Local Government Energy Audit Report

Brook Alley Garage

November 9, 2021

Prepared for:

City of Orange Township

Brook Alley Place

Orange, New Jersey 07050

Prepared by:

TRC

900 Route 9 North

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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.

Table of Contents

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.

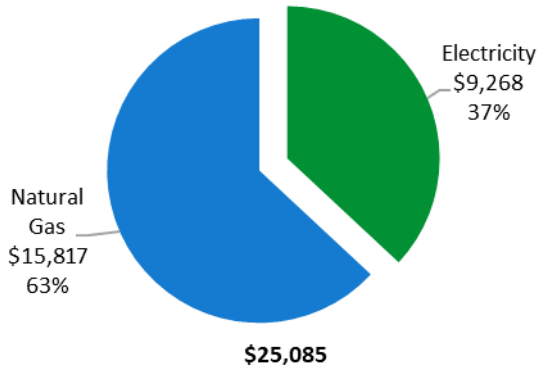
These "next generation" energy efficiency programs feature new ways of managing and delivering programs historically administered by New Jersey's Clean Energy Program™ (NJCEP). All of the investor-owned gas and electric utility companies will now also offer complementary energy efficiency programs and 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 Brook Alley Garage. 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: $25,085 Electricity: 50,652 kWh Natural Gas: 18,949 Therms	
ENERGY STAR® Benchmarking Score	N/A	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.

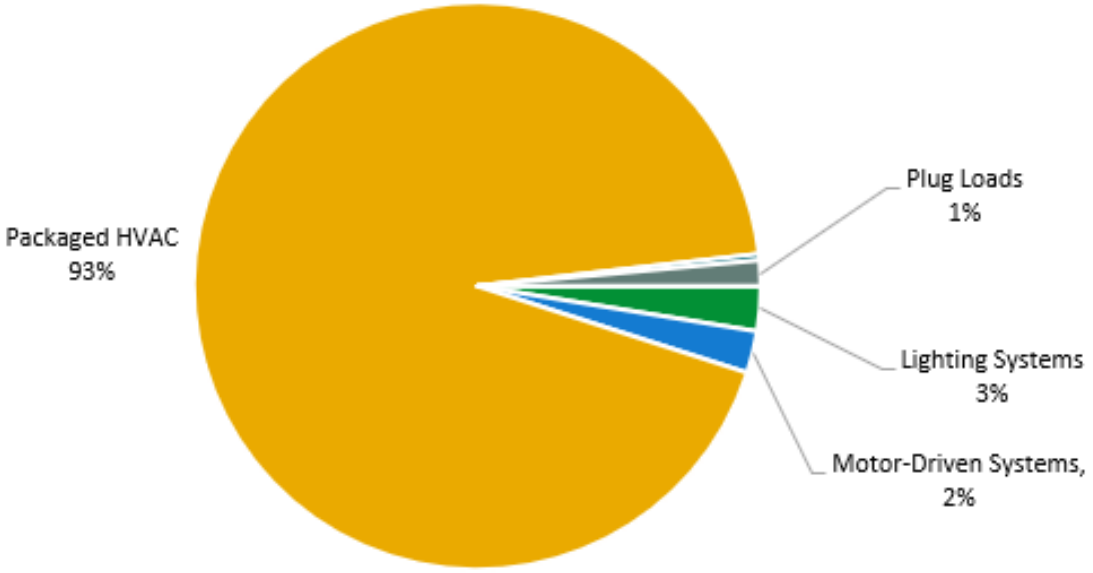


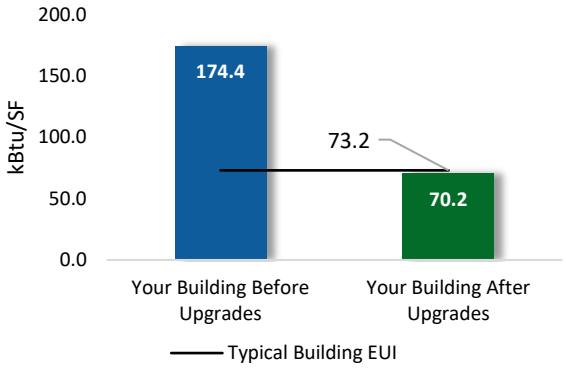
Figure 1 - Energy Use by System

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.

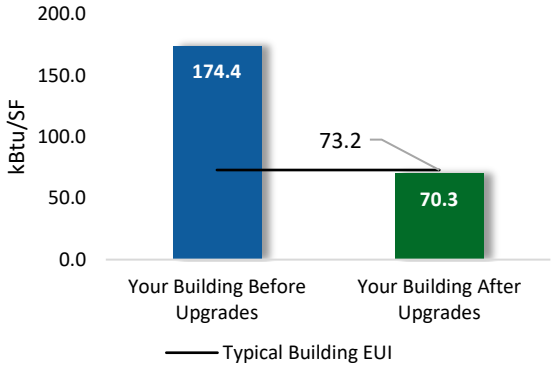
Scenario 1: Full Package (all evaluated measures)

Installation Cost	$73,082
Potential Rebates & Incentives[1]	$7,222
Annual Cost Savings	$12,039
Annual Energy Savings	Electricity: 11,175 kWh Natural Gas: 11,972 Therms
Greenhouse Gas Emission Savings	76 Tons
Simple Payback	5.5 Years
Site Energy Savings (all utilities)	60%



Scenario 2: Cost Effective Package[2]

Installation Cost	$71,154
Potential Rebates & Incentives	$7,222
Annual Cost Savings	$11,987
Annual Energy Savings	Electricity: 10,893 kWh Natural Gas: 11,972 Therms
Greenhouse Gas Emission Savings	76 Tons
Simple Payback	5.3 Years
Site Energy Savings (all utilities)	60%



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			**6,623**	**1.5**	**-2**	**$1,199**	**$4,573**	**$983**	**$3,590**	**3.0**	**6,491**
ECM 1	Install LED Fixtures	Yes	0	0.0	0	$0	$680	$0	$680	0.0	0
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	30	0.0	0	$5	$118	$20	$98	18.1	29
ECM 3	Retrofit Fixtures with LED Lamps	Yes	6,488	1.4	-1	$1,175	$3,557	$963	$2,594	2.2	6,358
ECM 4	Install LED Exit Signs	Yes	105	0.0	0	$19	$217	$0	$217	11.4	103
Lighting Control Measures			**2,326**	**0.5**	**-1**	**$421**	**$3,010**	**$375**	**$2,635**	**6.3**	**2,280**
ECM 5	Install Occupancy Sensor Lighting Controls	Yes	2,326	0.5	-1	$421	$3,010	$375	$2,635	6.3	2,280
Unitary HVAC Measures			**1,843**	**1.2**	**0**	**$337**	**$5,797**	**$80**	**$5,717**	**17.0**	**1,856**
ECM 6	Install High Efficiency Air Conditioning Units	No	282	0.2	0	$52	$1,928	$0	$1,928	37.4	284
ECM 7	Install High Efficiency PTAC/PTHP	Yes	1,561	1.0	0	$286	$3,869	$80	$3,789	13.3	1,572
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**627**	**$5,233**	**$25,058**	**$5,000**	**$20,058**	**3.8**	**73,398**
ECM 8	Install Infrared Heaters	Yes	0	0.0	627	$5,233	$25,058	$5,000	$20,058	3.8	73,398
HVAC System Improvements			**220**	**0.0**	**190**	**$1,630**	**$1,222**	**$770**	**$452**	**0.3**	**22,519**
ECM 9	Install Occupancy-Controlled Thermostats	Yes	0	0.0	190	$1,590	$1,193	$750	$443	0.3	22,298
ECM 10	Install Pipe Insulation	Yes	220	0.0	0	$40	$29	$20	$9	0.2	221
Domestic Water Heating Upgrade			**164**	**0.0**	**0**	**$30**	**$14**	**$14**	**$0**	**0.0**	**165**
ECM 11	Install Low-Flow DHW Devices	Yes	164	0.0	0	$30	$14	$14	$0	0.0	165
Custom Measures			**0**	**0.0**	**382**	**$3,189**	**$33,408**	**$0**	**$33,408**	**10.5**	**44,727**
ECM 12	Building Envelope Improvements	Yes	0	0.0	382	$3,189	$33,408	$0	$33,408	10.5	44,727
TOTALS (COST EFFECTIVE MEASURES)			**10,893**	**3.0**	**1,197**	**$11,987**	**$71,154**	**$7,222**	**$63,932**	**5.3**	**151,152**
TOTALS (ALL MEASURES)			**11,175**	**3.2**	**1,197**	**$12,039**	**$73,082**	**$7,222**	**$65,860**	**5.5**	**151,436**

* - 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 Brook Alley Garage. 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 May 5, 2021, TRC performed an energy audit at Brook Alley Garage located in Orange, New Jersey. TRC met with Carnell Townes to review the facility operations and help focus our investigation on specific energy-using systems.

