Local Government Energy Audit Report

Cranbury Public Library

August 26, 2024

Prepared for:
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Cranbury, New Jersey 08512

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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 on 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.

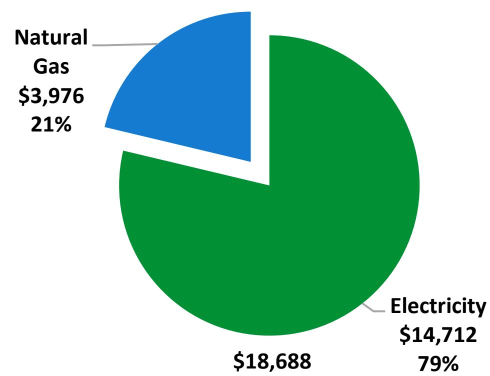
The customer and their respective contractor(s) are responsible to implement energy conservation measures in complete conformance with all applicable local, state, and federal requirements.

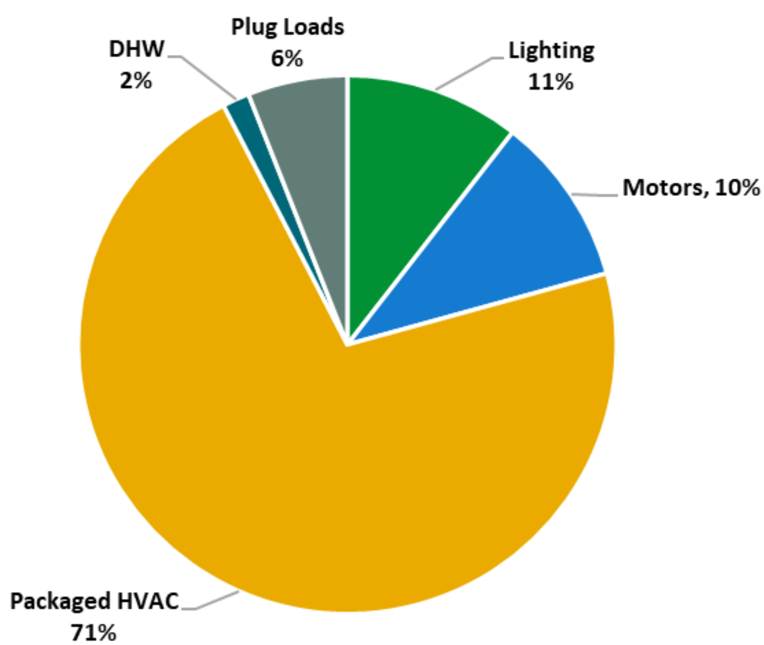
Table of Contents

1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Cranbury Public Library. 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 Energy Utilities	Costs: $18,688 Electricity: 92,960 kWh Natural Gas: 3,619 Therms Water: 21,000 Gallons	
ENERGY STAR® Benchmarking Score	N/A *(1-100 scale)*	A standard energy use benchmark is not available for this facility type. This report contains suggestions about how to improve building performance and reduce energy costs.



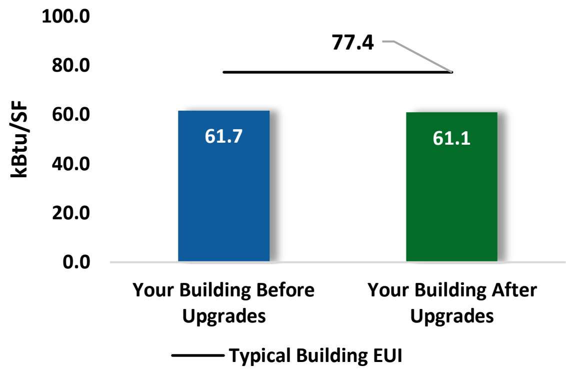
Energy Use by System

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.

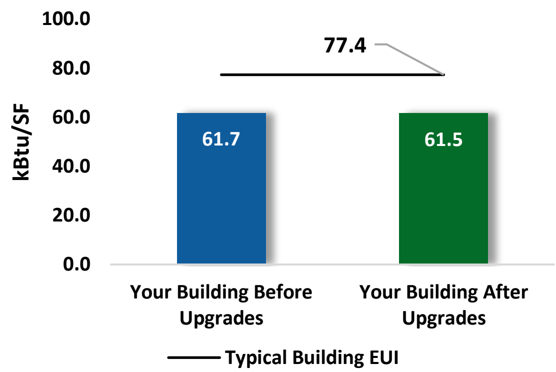
Scenario 1: Full Package (All Evaluated Measures)

Installation Cost	$3,020
Potential Rebates & Incentives[1]	$30
Annual Cost Savings	$4
Annual Energy Savings	Electricity: -632 kWh Natural Gas: 95 Therms
Greenhouse Gas Emission Savings	0 Tons
Simple Payback	665.4 Years
Site Energy Savings (All Utilities)	1%



Scenario 2: Cost Effective Package[2]

Installation Cost	$120
Potential Rebates & Incentives	$30
Annual Cost Savings	$41
Annual Energy Savings	Electricity: 156 kWh Natural Gas: 15 Therms
Greenhouse Gas Emission Savings	0 Tons
Simple Payback	2.2 Years
Site Energy Savings (all utilities)	0%



On-site Generation Potential

Photovoltaic	High
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)
HVAC System Improvements			**74**	**0.0**	**0**	**$12**	**$50**	**$10**	**$40**	**3.4**	**74**
ECM 1	Install Pipe Insulation	Yes	74	0.0	0	$12	$50	$10	$40	3.4	74
Domestic Water Heating Upgrade			**82**	**0.0**	**2**	**$30**	**$70**	**$20**	**$50**	**1.7**	**262**
ECM 2	Install Low-Flow DHW Devices	Yes	82	0.0	2	$30	$70	$20	$50	1.7	262
Custom Measures* **			**-788**	**0.0**	**8**	**-$37**	**$2,900**	**$0**	**$2,900**	**-78.4**	**143**
ECM 3	Replace Gas Fired Water Heater with Heat Pump Water Heater***	No	-788	0.0	8	-$37	$2,900	$0	$2,900	-78.4	143
TOTALS (COST EFFECTIVE MEASURES)			**156**	**0.0**	**2**	**$41**	**$120**	**$30**	**$90**	**2.2**	**336**
TOTALS (ALL MEASURES)			**-632**	**0.0**	**10**	**$4**	**$3,020**	**$30**	**$2,990**	**665.4**	**480**

* - All incentives presented in this table are included as placeholders for planning purposes 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).

*** - Negative payback explained in section 4.3

All Evaluated Energy Improvements[3]

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

[3] 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.

1.1 Planning Your Project

Careful planning makes for a successful energy project. When considering this scope of work, you will have some decision 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.

Options from Your Utility Company

Prescriptive and Custom Rebates

For facilities wishing to pursue only selected individual measures (or planning to phase implementation of selected measures over multiple years), incentives are available through the Prescriptive and Custom Rebates program. To participate, you can use internal resources or an outside firm or contractor to perform the final design of the ECM(s) and install the equipment. Program pre-approval may be required for some incentives. Contact your utility company for more details prior to project installation.

Direct Install

The Direct Install program provides turnkey installation of multiple measures through an authorized contractor. This program can provide incentives up to 70% or 80% of the cost of selected measures. A Direct Install contractor will assess and verify individual measure eligibility and perform the installation work. The Direct Install program is available to sites with an average peak demand of less than 200 kW.

Engineered Solutions

The Engineered Solutions program provides tailored energy-efficiency assistance and turnkey engineering services to municipalities, universities, schools, hospitals, and healthcare facilities (MUSH), non-profit entities, and multifamily buildings. The program provides all professional services from audit, design, construction administration, to commissioning and measurement and verification for custom whole-building energy-efficiency projects. Engineered Solutions allows you to install as many measures as possible under a single project as well as address measures that may not qualify for other programs.

For more details on these programs please contact your utility provider.

Options from New Jersey's Clean Energy Program

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 and Power (CHP)

The CHP program provides incentives for combined heat and power (i.e., 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.

Successor Solar Incentive Program (SuSI)

New Jersey is committed to supporting solar energy. Solar projects help the state reach the renewable goals outlined in the state's Energy Master Plan. The SuSI program is used to register and certify solar projects in New Jersey. Rebates are not available, but certified solar projects are able to earn one SREC II (Solar Renewable Energy Certificates II) for each megawatt-hour of solar electricity produced from a qualifying solar facility.

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.

Large Energy User Program (LEUP)

LEUP is designed to promote self-investment in energy efficiency for the largest energy consumers in the state. Customers in this category spend about $5 million a year on energy bills. This program incentivizes owners/users of buildings to upgrade or install energy conserving measures in existing buildings to help offset the capital costs associated with the project. The efficiency upgrades are customized to meet the requirements of the customers' existing facilities, while advancing the State's energy efficiency, conservation, and greenhouse gas reduction goals.

For more details on these programs please visit New Jersey's Clean Energy Program website.

2 Existing Conditions

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for the Cranbury Public Library. 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 June 5, 2024, TRC performed an energy audit at the Cranbury Public Library located in Cranbury, New Jersey. TRC met with Brooke Basista to review the facility operations and help focus our investigation on specific energy-using systems.

The Cranbury Public Library is a single story, 11,000 square foot building built in 2022. Spaces include, an archival room, circulation area, conference room, corridors, gallery area, large meeting room, offices, reading sections, restrooms, and mechanical spaces. The facility is 100% heated by air handling units (AHUs) equipped with gas-fired sections and electric resistance heaters. The entire facility is cooled by split AC and VRF systems.

Recent Improvements and Facility Concerns

The building is newly constructed and there are no facility concerns at the moment.

2.2 Building Occupancy

The facility is occupied Monday through Sunday with varying business hours. Janitorial services are performed during operational hours. Outside groups utilize the large meeting room as needed, after the library closes. Thirteen staff work at the library which sees around 100 patron visits per day.

Building Name	Weekday/Weekend	Operating Schedule
Cranbury Public Library Monday - Thrusday	Weekday	10:00 AM - 8:00 PM
	Weekend	N/A
Cranbury Public Library Friday	Weekday	10:00 AM - 5:00 PM
	Weekend	N/A
Cranbury Public Library Saturday	Weekday	N/A
	Weekend	10:00 AM - 4:00 PM
Cranbury Public Library Sunday	Weekday	N/A
	Weekend	12:00 PM - 4:00 PM

Building Occupancy Schedule

2.3 Building Envelope

Building walls are comprised of concrete masonry units (CMU) with an exterior vinyl siding. The roof is pitched, insulated, and the wood deck is clad in asphalt shingles. The facility envelope and roof are in good condition given the building's short age. Facility windows consist of operable and fixed, double paned units, with aluminum frames. All facility windows are in good condition and are sealed well. Facility doors include two types: aluminum framed glass units and solid metal units. Both door types are in good condition. Additionally, door seals are in good condition apart from the primary entrance doors where a gap in the doors can increase outside air infiltration.

Exterior Vinyl Siding

Pitched Asphalt Shingle Roof

Facility Windows

Solid Metal Door & Door Seal Gap

Solid Metal Door & Door Seal Gap

Aluminum Framed Glass Doors

2.4 Lighting Systems

The interior lighting system consists of LED sources. The most common LED lamps include, drop ceiling recessed 2-foot x 2-foot LED panels, recessed linear LED fixtures, LED downlight recessed fixtures, and LED decorative pendant fixtures. Wall switch and occupancy sensors control the lights and exit signs are up to date with LED technology. Overall, the current lighting system is in good condition and light levels are adequate.

Exterior lighting is provided by LED wall packs, LED bollards, and LED pole lights located in the parking lot. Photocells control the exterior lighting fixtures.

LED Linear Fixtures

LED Decorative Pendant

Ambient 2-foot x 2-foot LED Panel

LED Downlight Recessed Fixture

Wall Mounted Occupancy Sensor

LED Exit Sign

LED Wall Pack with Photocell

LED Bollard

LED Pole Light

2.5 Air Handling Systems (AHUs)

Unitary Electric HVAC Equipment

Eight split AC condensing units serve the building and terminate at evaporator coils installed in the above ceiling AHUs. The units' cooling capacities vary from 3.0 tons to 5.0 tons with the seasonal energy efficiency ratio (SEER) ratings ranging from 14 to 15.25.

A Data Aire™, 1 ton, 12 EER condensing unit serves the archival room, maintaining a safe climate for records.

A variable refrigerant flow (VRF) unit rated at 4 tons, only provides cooling to the building. All unitary HVAC equipment is new and is in good condition.

Exterior Condensing Units

VRF System

Unitary Heating Equipment

The conference room, director's office, and staff room are served by electric resistance heaters. Three additional heaters are located above ceiling. The units provide 3.41 MBh to 13.64 MBh (1 kW to 4 kW) of heating and are controlled by on-board dial or wall thermostat. The accessible units are new and in good condition.

