissions, which will in turn create well-paying local jobs, grow the state's economy, and improve public health while ensuring a cleaner environment for current and future residents.

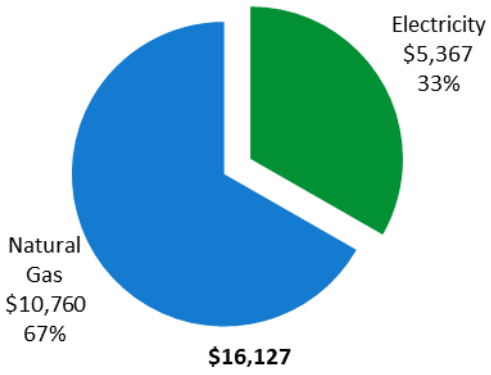
These "next generation" energy efficiency programs feature new ways of managing and delivering programs historically administered by New Jersey's Clean Energy Program™ (NJCEP). All of the investor-owned gas and electric utility companies will now also offer complementary energy efficiency programs and incentives directly to customers like you. NJCEP will still offer programs for new construction, renewable energy, the Energy Savings Improvement Program (ESIP), and large energy users.

New utility programs are expected to start rolling out in the spring and summer of 2021. Keep up to date with developments by visiting the NJCEP website.

1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Park Department Maintenance. 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: $16,127 Electricity: 39,842 kWh Natural Gas: 15,312 Therms	
ENERGY STAR® Benchmarking Score	N/A *(1-100 scale)*	A standard energy use benchmark is not available for this facility type. This report contains suggestions about how to improve building performance and reduce energy costs.

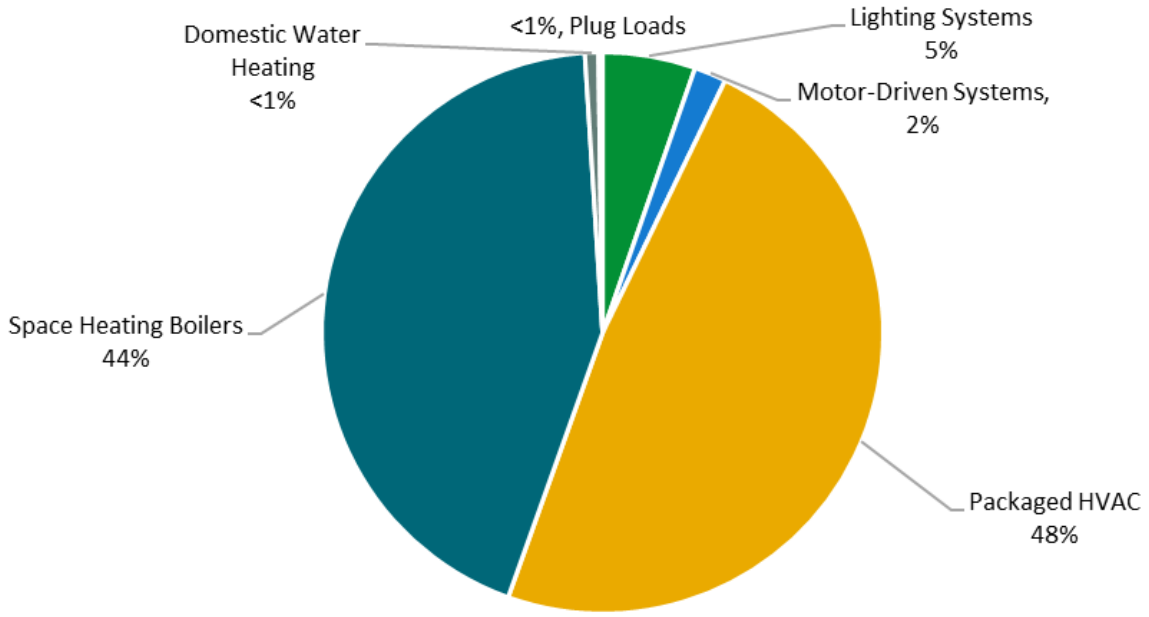


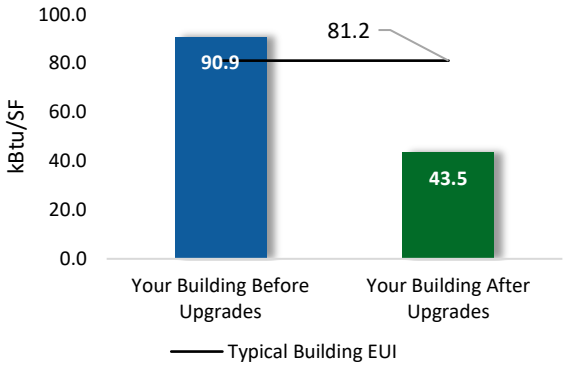
Figure 1 - Energy Use by System

POTENTIAL IMPROVEMENTS

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

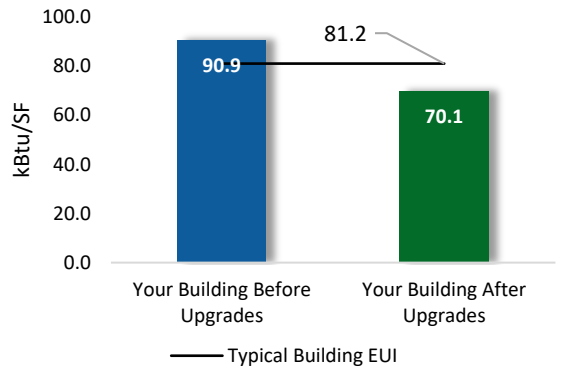
Scenario 1: Full Package (all evaluated measures)

Installation Cost	$91,424
Potential Rebates & Incentives[1]	$4,903
Annual Cost Savings	$8,175
Annual Energy Savings	Electricity: 18,725 kWh Natural Gas: 8,045 Therms
Greenhouse Gas Emission Savings	57 Tons
Simple Payback	10.6 Years
Site Energy Savings (all utilities)	52%



Scenario 2: Cost Effective Package[2]

Installation Cost	$31,612
Potential Rebates & Incentives	$4,903
Annual Cost Savings	$4,746
Annual Energy Savings	Electricity: 18,725 kWh Natural Gas: 3,165 Therms
Greenhouse Gas Emission Savings	28 Tons
Simple Payback	5.6 Years
Site Energy Savings (all utilities)	23%



On-site Generation Potential

Photovoltaic	None
Combined Heat and Power	None

[1] Incentives are based on previously run state rebate programs. Contact your utility provider for current program incentives that may apply.

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

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**13,355**	**2.7**	**-3**	**$1,778**	**$5,709**	**$1,043**	**$4,666**	**2.6**	**13,092**
ECM 1	Install LED Fixtures	Yes	7,087	1.3	-2	$943	$2,955	$300	$2,655	2.8	6,945
ECM 2	Retrofit Fixtures with LED Lamps	Yes	6,268	1.4	-1	$834	$2,754	$743	$2,011	2.4	6,147
Lighting Control Measures			**2,754**	**0.6**	**-1**	**$367**	**$3,660**	**$820**	**$2,840**	**7.7**	**2,699**
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	2,126	0.5	0	$283	$3,210	$420	$2,790	9.9	2,084
ECM 4	Install High/Low Lighting Controls	Yes	628	0.1	0	$84	$450	$400	$50	0.6	616
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**173**	**$1,218**	**$18,060**	**$2,600**	**$15,460**	**12.7**	**20,300**
ECM 5	Install High Efficiency Furnaces	Yes	0	0.0	92	$645	$12,363	$2,000	$10,363	16.1	10,743
ECM 6	Install Infrared Heaters	Yes	0	0.0	82	$574	$5,696	$600	$5,096	8.9	9,557
HVAC System Improvements			**374**	**0.0**	**147**	**$1,082**	**$2,114**	**$440**	**$1,674**	**1.5**	**17,559**
ECM 7	Install Programmable Thermostats	Yes	0	0.0	53	$375	$990	$0	$990	2.6	6,252
ECM 8	Install Pipe Insulation	Yes	374	0.0	93	$706	$1,124	$440	$684	1.0	11,307
Custom Measures			**2,242**	**0.0**	**488**	**$3,731**	**$61,882**	**$0**	**$61,882**	**16.6**	**59,396**
ECM 9	Building Envelope Improvements	No	0	0.0	488	$3,429	$59,812	$0	$59,812	17.4	57,139
ECM 10	Install Heat Pump Water Heater	Yes	2,242	0.0	0	$302	$2,070	$0	$2,070	6.9	2,258
TOTALS (COST EFFECTIVE MEASURES)			**18,725**	**3.3**	**316**	**$4,746**	**$31,612**	**$4,903**	**$26,709**	**5.6**	**55,908**
TOTALS (ALL MEASURES)			**18,725**	**3.3**	**804**	**$8,175**	**$91,424**	**$4,903**	**$86,521**	**10.6**	**113,047**

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

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

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

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

For details on these programs please visit New Jersey's Clean Energy Program website or contact your utility provider.