Brook Alley Garage is primarily a single-story building with a small office area that has two stories. It is an 11,856 square foot building that was built in 1968. Spaces include offices, a break, bathroom, and garage bays.

2.2 Building Occupancy

The facility is occupied year-round. Staff tend to come and come from this facility throughout the day and on weekends as necessary.

Building Name	Weekday/Weekend	Operating Schedule
Brook Alley Garage	Weekday	7:00 AM- 5:00 PM
	Weekend	Depends on Ongoing Work

Figure 3 - Building Occupancy Schedule

2.3 Building Envelope

Building walls are concrete block over structural steel with no added insulation. The roof is flat and appears to be in fair condition, and it is supported with steel trusses.

Most of the windows are double paned and have aluminum frames. The glass-to-frame seals are generally in fair condition. The operable window weather seals are in poor condition, especially in the break room where significant moisture was visible on the window. A few window panes are shattered and need to be replaced. Exterior doors have aluminum frames and are in good condition with undamaged door seals. Degraded window and door seals increase drafts and outside air infiltration.

There are ten garage doors that have no insulation. They are sometimes left open for extended periods of time.

Building Exterior

Exterior- Garage Doors

Break Room Window- Poor Seals

Supervisor's Office Window

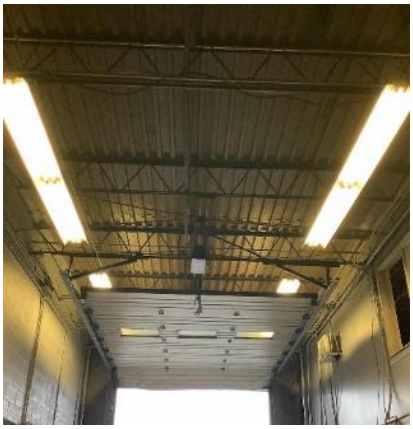
2.4 Lighting Systems

The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. There is also one fluorescent 40-Watt T12 fixture and a few new LED fixtures. Some office area fixtures have been retrofit with LED lamps. Additionally, there are some incandescent general-purpose lamps. Typically, T8 fluorescent lamps use electronic ballasts and T12 fluorescent lamps use magnetic ballasts.

Fixtures include 2- 4- or 6-lamp, 4-foot-long industrial strip fixtures. Most fixtures are in fair condition, and all are controlled with wall switches.

All exit signs have compact fluorescent bulbs.

Interior lighting levels were generally sufficient.



Garage Bay Fixtures- 4' 4L

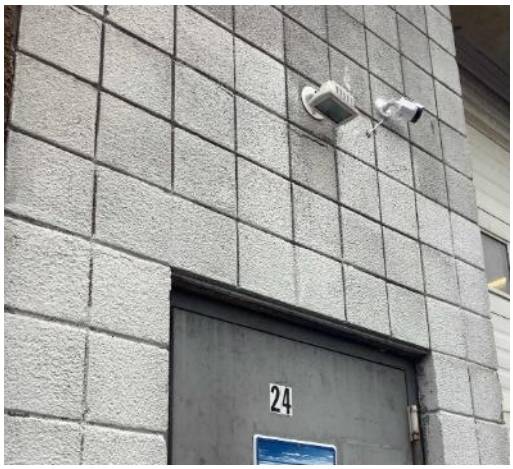
Supervisors Office- 2x2 LED Panels

Garage Bay- Fluorescent Fixtures

Custodian's Closet- Incandescent A19 Bulb

Exterior fixtures include cylindrical downlight sconces with HID lamps, and a single LED fixture. These fixtures are controlled by a photocell, but staff relayed that none of these fixtures currently operate.

Cylindrical Sconce- HID Fixture



LED Fixture

Photocell

2.5 Air Handling Systems

Unitary Heating Equipment

All garage bays are heated with gas fired unit heaters. The small bay has two unit heaters, only one of which is operable, while the main garage area has four unit heaters that provide space heating. Each of these units have an estimated rating ranging from 75 to 80 MBH with efficiencies between 75% and 80%.

These units are controlled with a mix of dial and programmable type wall mounted thermostats and override on/off switches. At the time of the audit, the thermostat set points varied from 62 to 70°F. Each of these unit heaters has a constant speed supply fan estimated at ¾ HP that operates when the heater is on.

There is also a single electric resistance baseboard heater in the supervisor's office. This can be manually turned on and off as needed.

Small Garage Bay Gas Unit Heaters

Small Garage Bay Thermostat

Main Garage

Main Garage Digital Thermostat

Main Garage- Carrier Unit

Supervisor's Office- Electric Baseboard

Unitary Electric Heating, Ventilation, and Air Conditioning (HVAC) Equipment

Smaller enclosed spaces in the Brook Alley Garage use window, and through-the wall air conditioning (AC) units for cooling, as well as packaged terminal air conditioning (PTAC) units for heating and cooling. The PTACs are equipped with electric resistance heat. Units vary in capacity from 0.5 to 1 ton. The units are in fair condition. They range in efficiency between 9.8 EER and 11.2 EER, and the PTACs operate with a coefficient of performance (COP) of 1 while heating. Most are not ENERGY STAR® labeled.

Supervisor's Office- PTAC

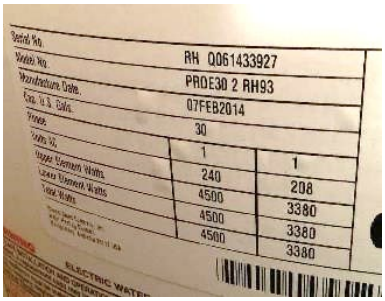
Supervisor's Office- Through Wall AC Unit

2.6 Domestic Hot Water

Hot water is produced by a 30-gallon, 3.38 kW electric storage water heater with an energy factor in the 0.85 to 0.93 range. The domestic hot water pipes that are visible are not insulated.

Domestic Hot Water (DHW) Piping

DHW Heater



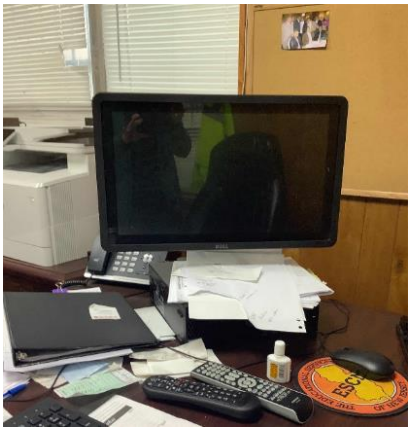
DHW Heater Nameplate

2.7 Plug Load & Vending Machines

The location is doing a fair job managing their electrical plug loads. This report makes additional suggestions for ECMs in this area as well as energy efficient best practices.

There are three computer workstations throughout the facility. Plug loads throughout the building include general kitchen and office equipment, as well as various tools used in the garage as noted in Section 2.9.

There is a single residential style refrigerator and two mini refrigerators in office spaces that are used to store food. These vary in condition and efficiency. Most refrigerators had minimal food stored inside, and the building may want to consider consolidating to one refrigerator for the facility.



Office Workstation

Break Room Television

Break Room Refrigerator

Tree Cutting Garage- Mini-Fridge

2.8 Water-Using Systems

There is one unisex restroom with a toilet, urinal, and a single sink. The faucet flow rate is 1.5 gallons per minute (gpm). Toilets are rated at 1.6 gallons per flush (gpf).