Electric Resistance Heater

During the heating season, the adult reading section is occasionally served by a gas-fired fireplace. Name plate data for the unit was unavailable, as a result, the unit has an estimated capacity of 32 MBh.

Gas Fireplace

Air Handling Units (AHUs)

Air handling units are equipped with DX evaporator coils, gas-fired heating sections, and supply fan. Eight AHUs serve the building providing heating and cooling. The units were located above ceiling and were inaccessible during the audit. The units are new, with no reported facility concerns. According to the architectural schedule condensate pumps likely serve the AHU evaporative coils. Programmable thermostats control the AHUs and the occupied heating and cooling setpoints are 70°F and 74°F, respectively.

Unit Name	Location Served	Heating Capacity (MBh)	Annual Fuel Utilization Efficiency (AFUE)	Supply Fan (hp)
AH-1	Adult Reading Section	85	0.96	1.0
AH-2	Adult Reading Section	85	0.96	1.0
AH-3	Children's Section	85	0.96	1.0
AH-4	Teen Section	85	0.96	0.75
AH-5	Circulation Desk	62	0.96	0.50
AH-6	Meeting Room	85	0.96	0.75
AH-7	Meeting Room	85	0.96	1.0
AH-8	Gallery & Attic	85	0.96	1.0

2.6 Domestic Hot Water

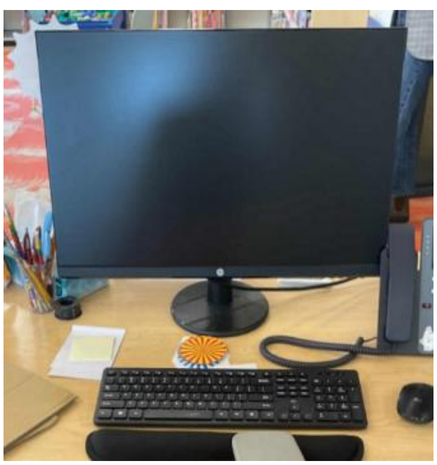
Hot water is produced by an A.O. Smith, natural gas, 50-gallon, 62 MBh, domestic hot water tank. The unit is new and is in good condition. DHW pipes are well insulated and in good condition.

A Chronomite®, 2.4 kW, instantaneous water heater serves the staff restroom. The unit is in good condition and a pipe insulation measure has been evaluated.

Gas Fired DHW Tank *Instantaneous Water Heater*

2.7 Plug Load

Plug loads across the site include general office equipment including, coffee machines, microwaves, paper shredders, printers, and televisions. There are 19 desktops throughout the facility. Two residential mini refrigerators are used to store employee food and drink. An outdoor information sign that operates at the front of the building also contributes to the plug load.



Library Plug Loads

2.8 Water-Using Systems

Water is provided by New Jersey American Water. Potable water is used for drinking, cleaning, and sanitary fixtures. Water leaks were not observed/reported.

EPA WaterSense® has set maximum flow rates for sanitary fixtures. They are: 1.28 gallons per flush (gpf) for toilets, 0.5 gpf for urinals, 1.5 gallons per minute (gpm) for lavatory faucets, and 2.0 gpm for showerheads. There are three restrooms with toilets, urinals, and sinks. Faucet flow rates are at 1.8 gpm or lower.

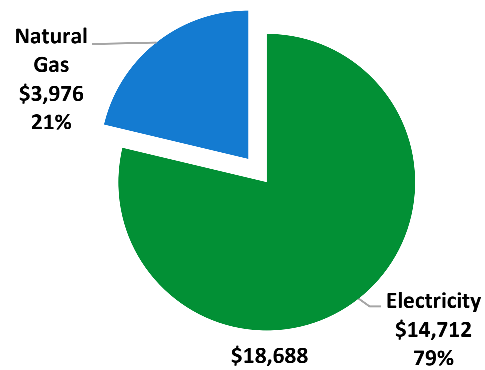
Kitchen Faucet

Restroom Faucet

3 Energy and Water Use and Costs

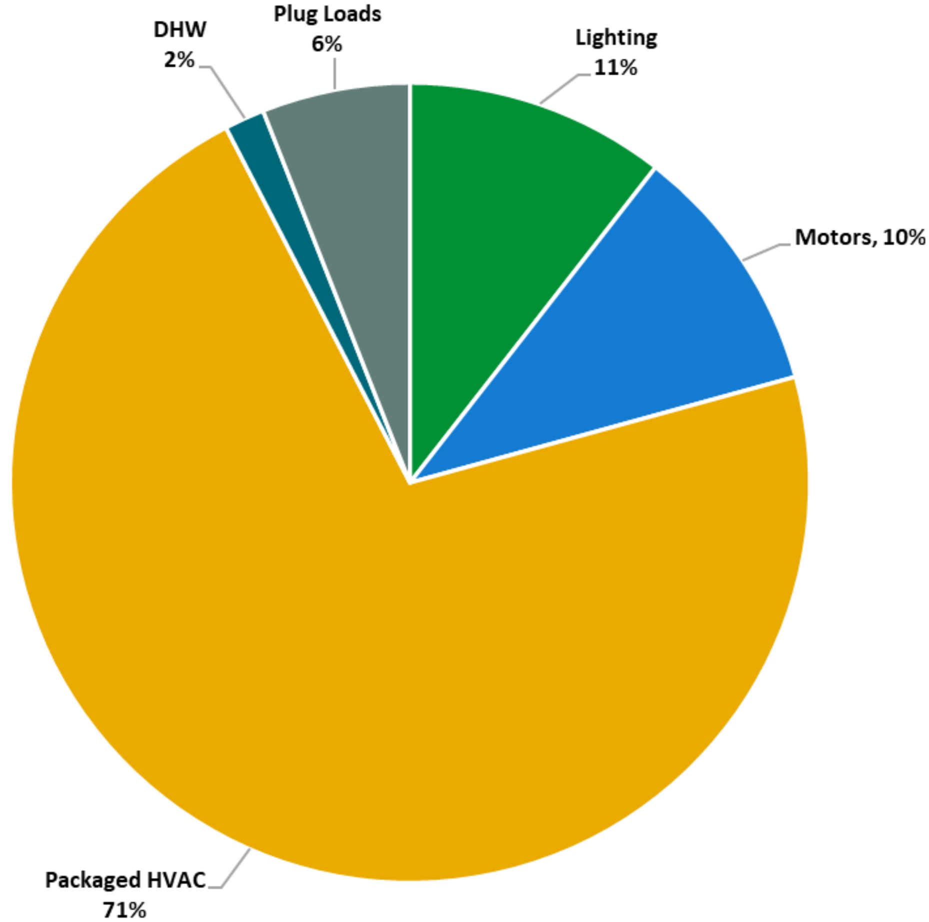
Twelve months of utility billing data are used to develop annual energy consumption and cost data. This information creates a profile of the annual energy consumption and energy costs.

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	92,960 kWh	$14,712
Natural Gas	3,619 Therms	$3,976
Total		**$18,688**



An energy balance identifies and quantifies energy use in your various building systems. This can highlight areas with the most potential for improvement. This energy balance was developed using calculated energy use for each of the end uses noted in the figure.

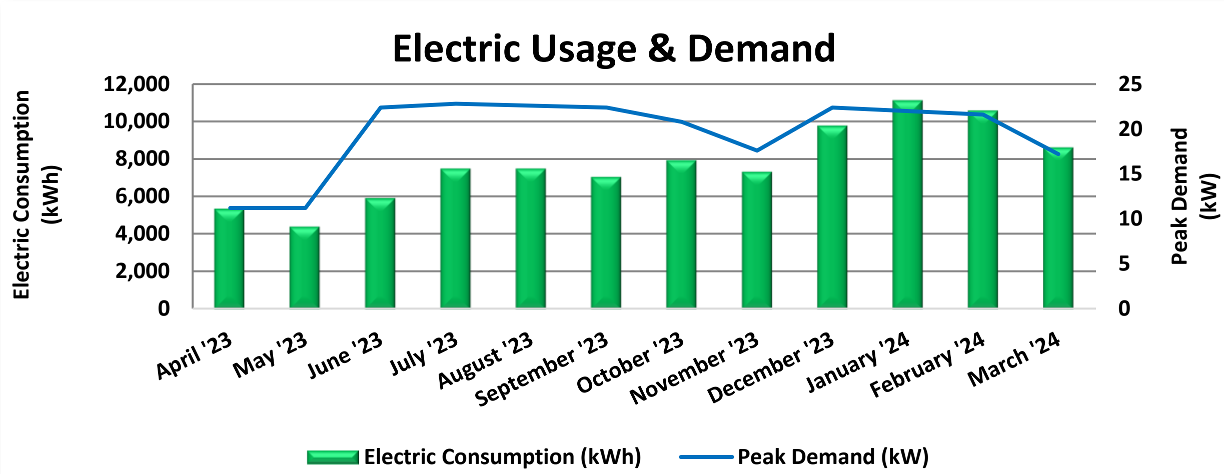
The energy auditor collects information regarding equipment operating hours, capacity, efficiency, and other operational parameters from facility staff, drawings, and on-site observations. This information is used as the inputs to calculate the existing conditions energy use for the site. The calculated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



Energy Balance by System

3.1 Electricity

PSE&G delivers electricity under rate class General Lighting & Power (GLP).



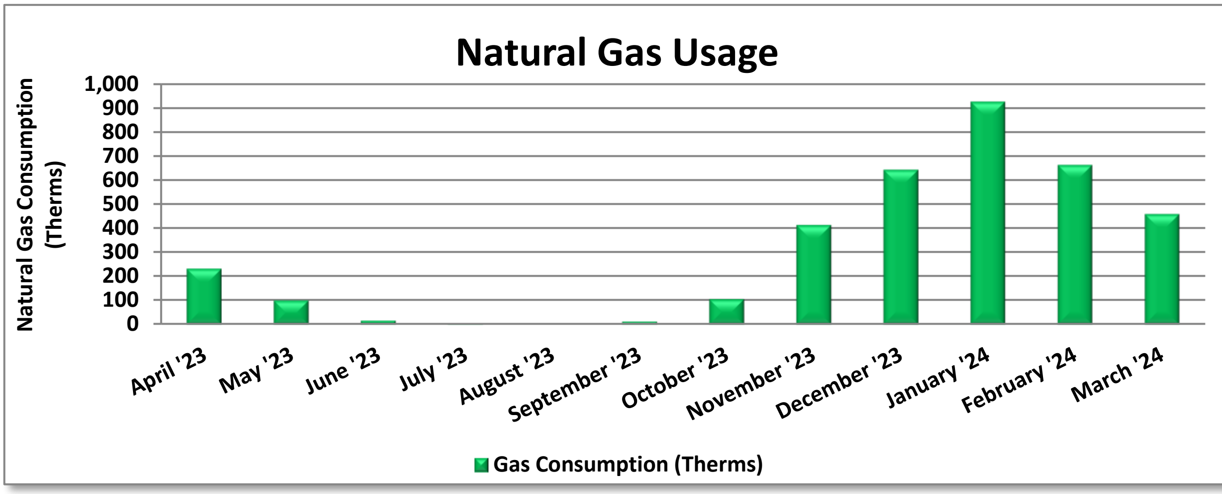
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
4/25/23	30	5,360	11	$52	$878
5/24/23	29	4,400	11	$52	$803
6/24/23	31	5,920	22	$340	$1,215
7/25/23	31	7,480	23	$350	$1,375
8/23/23	29	7,480	23	$362	$1,389
9/22/23	30	7,040	22	$374	$1,315
10/23/23	31	7,920	21	$110	$1,139
11/21/23	29	7,320	18	$94	$1,064
12/22/23	31	9,760	22	$119	$1,329
1/24/24	33	11,120	22	$117	$1,475
2/23/24	30	10,560	22	$115	$1,426
3/25/24	31	8,600	17	$91	$1,304
Totals	**365**	**92,960**	**23**	**$2,177**	**$14,712**
Annual	**365**	**92,960**	**23**	**$2,177**	**$14,712**

Notes:

- Peak demand of 23 kW occurred in July '23.
- Average demand over the past 12 months was 20 kW.
- The average electric cost over the past 12 months was $0.158/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.

3.2 Natural Gas

PSE&G delivers natural gas under rate class General Service Gas Heating - GSG (HTG).