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 Park Department Maintenance. This report provides information on how your facility uses energy, identifies energy conservation measures (ECMs) that can reduce your energy use, and provides information and assistance to help you implement the ECMs.

TRC conducted this study as part of a comprehensive effort to assist New Jersey educational and local government facilities in controlling energy costs and protecting our environment by offering a wide range of energy management options and advice.

2.1 Site Overview

On April 14, 2021, TRC performed an energy audit at Park Department Maintenance located in Trenton, New Jersey. TRC met with Phil Demola to review the facility operations and help focus our investigation on specific energy-using systems.

The Park Department Maintenance is a multi-story, 18,348 square foot building built in 1950. The buildings make up the facility. The main building with two smaller buildings currently being used as unconditioned storage. Spaces include mechanic garage, workshop, office, restroom, storage, and mechanical spaces.

2.2 Building Occupancy

The facility is used year-round. An unknown number of staff work out of this facility.

Building Name	Weekday/Weekend	Operating Schedule
Park Department Maintenance Building 1	Weekday	7:00 AM - 3:00 PM
	Weekend	7:00 AM - 3:00 PM
Park Department Maintenance Building 2	Weekday	7:00 AM - 3:00 PM
	Weekend	7:00 AM - 3:00 PM
Park Department Maintenance Building 3	Weekday	7:00 AM - 3:00 PM
	Weekend	7:00 AM - 3:00 PM

Figure 3 - Building Occupancy Schedule

2.3 Building Envelope

The exterior of the main building is brick and wood shingles. The interior structure of the building is comprised of block with wood columns and beams, with a wood truss system extending over the main exposed area. Other sections of the main building and the support buildings are made of brick or block with wood truss supported by steel beams. The interior of the building is exposed.

Exterior Façade

Exterior Façade

Interior Truss

Most of the windows are single glazed and have wood frames. The glass-to-frame seals are in poor condition. The operable window weather seals are in poor condition, showing evidence of excessive wear. Exterior doors have wood frames and are in poor condition with worn door seals. Degraded window and door seals increase drafts and outside air infiltration.

Garage Doors

Windows

Windows

2.4 Lighting Systems

The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. Additionally, there are some compact fluorescent lamps (CFL) and LED general purpose lamps. Typically, T8 fluorescent lamps use electronic ballasts. Fixture types include 2-lamp or 4-lamp, 4-foot-long surface mounted fixtures. A few fixtures have been retrofit to operate LED linear (tubular) LED "corn cob" (screw-based) lamps. All exit signs are LED. Exterior fixtures are controlled by timeclock.

Interior Fluorescent Surface Mount

Exterior Wall Pack Fixtures

Timeclock

2.5 Air Handling Systems

Unitary Electric HVAC Equipment

The office has a window air conditioning (AC) unit. It is rated to provide 0.5 ton of cooling and is ENERGY STAR® labeled.

Window AC Unit

Unitary Heating Equipment

The Shade Tree Division and mechanics garages are heated with a total of three suspended gas-fired furnaces. These each have an output capacity of 128 MBh. The units are in fair condition. Equipment is controlled by a manual dial thermostat.

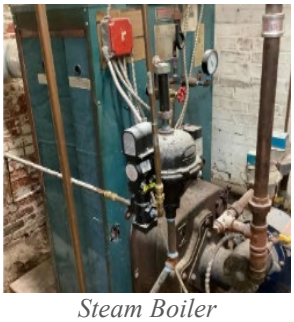
Suspended Gas fired Furnace

Suspended Gas fired Furnace

Thermostat

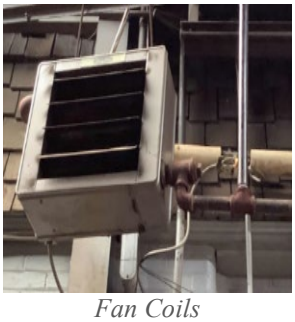
2.6 Heating Steam Systems

One Burham Commercial 347 MBh steam boiler serves part of the building's heating load. It is in fair condition. The boiler provides steam which is distributed by five fan coils in the main section of the building.



Steam Boiler

Steam Boiler



Fan Coils

2.7 Domestic Hot Water

Hot water is produced by a 40-gallon, 4.5 kW electric storage water heater. The domestic hot water pipes are not insulated.

Domestic Hot Water Storage Heater

Unit Label

2.8 Plug Load & Vending Machines

The location is doing a great job managing their electrical plug loads. This report makes additional suggestions for ECMs in this area as well as Energy Efficient Best Practices.

Plug loads throughout the building include microwaves, fans, printer, water cooler, lift, air compressor, tools for mechanics garage, and tools for the carpentry workshop.

Fan

Air Compressor

Lift

Printer

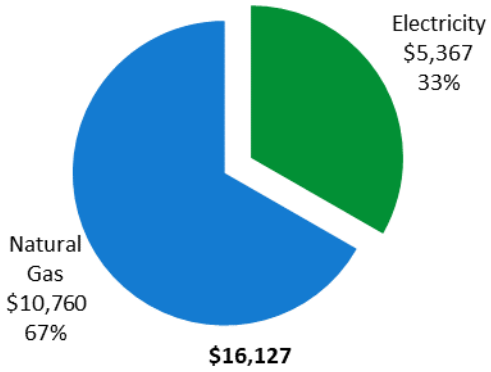
2.9 Water-Using Systems

There is one restroom with toilets, urinals, and sinks.

3 Energy Use and Costs

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

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	39,842 kWh	$5,367
Natural Gas	15,312 Therms	$10,760
Total		**$16,127**



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.

The facility has high gas consumption. In this report we have provided different options to reduce the demand. Options include changing gas furnaces to high efficient furnaces or replacing them with infrared heaters. Other options include insulating the roof and/or walls, and better controls for equipment. Recommendations should be evaluated with a design team to determine which option(s) are the most effective for this facility. Cost and savings will vary based on upgrades. The calculated gas savings for each of the measures do not account for interactive effects so if they implement more than one of the measures, the total savings will be less than the sum of savings shown in the summary.