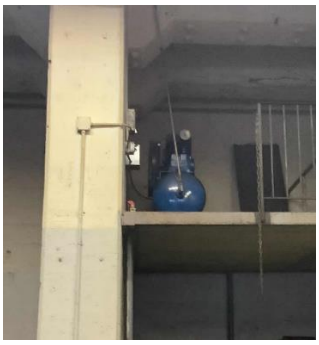
Bathroom Faucet

Bathroom Urinal

2.9 Process Equipment

This garage space is used for maintenance and repairs on municipal vehicles. There is equipment in the facility that tailors to these requirements, including two air compressors and a variety of both compressed air and electric powered tools. Many of these tools are used infrequently depending on daily tasks. Tool usage was estimated for the baseline analysis.

Each garage door has an electric garage door opener. These units have fractional horsepower motors with low operating hours.



Large Air Compressor

Air Compressor

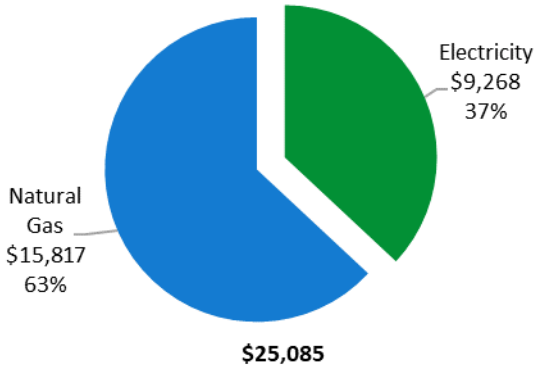
Garage Door

Garage Door Opener

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	50,652 kWh	$9,268
Natural Gas	18,949 Therms	$15,817
Total		**$25,085**



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. Natural gas for space heating does make up most of the energy use for this building, at over 90% of the building's energy use.

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

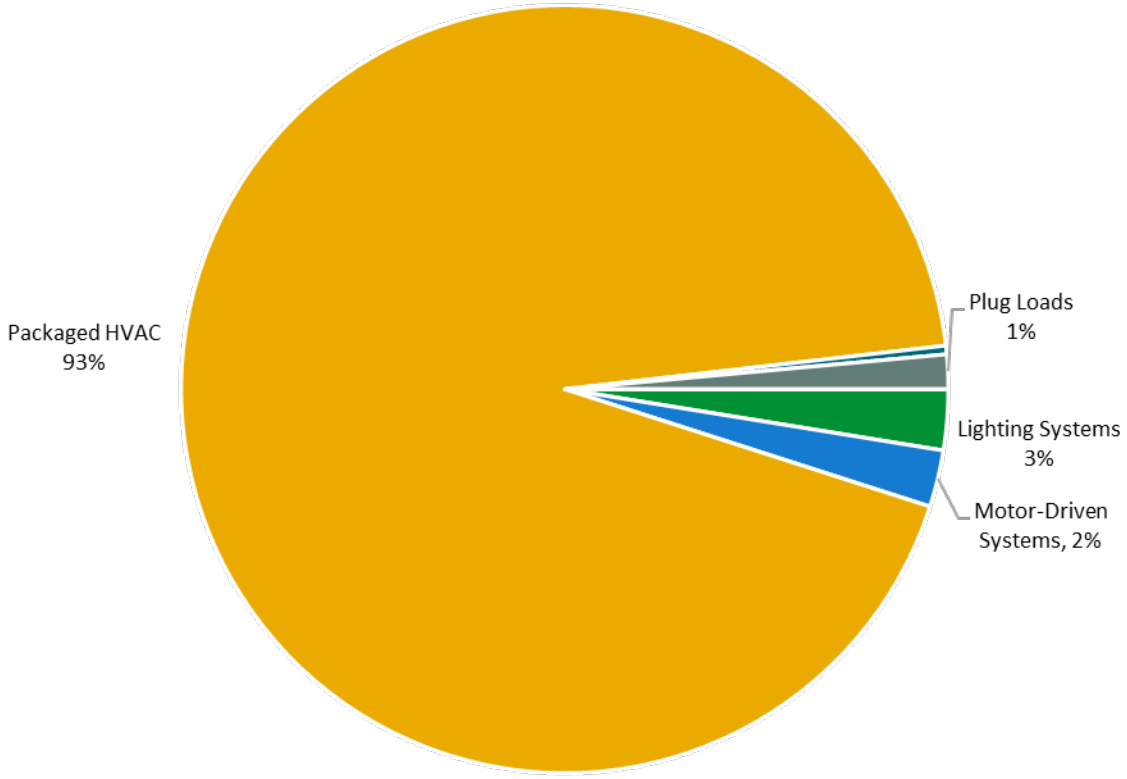
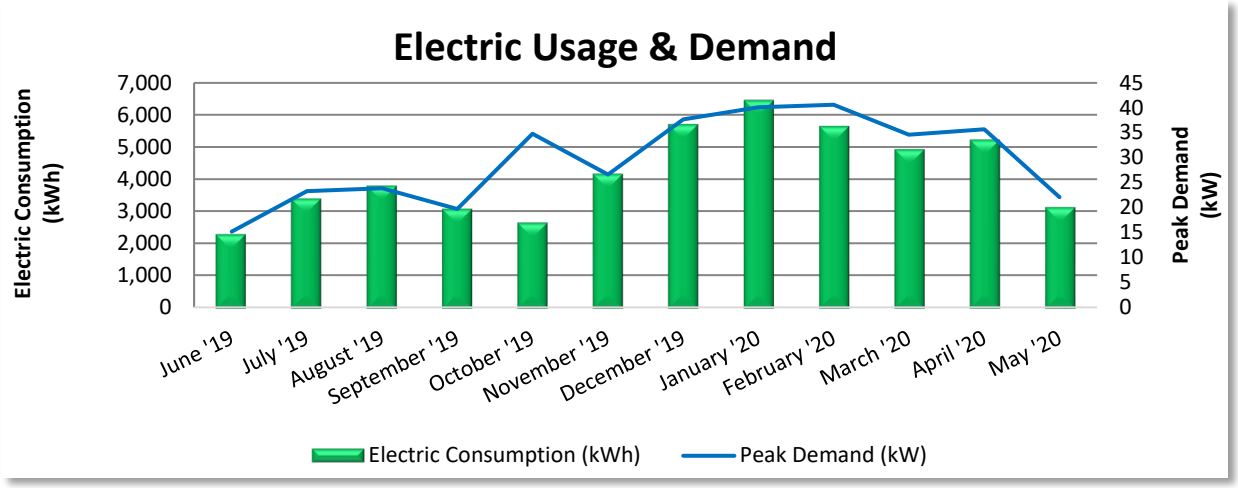


Figure 4 - Energy Balance

3.1 Electricity

PSE&G supplies and delivers electricity under rate class GLP.