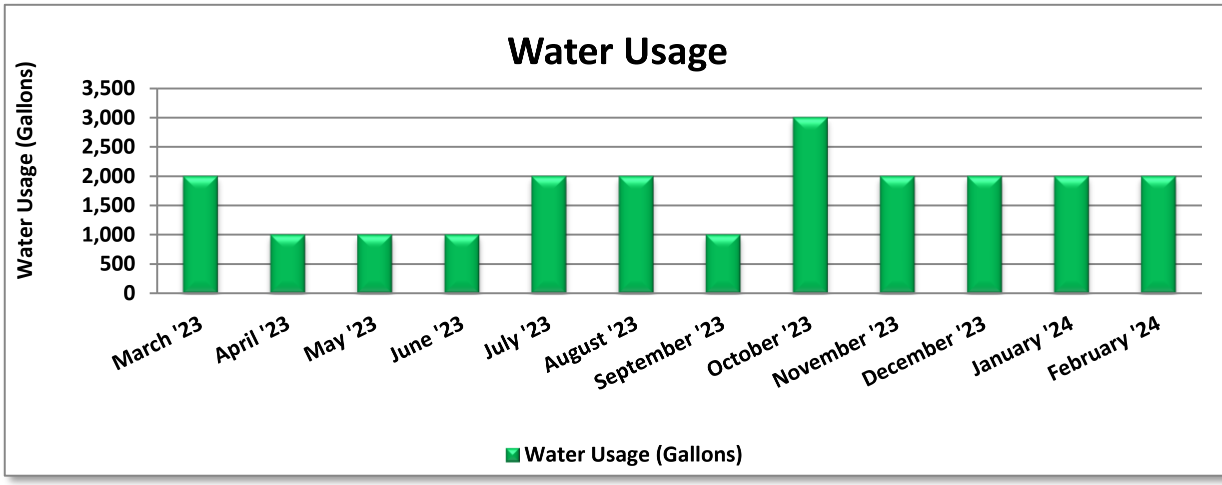
Gas Billing Data			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
4/25/23	28	232	$247
5/24/23	29	100	$117
6/23/23	30	17	$35
7/24/23	31	1	$21
8/22/23	29	0	$20
9/22/23	31	12	$31
10/20/23	28	106	$130
11/20/23	31	413	$467
12/21/23	31	642	$705
1/24/24	34	926	$986
2/23/24	30	662	$702
3/22/24	28	459	$461
Totals	**360**	**3,570**	**$3,922**
Annual	**365**	**3,619**	**$3,976**

Notes:

- The average gas cost for the past 12 months is $1.099/therm, which is the blended rate used throughout the analysis.

3.3 Water

New Jersey American Water delivers water to the project site.



Water Billing Data			
›d Ending	Days in Period	Water Usage (gallons)	Water Cost
4/1/23	30	2,000	$116
5/1/23	30	1,000	$115
6/1/23	31	1,000	$115
7/1/23	30	1,000	$115
8/1/23	31	2,000	$124
9/1/23	31	2,000	$124
10/1/23	30	1,000	$115
11/1/23	31	3,000	$140
12/1/23	30	2,000	$131
1/1/24	31	2,000	$131
2/1/24	31	2,000	$131
3/1/24	29	2,000	$131
Totals	**365**	**21,000**	**$1,490**
Annual	**365**	**21,000**	**$1,490**

Notes:

- The average cost of water for the past 12 months is $0.0709/gal.

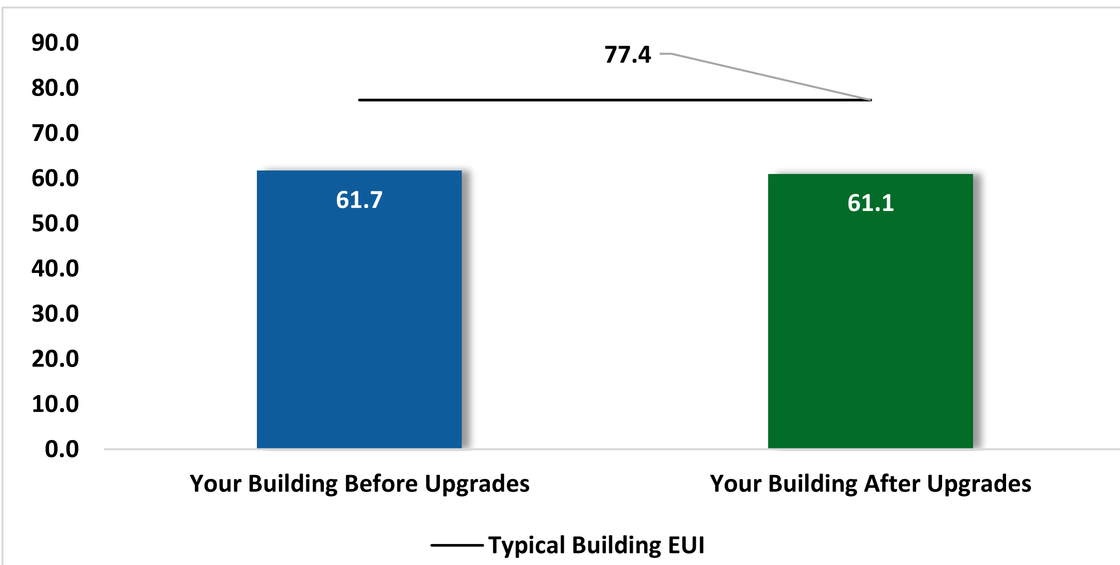
3.4 Benchmarking

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.

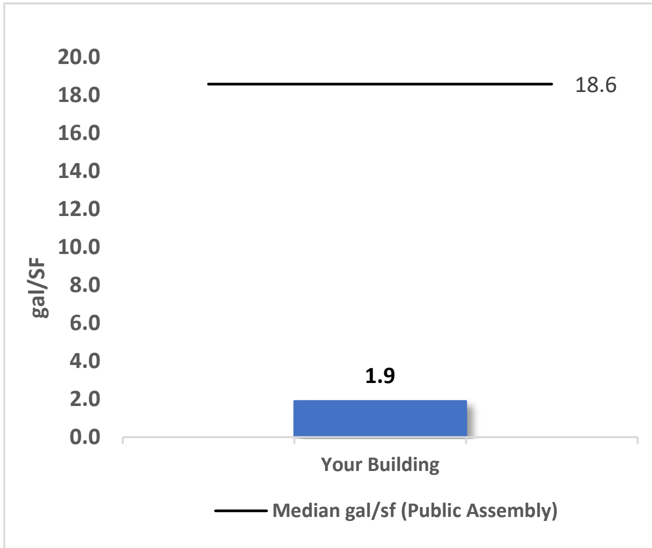


Energy Use Intensity Comparison[4]

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. Several factors can cause a building to vary from 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.

[4] Based on all evaluated ECMs

Water Benchmarking



A benchmark is provided for your building's water use based on the annual water use in gallons per square foot of building area (gal/sf-yr.). Your building is compared to other similar buildings based on average water usage as available from the 2012 Commercial Buildings Energy Consumption Survey (CBECS) and from the EPA ENERGY STAR Data Trends Water Use Tracking database.

Tracking your Energy Performance

Keeping track of your energy and water use on a monthly basis is one of the best ways to keep utility costs in check and keep your facility operating efficiently. 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 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.

3.5 Understanding Your Utility Bills

The State of New Jersey Department of the Public Advocate provides detailed information on how to read natural gas and electric bills. Your bills contain important information including account numbers, meter numbers, rate schedules, meter readings, and the supply and delivery charges. Gas and electric bills both provide comparisons of current energy consumption with prior usage.

Sample bills, with annotation, may be viewed at:
https://www.nj.gov/rpa/docs/Understanding_Electric_Bill.pdf
https://www.nj.gov/rpa/docs/Understanding_Gas_Bill.pdf

Why Utility Bills Vary

Utility bills vary from one month to another for many reasons. For this reason, assessing the effects of your energy savings efforts can be difficult.

Billing periods vary, typically ranging between 28 and 33 days. Electric bills provide the kilowatt-hours (kWh) used per month while gas bills provide therms (or hundreds of cubic feet - CCF) per month consumption information. Monthly consumption information can be helpful as a tool to assess your efforts to reduce energy, particularly when compared to monthly usage from a similar calendar period in a prior year.

Bills typically vary seasonally, often with more gas consumed in the winter for heating, and more electricity used in the summer when air conditioning is used. Facilities with electric heating may experience higher electricity use in the winter. Seasonal variance will be impacted by the type of heating and cooling systems used. Normal seasonal fluctuations are further impacted by the weather. Extremely cold or hot weathers causes HVAC equipment to run longer, increasing usage. Other monthly fluctuations in usage can be caused by changes in building occupancy. Utility bills provide a comparison of usage between the current period and comparable billing month period of the prior year. Year-to-year monthly use comparisons can point to trends with energy savings for measures/projects that were implemented within the timeframe, but these comparisons do not account for changing weather of occupancy patterns.

The price of fuel and purchased power used to produce and delivery electricity and gas fluctuates. Any increase or decrease in these costs will be reflected in your monthly bill. Additionally, billing rates occasionally change after justification and approval of the NJBPU. For this reason, it is more useful to review energy use rather than cost when assessing energy use trends or the impact of energy conservation measures implemented.

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 in this report are based on the previously run state rebate program SmartStart, which has been retired. Now, all investor-owned gas and electric utility companies are offering complementary energy efficiency programs directly to their customers. Some measures and proposed upgrades may be eligible for higher incentives than those shown below. The incentives in the summary tables should be used for high-level planning purposes. To verify incentives, reach out to your utility provider or visit the NJCEP website for more information.

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)
HVAC System Improvements			**74**	**0.0**	**0**	**$12**	**$50**	**$10**	**$40**	**3.4**	**74**
ECM 1	Install Pipe Insulation	Yes	74	0.0	0	$12	$50	$10	$40	3.4	74
Domestic Water Heating Upgrade			**82**	**0.0**	**2**	**$30**	**$70**	**$20**	**$50**	**1.7**	**262**
ECM 2	Install Low-Flow DHW Devices	Yes	82	0.0	2	$30	$70	$20	$50	1.7	262
Custom Measures***			**-788**	**0.0**	**8**	**-$37**	**$2,900**	**$0**	**$2,900**	**-78.4**	**143**
ECM 3	Replace Gas Fired Water Heater with Heat Pump Water Heater***	No	-788	0.0	8	-$37	$2,900	$0	$2,900	-78.4	143
TOTALS (COST EFFECTIVE MEASURES)			**156**	**0.0**	**2**	**$41**	**$120**	**$30**	**$90**	**2.2**	**336**
TOTALS (ALL MEASURES)			**-632**	**0.0**	**10**	**$4**	**$3,020**	**$30**	**$2,990**	**665.4**	**480**

* - All incentives presented in this table are included as placeholders for planning purposes 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).

*** - Negative payback explained in section 4.3

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)
HVAC System Improvements		**74**	**0.0**	**0**	**$12**	**$50**	**$10**	**$40**	**3.4**	**74**
ECM 1	Install Pipe Insulation	74	0.0	0	$12	$50	$10	$40	3.4	74
Domestic Water Heating Upgrade		**82**	**0.0**	**2**	**$30**	**$70**	**$20**	**$50**	**1.7**	**262**
ECM 2	Install Low-Flow DHW Devices	82	0.0	2	$30	$70	$20	$50	1.7	262
TOTALS (COST EFFECTIVE MEASURES)		**156**	**0.0**	**2**	**$41**	**$120**	**$30**	**$90**	**2.2**	**336**

* - All incentives presented in this table are included as placeholders for planning purposes 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).

Cost Effective ECMs

4.1 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		**74**	**0.0**	**0**	**$12**	**$50**	**$10**	**$40**	**3.4**	**74**
ECM 1	Install Pipe Insulation	74	0.0	0	$12	$50	$10	$40	3.4	74

ECM 1: Install Pipe Insulation

Install insulation on domestic hot water system piping. Distribution system thermal losses are dependent on system fluid temperature, the size of the distribution system, and the extent and condition of piping insulation. When the insulation has been damaged due to exposure to water, when the insulation has been removed from some areas of the pipe, or when valves have not been properly insulated, system thermal efficiency can be significantly reduced. This measure saves energy by reducing heat transfer in the distribution system.

Affected Systems: instantaneous water heater piping located in the staff restroom

4.2 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		**82**	**0.0**	**2**	**$30**	**$70**	**$20**	**$50**	**1.7**	**262**
ECM 2	Install Low-Flow DHW Devices	82	0.0	2	$30	$70	$20	$50	1.7	262

ECM 2: 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
Faucet aerator (kitchen)	1.5 gpm
Showerhead	2.0 gpm
Pre-rinse spray valve (kitchen)	1.28 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.

4.3 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		**-788**	**0.0**	**8**	**-$37**	**$2,900**	**$0**	**$2,900**	**-78.4**	**143**
ECM 3	Replace Gas Fired Water Heater with Heat Pump Water Heater***	-788	0.0	8	-$37	$2,900	$0	$2,900	-78.4	143

ECM 3: Replace Gas Fired Water Heater with Heat Pump Water Heater

We evaluated replacing the existing gas water heater with a heat pump water heater (HPWH).