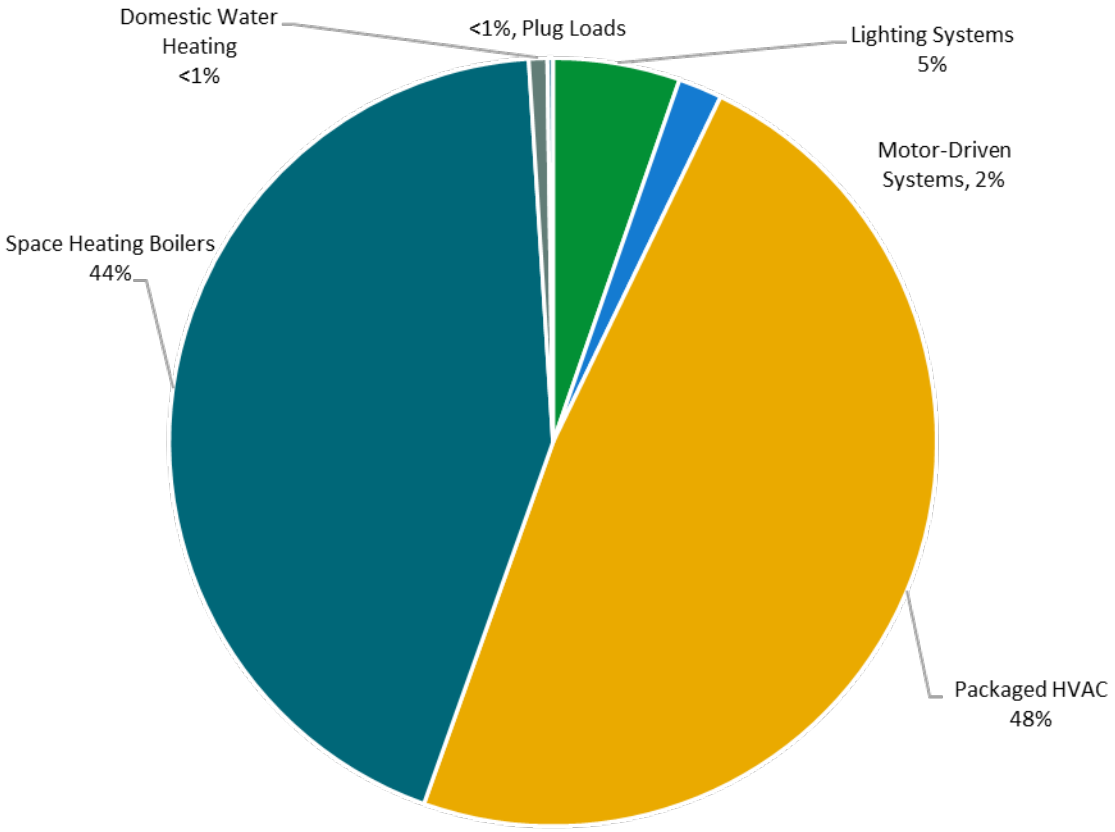
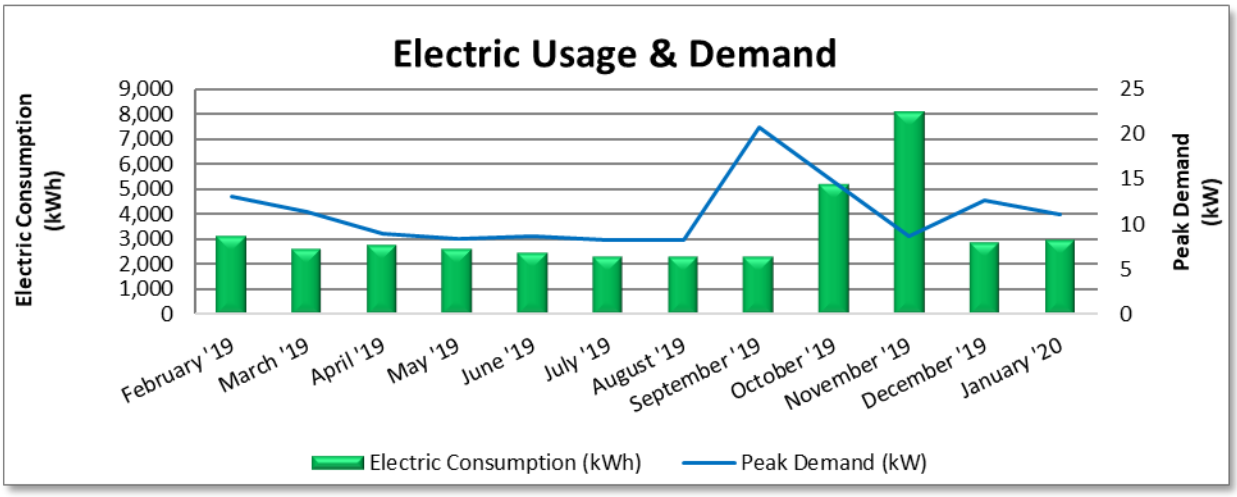


Figure 4 - Energy Balance

3.1 Electricity

PSE&G delivers electricity under rate class General Lighting & Power (GLP), with electric supply provided by Direct Energy Business, LLC., a third-party supplier.



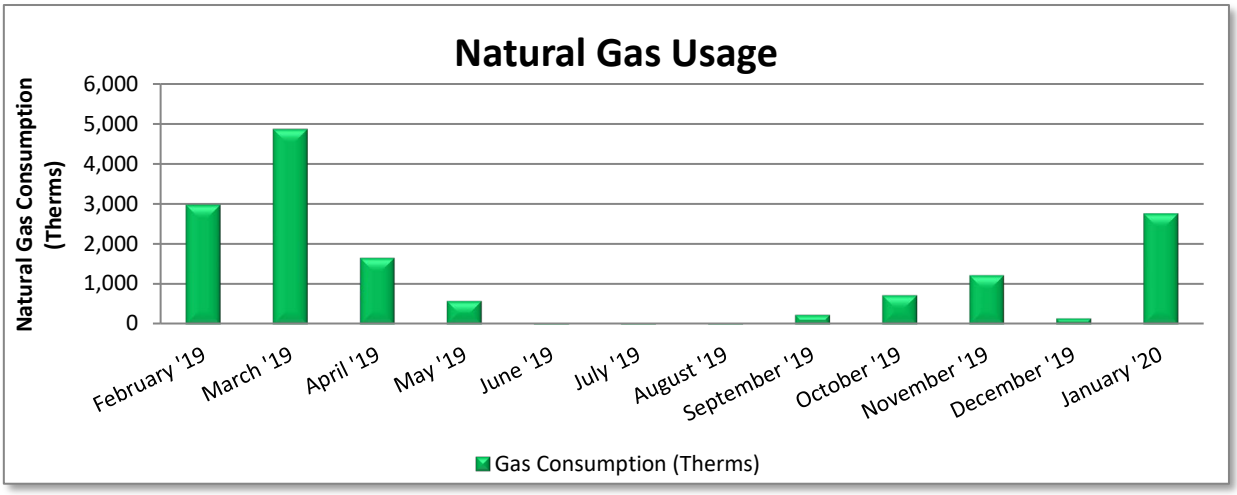
Electric Billing Data					
Period Ending	**Days in Period**	**Electric Usage (kWh)**	**Demand (kW)**	**Demand Cost**	**Total Electric Cost**
3/9/19	27	3,167	13	$52	$427
4/9/19	31	2,645	11	$45	$348
5/9/19	30	2,787	9	$35	$363
6/10/19	32	2,620	8	$116	$416
7/10/19	30	2,462	9	$118	$398
8/8/19	29	2,336	8	$113	$369
9/9/19	32	2,320	8	$113	$368
10/8/19	29	2,329	21	$41	$309
11/8/19	31	5,197	15	$37	$628
12/9/19	31	8,065	9	$34	$947
1/9/20	31	2,908	13	$50	$395
2/10/20	32	3,006	11	$44	$400
Totals	**365**	**39,842**	**21**	**$797**	**$5,367**
Annual	**365**	**39,842**	**21**	**$797**	**$5,367**

Notes:

- Peak demand of 21 kW occurred in September 2019.
- Average demand over the past 12 months was 11 kW.
- The average electric cost over the past 12 months was $0.135/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.

3.2 Natural Gas

PSE&G delivers natural gas under rate class Large Volume Gas (LVG).



Gas Billing Data			
Period Ending	**Days in Period**	**Natural Gas Usage (Therms)**	**Natural Gas Cost**
3/9/19	27	2,985	$1,900
4/9/19	31	4,864	$2,921
5/9/19	30	1,658	$1,084
6/10/19	32	587	$472
7/10/19	30	30	$155
8/8/19	29	29	$154
9/9/19	32	32	$156
10/8/19	29	243	$285
11/8/19	31	736	$614
12/9/19	31	1,228	$946
1/9/20	31	156	$231
2/10/20	32	2,764	$1,842
Totals	**365**	**15,312**	**$10,760**
Annual	**365**	**15,312**	**$10,760**

Notes:

- The average gas cost for the past 12 months is $0.703/therm, which is the blended rate used throughout the analysis.