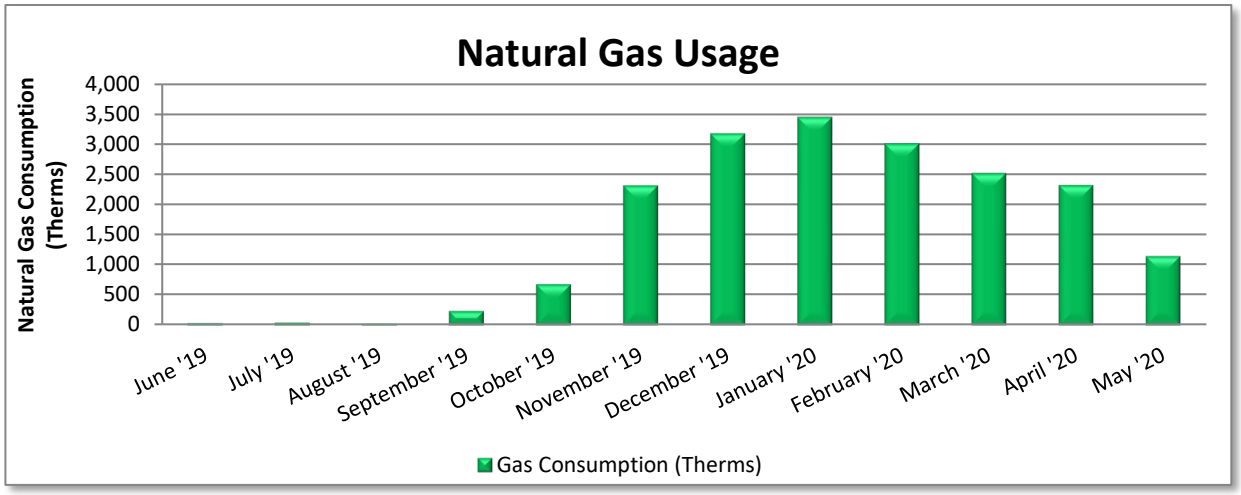
Electric Billing Data					
Period Ending	**Days in Period**	**Electric Usage (kWh)**	**Demand (kW)**	**Demand Cost**	**Total Electric Cost**
6/20/19	30	2,309	15	$292	$622
7/22/19	32	3,420	23	$533	$781
8/20/19	29	3,818	24	$535	$793
9/19/19	30	3,090	20	$477	$673
10/18/19	29	2,669	35	$68	$440
11/19/19	32	4,190	27	$105	$688
12/19/19	30	5,713	38	$148	$948
1/22/20	34	6,465	40	$171	$1,080
2/20/20	29	5,653	41	$160	$957
3/20/20	29	4,945	35	$299	$832
4/21/20	32	5,241	36	$360	$861
5/20/20	29	3,139	22	$249	$592
Totals	**365**	**50,652**	**41**	**$3,397**	**$9,268**
Annual	**365**	**50,652**	**41**	**$3,397**	**$9,268**

Notes:

- Peak demand of 41 kW occurred in February '20.
- Average demand over the past 12 months was 30 kW.
- The average electric cost over the past 12 months was $0.183/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 supplies and delivers natural gas under rate class LVG.



Gas Billing Data			
Period Ending	**Days in Period**	**Natural Gas Usage (Therms)**	**Natural Gas Cost**
6/20/19	30	36	$158
7/22/19	32	46	$162
8/20/19	29	28	$152
9/19/19	30	242	$266
10/18/19	29	681	$575
11/19/19	32	2315	$2,159
12/19/19	30	3170	$2,721
1/22/20	34	3445	$2,823
2/20/20	29	3009	$2,434
3/20/20	29	2516	$2,088
4/21/20	32	2317	$1,481
5/20/20	29	1144	$797
Totals	**365**	**18,949**	**$15,817**
Annual	**365**	**18,949**	**$15,817**

Notes:

- The average gas cost for the past 12 months is $0.835/therm, which is the blended rate used throughout the analysis.
- The gas usage profile shows high usage in the winter months, and minimal use in the summer months, as natural gas is used solely for space heating.

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.

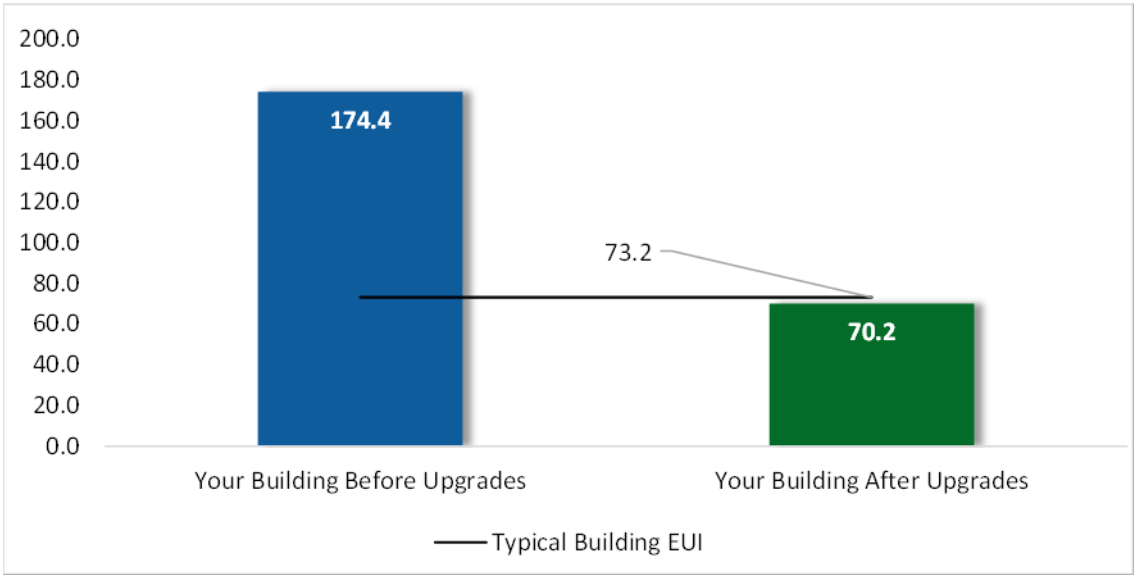


Figure 5 - Energy Use Intensity Comparison[3]

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			**6,623**	**1.5**	**-2**	**$1,199**	**$4,573**	**$983**	**$3,590**	**3.0**	**6,491**
ECM 1	Install LED Fixtures	Yes	0	0.0	0	$0	$680	$0	$680	0.0	0
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	30	0.0	0	$5	$118	$20	$98	18.1	29
ECM 3	Retrofit Fixtures with LED Lamps	Yes	6,488	1.4	-1	$1,175	$3,557	$963	$2,594	2.2	6,358
ECM 4	Install LED Exit Signs	Yes	105	0.0	0	$19	$217	$0	$217	11.4	103
Lighting Control Measures			**2,326**	**0.5**	**-1**	**$421**	**$3,010**	**$375**	**$2,635**	**6.3**	**2,280**
ECM 5	Install Occupancy Sensor Lighting Controls	Yes	2,326	0.5	-1	$421	$3,010	$375	$2,635	6.3	2,280
Unitary HVAC Measures			**1,843**	**1.2**	**0**	**$337**	**$5,797**	**$80**	**$5,717**	**17.0**	**1,856**
ECM 6	Install High Efficiency Air Conditioning Units	No	282	0.2	0	$52	$1,928	$0	$1,928	37.4	284
ECM 7	Install High Efficiency PTAC/PTHP	Yes	1,561	1.0	0	$286	$3,869	$80	$3,789	13.3	1,572
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**627**	**$5,233**	**$25,058**	**$5,000**	**$20,058**	**3.8**	**73,398**
ECM 8	Install Infrared Heaters	Yes	0	0.0	627	$5,233	$25,058	$5,000	$20,058	3.8	73,398
HVAC System Improvements			**220**	**0.0**	**190**	**$1,630**	**$1,222**	**$770**	**$452**	**0.3**	**22,519**
ECM 9	Install Occupancy-Controlled Thermostats	Yes	0	0.0	190	$1,590	$1,193	$750	$443	0.3	22,298
ECM 10	Install Pipe Insulation	Yes	220	0.0	0	$40	$29	$20	$9	0.2	221
Domestic Water Heating Upgrade			**164**	**0.0**	**0**	**$30**	**$14**	**$14**	**$0**	**0.0**	**165**
ECM 11	Install Low-Flow DHW Devices	Yes	164	0.0	0	$30	$14	$14	$0	0.0	165
Custom Measures			**0**	**0.0**	**382**	**$3,189**	**$33,408**	**$0**	**$33,408**	**10.5**	**44,727**
ECM 12	Building Envelope Improvements	Yes	0	0.0	382	$3,189	$33,408	$0	$33,408	10.5	44,727
TOTALS			**11,175**	**3.2**	**1,197**	**$12,039**	**$73,082**	**$7,222**	**$65,860**	**5.5**	**151,436**