A gas fired water heater uses a burner to heat water. Air source heat pump water heaters use a refrigeration cycle to transfer heat from the surrounding air to the domestic water. Water heater efficiency is rated by the uniform energy factor (UEF). For a relative comparison of water heater UEFs, the criteria for certifying a water heater in the ENERGY STAR program are provided below. These values indicate that HPWH heaters are significantly more efficient than gas fired water heaters.

There are two types of HPWH: those integrated with the heat pump and storage tank in the same unit, and those that are split into two sections (with the storage tank separate from the heat pump). The measure considers an integrated HPWH.

ENERGY STAR Uniform Energy Factor (UEF) Criteria for Certified Water Heaters *

Water Heater Type	*Minimum UEF*	*Other*
Integrated HPWH	3.3	
Integrated HPWH	2.2	120 Volt, 15 Amp circuit
Split System HPWH	2.2	
Gas Fired Storage	0.64	≤ 55-gal, Medium Draw Pattern
Gas Fired Storage	0.68	≤ 55-gal, High Draw Pattern
Gas Fired Storage	0.78	> 55-gal, Medium Draw Pattern
Gas Fired Storage	0.80	> 55-gal, High Draw Pattern
Gas Fired Storage	0.80	Residential Duty
Gas Fired Instantaneous	0.87	

** Note: Uniform Energy Factor (UEF): The newest measure of water heater overall efficiency. The higher the UEF value is, the more efficient the water heater. UEF is determined by the Department of Energy's test method outlined in 10 CFR Part 430, Subpart B, Appendix E.*[5]

[5] https://www.energy.gov/sites/prod/files/2014/06/f17/rwh_tp_final_rule.pdf

HPWH reject cold air. As such, they need to be installed in an unconditioned space of about 750 cubic feet with good ventilation[6]. Ideal locations are garages, large enclosed, unconditioned storage areas, or areas with excess heat such as a furnace or boiler room. The HPWH will also produce condensate so accommodations for draining the condensate need to be provided.

Most HPWH operate effectively down to an air temperature of 40 °F. Below that temperature, an electric resistance booster heater is typically required to achieve full heating capacity. It is critical that the HPWH controls are set up so that the electric resistance heat only engages when the air temperature is too cold for the HPWH to extract heat from it. HPWHs have a slow recovery. During periods of high demand, the electric resistance heating element, if enabled, may be energized to maintain set point, thus reducing the overall efficiency of the unit. It is recommended that a careful analysis of the hot water demand be conducted to determine if the application makes economic sense, and the HPWH heating capacity and storage are properly sized.

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

Switching from a gas fired water heater to a HPWH has the potential to reduce the sites overall greenhouse gas emissions. If the electricity for the HPWH is provided by an on-site photovoltaic (PV) system, then there are essentially no greenhouse gas (GHG) emissions. A 2016 study conducted at Cornell[7] calculated the kg of methane (CH_4) and carbon dioxide (CO_2) produced per GJ of water heated. The study compared HPWH to gas and electric fired, storage and tankless water heaters. The study also considered electricity produced from natural gas and coal fired electric plants. In all cases the study found that HPWHs produced less methane than all of the other water heaters. The study also found that HPWH produced less carbon dioxide than electric resistance water heaters but more carbon dioxide than tankless gas water heaters and about the same amount of carbon dioxide as storage gas water heaters. The summary tables provide the reduction in CO2 equivalent emissions based on the typical New Jersey electric utility.

This measure has a negative simple payback due to the relative cost of electricity to natural gas. At this site the cost per Btu for natural gas is significantly lower than for electricity. Therefore, even though this measure will result in a net energy savings in terms of Btu at this site it will increase the overall cost for providing domestic hot water.

Affected Units: gas DHW tank located in the mechanical closet

4.4 Measures for Future Consideration

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

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[6] https://basc.pnnl.gov/code-compliance/heat-pump-water-heaters-code-compliance-brief#:~:text=HPWH%20must%20have%20unrestricted%20airflow,depending%20on%20size%20of%20system

[7] Greenhouse gas emissions from domestic hot water: Heat pumps compared to most commonly used systems. Bongghi Hong, Robert W. Howarth. Department of Ecology and Evolutionary Biology, Cornell University. Energy Science and Engineering 2016.

Cranbury Public Library 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.

Installation of a Building Automation System

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

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

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

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

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

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

Upgrade to a Heat Pump System

Electric resistance heating units work by passing an electric current through wires to heat them. The system is 100% efficient since for every unit of electricity consumed, one unit of heat is produced.

But there is a way to convert electricity to create heat at better than a 1:1 ratio. Heat pumps operate on a more efficient principle, the refrigeration cycle. Instead of directly converting electricity to heat, electricity does the work, via a compressor, of moving refrigerant through a system that transfers heat from a cooler place to a warmer place. That system can move three to five as much energy as is available using electric resistance heating methods. Heat pumps work in a similar manner to an air conditioner, except they reverse the cooling process to circulate warm air instead of cold air. Also, heat pumps are generally capable of dispensing refrigerated air as they can typically be operated in air conditioning mode.

Electric resistance heat, including electric furnaces and baseboard heaters, can be inexpensive to install but often expensive to run. Facilities with these systems can save substantial energy at a moderate cost by installing a heat pump when they replace a central air conditioner.

Even in buildings without central air-conditioning, there are opportunities to save energy when an existing electric furnace needs to be replaced, as well as opportunities to install ductless electric heat pumps in buildings with baseboard electric heaters and electric fan coils. Unit ventilators with built-in electric resistance heaters can be replaced with unit ventilators with integrated heat pumps.

Electric heat pumps have high coefficient of performance (COP) ratings and are substantially more efficient than traditional electric heating systems. Further investigation is required to determine whether installing a heat pump system is a cost-effective solution when replacing existing electrical heating systems.

VRF Systems

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

- Multiple indoor units connected to a common outdoor unit.
- Scalability
- Variable capacity
- Distributed control
- Simultaneous heating and cooling capability

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

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

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

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

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 5% –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, and planned capital upgrades, and it 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 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 cannot manage what you do not 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[8]. Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

Weatherization

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

Doors and Windows

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

Window Treatments/Coverings

Use high-reflectivity films or cover windows with shades or shutters to reduce solar heat gain and reduce the load on cooling and heating systems. Older, single-pane windows and east- or west-facing windows are especially prone to solar heat gain. In addition, use shades or shutters at night during cold weather to reduce heat loss.

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

Lighting Maintenance

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

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

Lighting Controls

As part of a lighting maintenance schedule, test lighting controls to ensure proper functioning. For occupancy sensors, this requires triggering the sensor and verifying that the sensor's timer settings are correct. For daylight and photocell sensors, maintenance involves cleaning sensor lenses and confirming that setpoints and sensitivity are configured properly. Adjust exterior lighting time clock controls seasonally as needed to match your lighting requirements.

Motor Maintenance

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

AC System Evaporator/Condenser Coil Cleaning

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

HVAC Filter Cleaning and Replacement

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

Ductwork Maintenance

Duct maintenance has two primary goals: keep the ducts clean to avoid air quality problems and seal leaks to save energy. Check for cleanliness, obstructions that block airflow, water damage, and leaks. Ducts should be inspected at least every two years.

The biggest symptoms of clogged air ducts are differing temperatures throughout the building and areas with limited airflow from supply registers. If a particular air duct is clogged, then air flow will only be cut off to some rooms in the building—not all of them. The reduced airflow will make it more difficult for those areas to reach the temperature setpoint, which will cause the HVAC system to run longer to cool or heat that area properly. If you suspect clogged air ducts, ensure that all areas in front of supply registers are clear of items that may block or restrict air flow, and you should check for fire dampers or balancing dampers that have failed closed.

Duct leakage in commercial buildings can account for 5%–25% of the supply airflow. In the case of rooftop air handlers, duct leakage can occur to the outside of the building wasting conditioned air. Check ductwork for leakage. Eliminating duct leaks can improve ventilation system performance and reduce heating and cooling system operation.

Distribution system losses are dependent on-air system temperature, the size of the distribution system, and the level of insulation of the ductwork. Significant energy savings can be achieved when insulation has not been well maintained. When the insulation is missing or worn, the system efficiency can be significantly reduced. This measure saves energy by reducing heat transfer in the distribution system.

Label HVAC Equipment

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

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

Water Heater Maintenance

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

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

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

Procurement Strategies

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

6 Water Best Practices

Getting Started

The commercial and institutional sector is the second largest consumer of publicly supplied water in the United States, accounting for 17% of the withdrawals from public water supplies[9]. In New Jersey, excluding water used for power generation, approximately 80% of total water use was attributed to potable supply during the period of 2009 to 2018. Water withdrawals for potable supply have not changed noticeably during the period from 1990 to 2018[10].

Water management planning serves as the foundation for any successful water reduction effort. It is the first step a commercial or institutional facility owner or manager should take to achieve and sustain long-term water savings. Understanding how water is used within a facility is critical for the water management planning process. A water assessment provides a comprehensive account of all known water uses at the facility. It allows the water management team to establish a baseline from which progress and program success can be measured. It also enables the water management team to set achievable goals and identify and prioritize specific projects based on the relative savings opportunities and project cost-effectiveness.

Water conservation devices may significantly reduce your water and sewer usage costs. Any reduction in water use reduces grid-level electricity use since a significant amount of electricity is used to treat and deliver water from reservoirs to end users.

For more information regarding water conservation or additional details regarding the practices shown below go to the EPA's WaterSense website[11] or download a copy of EPA's "WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities"[12] to get ideas for creating a water management plan and best practices for a wide range of water using systems.

Leak Detection and Repair

Identifying and repairing leaks and other water use anomalies within a facility's water distribution system or from processes or equipment can keep a facility from wasting significant quantities of water. Examples of common leaks include leaking toilets and faucets, drip irrigation malfunctions, stuck float valves, and broken distribution lines. Reading meters, installing failure abatement technologies, and conducting visual and auditory inspections are important best practices to detect leaks. Train building occupants, employees, and visitors to report any leaks that they detect. To reduce unnecessary water loss, detected leaks should be repaired quickly. Repairing leaks in water distribution that is pressurized by on-site pumps or in heated or chilled water piping will also reduce energy use.

Toilets and Urinals

Toilets and urinals are considered sanitary fixtures and are found in most facilities. High efficiency fixtures are at least 20% more efficient than available standard products. Leaking or damaged equipment is a substantial source of water waste. Train users to report continuously flushing, leaking, or otherwise improperly operating equipment to the appropriate personnel. Depending on the age of the equipment

[9] Estimated from analyzing data in: Solley, Wayne B,. et al, "Estimated Use of Water in the United States in 1995", U.S Geological Survey Circular 1200, (1998)

[10] https://dep.nj.gov/wp-content/uploads/dsr/trends-water-supply.pdf

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

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

and the frequency of use, it may be cost effective to replace older inefficient fixtures with current generation WaterSense labeled equipment.

Commercial facilities typically use tank toilets or wall-mount flushometers. Educate and inform users with restroom signage and other means to avoid flushing inappropriate objects. For tank toilets, periodically check to ensure fill valves are working properly and that water level is set correctly. Annually test toilets to ensure the flappers are not worn or allowing water to seep from the tank into the bowl and down the sewer. Control stops and piston valves on flushometer toilets should be checked at least annually.

Most urinals use water to flush liquid. These standard single-user fixtures are present in most facilities. Non-water urinals use a specially designed trap that allows liquid waste to drain out of the fixture through a trap seal, and into the drainage system. Flushing urinals should be inspected at least annually for proper valve and sensor operation. For non-water urinals, follow maintenance practices as directed by the manufacturer to ensure products perform as expected. Non-water urinals can be considered during urinal replacement, however, review the condition and design of the existing plumbing system and the expected usage patterns to ensure that these products will provide the anticipated performance.

Faucets and Showerheads

Faucets and showerheads are sanitary fixtures that generally dispense heated water. Reducing water use by these fixtures translates into a reduction of site fuel or electric use depending on how water is heated. High efficiency fixtures are at least 20% more efficient than available standard products. Leaking or damaged equipment is a substantial source of water waste. Train users to report continuously dripping, leaking, or otherwise improperly operating equipment to the appropriate personnel. Depending on the age of the equipment and the frequency of use, it may be cost effective to replace older fixtures with current generation WaterSense labeled equipment.

