Local Government Energy Audit Report

Bernardsville Library

January 29, 2023

Prepared for:
Bernardsville Public Library
1 Anderson Hill Rd
Bernardsville, New Jersey 07924

Prepared by:
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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.

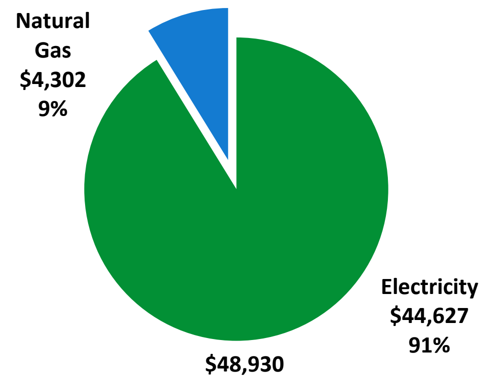
The customer and their respective contractor(s) are responsible to implement energy conservation measures in complete conformance with all applicable local, state, and federal requirements.

Table of Contents

1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Bernardsville 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 Utilities	Costs: $48,930 Electricity: 340,440 kWh Natural Gas: 3,774 Therms	
ENERGY STAR® Benchmarking Score	N/A *(1-100 scale)*	A standard energy use benchmark is not available for this facility type. This report contains suggestions about how to improve building performance and reduce energy costs.

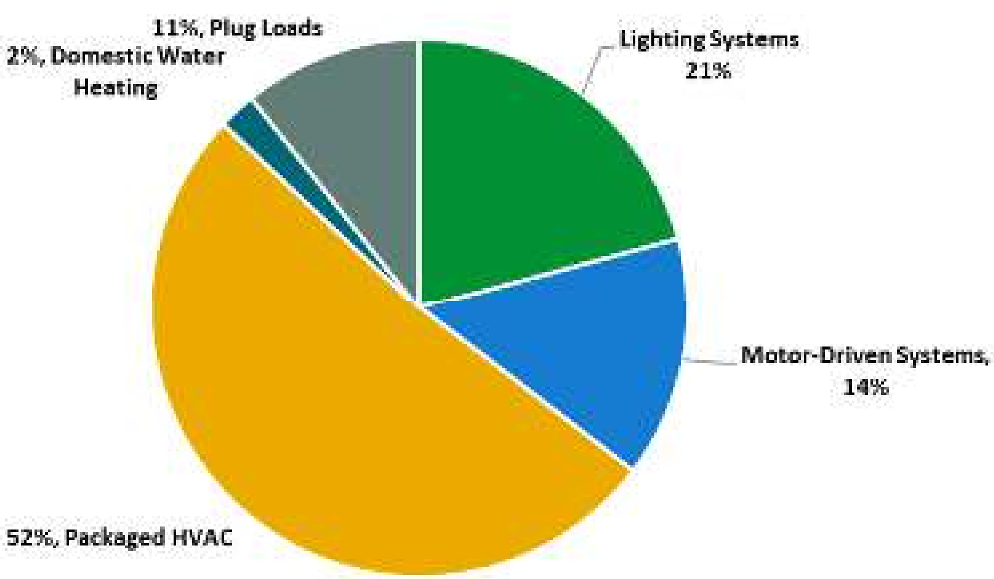


Figure 1 - Energy Use by System

POTENTIAL IMPROVEMENTS

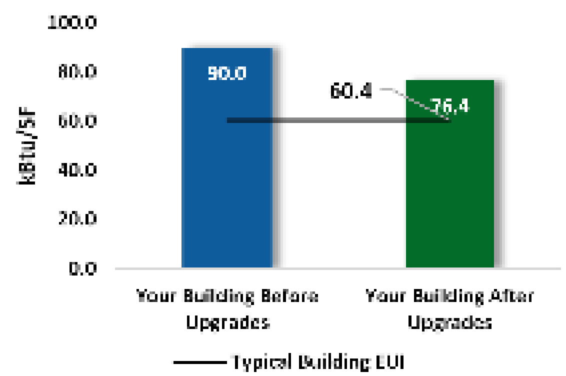
This energy audit considered a range of potential energy improvements in your building. Costs and savings will vary between improvements. Presented below are two potential scopes of work for your consideration.