* - 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 3 – 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		**6,623**	**1.5**	**-2**	**$1,199**	**$4,573**	**$983**	**$3,590**	**3.0**	**6,491**
ECM 1	Install LED Fixtures	0	0.0	0	$0	$680	$0	$680	0.0	0
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	30	0.0	0	$5	$118	$20	$98	18.1	29
ECM 3	Retrofit Fixtures with LED Lamps	6,488	1.4	-1	$1,175	$3,557	$963	$2,594	2.2	6,358
ECM 4	Install LED Exit Signs	105	0.0	0	$19	$217	$0	$217	11.4	103
Lighting Control Measures		**2,326**	**0.5**	**-1**	**$421**	**$3,010**	**$375**	**$2,635**	**6.3**	**2,280**
ECM 5	Install Occupancy Sensor Lighting Controls	2,326	0.5	-1	$421	$3,010	$375	$2,635	6.3	2,280
Unitary HVAC Measures		**1,561**	**1.0**	**0**	**$286**	**$3,869**	**$80**	**$3,789**	**13.3**	**1,572**
ECM 7	Install High Efficiency PTAC/PTHP	1,561	1.0	0	$286	$3,869	$80	$3,789	13.3	1,572
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**627**	**$5,233**	**$25,058**	**$5,000**	**$20,058**	**3.8**	**73,398**
ECM 8	Install Infrared Heaters	0	0.0	627	$5,233	$25,058	$5,000	$20,058	3.8	73,398
HVAC System Improvements		**220**	**0.0**	**190**	**$1,630**	**$1,222**	**$770**	**$452**	**0.3**	**22,519**
ECM 9	Install Occupancy-Controlled Thermostats	0	0.0	190	$1,590	$1,193	$750	$443	0.3	22,298
ECM 10	Install Pipe Insulation	220	0.0	0	$40	$29	$20	$9	0.2	221
Domestic Water Heating Upgrade		**164**	**0.0**	**0**	**$30**	**$14**	**$14**	**$0**	**0.0**	**165**
ECM 11	Install Low-Flow DHW Devices	164	0.0	0	$30	$14	$14	$0	0.0	165
Custom Measures		**0**	**0.0**	**382**	**$3,189**	**$33,408**	**$0**	**$33,408**	**10.5**	**44,727**
ECM 12	Building Envelope Improvements	0	0.0	382	$3,189	$33,408	$0	$33,408	10.5	44,727
TOTALS		**10,893**	**3.0**	**1,197**	**$11,987**	**$71,154**	**$7,222**	**$63,932**	**5.3**	**151,152**

* - 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 4 – 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		**6,623**	**1.5**	**-2**	**$1,199**	**$4,573**	**$983**	**$3,590**	**3.0**	**6,491**
ECM 1	Install LED Fixtures	0	0.0	0	$0	$680	$0	$680	0.0	0
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	30	0.0	0	$5	$118	$20	$98	18.1	29
ECM 3	Retrofit Fixtures with LED Lamps	6,488	1.4	-1	$1,175	$3,557	$963	$2,594	2.2	6,358
ECM 4	Install LED Exit Signs	105	0.0	0	$19	$217	$0	$217	11.4	103

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: exterior of building.

ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

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

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

This measure does not have a great payback, due to the low operating hours and burnt out bulbs, but we recommend completing all lighting in this building as combined it has a strong payback period. Additionally, elimination of T-12 fluorescent sources will reduce the need to stock this type of replacement lamp.

Affected building areas: T-12 lamps in tree cutting storage.

ECM 3: Retrofit Fixtures with LED Lamps

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

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

Affected building areas: all areas with fluorescent fixtures with T8 tubes and incandescent bulbs.

ECM 4: Install LED Exit Signs

Replace compact fluorescent exit signs with LED exit signs. LED exit signs require virtually no maintenance and have a life expectancy of at least 20 years. This measure saves energy by installing LED fixtures, which use less power than other technologies with an equivalent lighting output. Maintenance savings and improved reliability may also be achieved, as the longer-lasting LED lamps will not need to be replaced as often as the existing 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		**2,326**	**0.5**	**-1**	**$421**	**$3,010**	**$375**	**$2,635**	**6.3**	**2,280**
ECM 5	Install Occupancy Sensor Lighting Controls	2,326	0.5	-1	$421	$3,010	$375	$2,635	6.3	2,280

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 5: Install Occupancy Sensor Lighting Controls

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

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

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

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

Affected building areas: offices, bathroom, break room, and garage bays.

4.3 Unitary HVAC

#	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)
Unitary HVAC Measures		**1,843**	**1.2**	**0**	**$337**	**$5,797**	**$80**	**$5,717**	**17.0**	**1,856**
ECM 6	Install High Efficiency Air Conditioning Units	282	0.2	0	$52	$1,928	$0	$1,928	37.4	284
ECM 7	Install High Efficiency PTAC/PTHP	1,561	1.0	0	$286	$3,869	$80	$3,789	13.3	1,572

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

ECM 6: Install High Efficiency Air Conditioning Units

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

Affected units: supervisor's office and break room.

ECM 7: Install High Efficiency PTAC/PTHP

Replace packaged terminal air conditioners and heat pumps (PTAC and PTHP) with high efficiency units. A higher EER or SEER rating indicates a more efficient cooling system and a higher HSPF rating indicates more efficient heating mode. The magnitude of energy savings for this measure depends on the relative efficiency of the older unit versus the new high efficiency unit, the average heating and cooling loads, and the estimated annual operating hours.

Affected units: supervisor's office.

4.4 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**	**627**	**$5,233**	**$25,058**	**$5,000**	**$20,058**	**3.8**	**73,398**
ECM 8	Install Infrared Heaters	0	0.0	627	$5,233	$25,058	$5,000	$20,058	3.8	73,398

ECM 8: Install Infrared Heaters

Replace 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 of 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.

The recommendation of this measure depends on the heating goals of the facility. If the garage space is heated to keep staff comfortable when in the building, this measure should be utilized, but if the space is heated mainly to keep the engines warm, you may want to consider using engine block heaters for any critical vehicles and continue using the unit heaters to keep the building much cooler, such as around 45°F - 50°F, rather than in the 60°F - 70°F range as is the current case.

Also, note, the project economics do not include replacement of the non-functioning heater in the warehouse bay.

Affected building areas: garage bays.

4.5 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		**220**	**0.0**	**190**	**$1,630**	**$1,222**	**$770**	**$452**	**0.3**	**22,519**
ECM 9	Install Occupancy-Controlled Thermostats	0	0.0	190	$1,590	$1,193	$750	$443	0.3	22,298
ECM 10	Install Pipe Insulation	220	0.0	0	$40	$29	$20	$9	0.2	221

ECM 9: Install Occupancy-Controlled Thermostats

Replace manual thermostats with occupancy-controlled thermostats. An occupancy controlled-thermostat is paired with a door detector and/or sensor to identify movement and determine if a room is occupied or unoccupied. When occupancy is detected, the thermostat enables the programmed temperature setpoint. If no occupancy is sensed, the thermostat switches to unoccupied mode after a set period of time and reduces the temperature setpoint.

By reducing heating temperature setpoints and increasing cooling temperature setpoints when the space is unoccupied, the operation of the HVAC equipment is reduced while still maintaining reasonable space temperatures for building usage. Occupancy controlled thermostats provide energy savings by reducing heating and cooling energy usage when rooms are unoccupied.

The recommendation of this measure depends on the heating goals of the facility, as stated in the description of ECM 8. If the garage space is heated to keep staff comfortable when in the building, this measure should be utilized, however, if the space is mainly heated to keep the engines warm, it would be more cost effective to set thermostats as low as possible to achieve that purpose.

ECM 10: Install Pipe Insulation

Install insulation on 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: domestic hot water piping.

4.6 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**164**	**0.0**	**0**	**$30**	**$14**	**$14**	**$0**	**0.0**	**165**
ECM 11	Install Low-Flow DHW Devices	164	0.0	0	$30	$14	$14	$0	0.0	165

ECM 11: Install Low-Flow DHW Devices

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

Device	Flow Rate
Faucet aerators (lavatory)	0.5 gpm

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

4.7 Custom Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Custom Measures		**0**	**0.0**	**382**	**$3,189**	**$33,408**	**$0**	**$33,408**	**10.5**	**44,727**
ECM 12	Building Envelope Improvements	0	0.0	382	$3,189	$33,408	$0	$33,408	10.5	44,727

ECM 12: 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 building.

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 recommend the installation of rigid board wall insulation on all sides of the building to reduce heat loss through walls. A discussion of the roll up doors and windows is included in the Section 4.8, "Measures for Future Consideration".

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.