Faucets are used for a variety of purposes, and standard flow rates are dictated by the intended use. Public use lavatory faucets and kitchen faucets are subject to maximum flow rates while service sinks are not. Periodically inspect faucet aerators for scale buildup to ensure flow is not being restricted. Clean or replace the aerator or other spout end device as needed. Check and adjust automatic sensors (where installed) to ensure they are operating properly to avoid faucets running longer than necessary. Post materials in restrooms and kitchens to ensure user awareness of the facility's water-efficiency goals. Remind users to turn off the tap when they are done and to consider turning the tap off during sanitation activities when it is not being used. Consider installing lavatory and kitchen faucet fixtures with reduced flow. Federal standards limit kitchen and restroom faucet flows to 2.2 gpm. To qualify for a WaterSense label a faucet cannot exceed 1.5 gpm.

Effective in 1992, the maximum allowable flow rate for all showerheads sold in the United States is 2.5 gpm. Since this standard was enacted, many showerheads have been designed to use even less water. WaterSense labeled equipment is designed to use 2.0 gpm, or less. For optimum showerhead efficiency, the system pressure should be tested to make sure that it is between 20 and 80 pounds per square inch (psi). Verify that plumbing lines are routed through a shower valve to prevent water pressure fluctuations. Periodically inspect showerheads for scale buildup to ensure flow is not being restricted. In general, replace showerheads with 2.5 gpm flow rates or higher with WaterSense labeled models. Note: Use of poor performing replacement reduced flow showerheads may result in increased use if the duration of use is increased to compensate for reduced performance. WaterSense labeled showerheads are independently certified to meet or exceed minimum performance requirements for spray coverage and force.

7 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.

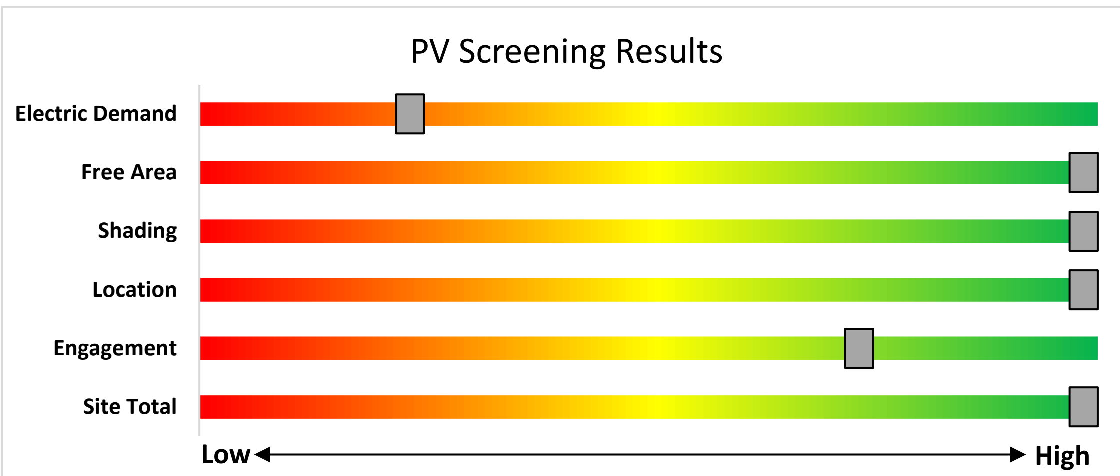
7.1 Solar Photovoltaic

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

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

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

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



Potential	High	
System Potential	20	kW DC STC
Electric Generation	23,827	kWh/yr
Displaced Cost	$3,770	/yr
Installed Cost	$52,000	

Photovoltaic Screening

Successor Solar Incentive Program (SuSI)

The SuSI program replaces the SREC Registration Program (SRP) and the Transition Incentive (TI) program. The SuSI program is used to register and certify solar projects in New Jersey. Rebates are not available for solar projects. Solar projects may qualify to earn SREC- IIs (Solar Renewable Energy Certificates-II), however, the project owners must register their solar projects prior to the start of construction to establish the project's eligibility.

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:

- **Successor Solar Incentive Program (SuSI):** https://www.njcleanenergy.com/renewable-energy/programs/susi-program
- **Basic Info on Solar PV in NJ**: http://www.njcleanenergy.com/whysolar
- **NJ Solar Market FAQs**: ww.njcleanenergy.com/renewable-energy/program-updates-and-background-information/solar-transition/solar-market-faqs
- **Approved Solar Installers in the NJ Market**: http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/?id=60&start=1

7.2 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.

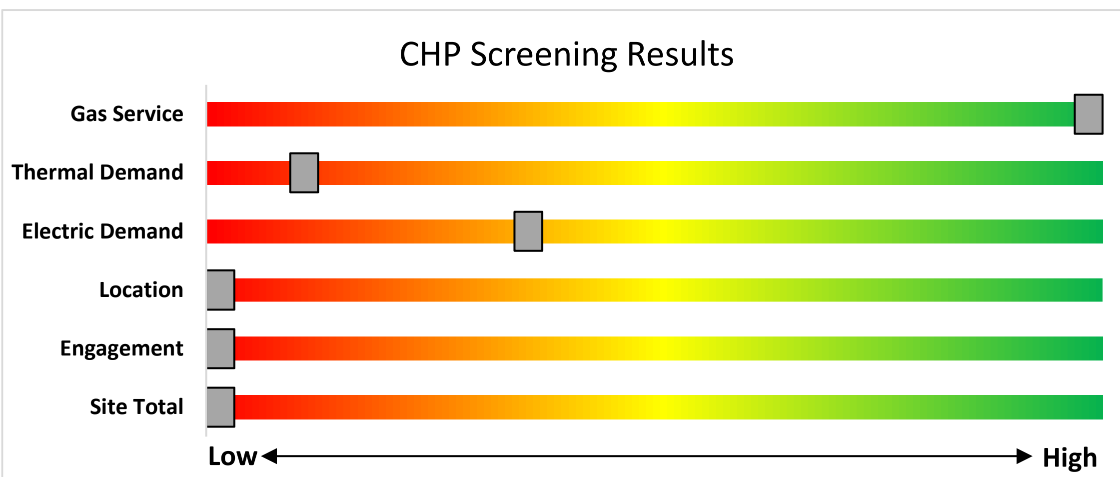
CHP systems typically produce a portion of the electric power used on-site, with the balance of electric power needs supplied by the local utility company. The heat is used to supplement (or replace) existing boilers and provide space heating and/or domestic hot water heating. Waste heat can also be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



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/

8 Electric Vehicles

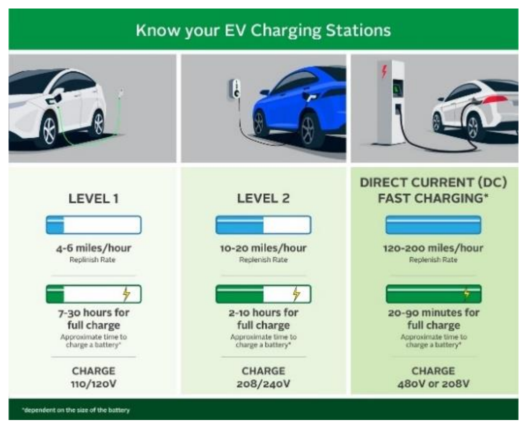
All electric vehicles (EVs) have an electric motor instead of an internal combustion engine. EVs function by plugging into a charge point, taking electricity from the grid, and then storing it in rechargeable batteries. Although electricity production may contribute to air pollution, the U.S. EPA categorizes all-electric vehicles as zero-emission vehicles because they produce no direct exhaust or tailpipe emissions.

EVs are typically more expensive than similar conventional and hybrid vehicles, although some cost can be recovered through fuel savings, federal tax credit, or state incentives.

8.1 EV Charging

EV charging stations provide a means for electric vehicle operators to recharge their batteries at a facility. While many EV drivers charge at home, others do not have access to regular home charging, and the ability to charge at work or in public locations is critical to making EVs practical for more drivers. Charging can also be used for electric fleet vehicles, which can reduce fuel and maintenance costs for fleets that replace gas or diesel vehicles with EVs.

EV charging comes in three main types. For this assessment, the screening considers addition of Level 2 charging, which is most common at workplaces and other public locations. Depending on the site type and usage, other levels of charging power may be more appropriate.



The preliminary assessment of EV charging at the facility shows that there is medium potential for adding EV chargers to the facility's parking, based on potential costs of installation and other site factors.

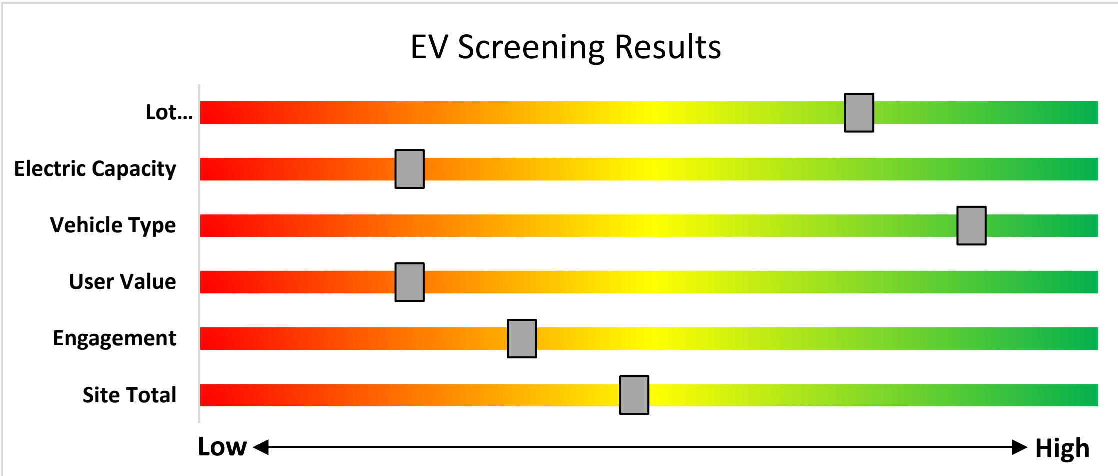
The primary costs associated with installing EV charging are the charger hardware and the cost to extend power from the facility to parking spaces. This may include upgrades to electric panels to serve increased loads.

The type and size of the parking area impact the costs and feasibility of adding EV charging. Parking structure installations can be less costly than surface lot installations as power may be readily available, and equipment and wiring can be surface mounted. Parking lot installations often require trenching through concrete or asphalt surface. Large parking areas provide greater flexibility in charger siting than smaller lots.

The location and capacity of facility electric panels also impact charger installation costs. A Level 2 charger generally requires a dedicated 208-240V, 40 Amp circuit. The electric panel nearest the planned installation may not have available capacity and may need to be upgraded to serve new EV charging loads. Alternatively, chargers could be powered from a more distant panel. The distance from the panel to the location of charging stations ties directly to costs, as conduits, cables, and potential trenching costs all increase on a per-foot basis. The more charging stations planned, the more likely it is that additional electrical capacity will be needed.

Other factors to consider when planning for EV charging at a facility include who the intended users are, how long they park vehicles at the site, and whether they will need to pay for the electricity they use. Adding EV charging may have a negative financial impact due to increased electric demand charges.

The graphic below displays the results of the EV charging assessment conducted as part of this audit. The position of each slider indicates the impact each factor has on the feasibility of installing EV charging at the site.



EV Charger Screening

Electric Vehicle Programs Available

New Jersey is leading the way on electric vehicle (EV) adoption on the East Coast. There are several programs designed to encourage EV adoption in New Jersey, which is crucial to reaching a 100% clean energy future.

NJCEP offers a variety of EV programs for vehicles, charging stations, and fleets. Certain EV charging stations that receive electric utility service from Atlantic City Electric Company (ACE), Public Service Electric and Gas Company (PSE&G) or Jersey Central Power and Light (JCP&L), may be eligible for additional electric vehicle charging incentives directly from the utility. Projects may be eligible for both the incentives offered by this BPU program and incentives offered by ACE, PSE&G or JCP&L, up to 90% of the combined charger purchase and installation costs. Please check ACE, PSE&G or JCP&L program eligibility requirements before purchasing EV charging equipment, as additional conditions on types of eligible chargers may apply for utility incentives.

EV Charging incentive information is available from Atlantic City Electric, PSE&G and JCP&L. For more information and to keep up to date on all EV programs please visit https://www.njcleanenergy.com/commercial-industrial/programs/electric-vehicle-programs

9 Project Funding and Incentives

Ready to improve your building's performance? New Jersey's Clean Energy Programs and Utility Energy Efficiency Programs can help. Pick the program that works best for you. This section provides an overview of currently available incentive programs in New Jersey.