3.3 Benchmarking

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

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

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.

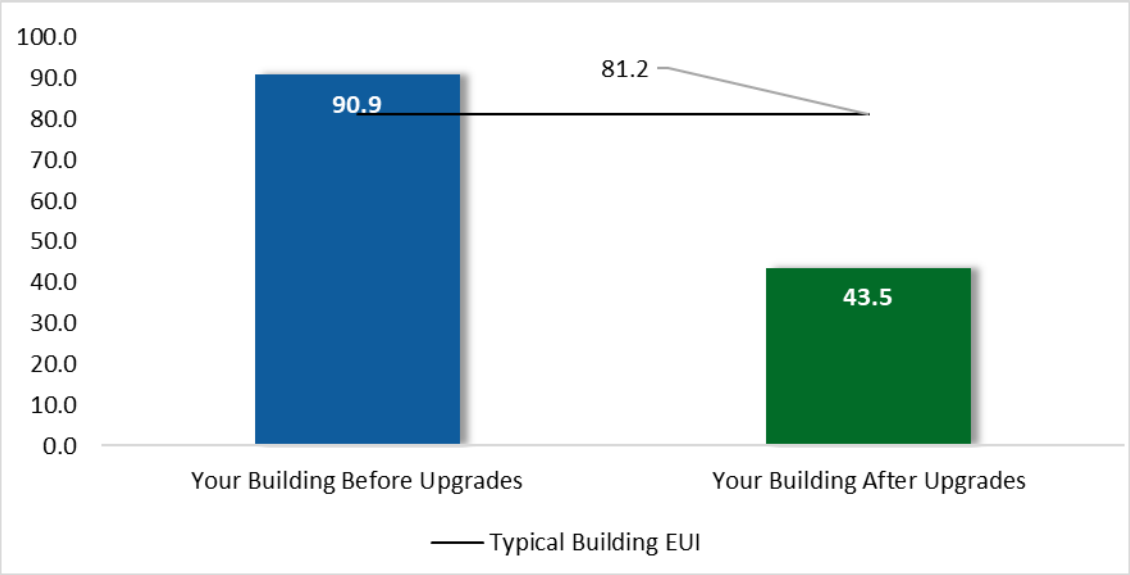


Figure 5 - Energy Use Intensity Comparison[3]

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

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

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

Financial incentives are based on previously run state rebate programs. New utility programs are expected to start rolling out in the spring and summer of 2021. Keep up to date with developments by visiting the NJCEP website. Some measures and proposed upgrades may be eligible for higher incentives than those shown below.

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

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**13,355**	**2.7**	**-3**	**$1,778**	**$5,709**	**$1,043**	**$4,666**	**2.6**	**13,092**
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ECM 5	Install High Efficiency Furnaces	Yes	0	0.0	92	$645	$12,363	$2,000	$10,363	16.1	10,743
ECM 6	Install Infrared Heaters	Yes	0	0.0	82	$574	$5,696	$600	$5,096	8.9	9,557
HVAC System Improvements			**374**	**0.0**	**147**	**$1,082**	**$2,114**	**$440**	**$1,674**	**1.5**	**17,559**
ECM 7	Install Programmable Thermostats	Yes	0	0.0	53	$375	$990	$0	$990	2.6	6,252
ECM 8	Install Pipe Insulation	Yes	374	0.0	93	$706	$1,124	$440	$684	1.0	11,307
Custom Measures			**2,242**	**0.0**	**488**	**$3,731**	**$61,882**	**$0**	**$61,882**	**16.6**	**59,396**
ECM 9	Building Envelope Improvements	No	0	0.0	488	$3,429	$59,812	$0	$59,812	17.4	57,139
ECM 10	Install Heat Pump Water Heater	Yes	2,242	0.0	0	$302	$2,070	$0	$2,070	6.9	2,258
TOTALS			**18,725**	**3.3**	**804**	**$8,175**	**$91,424**	**$4,903**	**$86,521**	**10.6**	**113,047**

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

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

Figure 6 – All Evaluated ECMs

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**13,355**	**2.7**	**-3**	**$1,778**	**$5,709**	**$1,043**	**$4,666**	**2.6**	**13,092**
ECM 1	Install LED Fixtures	7,087	1.3	-2	$943	$2,955	$300	$2,655	2.8	6,945
ECM 2	Retrofit Fixtures with LED Lamps	6,268	1.4	-1	$834	$2,754	$743	$2,011	2.4	6,147
Lighting Control Measures		**2,754**	**0.6**	**-1**	**$367**	**$3,660**	**$820**	**$2,840**	**7.7**	**2,699**
ECM 3	Install Occupancy Sensor Lighting Controls	2,126	0.5	0	$283	$3,210	$420	$2,790	9.9	2,084
ECM 4	Install High/Low Lighting Controls	628	0.1	0	$84	$450	$400	$50	0.6	616
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**173**	**$1,218**	**$18,060**	**$2,600**	**$15,460**	**12.7**	**20,300**
ECM 5	Install High Efficiency Furnaces	0	0.0	92	$645	$12,363	$2,000	$10,363	16.1	10,743
ECM 6	Install Infrared Heaters	0	0.0	82	$574	$5,696	$600	$5,096	8.9	9,557
HVAC System Improvements		**374**	**0.0**	**147**	**$1,082**	**$2,114**	**$440**	**$1,674**	**1.5**	**17,559**
ECM 7	Install Programmable Thermostats	0	0.0	53	$375	$990	$0	$990	2.6	6,252
ECM 8	Install Pipe Insulation	374	0.0	93	$706	$1,124	$440	$684	1.0	11,307
Custom Measures		**2,242**	**0.0**	**0**	**$302**	**$2,070**	**$0**	**$2,070**	**6.9**	**2,258**
ECM 10	Install Heat Pump Water Heater	2,242	0.0	0	$302	$2,070	$0	$2,070	6.9	2,258
TOTALS		**18,725**	**3.3**	**316**	**$4,746**	**$31,612**	**$4,903**	**$26,709**	**5.6**	**55,908**

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

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

Figure 7 – Cost Effective ECMs

4.1 Lighting

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**13,355**	**2.7**	**-3**	**$1,778**	**$5,709**	**$1,043**	**$4,666**	**2.6**	**13,092**
ECM 1	Install LED Fixtures	7,087	1.3	-2	$943	$2,955	$300	$2,655	2.8	6,945
ECM 2	Retrofit Fixtures with LED Lamps	6,268	1.4	-1	$834	$2,754	$743	$2,011	2.4	6,147

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

ECM 1: Install LED Fixtures

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

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

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

Affected building areas: Shade Tree Garage

ECM 2: Retrofit Fixtures with LED Lamps

Replace fluorescent, or CFL lamps with LED lamps. Many LED tubes are direct replacements for existing fluorescent tubes and can be installed while leaving the fluorescent fixture ballast in place. LED lamps can be used in existing fixtures as a direct replacement for most other lighting technologies.

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

Affected building areas: all areas with fluorescent fixtures with T8 tubes; exterior CFL lamps

4.2 Lighting Controls

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**2,754**	**0.6**	**-1**	**$367**	**$3,660**	**$820**	**$2,840**	**7.7**	**2,699**
ECM 3	Install Occupancy Sensor Lighting Controls	2,126	0.5	0	$283	$3,210	$420	$2,790	9.9	2,084
ECM 4	Install High/Low Lighting Controls	628	0.1	0	$84	$450	$400	$50	0.6	616

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

ECM 3: Install Occupancy Sensor Lighting Controls

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

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

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

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

Affected building areas: garage 1 and 4, office, and workshop areas

ECM 4: Install High/Low Lighting Controls

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

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

The controller lowers the light level by dimming the fixture output. Therefore, the controlled fixtures need to have a dimmable ballast or driver. This will need to be 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: garage 1 and 3.