The savings calculations for this measure assume that the proposed radiant heaters have been installed (ECM 8), and that the space temperatures have been reset based on the assumptions outlined in ECM 9.

4.9 Measures for Future Consideration

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

City of Orange Township may wish to consider the Energy Savings Improvement Program (ESIP) or other whole building approach. With interest in implementing comprehensive, largescale and/or complex system wide projects, these measures may be pursued during development of a future energy savings plan. We recommend that you work with your energy service company (ESCO) and/or design team to:

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

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

Upgrade to a Heat Pump System

An electric hot water heater has no flue loss through a chimney. The AFUE rating for an all-electric DHW heater is between 95% and 100%. The lower values are for units installed outdoors because they have greater jacket heat loss. However, despite their high efficiency, the higher cost of electricity in most parts of the country makes all-electric heaters an uneconomic choice. If you are interested in electric DHW heating, consider installing a heat pump system.

Electric heaters can be inexpensive to install and expensive to run. Facilities with these systems can save substantial energy at a moderate cost by installing a hot water heat pump when they replace the existing heater. Electric heat pumps have high COP ratings and are substantially more efficient than traditional DHW heating systems. Further investigation is required to determine whether installing a heat pump system is a cost-effective solution when replacing existing electrical DHW heater, but the hot water heater unit would need to be relocated to a space that was more open, as a heat pump unit needs large volumes of air to pull heat from in order to heat the water efficiently.

Window Replacements

Energy efficient windows are an important consideration when improving the building envelope. The heat transfer through the glass panes is responsible for a significant portion of the facility's heating and cooling energy consumption. We recommend replacing single pane windows with double pane windows and considering models that are gas-filled with low-e coatings to reduce heat loss. Windows should be selected with low- U-factors to maximize energy savings. The U-factor is the rate at which the window conducts non-solar heat flow and is a key indicator of performance. The lower the U-factor, the higher the efficiency of the window. Window frames and sashes should be efficient as well. If metal frames are specified or required by code, the frame extrusions should have a thermal break to reduce conduction through the frame. As part of the installation, the window frames should be properly sealed with caulk materials to ensure the mitigation of air infiltration. Building envelopes that limit air infiltration and that have adequate fenestrations play a key role in optimizing heating and cooling efficiency, controlling moisture, and providing occupant comfort. Window system replacement is an expensive upgrade that generally involves architectural elements. We recommend this as a measure for further study.

High Speed Insulated Overhead Doors

Energy efficient overhead doors are an important consideration when improving the building envelope of the garage areas. The heat loss when overhead doors are open is responsible for a significant portion of the facility's heating energy consumption. We recommend replacing overhead doors with high speed insulated overhead doors. This measure will permit overhead doors to open and close more than twice as quickly as the existing case, significantly reducing heat loss in the garage area. The insulation will further mitigate heat loss when the doors are closed.

As part of the installation, the overhead door frames should be properly sealed with weather stripping and sealing materials to ensure the mitigation of air infiltration. Building envelopes that limit air infiltration play a key role in optimizing heating and cooling efficiency, controlling moisture, and providing occupant comfort. Overhead door replacement may be an expensive upgrade, especially as it may involve structural or architectural elements.

Overall savings will also vary depending on the type of heating system present. Since infrared heaters tend to radiate heat directly to occupants or objects, they contribute less to overall heat loss than forced air systems do. Areas with forced air heat are the better candidates for this measure.

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.

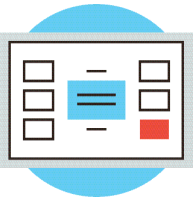
Lighting Maintenance

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

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

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

Thermostat Schedules and Temperature Resets



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

Water Heater Maintenance

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

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

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

Compressed Air System Maintenance

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

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

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

Water Conservation

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

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

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

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

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

Procurement Strategies

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

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

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

6 On-site Generation

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

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

6.1 Solar Photovoltaic

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

A preliminary screening based on the facility's electric demand, size and location of free area, and shading elements shows that the facility has 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.

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.