NJBPU and NJCEP Administered Programs

- New Construction (residential, commercial, industrial, government)
- Large Energy Users
- Energy Savings Improvement Program (financing)
- State Facilities Initiative*
- Local Government Energy Audits
- Combined Heat & Power & Fuel Cells

*State facilities are also eligible for utility programs

Utility Administered Programs

- Existing buildings (residential, commercial, industrial, government)
- Efficient Products
  - Lighting & Marketplace
  - HVAC
  - Appliance Rebates
  - Appliance Recycling

9.1 New Jersey's Clean Energy Program

Save money while saving the planet! New Jersey's Clean Energy Program is a statewide program that offers incentives, programs, and services that benefit New Jersey residents, businesses, educational, non-profit, and government entities to help them save energy, money, and the environment.

Large Energy Users

The Large Energy Users Program (LEUP) is designed to foster self-directed investment in energy projects. This program is offered to New Jersey's largest energy customers. To qualify entities must have incurred at least $5 million in total energy costs in the prior fiscal year.

Incentives

Incentives are based on the specifications below. The maximum incentive per entity is the lesser of:

- $4 million
- 75% of the total project(s) cost
- 90% of total NJCEP fund contribution in previous year
- $0.33 per projected kWh saved; $3.75 per projected Therm saved annually.

How to Participate

To participate in LEUP, you will first need submit an enrollment application. This program requires all qualified and approved applicants to submit an energy plan that outlines the proposed energy efficiency work for review and approval. Applicants may submit a Draft Energy Efficiency Plan (DEEP), or a Final Energy Efficiency Plan (FEEP). Once the FEEP is approved, the proposed work can begin.

Detailed program descriptions, instructions for applying, and applications can be found at http://www.njcleanenergy.com/LEUP.

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[13]

Eligible Technology	Size (Installed Rated Capacity)	Incentive ($/Watt)[5]	% of Total Cost Cap per Project	$ Cap per Project
CHPs powered by non-renewable or renewable fuel source, or a combination:[4] - Gas Internal Combustion Engine - Gas Combustion Turbine - Microturbine Fuel Cells ≥60%	≤500 kW[1]	$2.00	30-40%[2]	$2 million
	>500 kW - 1 MW[1]	$1.00		
	> 1 MW - 3 MW[1]	$0.55	30%	$3 million
	>3 MW[1]	$0.35		
Fuel Cells ≥40%	Same as above[1]	Applicable amount above	30%	$1 million
Waste Heat to Power (WHP)[3] Powered by non-renewable fuel source. Heat recovery or other mechanical recovery from existing equipment utilizing new electric generation equipment (e.g. steam turbine)	≤1MW[1]	$1.00	30%	$2 million
	> 1MW[1]	$.50	30%	$3 million

[13]
[1] Incentives are tiered, which means the incentive levels vary based upon the installed rated capacity, as listed in the chart above. For example, a 4 MW CHP system would receive $2.00/Watt for the first 500 kW, $1.00/Watt for the second 500 kW, $0.55/Watt for the next 2 MW and $0.35/Watt for the last 1 MW (up to the caps listed).
[2] The maximum incentive will be limited to 30% of total project. For CHP projects up to 1 MW, this cap will be increased to 40% where a cooling application is used or included with the CHP system (e.g. absorption chiller).
[3] Projects will be eligible for incentives shown above, not to exceed the lesser of % of total project cost per project cap or maximum $ per project cap. Projects installing CHP or FC with WHP will be eligible for incentive shown above, not to exceed the lesser caps of the CHP or FC incentive. Minimum efficiency will be calculated based on annual total electricity generated, utilized waste heat at the host site (i.e. not lost/rejected), and energy input.
[4] Systems fueled by a Class 1 Renewable Fuel Source, as defined by N.J.A.C. 14:8-2.5, are eligible for a 30% incentive bonus. If the fuel is mixed, the bonus will be prorated accordingly. For example, if the mix is 60/40 (60% being a Class 1 renewable), the bonus will be 18%. This bonus will be included in the final performance incentive payment, based on system performance and fuel mix consumption data. Total incentive, inclusive of bonus, shall not exceed above stipulated caps.
[5] CHP-FC systems located at Critical Facility and incorporating blackstart and islanding technology are eligible for a 25% incentive bonus. This bonus incentive will be paid with the second/Installation incentive payment. Total incentive, inclusive of bonus, shall not exceed above stipulated caps.

How to Participate

You will 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 http://www.njcleanenergy.com/CHP.

Successor Solar Incentive Program (SuSI)

The SuSI program replaces the SREC Registration Program (SRP) and the Transition Incentive (TI) program. The program is used to register and certify 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 SREC-IIs (Solar Renewable Energy Certificates-II). SuSI consists of two sub-programs. The Administratively Determined Incentive (ADI) Program and the Competitive Solar Incentive (CSI) Program.

Administratively Determined Incentive (ADI) Program

The ADI Program provides administratively set incentives for net metered residential projects, net metered non-residential projects 5 MW or less, and all community solar projects.

After the registration is accepted, construction is complete, and a complete final as-built packet has been submitted, the project is issued a New Jersey certification number, which enables it to generate New Jersey SREC- IIs.

Market Segments	Size MW dc	Incentive Value ($/SREC II)	Public Entities Incentive Value - $20 Adder ($/SRECII)
Net Metered Residential	All types and sizes	$90	N/A
Small Net Metered Non-Residential located on Rooftop, Carport, Canopy and Floating Solar	Projects smaller than 1 MW	$100	$120
Large Net Metered Non-Residential located on Rooftop, Carport, Canopy and Floating Solar	Projects 1 MW to 5 MW	$90	$110
Small Net Metered Non-Residential Ground Mount	Projects smaller than 1 MW	$85	$105
Large Net Metered Non-Residential Ground Mount	Projects 1 MW to 5 MW	$80	$100
LMI Community Solar	Up to 5 MW	$90	N/A
Non-LMI Community Solar	Up to 5 MW	$70	N/A
Interim Subsection (t)	All types and sizes	$100	N/A

Eligible projects may generate SREC-IIs for 15 years following the commencement of commercial operations which is defined as permission to operate (PTO) from the Electric Distribution Company. After 15 years, projects may be eligible for a NJ Class I REC.

SREC-IIs will be purchased monthly by the SREC-II Program Administrator who will allocate the SREC-IIs 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.

The ADI Program online portal is now open to new registrations.

Competitive Solar Incentive (CSI) Program

The CSI Program opened on April 15, 2023, and will serve as the permanent program within the SuSI Program providing incentives to larger solar facilities. The CSI Program is open to qualifying grid supply solar facilities, non-residential net metered solar installations with a capacity greater than five (5) megawatts ("MW"), and to eligible grid supply solar facilities installed in combination with energy storage.

CSI eligible facilities will only be allowed to register in the CSI program upon award of a bid pursuant to N.J.A.C. 14:8-11.10.

The CSI program structure has separate categories, or tranches, to ensure that a range of solar project types, including those on preferred sites, are able to participate despite potentially different project cost profiles. The Board has approved four tranches for grid supply and large net metered solar and an additional fifth tranche for storage in combination with grid supply solar. The following table lists procurement targets for the first solicitation:

Tranche	Project Type	MW (dc) Targets
Tranche 1.	Basic Grid Supply	140
Tranche 2.	Grid Supply on the Built Environment	80
Tranche 3.	Grid Supply on Contaminated Sites and Landfills	40
Tranche 4.	Net Metered Non- Residential	40
Tranche 5.	*Storage Paired with Grid	160 MWh

*The storage tranche of 160 MWh corresponds to a 4-hour storage pairing of 40 MW of solar

Solar projects help the State of New Jersey reach renewable energy goals outlined in the state's Energy Master Plan.

If you are considering installing solar on your building, visit the following link for more information: https://njcleanenergy.com/renewable-energy/programs/susi-program

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 contracts to help finance building energy upgrades. Annual payments are lower than the savings projected from the energy conservation measures (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 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.

Demand Response (DR) Energy Aggregator

Demand Response Energy Aggregator is a program designed to reduce the electric load when electric wholesale prices are high or when the reliability of the electric grid is threatened due to peak demand. Grid operators call upon curtailment service providers and commercial facilities to reduce electric usage during times of peak demand, making the grid more reliable and reducing transmission costs for all ratepayers. Curtailment service providers provide regular payments to medium and large consumers of electric power for their participation in DR programs. Program participation is voluntary, and participants receive payments whether or not their facility is called upon to curtail its electric usage.

Typically, an electric customer must be capable of reducing their electric demand, within minutes, by at least 100 kW or more in order to participate in a DR program. Customers with greater capability to quickly curtail their demand during peak hours receive higher payments. Customers with back-up generators on site may also receive additional DR payments for their generating capacity if they agree to run the generators for grid support when called upon. Eligible customers who have chosen to participate in DR programs often find it to be a valuable source of revenue for their facility, because the payments can significantly offset annual electric costs.

Participating customers can often quickly reduce their peak load through simple measures, such as temporarily raising temperature setpoints on thermostats (so that air conditioning units run less frequently) or agreeing to dim or shut off less critical lighting. This usually requires some level of building automation and controls capability to ensure rapid load reduction during a DR curtailment event. DR program participants may need to install smart meters or may need to also sub-meter larger energy-using equipment, such as chillers, to demonstrate compliance with DR program requirements.

DR does not include the reduction of electricity consumption based on normal operating practice or behavior. For example, if a company's normal schedule is to close for a holiday, the reduction of electricity due to this closure or scaled-back operation is not considered a DR activity in most situations.

The first step toward participation in a DR program is to contact a curtailment service provider. A list of these providers is available on the website of the independent system operator, PJM, and it includes contact information for each company, as well as the states where they have active business[14]. PJM also posts training materials for program members interested in specific rules and requirements regarding DR activity along with a variety of other DR program information[15].

Curtailment service providers typically offer free assessments to determine a facility's eligibility to participate in a DR program. They will provide details regarding program rules and requirements for metering and controls, assess a facility's ability to temporarily reduce electric load, and provide details on payments to be expected for participation in the program. Providers usually offer multiple options for DR to larger facilities, and they may also install controls or remote monitoring equipment of their own to help ensure compliance with all terms and conditions of a DR contract.

[14] http://www.pjm.com/markets-and-operations/demand-response.aspx.

[15] http://www.pjm.com/training/training-events.aspx.

9.2 Utility Energy Efficiency Programs

The Clean Energy Act, signed into law by Governor Murphy in 2018, requires New Jersey's investor-owned gas and electric utilities to reduce their customers' use by set percentages over time. To help reach these targets the New Jersey Board of Public Utilities approved a comprehensive suite of energy efficiency programs to be run by the utility companies.

Prescriptive and Custom

The Prescriptive and Custom rebate program through your utility provider offers incentives for installing prescriptive and custom energy efficiency measures at your facility. This program provides an effective mechanism for securing incentives for energy efficiency measures installed individually or as part of a package of energy upgrades. This program serves most common equipment types and sizes.

Equipment Examples

Lighting
Lighting Controls
HVAC Equipment
Refrigeration
Gas Heating
Gas Cooling
Commercial Kitchen Equipment
Food Service Equipment
Variable Frequency Drives
Electronically Commutate Motors
Variable Frequency Drives
Plug Loads Controls
Washers and Dryers
Agricultural
Water Heating

The Prescriptive program provides fixed incentives for specific energy efficiency measures. Prescriptive incentives vary by equipment type. The Custom program provides incentives for more unique or specialized technologies or systems that are not addressed through prescriptive incentives.

Direct Install

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

Incentives

The program pays up to 70% of the total installed cost of eligible measures.

How to Participate

To participate in Direct Install, you will work with a participating contractor. The contractor will be paid the measure incentives directly by the program, which will pass on to you in the form of reduced material and implementation costs. This means up to 70% of eligible costs are covered by the Direct Install program, subject to program rules and eligibility, while the remaining percent of the cost is paid to the contractor by the customer.