For this type of measure the occupancy sensors will generally be ceiling or fixture mounted. Sufficient sensor coverage must be provided to ensure that lights turn on in each area as an occupant approaches.

4.3 Gas-Fired Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**173**	**$1,218**	**$18,060**	**$2,600**	**$15,460**	**12.7**	**20,300**
ECM 5	Install High Efficiency Furnaces	0	0.0	92	$645	$12,363	$2,000	$10,363	16.1	10,743
ECM 6	Install Infrared Heaters	0	0.0	82	$574	$5,696	$600	$5,096	8.9	9,557

ECM 5: Install High Efficiency Furnaces

Replace standard efficiency furnaces with condensing furnaces. Improved combustion technology and heat exchanger design optimize heat recovery from the combustion gases which can significantly improve furnace efficiency. Savings result from improved system efficiency. Different energy savings options have been provided for comparison.

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

Affected units: Shade Tree one of the unit heaters, and mechanic's garage heater.

ECM 6: Install Infrared Heaters

Evaluate replacing forced air heating equipment with low-intensity infrared heating units with an enclosed flame, rather than an open flame on a ceramic or metal surface.

Forced air furnaces heat all the air in the space served, which is inefficient for large volume spaces with relatively few occupants, areas with high ceilings, or areas with high outside air infiltration. Infrared heaters heat objects and surfaces directly, including the occupants of the space, rather than heating large volumes of air. Infrared heaters also heat the floor which then re-radiates the heat. As a result, infrared heaters are more effective and efficient at maintaining occupant comfort at significantly lower cost for certain space types.

Affected building areas: Shade Tree Garage, the other unit heater.

4.4 HVAC Improvements

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
HVAC System Improvements		**374**	**0.0**	**147**	**$1,082**	**$2,114**	**$440**	**$1,674**	**1.5**	**17,559**
ECM 7	Install Programmable Thermostats	0	0.0	53	$375	$990	$0	$990	2.6	6,252
ECM 8	Install Pipe Insulation	374	0.0	93	$706	$1,124	$440	$684	1.0	11,307

ECM 7: Install Programmable Thermostats

Replace manual thermostats with programmable thermostats which provide energy savings by reducing heating and cooling energy usage when a room is unoccupied. Manual thermostats are generally adjusted to a single heating and cooling setpoint and left at that setting regardless of occupancy and they provide the same level of heating and cooling regardless of whether the space is being used. Programmable thermostats can maintain different temperature settings for different times of day and for different days of the week. By reducing heating temperature setpoints and raising cooling temperature setpoints when spaces are unoccupied, the operation of the HVAC equipment is reduced while maintaining comfortable space temperatures for building usage.

ECM 8: Install Pipe Insulation

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

Affected Systems: steam system and domestic hot water piping.

4.5 Custom Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Custom Measures		**2,242**	**0.0**	**488**	**$3,731**	**$61,882**	**$0**	**$61,882**	**16.6**	**59,396**
ECM 9	Building Envelope Improvements	0	0.0	488	$3,429	$59,812	$0	$59,812	17.4	57,139
ECM 10	Install Heat Pump Water Heater	2,242	0.0	0	$302	$2,070	$0	$2,070	6.9	2,258

ECM 9: Building Envelope Improvements

Heat flows from warmer to cooler areas until there is no longer a temperature difference. In your building, this means that in winter, heat flows directly from all heated spaces to adjacent unheated attics, garages, basements, and to the outdoors. Heat flow can also move indirectly through interior ceilings, walls, and floors--wherever there is a difference in temperature. During the cooling season, heat flows from the outdoors to the interior of a house.

To maintain comfort, the heat lost in the winter must be replaced by your heating system and the heat gained in the summer must be removed by your cooling system. Properly insulating your building will decrease this heat flow by providing an effective resistance to the flow of heat.

An insulating material's resistance to conductive heat flow is measured or rated in terms of its thermal resistance or R-value -- the higher the R-value, the greater the insulating effectiveness. The R-value depends on the type of insulation, its thickness, and its density. Installing more insulation increases the R-value and the resistance to heat flow. In general, increased insulation thickness will proportionally increase the R-value.

For more information: https://www.energy.gov/energysaver/weatherize/insulation.

Install Exterior Wall Insulation

We evaluated the installation of rigid board wall insulation on all sides of the building to reduce heat loss through walls.

Foam board or rigid foam insulation made from polystyrene or similar materials can be added to the building exterior. The material provides high insulating value for relatively little thickness but must be properly weatherproofed.

Install Roof Insulation

We evaluated the installation of spray on foam to insulate conditioned attic or ceiling spaces by reducing heat loss through the roof of the building.

Sprayed foam insulation made from polyurethane or similar materials can be pressure sprayed to the underside of the roof decking. Install spray foam insulation (and additional loose-fill insulation if desired) in the roof cavity to levels that meet or exceed the current adopted building and energy code.

Install Window Film

We evaluated the installation of low-E window film.

Window film is a self-adhesive polyester film applied as a “retrofit” to existing glass, primarily to control solar heat gain. As solar radiation strikes the glass, window film acts as a "sunscreen" to block UV rays and regulate the levels of heat and light passing through the glass. The amount of heat and light rejected is dependent upon the type of window film selected.

While standard window films provide savings during cooling season, these window films reduce solar gain through windows year-round, even when heat gain might be helpful (during the winter). In climates with prolonged heating seasons, standard window films can increase the amount of heat needed from the building’s HVAC system.

The emissivity (or thermal performance) of window film can make an impact on energy consumption. Low-E (or low emissivity) film provides superior insulation performance as compared to standard window film and is generally recommended in climates such as found in New Jersey in order to maximize savings year-round. Although Low-E film can be more expensive than standard reflective film, the return on investment is often better than standard film due to savings during additional savings during the heating season.

Install Replacement Windows

We evaluated the installation of high-performance windows.

If your windows are in good condition, taking steps to improve their efficiency may be the most cost-effective option to increase comfort and save money on energy costs rather than replacing them. However, aging windows, particularly those that are single pane, contribute substantially to building heat loss and replacement may be warranted. Even if not cost effective on the basis of energy savings alone, new windows may improve comfort and building aesthetics.

New Jersey experiences a range of temperatures, so window replacement should consider both heating and cooling impacts. For colder weather, consider selecting gas-filled windows with low-e coatings to reduce heat loss. Choose a low U-factor for better thermal resistance; the U-factor is the rate at which a window conducts non-solar heat flow. For summer, select windows with coatings to reduce heat gain. Look for a low solar heat gain coefficient (SHGC). SHGC is a measure of solar radiation admitted through a window. Low SHGCs reduce heat gain. Select windows with both low U-factors and low SHGCs to maximize energy savings in temperate climates with both cold and hot seasons.

Install Replacement Overhead Doors

We evaluated the installation of insulated overhead doors to replace existing uninsulated overhead doors.

Many maintenance shops and service areas are equipped with steel roll-up doors to facilitate vehicular access to the building interior for repair or storage. Older, traditional roll-up doors are uninsulated. Best operational practices are to keep doors closed when they are not in use. Regular door system maintenance should include sealing door perimeters and adjusting closure mechanisms to reduce infiltration. However, doors showing signs of physical damage or permanent leakage should be replaced.

When replacing doors, consider installing insulated steel roll-up doors. The barrier created from these insulated doors helps to maintain the temperature inside of your building by reducing heat transfer both into and out of the building. Insulated steel roll-up doors are measured by R-value, U-value, and STC rating. An R-value is the measure of thermal efficiency (the higher the number, the better it insulates), while U-value measures the transmission of heat through surfaces (the lower the number, the better). The STC rating concerns the sound transmission. A well-insulated door will help significantly with noise reduction.

Insulated doors typical contain polyethylene insulation, a foil backed, dual layer of heavy-duty "air-bubble" insulation secured into place with a strong adhesive and joined by mylar film. Also, insulated doors are often equipped with header seals and draft stops. These options provide additional barriers which help reduce infiltration.