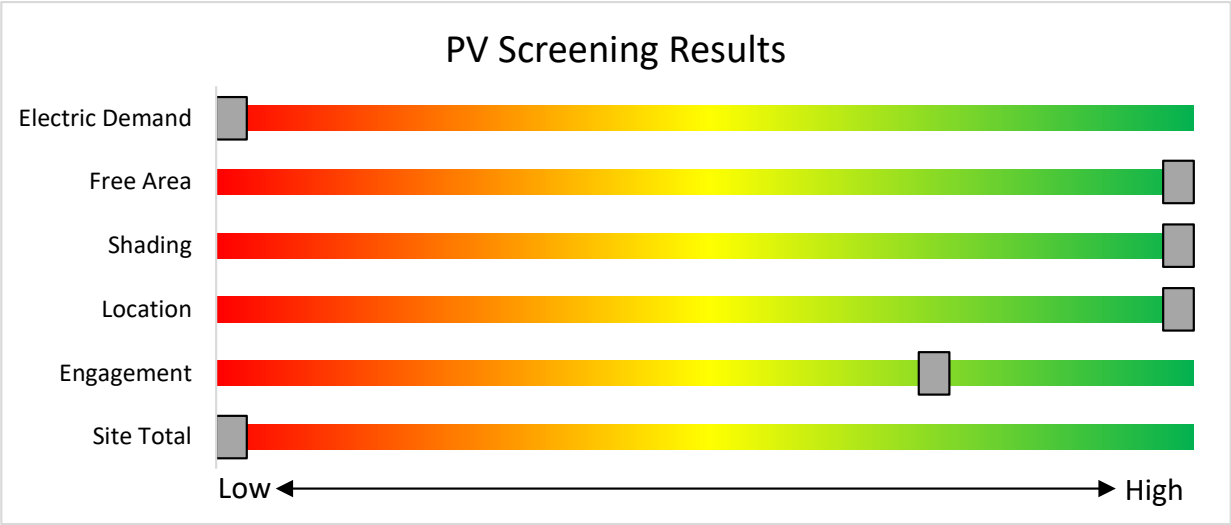


Figure 8 - Photovoltaic Screening

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

6.2 Combined Heat and Power

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

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

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

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

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

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

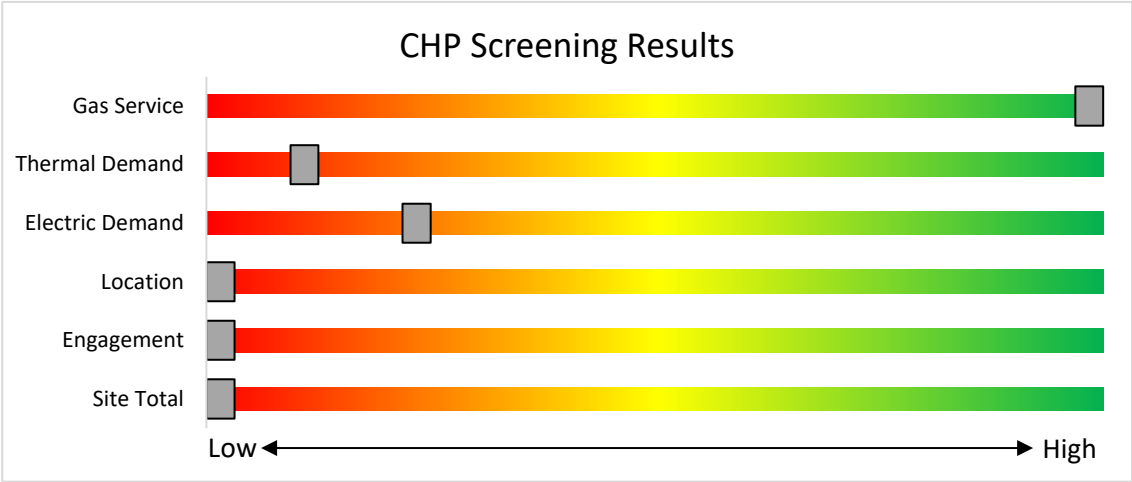


Figure 9 - Combined Heat and Power Screening

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

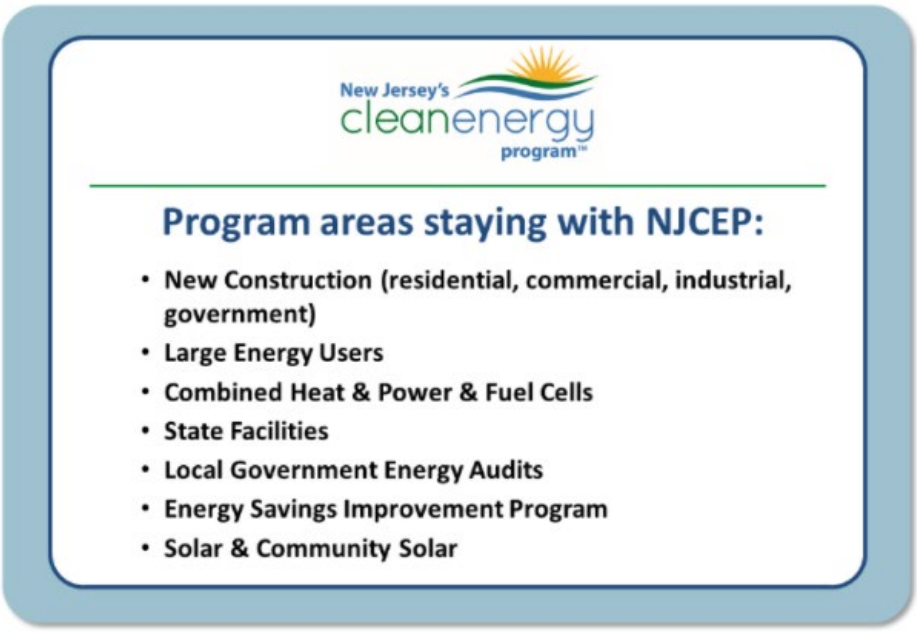
Ready to improve your building's performance? Your utility provider may be able to help.

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] Gas Internal Combustion Engine	≤500 kW	$2,000	30-40%[2]	$2 million
	>500 kW - 1 MW	$1,000		
Gas Combustion Turbine Microturbine Fuel Cells with Heat Recovery	> 1 MW - 3 MW	$550	30%	$3 million
	>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 in to contracts to help finance building energy upgrades. Annual payments are lower than the savings projected from the ECMs, ensuring that ESIP projects are cash flow positive for the life of the contract.

ESIP provides government agencies in New Jersey with a flexible tool to improve and reduce energy usage with minimal expenditure of new financial resources. NJCEP incentive programs described above can also be used to help further reduce the total project cost of eligible measures.

How to Participate

This LGEA report is the first step to participating in ESIP. Next, you will need to select an approach for implementing the desired ECMs:

(1) Use an energy services company or "ESCO."

(2) Use independent engineers and other specialists, or your own qualified staff, to provide and manage the requirements of the program through bonds or lease obligations.

(3) Use a hybrid approach of the two options described above where the ESCO is used for some services and independent engineers, or other specialists or qualified staff, are used to deliver other requirements of the program.

After adopting a resolution with a chosen implementation approach, the development of the energy savings plan (ESP) can begin. The ESP demonstrates that the total project costs of the ECMs are offset by the energy savings over the financing term, not to exceed 15 years. The verified savings will then be used to pay for the financing.

The ESIP approach may not be appropriate for all energy conservation and energy efficiency improvements. Carefully consider all alternatives to develop an approach that best meets your needs. A detailed program descriptions and application can be found at www.njcleanenergy.com/ESIP.

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

8.3 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 New Jersey Class I REC.

TRECs will be used by the identified compliance entities to satisfy a compliance obligation tied to a new Transition Incentive Renewable Portfolio Standard ("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.