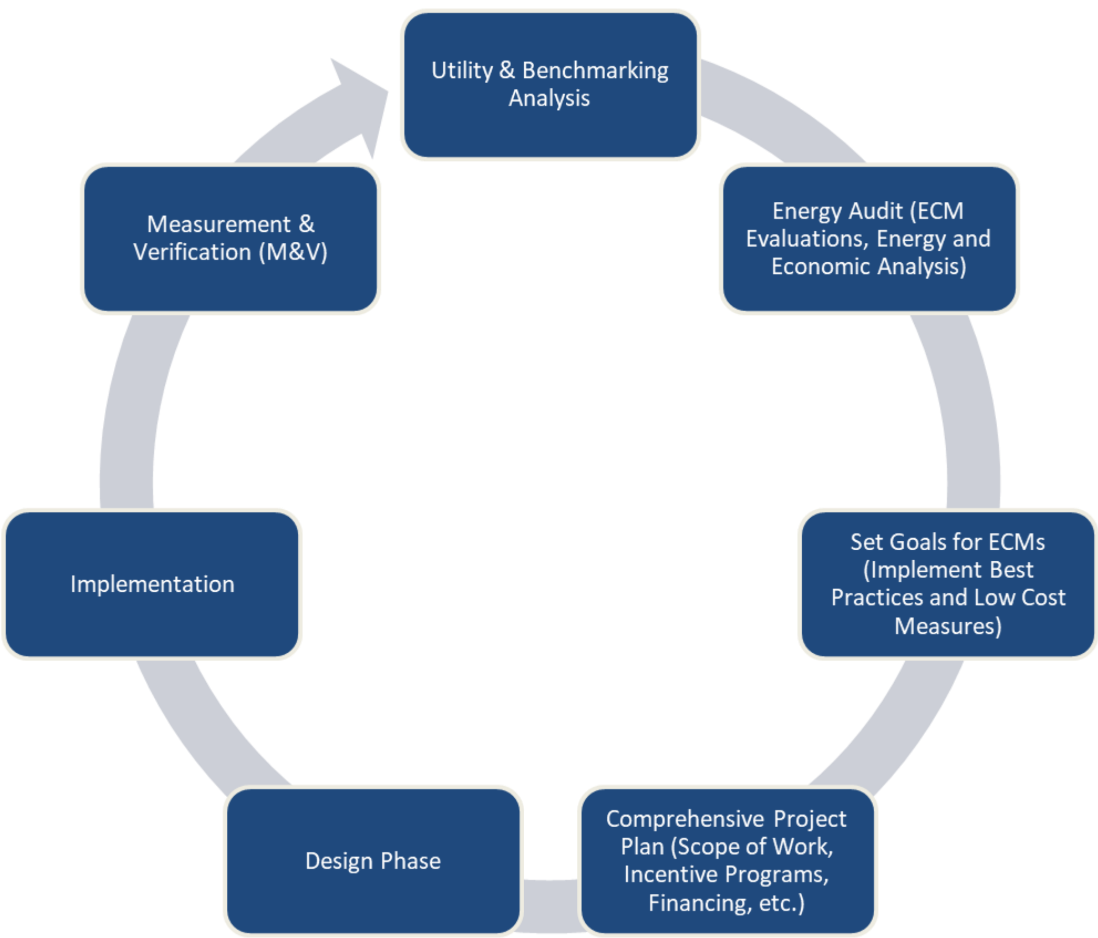
Engineered Solutions

The Engineered Solutions Program provides tailored energy-efficiency assistance and services to municipalities, universities, schools, hospitals, and healthcare facilities (MUSH), non-profit entities, and multifamily buildings. Customers receive expert guided services, including investment-grade energy auditing, engineering design, installation assistance, construction administration, commissioning, and measurement and verification (M&V) services to support the implementation of cost-effective and comprehensive efficiency projects. Engineered Solutions is generally a good option for medium to large sized facilities with a peak demand over 200 kW looking to implement as many measures as possible under a single project to achieve deep energy savings. Engineered Solutions has an added benefit of addressing measures that may not qualify for other programs. Many facilities pursuing an Energy Savings Improvement Program loan also use this program. Incentives for this program are based on project scope and energy savings achieved.

For more information on any of these programs, contact your local utility provider or visit https://www.njcleanenergy.com/transition.

10 Project Development

Energy conservation measures (ECMs) have been identified for your site, and their energy and economic analyses are provided within this LGEA report. Note that some of the identified projects may be mutually exclusive, such as replacing equipment versus upgrading motors or controls. 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 that includes the review of multiple bids for project work, incorporates potential operations and maintenance (O&M) cost savings, and maximizes your incentive potential.



Project Development Cycle

11 Energy Purchasing and Procurement Strategies

11.1 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. 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[16].

11.2 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 fluctuate monthly. The utility provides basic gas supply service 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[17].

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[16] www.state.nj.us/bpu/commercial/shopping.html

[17] 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
Adult Section	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Adult Section	20	LED - Fixtures: Ambient - 8' - Direct/Indirect Fixture	Occupancy Sensor	S	32	3,100		None	No	20	LED - Fixtures: Ambient - 8' - Direct/Indirect Fixture	Occupancy Sensor	32	3,100	0.0	0	0	$0	$0	$0	0.0
Adult Section	2	LED - Fixtures: Downlight Recessed	Occupancy Sensor	S	13	3,100		None	No	2	LED - Fixtures: Downlight Recessed	Occupancy Sensor	13	3,100	0.0	0	0	$0	$0	$0	0.0
Adult Section	10	LED - Fixtures: Ambient - 4' - Direct/Indirect Fixture	Occupancy Sensor	S	32	3,100		None	No	10	LED - Fixtures: Ambient - 4' - Direct/Indirect Fixture	Occupancy Sensor	32	3,100	0.0	0	0	$0	$0	$0	0.0
Archival Room	4	LED - Fixtures: Ambient 1x4 Fixture	Occupancy Sensor	S	32	1,500		None	No	4	LED - Fixtures: Ambient 1x4 Fixture	Occupancy Sensor	32	1,500	0.0	0	0	$0	$0	$0	0.0
Children's Area Foyer	1	LED - Fixtures: Downlight Recessed	Occupancy Sensor	S	13	3,100		None	No	1	LED - Fixtures: Downlight Recessed	Occupancy Sensor	13	3,100	0.0	0	0	$0	$0	$0	0.0
Children's Room	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Children's Room	13	LED - Fixtures: Ambient - 2' - Direct Fixture	Occupancy Sensor	S	22	3,100		None	No	13	LED - Fixtures: Ambient - 2' - Direct Fixture	Occupancy Sensor	22	3,100	0.0	0	0	$0	$0	$0	0.0
Children's Room	20	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	32	3,100		None	No	20	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	32	3,100	0.0	0	0	$0	$0	$0	0.0
Children's Room	2	LED - Fixtures: Ambient - 4' - Direct/Indirect Fixture	Occupancy Sensor	S	44	3,100		None	No	2	LED - Fixtures: Ambient - 4' - Direct/Indirect Fixture	Occupancy Sensor	44	3,100	0.0	0	0	$0	$0	$0	0.0
Children's Room	5	LED - Fixtures: Downlight Recessed	Occupancy Sensor	S	13	3,100		None	No	5	LED - Fixtures: Downlight Recessed	Occupancy Sensor	13	3,100	0.0	0	0	$0	$0	$0	0.0
Children's Room	14	LED - Fixtures: Decorative Pendant	Occupancy Sensor	S	32	3,100		None	No	14	LED - Fixtures: Decorative Pendant	Occupancy Sensor	32	3,100	0.0	0	0	$0	$0	$0	0.0
Circulation Area	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Circulation Area	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	32	3,100		None	No	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	32	3,100	0.0	0	0	$0	$0	$0	0.0
Circulation Area	4	LED - Fixtures: Ambient - 6' - Direct/Indirect Fixture	Occupancy Sensor	S	66	3,100		None	No	4	LED - Fixtures: Ambient - 6' - Direct/Indirect Fixture	Occupancy Sensor	66	3,100	0.0	0	0	$0	$0	$0	0.0
Conference Room	3	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	32	1,000		None	No	3	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	32	1,000	0.0	0	0	$0	$0	$0	0.0
Conference Room	6	LED - Fixtures: Downlight Recessed	Occupancy Sensor	S	13	1,000		None	No	6	LED - Fixtures: Downlight Recessed	Occupancy Sensor	13	1,000	0.0	0	0	$0	$0	$0	0.0
Corridor New Books	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor New Books	7	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	32	3,100		None	No	7	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	32	3,100	0.0	0	0	$0	$0	$0	0.0
Director's Office	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	32	2,000		None	No	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	32	2,000	0.0	0	0	$0	$0	$0	0.0
Director's Office	1	LED - Fixtures: Shelf-Mounted Display and Task Lights	Wall Switch	S	15	2,000		None	No	1	LED - Fixtures: Shelf-Mounted Display and Task Lights	Wall Switch	15	2,000	0.0	0	0	$0	$0	$0	0.0
Exterior Bollards	4	LED - Fixtures: Bollard Fixture	Photocell		15	4,380		None	No	4	LED - Fixtures: Bollard Fixture	Photocell	15	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior Parking Lot Lighting	3	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Photocell		80	4,380		None	No	3	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Photocell	80	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior Recessed	2	LED - Fixtures: Downlight Recessed	Photocell		13	4,380		None	No	2	LED - Fixtures: Downlight Recessed	Photocell	13	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior Wall Packs	3	LED - Fixtures: Wall Pack	Photocell		50	4,380		None	No	3	LED - Fixtures: Wall Pack	Photocell	50	4,380	0.0	0	0	$0	$0	$0	0.0

Location	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
	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
Front Entrance Foyer	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Front Entrance Foyer	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	S	13	3,100		None	No	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	13	3,100	0.0	0	0	$0	$0	$0	0.0
Gallery	4	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	4	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Gallery	16	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	32	3,100		None	No	16	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	32	3,100	0.0	0	0	$0	$0	$0	0.0
Gallery	15	LED - Fixtures: Downlight Recessed	Occupancy Sensor	S	13	3,100		None	No	15	LED - Fixtures: Downlight Recessed	Occupancy Sensor	13	3,100	0.0	0	0	$0	$0	$0	0.0
Large Group Room Closet	2	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	32	500		None	No	2	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	32	500	0.0	0	0	$0	$0	$0	0.0
Large Meeting Room	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Large Meeting Room	28	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	32	1,500		None	No	28	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	32	1,500	0.0	0	0	$0	$0	$0	0.0
Maker Space	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	32	3,100		None	No	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	32	3,100	0.0	0	0	$0	$0	$0	0.0
Mechanical Closet	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	33	500		None	No	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	33	500	0.0	0	0	$0	$0	$0	0.0
Meeting Room Foyer	1	LED - Fixtures: Ambient - 8' - Direct/Indirect Fixture	Occupancy Sensor	S	32	3,100		None	No	1	LED - Fixtures: Ambient - 8' - Direct/Indirect Fixture	Occupancy Sensor	32	3,100	0.0	0	0	$0	$0	$0	0.0
Men's Restroom	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	S	13	3,100		None	No	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	13	3,100	0.0	0	0	$0	$0	$0	0.0
Men's Restroom	9	LED - Fixtures: Linear Strip	Occupancy Sensor	S	24	3,100		None	No	9	LED - Fixtures: Linear Strip	Occupancy Sensor	24	3,100	0.0	0	0	$0	$0	$0	0.0
Pantry	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	33	1,500		None	No	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	33	1,500	0.0	0	0	$0	$0	$0	0.0
Quiet Study Room 1	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	S	13	1,000		None	No	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	13	1,000	0.0	0	0	$0	$0	$0	0.0
Quiet Study Room 2	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	S	13	1,000		None	No	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	13	1,000	0.0	0	0	$0	$0	$0	0.0
Staff Restroom	1	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	32	1,000		None	No	1	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	32	1,000	0.0	0	0	$0	$0	$0	0.0
Staff Room	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	32	3,100		None	No	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	32	3,100	0.0	0	0	$0	$0	$0	0.0
Teen Room	6	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	44	3,100		None	No	6	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	44	3,100	0.0	0	0	$0	$0	$0	0.0
Women's Restroom	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	S	13	3,100		None	No	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	13	3,100	0.0	0	0	$0	$0	$0	0.0
Women's Restroom	9	LED - Fixtures: Linear Strip	Occupancy Sensor	S	24	3,100		None	No	9	LED - Fixtures: Linear Strip	Occupancy Sensor	24	3,100	0.0	0	0	$0	$0	$0	0.0

Motor Inventory & Recommendations

		Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	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
Archival Room	Exhaust Fan	1	Exhaust Fan	0.25	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Staff Restroom	Exhaust Fan	1	Exhaust Fan	0.10	65.0%	No	Greenheck	SP-B110	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Men's Restroom	Exhaust Fan	1	Exhaust Fan	0.25	65.0%	No	Greenheck	SQ-95VG	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Women's Restroom	Exhaust Fan	1	Exhaust Fan	0.25	65.0%	No	Greenheck	SQ-95VG	W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Adult Section: AH-1	AHU Supply Fan	1	Supply Fan	1.00	85.5%	No			W	3,700		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Adult Section: AH-2	AHU Supply Fan	1	Supply Fan	1.00	85.5%	No			W	3,700		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Children's Room: AH-3	AHU Supply Fan	1	Supply Fan	1.00	85.5%	No			W	3,700		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Teen Room: AH-4	AHU Supply Fan	1	Supply Fan	0.75	70.0%	No			W	3,700		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Circulation Desk: AH-5	AHU Supply Fan	1	Supply Fan	0.50	70.0%	No			W	3,700		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Meeting Room: AH-6	AHU Supply Fan	1	Supply Fan	0.75	70.0%	No			W	3,700		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Meeting Room: AH-7	AHU Supply Fan	1	Supply Fan	1.00	85.5%	No			W	3,700		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Gallery & Attic: AH-8	AHU Supply Fan	1	Supply Fan	1.00	85.5%	No			W	3,700		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
The Cranbury Library	AHU Condensate Pump	1	Condensate Pump	0.03	65.0%	No			W	3,000		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0