ECM 10: Install Heat Pump Water Heater

A typical electric water heater uses electric resistance coils to heat water at a coefficient of performance (COP) of 1. Heat pump water heaters (HPWH) use a refrigeration cycle to transfer heat from the air to the domestic water. The typical average COP for a HPWH is about 2.5 so they require significantly less electricity to produce the same amount of hot water as a traditional electric water heater. HPWH also reject cold air. As such, they need to be in an unconditioned space with good ventilation. Ideal locations are garages or large enclosed, unconditioned storage areas.

Most HPHW operate effectively down to an air temperature of 40 °F. Below that temperature, an electric resistance booster heater is typically required to achieve full heating capacity. It is critical that the HPWH controls are set up so that the electric resistance heat only engages when the air temperature is too cold for the HPWH to extract heat from it.

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

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% 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.

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.

Motor Maintenance

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

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

Boiler Maintenance

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

Furnace Maintenance

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

Label HVAC Equipment

For improved coordination in maintenance practices, we recommend labeling or re-labeling the site HVAC equipment. Maintain continuity in labeling by following labeling conventions as indicated in the facility drawings or EMS building equipment list. Use weatherproof or heatproof labeling or stickers for permanence, but do not cover over original equipment nameplates, which should be kept clean and readable whenever possible. Besides equipment, label piping for service and direction of flow when possible. Ideally, maintain a log of HVAC equipment, including nameplate information, asset tag designation, areas served, installation year, service dates, and other pertinent information.

This investment in your equipment will enhance collaboration and communication between your staff and your contracted service providers and may help you with regulatory compliance.

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 gallons per flush (gpf) and for flush valve toilets is 1.28 gpf (this is lower than the current 1.6 gpf federal standard).

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

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

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

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

Procurement Strategies

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

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

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

6 On-site Generation

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

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

6.1 Solar Photovoltaic

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

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

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

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

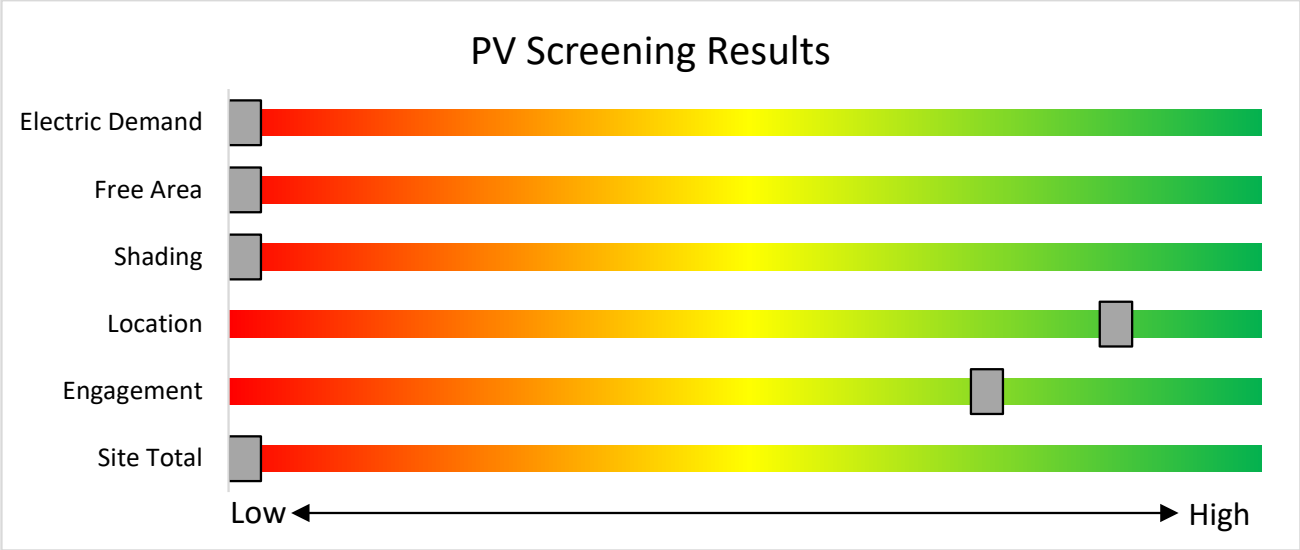


Figure 8 - Photovoltaic Screening

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

6.2 Combined Heat and Power

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

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

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

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

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

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

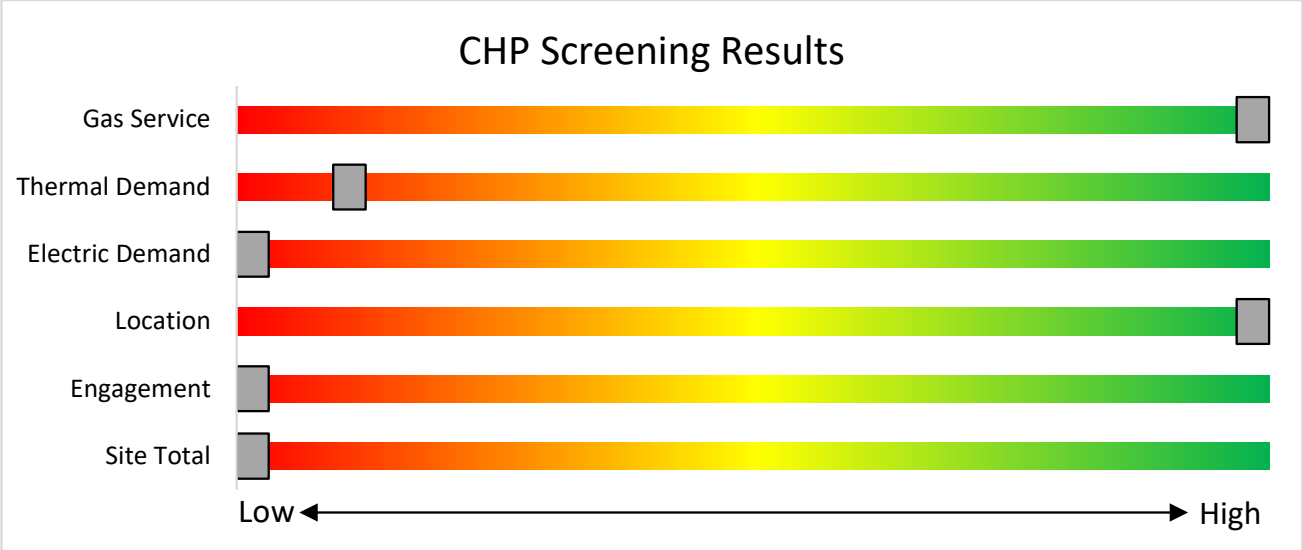


Figure 9 - Combined Heat and Power Screening

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

7 PROJECT FUNDING AND INCENTIVES

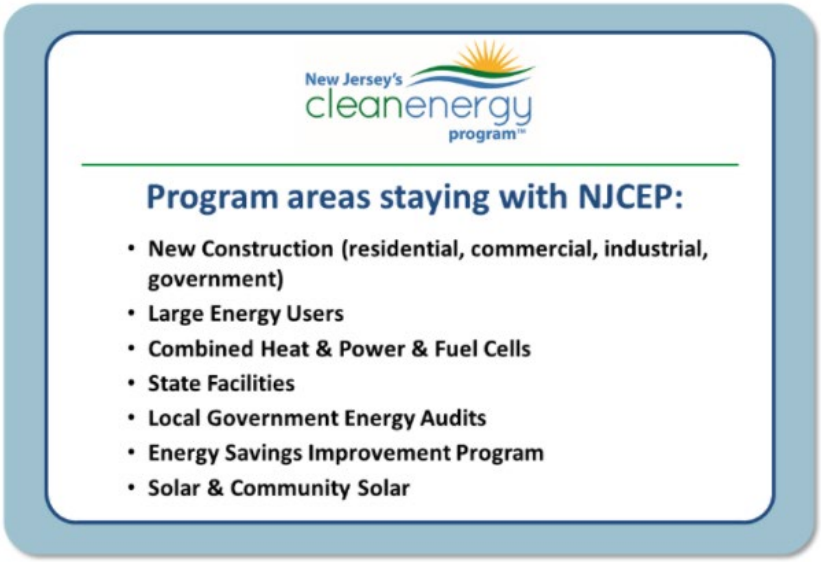
Ready to improve your building's performance? Your utility provider may be able to help.