Scenario 1: Full Package (All Evaluated Measures)

Installation Cost	$38,282
Potential Rebates & Incentives[1]	$6,513
Annual Cost Savings	$9,267
Annual Energy Savings	Electricity: 71,801 kWh Natural Gas: -127 Therms
Greenhouse Gas Emission Savings	35 Tons
Simple Payback	3.4 Years
Site Energy Savings (All Utilities)	15%

Scenario 2: Cost Effective Package[2]

Installation Cost	$38,282
Potential Rebates & Incentives	$6,513
Annual Cost Savings	$9,267
Annual Energy Savings	Electricity: 71,801 kWh Natural Gas: -127 Therms
Greenhouse Gas Emission Savings	35 Tons
Simple Payback	3.4 Years
Site Energy Savings (all utilities)	15%



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)
Lighting Upgrades			**44,776**	**11.6**	**-9**	**$5,762**	**$14,493**	**$3,036**	**$11,457**	**2.0**	**43,985**
ECM 1	Retrofit Fixtures with LED Lamps	Yes	44,776	11.6	-9	$5,762	$14,493	$3,036	$11,457	2.0	43,985
Lighting Control Measures			**15,480**	**4.0**	**-3**	**$1,992**	**$12,498**	**$1,635**	**$10,863**	**5.5**	**15,203**
ECM 2	Install Occupancy Sensor Lighting Controls	Yes	15,480	4.0	-3	$1,992	$12,498	$1,635	$10,863	5.5	15,203
Variable Frequency Drive (VFD) Measures			**9,977**	**3.1**	**0**	**$1,308**	**$11,114**	**$1,800**	**$9,314**	**7.1**	**10,047**
ECM 3	Install VFD on Variable Air Volume (VAV) Fans	Yes	9,977	3.1	0	$1,308	$11,114	$1,800	$9,314	7.1	10,047
HVAC System Improvements			**1,011**	**0.0**	**0**	**$133**	**$119**	**$20**	**$99**	**0.7**	**1,018**
ECM 4	Install Pipe Insulation	Yes	1,011	0.0	0	$133	$119	$20	$99	0.7	1,018
Domestic Water Heating Upgrade			**556**	**0.0**	**0**	**$73**	**$57**	**$22**	**$35**	**0.5**	**560**
ECM 5	Install Low-Flow DHW Devices	Yes	556	0.0	0	$73	$57	$22	$35	0.5	560
TOTALS (COST EFFECTIVE MEASURES)			**71,801**	**18.6**	**-13**	**$9,267**	**$38,282**	**$6,513**	**$31,768**	**3.4**	**70,813**
TOTALS (ALL MEASURES)			**71,801**	**18.6**	**-13**	**$9,267**	**$38,282**	**$6,513**	**$31,768**	**3.4**	**70,813**

* - 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).

Figure 2 – Evaluated Energy Improvements

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

1.1 Planning Your Project

Careful planning makes for a successful energy project. When considering this scope of work, you will have some decisions to make, such as:

- How will the project be funded and/or financed?
- Is it best to pursue individual ECMs, groups of ECMs, or use a comprehensive approach where all ECMs are installed together?
- Are there other facility improvements that should happen at the same time?

Pick Your Installation Approach

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

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. It 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 Bernardsville 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 September 14, 2023, TRC performed an energy audit at Bernardsville Library located in Bernardsville, New Jersey. TRC met with Laura Cole, Fran Daley, and Norm Luik to review the facility operations and help focus our investigation on specific energy-using systems.

Bernardsville Public Library occupies the first floor of a larger business complex built in 1998. The library is a 17,100 square foot space with other businesses operating on the lower floor which are not included in this report. Spaces include corridors, restrooms, a kitchenette, meeting rooms, offices, bookcase areas, and electrical and mechanical spaces. The facility is 100% heated by electric resistance baseboards and a variable air volume (VAV) system serving VAV boxes with electric resistance heat coils. Two roof top units (RTUs) cool 100% of the facility.

Aerial View of Facility

Recent Improvements and Facility Concerns

Facility staff plan to remodel the men and women's restroom and replace one of the DHW tanks in the library. The staff are primarily concerned with the roof insulation condition, high cost of electric resistance heat, as well as, retrofitting fluorescent lighting. Staff are additionally concerned with the condition of the exterior grounds irrigation system. At the time of the audit, leaks were present with the irrigation system's spigot connection.

2.2 Building Occupancy

The facility is occupied year-round, Monday through Sunday, with varying business hours. Five full time employees staff the library which sees an average of 237 patrons per day. Janitorial services are performed after hours.