Packaged HVAC Inventory & Recommendations

		Existing Conditions									Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/IEER/ EER)	Heating Mode Efficiency	Manufacturer	Model	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/IEER/ EER)	Heating Mode Efficiency	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Exterior HVAC	Condensing Unit: 6	1	Split-System	3.50		15.25		York	TCD42B32SA	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior HVAC	Condensing Unit: 7 & 8	2	Split-System	5.00		14.75		York	TCG60B31SB	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior HVAC	Condensing Unit: 5	1	Split-System	3.50		15.25		York	TCD42B32SA	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior HVAC	Condensing Unit: 1, 2, & 3	3	Split-System	5.00		14.75		York	TCG60B31SB	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior HVAC	Condensing Unit: 4	1	Split-System	3.00		14.00		York	TCD36B32SA	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior HVAC	Condensing Unit: Archive Room	1	Split-System	1.00		12.00		Data Aire	JG15G1AS	W		No							0.0	0	0	$0	$0	$0	0.0
Conference Room	Electric Resistance Heat	1	Electric Resistance Heat		6.80		1 COP	Indeeco	903U02000CBK-T1CD	W		No							0.0	0	0	$0	$0	$0	0.0
Director's Office	Electric Resistance Heat	1	Electric Resistance Heat		3.41		1 COP	Marley Engineered Products	2504WCA	W		No							0.0	0	0	$0	$0	$0	0.0
Staff Restroom	Electric Resistance Heat	1	Electric Resistance Heat		3.41		1 COP	Marley Engineered Products	2504WCA	W		No							0.0	0	0	$0	$0	$0	0.0
Adult Section	Gas Fire Place	1	Unit Heater		32.00		0.7 AFUE	Regency		W		No							0.0	0	0	$0	$0	$0	0.0
Exterior HVAC	Variable Refrigerant Flow Unit	1	Package Unit	4.00	50.00	15.00	12 HSPF	Hitachi		W		No							0.0	0	0	$0	$0	$0	0.0
Adult Section: AH-1	AHU Heating Section	1	Package Unit		85.00		0.96 AFUE	Lennox	UH090XV60C	W		No							0.0	0	0	$0	$0	$0	0.0
Adult Section: AH-2	AHU Heating Section	1	Package Unit		85.00		0.96 AFUE	Lennox	UH090XV60C	W		No							0.0	0	0	$0	$0	$0	0.0
Children's Room: AH-3	AHU Heating Section	1	Package Unit		85.00		0.96 AFUE	Lennox	UH090XV60C	W		No							0.0	0	0	$0	$0	$0	0.0
Teen Room: AH-4	AHU Heating Section	1	Package Unit		85.00		0.96 AFUE	Lennox	UH090XV48C	W		No							0.0	0	0	$0	$0	$0	0.0
Circulation Desk: AH-5	AHU Heating Section	1	Package Unit		62.00		0.96 AFUE	Lennox	UH070XV36B	W		No							0.0	0	0	$0	$0	$0	0.0
Meeting Room: AH-6	AHU Heating Section	1	Package Unit		85.00		0.96 AFUE	Lennox	UH090XV48C	W		No							0.0	0	0	$0	$0	$0	0.0
Meeting Room: AH-7	AHU Heating Section	1	Package Unit		85.00		0.96 AFUE	Lennox	UH090XV60C	W		No							0.0	0	0	$0	$0	$0	0.0
Gallery & Attic: AH-8	AHU Heating Section	1	Package Unit		85.00		0.96 AFUE	Lennox	UH090XV60C	W		No							0.0	0	0	$0	$0	$0	0.0
The Cranbury Library	Electric Resistance Heat	1	Electric Resistance Heat		13.64		1 COP	Qmark	AWH4408	W		No							0.0	0	0	$0	$0	$0	0.0

Location	Area(s)/System(s) Served	Existing Conditions: System Quantity	Existing Conditions: System Type	Existing Conditions: Cooling Capacity per Unit (Tons)	Existing Conditions: Heating Capacity per Unit (MBh)	Existing Conditions: Cooling Mode Efficiency (SEER/IEER/EER)	Existing Conditions: Heating Mode Efficiency	Existing Conditions: Manufacturer	Existing Conditions: Model	Existing Conditions: Remaining Useful Life	Proposed Conditions: ECM #	Proposed Conditions: Install High Efficiency System?	Proposed Conditions: System Quantity	Proposed Conditions: System Type	Proposed Conditions: Cooling Capacity per Unit (Tons)	Proposed Conditions: Heating Capacity per Unit (kBtu/hr)	Proposed Conditions: Cooling Mode Efficiency (SEER/EER)	Proposed Conditions: Heating Mode Efficiency	Energy Impact & Financial Analysis: Total Peak kW Savings	Energy Impact & Financial Analysis: Total Annual kWh Savings	Energy Impact & Financial Analysis: Total Annual MMBtu Savings	Energy Impact & Financial Analysis: Total Annual Energy Cost Savings	Energy Impact & Financial Analysis: Estimated M&L Cost ($)	Energy Impact & Financial Analysis: Total Incentives	Energy Impact & Financial Analysis: Simple Payback w/ Incentives in Years
The Cranbury Library	Electric Resistance Heat	2	Electric Resistance Heat		3.41		1 COP	Neptronic	DFC100H	W		No							0.0	0	0	$0	$0	$0	0.0

Pipe Insulation Recommendations

Location	Area(s)/System(s) Affected	Recommendation Inputs: ECM #	Recommendation Inputs: Length of Uninsulated Pipe (ft)	Recommendation Inputs: Pipe Diameter (in)	Energy Impact & Financial Analysis: Total Peak kW Savings	Energy Impact & Financial Analysis: Total Annual kWh Savings	Energy Impact & Financial Analysis: Total Annual MMBtu Savings	Energy Impact & Financial Analysis: Total Annual Energy Cost Savings	Energy Impact & Financial Analysis: Estimated M&L Cost ($)	Energy Impact & Financial Analysis: Total Incentives	Energy Impact & Financial Analysis: Simple Payback w/ Incentives in Years
Staff Restroom	Instantaneous Water Heater	1	4	0.75	0.0	74	0	$12	$50	$10	3.4

DHW Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions: System Quantity	Existing Conditions: System Type	Existing Conditions: Manufacturer	Existing Conditions: Model	Existing Conditions: Remaining Useful Life	Proposed Conditions: ECM #	Proposed Conditions: Replace?	Proposed Conditions: System Quantity	Proposed Conditions: System Type	Proposed Conditions: Fuel Type	Proposed Conditions: System Efficiency	Proposed Conditions: Efficiency Units	Energy Impact & Financial Analysis: Total Peak kW Savings	Energy Impact & Financial Analysis: Total Annual kWh Savings	Energy Impact & Financial Analysis: Total Annual MMBtu Savings	Energy Impact & Financial Analysis: Total Annual Energy Cost Savings	Energy Impact & Financial Analysis: Estimated M&L Cost ($)	Energy Impact & Financial Analysis: Total Incentives	Energy Impact & Financial Analysis: Simple Payback w/ Incentives in Years
Staff Restroom	Instantaneous Water Heater	1	Tankless Water Heater	Chronomite	SR-20L/120-1	W		No						0.0	0	0	$0	$0	$0	0.0
Mechanical Closet	DHW Tank	1	Storage Tank Water Heater (≤ 50 Gal)	A.O. Smith	GPDX-50L 300	W		No						0.0	0	0	$0	$0	$0	0.0

Low-Flow Device Recommendations

Location	Recommendation Inputs: ECM #	Recommendation Inputs: Device Quantity	Recommendation Inputs: Device Type	Recommendation Inputs: Existing Flow Rate (gpm)	Recommendation Inputs: Proposed Flow Rate (gpm)	Energy Impact & Financial Analysis: Total Peak kW Savings	Energy Impact & Financial Analysis: Total Annual kWh Savings	Energy Impact & Financial Analysis: Total Annual MMBtu Savings	Energy Impact & Financial Analysis: Total Annual Energy Cost Savings	Energy Impact & Financial Analysis: Estimated M&L Cost ($)	Energy Impact & Financial Analysis: Total Incentives	Energy Impact & Financial Analysis: Simple Payback w/ Incentives in Years
Pantry	2	1	Faucet Aerator (Kitchen)	1.80	1.50	0.0	0	0	$1	$10	$0	10.9
Staff Room	2	1	Faucet Aerator (Kitchen)	1.50	1.50	0.0	0	0	$0	$10	$0	0.0
Men's Restroom	2	2	Faucet Aerator (Lavatory)	1.80	0.50	0.0	0	1	$8	$20	$10	1.3
Staff Restroom	2	1	Faucet Aerator (Lavatory)	1.50	0.50	0.0	82	0	$13	$10	$0	0.8
Women's Restroom	2	2	Faucet Aerator (Lavatory)	1.80	0.50	0.0	0	1	$8	$20	$10	1.3

Plug Load Inventory

	Existing Conditions					
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
The Cranbury Library	1	Coffee Machine	900	No		
The Cranbury Library	19	Desktop	150	No		
The Cranbury Library	1	Fan (Portable)	50	No		
The Cranbury Library	1	Microwave	1,000	No		
The Cranbury Library	1	Cash Payment System	60	No		
The Cranbury Library	1	Cash Register	10	No		
The Cranbury Library	1	Exterior Information Sign	1,100	No		
The Cranbury Library	1	Water Fountain	150	No		
The Cranbury Library	1	AV Equipment	300	No		
The Cranbury Library	1	Electric Kettle	1,200	No		
The Cranbury Library	1	Paper Shredder	150	No		
The Cranbury Library	4	Printer (Medium/Small)	200	No		
The Cranbury Library	1	Printer/Copier (Large)	600	No		
The Cranbury Library	1	Projector	240	No		
The Cranbury Library	2	Refrigerator (Mini)	220	No		
The Cranbury Library	2	Television	50	No		
The Cranbury Library	1	Toaster	600	No		

APPENDIX B: ENERGY STAR STATEMENT OF ENERGY PERFORMANCE

Energy use intensity (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.

NJCEP uses the EPA's ENERGY STAR Portfolio Manager system to generate baseline energy usage results and comparable building EUIs. Portfolio Manager is specifically designed for benchmarking energy consumption within a building. Due to the building type, NJCEP is unable to provide an ENERGY STAR Statement of Energy Performance (SEP) for this facility. Utility bills have been entered into Portfolio Manager for this facility. We encourage you to keep the utility bills updated monthly within Portfolio Manager for energy and cost savings purposes.

LEARN MORE AT energystar.gov

ENERGY STAR® Statement of Energy Performance

N/A

ENERGY STAR® Score[1]

Cranbury Public Library

Primary Property Type: Library
Gross Floor Area (ft²): 11,000
Built: 2022

For Year Ending: February 29, 2024
Date Generated: June 24, 2024

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
Cranbury Public Library 30 Park Place West Cranbury, New Jersey 08512	Cranbury Public Library 30 Park Place West Cranbury, NJ 08512 (609) 722-6992	Brooke Basista 30 Park Place West Cranbury, NJ 08512 (609) 722-6992 ex. 205 director@cranburypubliclibrary.org

Property ID: 34515088

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
61.4 kBtu/ft²

Annual Energy by Fuel

Electric - Grid (kBtu)	311,132 (46%)
Natural Gas (kBtu)	363,727 (54%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	77.4
National Median Source EUI (kBtu/ft²)	143.6
% Diff from National Median Source EUI	-21%

Source EUI
113.9 kBtu/ft²

Annual Emissions

Total (Location-Based) GHG Emissions (Metric Tons CO2e/year)	47

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, which 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 (II)	*Solar renewable energy credit*: a credit you can earn from the state for energy produced from a photovoltaic array.
T5, T8, T12	A reference to a linear lamp diameter. The number represents increments of 1/8th of an inch.
Temperature Setpoint	The temperature at which a temperature regulating device (thermostat, for example) has been set.
therm	100,000 Btu. Typically used as a measure of natural gas consumption.
tons	A unit of cooling capacity equal to 12,000 Btu/hr.
Turnkey	Provision of a complete product or service that is ready for immediate use.
VAV	*Variable air volume*
VFD	*Variable frequency drive*: a controller used to vary the speed of an electric motor.
WaterSense	The symbol for water efficiency. The WaterSense program is managed by the EPA.
Watt (W)	Unit of power commonly used to measure electricity use.