7.1 Utility Energy Efficiency Programs

New utility programs are expected to start rolling out in the spring and summer of 2021. Keep up to date with developments by visiting the NJCEP website.

8 New Jersey's Clean Energy Programs

New Jersey's Clean Energy Program will continue to offer some energy efficiency programs.



8.1 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.

8.2 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 into 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 description and application can be found at www.njcleanenergy.com/ESIP.

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

8.3 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 NJ 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 ("TI-RPS"), which will exist in parallel with, and completely separate from, the existing Solar RPS for Legacy SRECs. The TI-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

9 PROJECT DEVELOPMENT

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

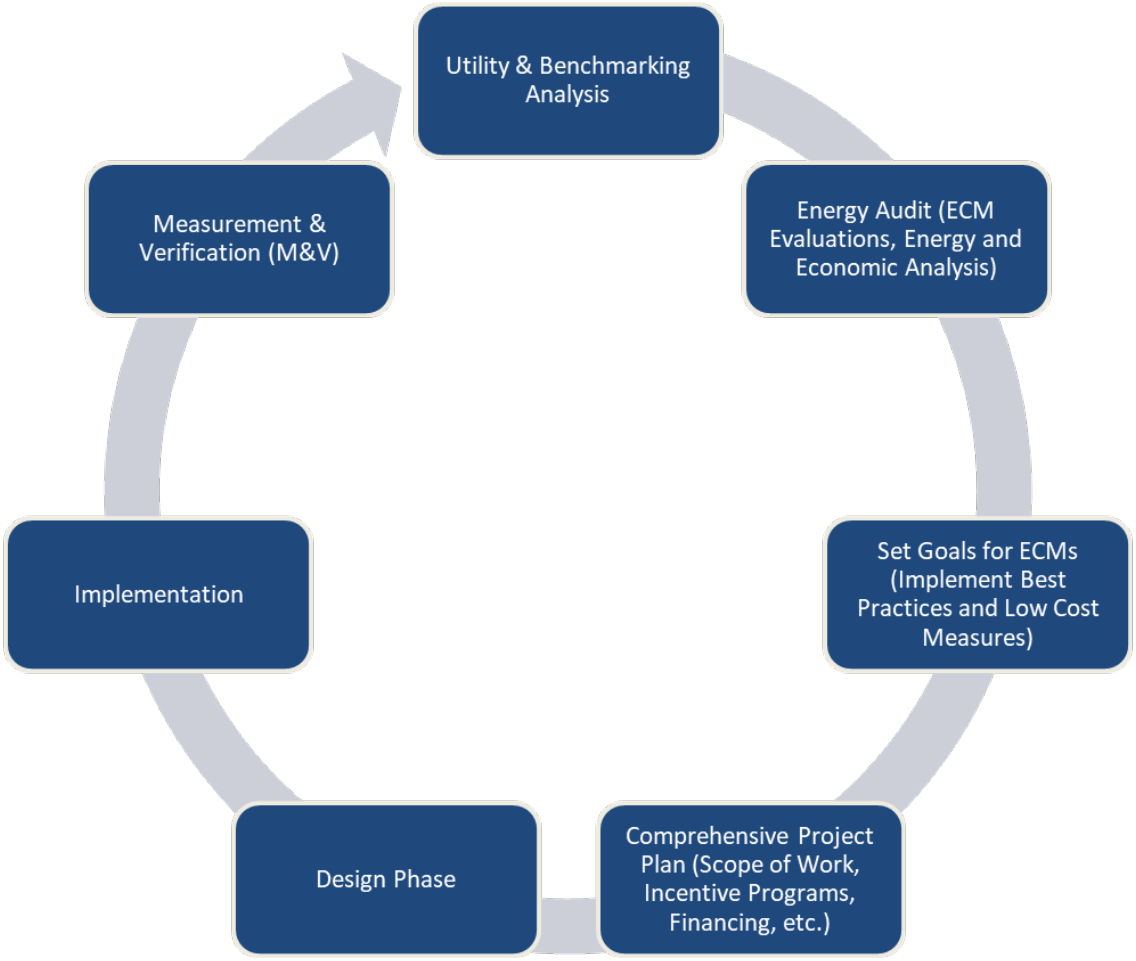


Figure 30 – Project Development Cycle

10 Energy Purchasing and Procurement Strategies

10.1 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].

10.2 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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Exterior 1	3	Compact Fluorescent: (1) 32W Spiral Plug-In Lamp	Timeclock		32	4,380	2	Relamp	No	3	LED Lamps: A19 Lamps	Timeclock	23	4,380	0.0	118	0	$16	$52	$3	3.1
Exterior 1	6	LED Lamps: (1) 30W Corn Bulb Screw-In Lamp	Timeclock		30	4,380		None	No	6	LED Lamps: (1) 30W Corn Bulb Screw-In Lamp	Timeclock	30	4,380	0.0	0	0	$0	$0	$0	0.0
Garage 1 middle bay	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
Garage 1 middle bay	1	LED - Linear Tubes: (2) 8' Lamps	Wall Switch	S	72	2,912	3	None	Yes	1	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	2,009	0.0	65	0	$9	$0	$0	0.0
Garage 1 middle bay	1	LED - Linear Tubes: (1) 8' Lamp	Wall Switch	S	36	2,912	3	None	Yes	1	LED - Linear Tubes: (1) 8' Lamp	Occupancy Sensor	36	2,009	0.0	32	0	$4	$270	$35	54.3
Garage 1 middle bay	3	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,912	2, 3	Relamp	Yes	3	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,009	0.1	646	0	$86	$489	$95	4.6
Garage 1	7	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,912	2, 4	Relamp	Yes	7	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	2,009	0.3	1,508	0	$201	$736	$365	1.8
Garage 4 shade tree	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
Garage 4 shade tree	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,912	2	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,912	0.0	163	0	$22	$73	$20	2.4
Garage 4 shade tree	6	Metal Halide: (1) 400W Lamp	None	S	458	3,494	1, 3	Fixture Replacement	Yes	6	LED - Fixtures: High-Bay	Occupancy Sensor	120	2,411	1.5	7,867	-2	$1,047	$4,275	$510	3.6
Garage barn 7	3	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,912	2, 3	Relamp	Yes	3	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,009	0.1	646	0	$86	$489	$95	4.6
Garage 2 mechanics bay	7	LED - Linear Tubes: (1) 8' Lamp	Wall Switch	S	36	2,912		None	No	7	LED - Linear Tubes: (1) 8' Lamp	Wall Switch	36	2,912	0.0	0	0	$0	$0	$0	0.0
Garage 2 mechanics bay	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,912	2	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,912	0.1	384	0	$51	$146	$40	2.1
Garage 2 mechanics bay	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,912	2	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,912	0.1	326	0	$43	$146	$40	2.4
Kitchen break room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,912	2, 3	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,009	0.0	122	0	$16	$37	$10	1.6
Kitchen break room	4	LED - Linear Tubes: (1) 8' Lamp	Wall Switch	S	36	2,912	3	None	Yes	4	LED - Linear Tubes: (1) 8' Lamp	Occupancy Sensor	36	2,009	0.0	130	0	$17	$270	$35	13.6
Mechanical 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,912	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,912	0.0	96	0	$13	$37	$10	2.1
Office - Enclosed 1	1	LED - Linear Tubes: (1) 8' Lamp	None	S	36	2,912	3	None	Yes	1	LED - Linear Tubes: (1) 8' Lamp	Occupancy Sensor	36	2,009	0.0	32	0	$4	$0	$0	0.0
Office - Enclosed 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	None	S	62	2,912	2, 3	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,009	0.0	122	0	$16	$307	$45	16.1
Office - Enclosed 1	1	LED - Linear Tubes: (2) 8' Lamps	Wall Switch	S	72	2,912	3	None	Yes	1	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	2,009	0.0	65	0	$9	$0	$0	0.0
Restroom - 1	1	LED - Linear Tubes: (2) 8' Lamps	Wall Switch	S	72	2,912		None	No	1	LED - Linear Tubes: (2) 8' Lamps	Wall Switch	72	2,912	0.0	0	0	$0	$0	$0	0.0
Storage 1	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Storage 1	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,912	2, 3	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,009	0.3	1,293	0	$172	$708	$120	3.4
Workshop 1	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
Workshop 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,912	2, 3	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,009	0.0	122	0	$16	$37	$10	1.6