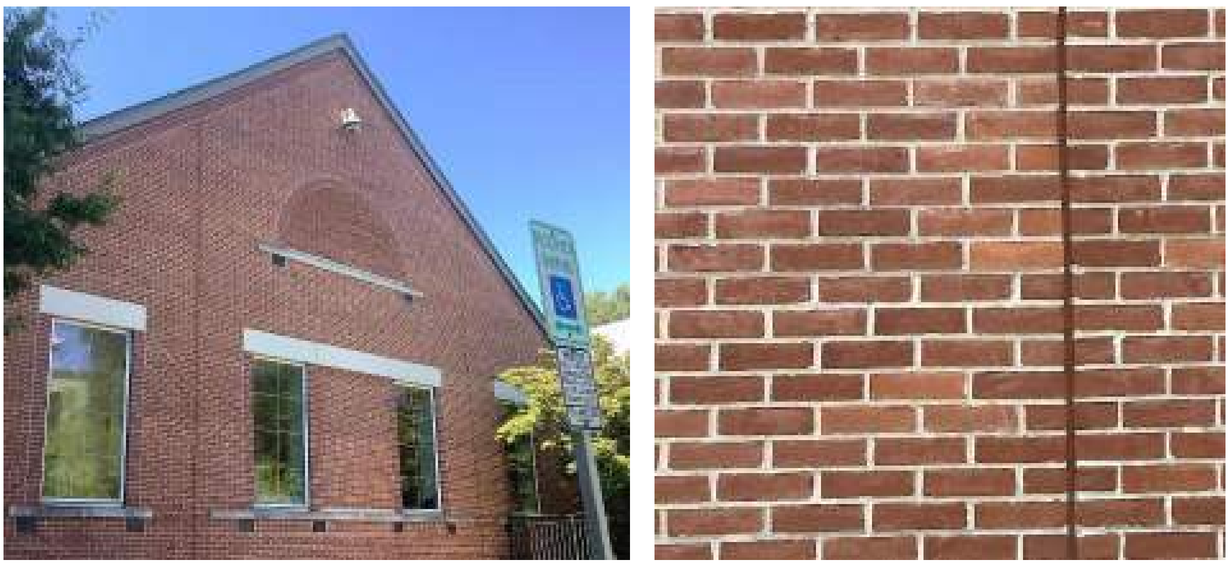
Building Name	Weekday/Weekend	Operating Schedule
Bernardsville Public Library Patron Hours: Monday - Wednesday	Weekday	10:00 AM - 8:00 PM
	Weekend	N/A
Bernardsville Public Library Patron Hours: Thursday - Friday	Weekday	10:00 AM - 5:00 PM
	Weekend	N/A
Bernardsville Public Library Patron Hours: Saturday	Weekday	N/A
	Weekend	10:00 AM - 2:00 PM
Bernardsville Public Library Patron Hours: Sunday	Weekday	N/A
	Weekend	1:00 PM - 5:00 PM
Bernardsville Public Library Staff Hours: Monday - Wednesday	Weekday	9:00 AM - 8:00 PM
	Weekend	N/A
Bernardsville Public Library Staff Hours: Thursday - Friday	Weekday	9:00 AM - 5:00 PM
	Weekend	N/A
Bernardsville Public Library Staff Hours: Saturday	Weekday	N/A
	Weekend	9:30 AM - 2:00 PM
Bernardsville Public Library Staff Hours: Sunday	Weekday	N/A
	Weekend	12:30 PM - 5:00 PM

Figure 3 - Building Occupancy Schedule

2.3 Building Envelope

Bernardsville Public Library's envelope is comprised of a red brick façade which is in good condition. Two roof types are present: a flat, rubber membrane roof and a pitched asphalt shingle roof. The flat roof houses the two RTUs and an exhaust fan as well as HVAC equipment that serves other tenants in the complex.

Facility windows are mainly non-operable double-paned glass windows with wood frames. All windows are in good condition and are sealed well. Exterior doors consist of three types: solid metal, wood framed glass units, and aluminum framed glass units. The solid metal and aluminum framed glass units are in good condition. The wood framed glass unit is in fair condition with signs of wear and evidence of potential wood decay. Door weather stripping throughout the facility is in fair condition.