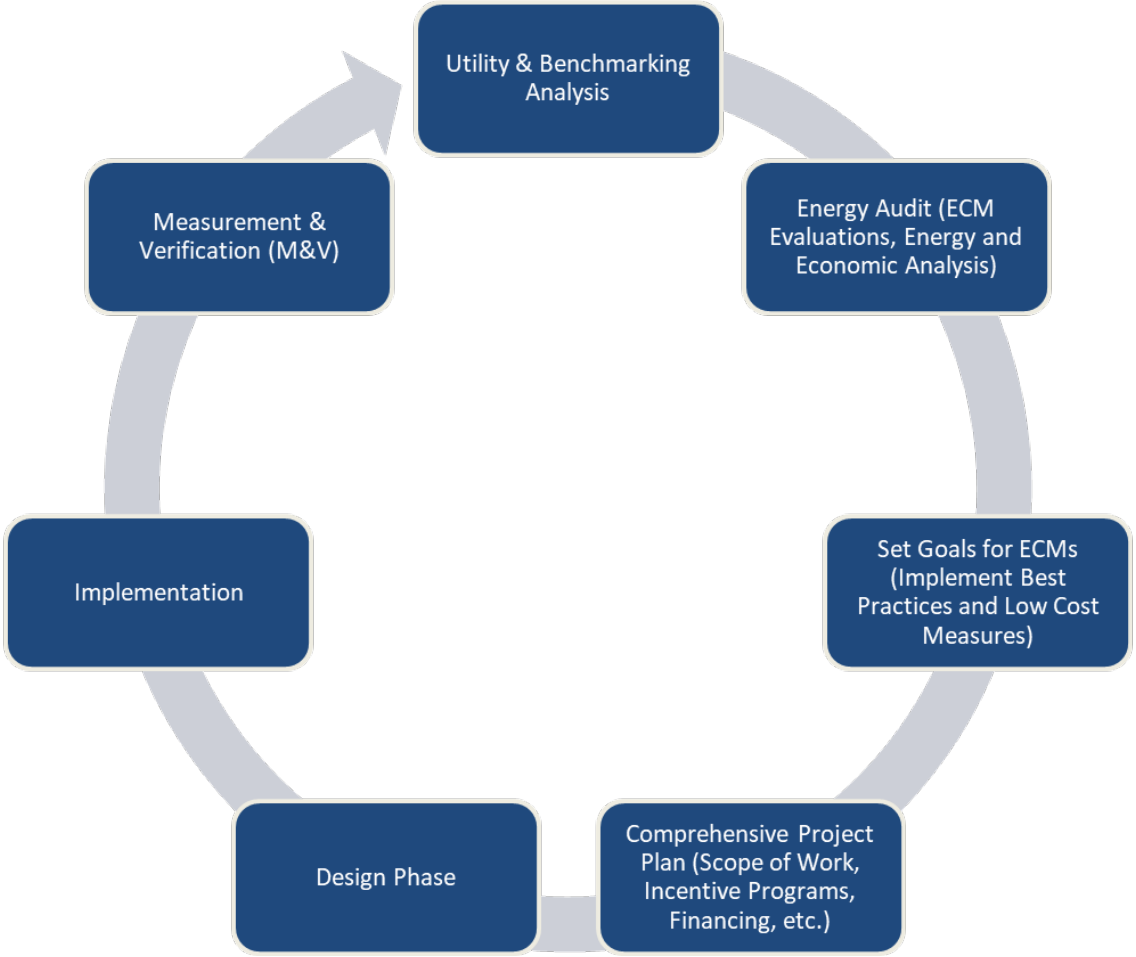


Figure 50 – Project Development Cycle

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	LED - Fixtures: Outdoor Wall Mount	Photocell		20	0		None	No	1	LED - Fixtures: Outdoor Wall Mount	Photocell	20	0	0.0	0	0	$0	$0	$0	0.0
Exterior	3	Metal Halide: (1) 100W Lamp	Photocell		128	0	1	Fixture Replacement	No	3	LED - Fixtures: Wall Sconces	Photocell	30	0	0.0	0	0	$0	$680	$0	0.0
Garage office	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,600	5	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,794	0.0	47	0	$8	$116	$20	11.3
Garage office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	31	2,600	3, 5	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,794	0.0	57	0	$10	$189	$40	14.4
Janitorial closet	1	Incandescent: A19	Wall Switch	S	60	2,600	3, 5	Relamp	Yes	1	LED Lamps: 9W A19	Occupancy Sensor	9	1,794	0.0	140	0	$25	$133	$1	5.2
Main Garage Area	1	Exit Signs: Fluorescent	None		10	8,760	4	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.0	35	0	$6	$72	$0	11.4
Main Garage Area	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	3,000	3, 5	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,070	0.3	1,332	0	$241	$708	$155	2.3
Main Garage Area	24	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	3,000	3, 5	Relamp	Yes	24	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,070	1.2	5,327	-1	$964	$2,833	$620	2.3
Main Garage Area	5	Linear Fluorescent - T8: 4' T8 (32W) - 6L	Wall Switch	S	88	2,600	3	Relamp	No	5	LED - Linear Tubes: (6) 4' Lamps	Wall Switch	87	2,600	0.0	13	0	$2	$548	$150	169.0
Restroom - Unisex 1	2	Incandescent: A19	Wall Switch	S	30	2,600	3, 5	Relamp	Yes	2	LED Lamps: 9W A19	Occupancy Sensor	9	1,794	0.0	124	0	$22	$304	$37	11.9
Supervisors office	1	LED - Fixtures: Ambient 2x2 Fixture	Wall Switch	S	40	2,600	5	None	Yes	1	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	40	1,794	0.0	32	0	$6	$0	$0	0.0
Supervisors office	2	LED - Fixtures: Ambient 1x4 Fixture	Wall Switch	S	30	2,600	5	None	Yes	2	LED - Fixtures: Ambient 1x4 Fixture	Occupancy Sensor	30	1,794	0.0	48	0	$9	$116	$20	11.0
Tree cutting storage	1	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	S	88	1,000	2, 5	Relamp & Reballast	Yes	1	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	690	0.0	48	0	$9	$234	$20	24.7
Warehouse bay 1	2	Exit Signs: Fluorescent	None		10	8,760	4	Fixture Replacement	No	2	LED Exit Signs: 2 W Lamp	None	6	8,760	0.0	70	0	$13	$145	$0	11.4
Warehouse bay 1	7	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	3,000	3, 5	Relamp	Yes	7	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,070	0.3	1,554	0	$281	$1,051	$210	3.0
Break room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,600	3, 5	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,794	0.0	109	0	$20	$307	$45	13.2
Break room	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	43	2,600	3, 5	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,794	0.0	14	0	$3	$146	$40	41.3

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
Main Garage	Garage Bays	9	Other	0.5	70.0%	No	Life Master	MT5011	W	61		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Break Room	Break Room	1	Exhaust Fan	0.5	70.0%	No	Unknown	Unknown	W	2,745		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Warehouse Bay 1	Garage Bays	1	Other	0.5	70.0%	No	Life Master	MT5011	W	61		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Main Garage	Garage Bays	1	Supply Fan	0.8	70.0%	No	Unknown	Unknown	W	3,750		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Warehouse Bay 1	Garage Bays	4	Supply Fan	0.8	70.0%	No	Unknown	Unknown	W	3,750		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Main Garage	Various	1	Air Compressor	2.0	86.0%	No	Prolift	Unknown	W	730		No	86.0%	No		0.0	0	0	$0	$0	$0	0.0
Main Garage	Various	1	Air Compressor	2.0	89.0%	No	Unknown	Unknown	W	730		No	89.0%	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
Warehouse Bay 1	Bay 1	1	Unit Heater		76.09		0.760935900202533 AFUE	Carrier	Unknown	W	8	Yes	1	Infrared Heater		60.87		0.93 Et	0.0	0	130	$1,088	$4,991	$1,000	3.7
Main Garage	Garage	2	Unit Heater		79.00		0.790049875156172 AFUE	Reznor	Unknown	W	8	Yes	2	Infrared Heater		63.20		0.93 29.4206968253968	0.0	0	242	$2,019	$10,060	$2,000	4.0
Main Garage	Garage	2	Unit Heater		77.05		0.770519354922616 AFUE	Gama	C9MPX100L20A2	W	8	Yes	2	Infrared Heater		61.64		0.93 29.4206968253968	0.0	0	255	$2,125	$10,007	$2,000	3.8
Supervisors Office	Supervisors Office	1	Packaged Terminal AC	1.00	11.00	9.80	1 COP	West Point	MWJ-12ERN1-MI8	W	7	Yes	1	Packaged Terminal HP	1.00	11.00	10.50	3.1 COP	1.0	1,561	0	$286	$3,869	$80	13.3
Supervisors Office	Supervisors Office	1	Electric Resistance Heat		7.68		1 COP	Unknown	Unknown	B		No							0.0	0	0	$0	$0	$0	0.0
Supervisors Office	Supervisors Office	1	Window AC	0.50		10.00		GE		B	6	Yes	1	Window AC	0.50		12.00		0.1	88	0	$16	$522	$0	32.6
Break Room	Break Room	2	Through-The-Wall AC	1.00		10.80		Frigidaire	FAC126P1A	W	6	Yes	2	Through-The-Wall AC	1.00		12.00		0.1	194	0	$36	$1,406	$0	39.5
Tree Cutting Storage Room	Tree Cutting Storage Room	1	Window AC	0.50		10.00		GE		B		No							0.0	0	0	$0	$0	$0	0.0
Garage Office	Garage Office	1	Packaged Terminal AC	1.00	8.00	11.20	1 COP	LG	LW1216HR	W		No							0.0	0	0	$0	$0	$0	0.0

Occupancy Controlled 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 (MBh)	Output Heating Capacity of Controlled System (MBh)	Cooling Setpoint Temp (deg F)	Heating Setpoint Temp (deg F)	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	Garage Bays	9	4.00	0.00	0.00	312.11	70	70	0.0	0	152	$1,272	$954	$600	0.3
Garage Bay 1	Garage Bay 1	9	1.00	0.00	0.00	76.09	70	70	0.0	0	38	$318	$239	$150	0.3

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
Janitors Closet	DHW Piping	10	5	1.00	0.0	220	0	$40	$29	$20	0.2

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
Janitorial closet	Bathroom	1	Storage Tank Water Heater (≤ 50 Gal)	Rheem	PROE30 2 RH93	W		No						0.0	0	0	$0	$0	$0	0.0

Low-Flow Device Recommendations

	Recommendation Inputs					Energy Impact & Financial Analysis						
Location	ECM #	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Restroom	11	2	Faucet Aerator (Lavatory)	1.50	0.50	0.0	164	0	$30	$14	$14	0.0

Plug Load Inventory

	Existing Conditions					
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Break room	1	Microwave	1,500	No	Emerson	
Break room	1	Refrigerator	700	No	Frigidaire	FFHT1715LWD
Break room	1	Television	200	No	Toshiba	
Garage office	1	Laptop	75	No	Toughbook charge	
Garage office	1	Printer (Medium/Small)	600	No	Hp	
Supervisors office	2	Desktop	270	No		
Supervisors office	1	Microwave	1,500	No		
Supervisors office	1	Refrigerator (Mini)	300	No	Insignia	
Supervisors office	2	Television	200	No		
Tree cutting storage	1	Microwave	1,500	No		
Tree cutting storage	1	Refrigerator (Mini)	300	No	Sanyo	
Garage	15	Various Tools	300	No	Various	Various

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	644,356	652,729	Install Exterior Wall Insulation	288,832	652,729	0.00	0	382	$3,189	$33,408	$0	$0	$0	$33,408	10.48	10.48					

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]

Public Works - Brook Alley Garage

Primary Property Type: Repair Services (Vehicle, Shoe, Locksmith, etc.)
Gross Floor Area (ft²): 11,856
Built: 1968

For Year Ending: December 31, 2019
Date Generated: May 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
Public Works - Brook Alley Garage Brook Alley Place & Center Street City of Orange Township, New Jersey 07050	Orange Township City Municipality 29 North Day Street Orange Township, City of, NJ 07050 862-438-0647	Kathrina Nease 29 North Day Street Orange Township, City of, NJ 07050 862-438-0647 knease@orangenj.gov

Property ID: 15960985

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
91.3 kBtu/ft²

Source EUI
120.9 kBtu/ft²

Annual Energy by Fuel	
Electric - Grid (kBtu)	169,246 (16%)
Natural Gas (kBtu)	913,456 (84%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	73.2
National Median Source EUI (kBtu/ft²)	96.9
% Diff from National Median Source EUI	25%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	65

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.