	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Workshop 1	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,912	2, 3	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,009	0.3	1,293	0	$172	$708	$155	3.2
Garage 3	5	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,912	2, 4	Relamp	Yes	5	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	2,009	0.2	1,077	0	$143	$590	$275	2.2

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?	Manufacturer	Model	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Garage mechanics bay	Garage mechanics bay	1	Air Compressor	5.0	89.5%	No	Unknown	Unknown	W	1,000		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Restroom - 1	Restroom - 1	1	Exhaust Fan	0.1	65.0%	No	Unknown	Unknown	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Garage 1	Garage 1	1	Other	0.3	65.0%	No	Unknown	Unknown	W	730		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Garage mechanics bay	Garage mechanics bay	1	Other	0.3	65.0%	No	Unknown	Unknown	W	730		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Garage mechanics bay	Garage mechanics bay	2	Other	2.0	85.5%	No	Fenner	2235-CC	W	200		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Park Department Maintenance	1	Combustion Air Fan	0.3	65.0%	No	Power Flame	BCJR1SA-10	W	4,908		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Park Department Maintenance	Park Department Maintenance	5	Fan Coil Unit	0.3	65.0%	No	Unknown	Unknown	B	3,272		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0

Packaged 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)	Cooling Mode Efficiency (SEER/IEER/EER)	Heating Mode Efficiency	Manufacturer	Model	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/IEER/EER)	Heating Mode Efficiency	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Garage 4 shade tree	Garage 4 shade tree	1	Forced Air Furnace		128.00		0.8 AFUE	Unknown	Unknown	W	6	Yes	1	Infrared Heater		102.40		0.93 Et	0.0	0	82	$574	$5,696	$600	8.9
Garage 4 shade tree	Garage 4 shade tree	1	Forced Air Furnace		128.00		0.8 AFUE	Unknown	Unknown	W	5	Yes	1	Forced Air Furnace		128.00		0.97 AFUE	0.0	0	46	$322	$6,182	$1,000	16.1
Garage mechanics bay	Garage mechanics bay	1	Forced Air Furnace		128.00		0.8 AFUE	Unknown	Unknown	W	5	Yes	1	Forced Air Furnace		128.00		0.97 AFUE	0.0	0	46	$322	$6,182	$1,000	16.1
Office - Enclosed 1	Office - Enclosed 1	1	Window AC	0.50		10.00		Frigidaire	Unknown	B		No							0.0	0	0	$0	$0	$0	0.0

Space Heating Boiler Inventory & Recommendations

		Existing Conditions						Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Manufacturer	Model	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical 1	Park Department Maintenance	1	Forced Draft Steam Boiler	347	Burnham Commercial	V903A	W		No						0.0	0	0	$0	$0	$0	0.0

Programmable Thermostat Recommendations

		Recommendation Inputs					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	ECM #	Thermostat Quantity	Cooling Capacity of Controlled System (Tons)	Electric Heating Capacity of Controlled System (kBtu/hr)	Output Heating Capacity of Controlled System (MBh)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Garage 4 shade tree	Garage 4 shade tree	7	1.00	0.00	0.00	128.00	0.0	0	18	$125	$330	$0	2.6
Garage 4 shade tree	Garage 4 shade tree	7	1.00	0.00	0.00	128.00	0.0	0	18	$125	$330	$0	2.6
Garage mechanics bay	Garage mechanics bay	7	1.00	0.00	0.00	128.00	0.0	0	18	$125	$330	$0	2.6

Pipe Insulation Recommendations

		Recommendation Inputs			Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	ECM #	Length of Uninsulated Pipe (ft)	Pipe Diameter (in)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen Break Room	Building	8	10	0.75	0.0	374	0	$50	$58	$40	0.4
Building	Steam Heat	8	50	2.00	0.0	0	52	$368	$627	$200	1.2
Building	Steam Heat	8	50	2.00	0.0	0	41	$288	$440	$200	0.8

DHW Inventory & Recommendations

		Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Manufacturer	Model	Remaining Useful Life	ECM #	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen break room	Park Department Maintenance	1	Storage Tank Water Heater (≤ 50 Gal)	AO Smith	ELJF 40	W		No						0.0	0	0	$0	$0	$0	0.0

Plug Load Inventory

	Existing Conditions					
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Office - Enclosed 1	2	Fan(Ceiling)	200	No	Unknown	Unknown
Garage 1	1	Fan (Large)	200	No	Unknown	Unknown
Kitchen break room	1	Microwave	1,000	No	GE	Unknown
Office - Enclosed 1	1	Microwave	800	No	Sharp	Unknown
Office - Enclosed 1	1	Printer (Medium/Small)	600	No	Unknown	Unknown
Kitchen break room	1	Water Cooler	200	No	Halsey Taylor	Unknown

Custom (High Level) Measure Analysis

Building Envelope Improvements

Existing Conditions			Proposed Conditions			Energy Impact & Financial Analysis										
Description	Conduction Loss (kBtu/yr)	Infiltration Loss (kBtu/yr)	Description	Conduction Loss (kBtu/yr)	Infiltration Loss (kBtu/yr)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Base Incentives	Enhanced Incentives	Total Incentives	Total Net Cost	Payback w/o Incentives in Years	Payback w/ Incentives in Years
Existing Building Envelope with Opportunities for Improvement	455,684	619,661	Install Exterior Wall Insulation and Install Roof Insulation	64,464	619,661	0.00	0	488	$3,429	$59,812	$0	$0	$0	$59,812	17.44	17.44

Heat Pump Water Heater

Existing Conditions						Proposed Conditions				Energy Impact & Financial Analysis										
Description	Area(s)/System(s) Served	SF of Area Served	Fuel Type	Input Capacity per Unit (kW)	Tank Capacity per Unit (Gal)	Description	COP	Tank Capacity per Unit (Gal)	Estimated Unit Cost	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Base Incentives	Enhanced Incentives	Total NJCEP Incentives	Total Net Cost	Payback w/o Incentives in Years	Payback w/ Incentives in Years
Storage Tank Water Heater (≤50 Gal)	Building	850	Electric	4.5	40	Heat Pump Water Heater	2.5	40	$2,069.90	0.00	2,242	0	$302	$2,070	$0	$0	$0	$2,070	6.85	6.85

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]

Traffic & Parking Shop

Primary Property Type: Repair Services (Vehicle, Shoe, Locksmith, etc.)
Gross Floor Area (ft²): 13,100
Built: 1959

For Year Ending: February 29, 2020
Date Generated: July 28, 2021

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
Traffic & Parking Shop 250 North Alley Trenton, New Jersey 08618	City of Trenton 319 East State Street Trenton, NJ 08618 (609) 989-3615	Hoggarth Stephen 319 East State Street Trenton, NJ 08618 (609) 989-3615 hstephen@trentonnj.org

Property ID: 15545419

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
81.7 kBtu/ft²

Source EUI
109.9 kBtu/ft²

Annual Energy by Fuel		
Electric - Grid (kBtu)	180,774 (17%)	
Natural Gas (kBtu)	888,932 (83%)	

National Median Comparison	
National Median Site EUI (kBtu/ft²)	72
National Median Source EUI (kBtu/ft²)	96.9
% Diff from National Median Source EUI	13%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	64

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.