Exterior Envelope

Rubber Membrane Roof & Pitched Asphalt Shingle Roof

Facility Windows

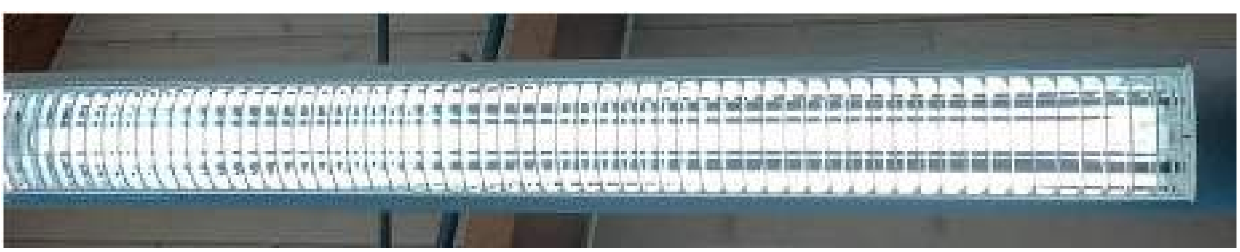
Solid Metal, Aluminum Framed Glass, & Wood Framed Glass Units

Wood Door Condition

2.4 Lighting Systems

The primary lighting system for the library consists of fluorescent lighting. Common indoor lighting includes, CFL biaxial plug-in lamps, CFL A19 screw in bulbs, as well as 2-foot, 3-foot, and 4-foot T8 linear fluorescent tubes with one, two, and three lamps per fixture. Emergency exit signs are up to date with LED technology. Other lighting technology includes PAR38 halogen bulbs, LED downlight recessed fixtures, LED A19 bulbs, and 4-foot T8 equivalent linear LED tubes. At the time of the audit some fluorescent fixtures in the main hall had failed and were not running. However, adequate light levels were still maintained. Manual wall switches control the indoor lighting, and the current lighting system is in fair condition.

Exterior lighting is provided by CFL sconces equipped with double biaxial plug-in lamps. Time clocks control the lights, and the fixtures are in good condition.



4-Foot T8 Linear Fluorescent Tubes

LED Downlight Recessed Fixture, LED Exit Sign, & Halogen PAR38 Lamp

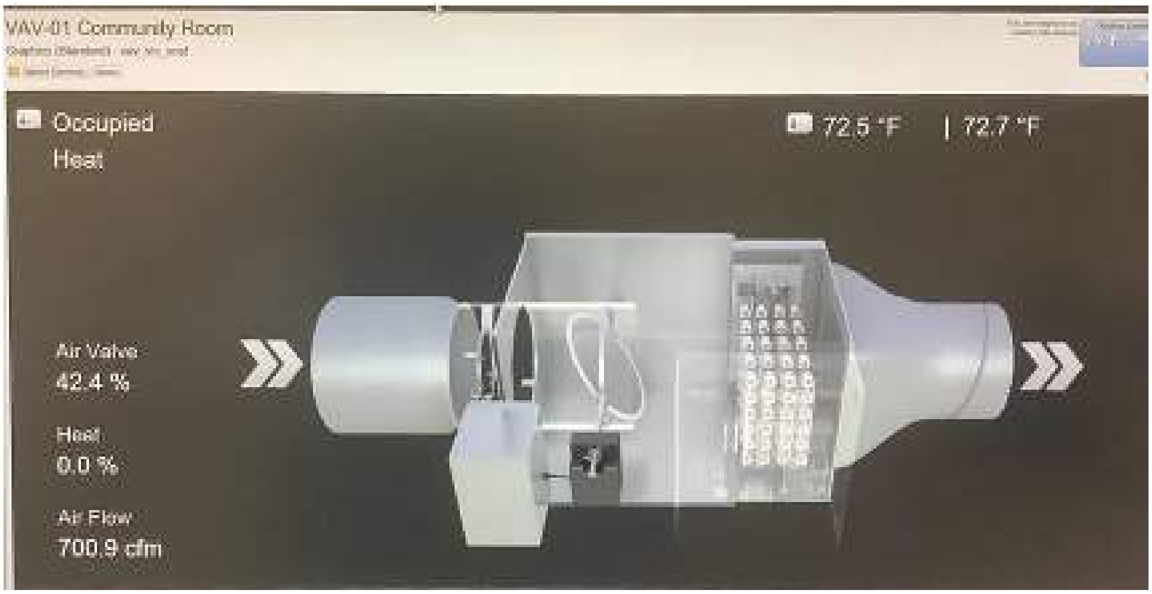
Main Library Area

Exterior CFL Sconces

2.5 Air Handling Systems

Unitary Heating Equipment

Bernardsville Public Library is served by 20 VAV boxes 16 of which are equipped with 5.1 MBh (1.5kW) electric resistance heating coils. The library is primarily heated using the electric resistance coils with the two RTUs providing pre-heated air to the VAVs. A Trane building automation system (BAS) controls the boxes. Temperature setpoints vary from 71.5°F to 73°F.



VAV Box with Electric Resistance Heating

The VAVs are supplemented by 29 electric baseboard heating units located throughout the facility. These units are rated at 6.8 MBh (2 kW) and are locally controlled by thermostat or onboard dial. The units are operating within their rated useful life and are in good condition. Staff have expressed interest in the installation of timer control systems for the baseboards. While we cannot evaluate the cost and payback period, this measure could help reduce the runtime and thus the electrical consumption of the electric baseboards.

Electric Baseboard Heat

Humidification Equipment

The Local History room is equipped with a Nortec (now known as Condair) above ceiling humidifier to maintain a safe climate for historical documents and items. This unit has been estimated to use 6 kW and a 0.3 hp constant speed supply fan motor. This unit has been accounted for under Section 2.9 Plug Load and Vending Machines.

Humidifier Control Panel

Electric Baseboard Thermostat

Packaged Units

The library is served by two Trane Intellipak RTUs that provide DX cooling and gas heating. They provide 40 tons of cooling and 283 MBh of heating. The units are equipped with economizers and variable frequency drives (VFDs) on the supply fans. The RTUs have an estimated energy efficiency ratio (EER) of 14.7 and a thermal efficiency of 80%. The RTU exhaust fan motors are constant speed. At the time of the audit the temperature set point was 74°F according to the BAS system which controls the RTUs. Installed in 2016 the units are operating within their rated useful life and are in good condition.

Unit	Area Served	DX Cooling	Gas Heating	Supply Fan (hp)	Return/Exhaust Fan (HP)
RTU-1	North Area	Yes	Yes	15.0	5.0
RTU-1	South Area	Yes	Yes	15.0	5.0

RTU

RTU BAS View

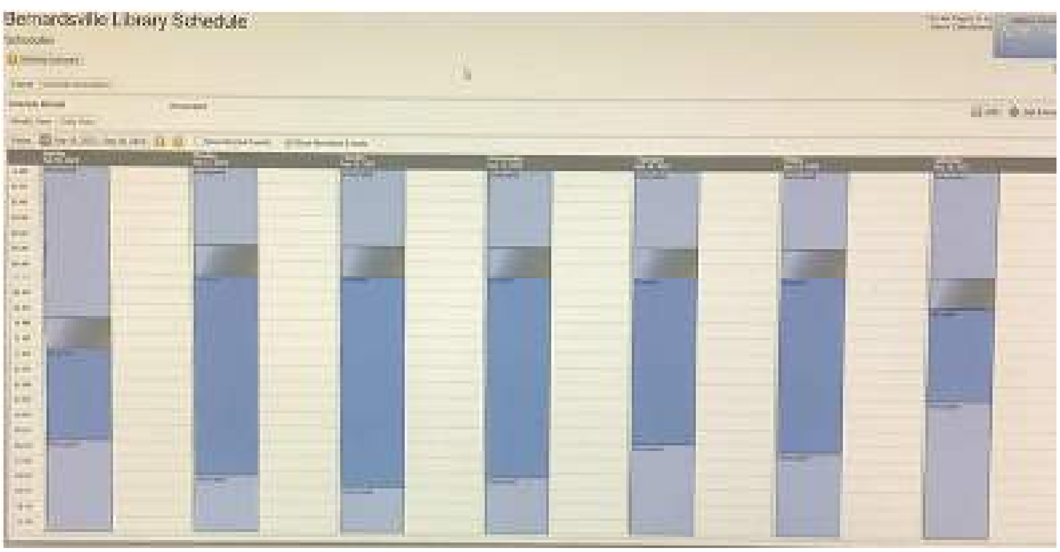
2.6 Building General Exhaust Air Systems

One exhaust fan located on the roof serves to ventilate the library. Powered by a fractional horsepower motor, the fan is believed to be controlled by switch and is in good condition.

Exhaust Fan

2.7 Building Automation System (BAS)

A Trane BAS controls the HVAC equipment, including the two RTUs and the 20 VAV boxes throughout the space. The BAS provides equipment scheduling control and monitors and controls space temperatures, supply air temperatures, as well as air flow rates (in cfm).



BAS Schedule Screenshot

2.8 Domestic Hot Water

Two electric water heaters serve the domestic hot water (DHW) demand. An A.O. Smith 15-gallon, 6 kW, DHW tank located in the Roof Access room serves various areas throughout the building. A DHW tank located above the men's restroom ceiling has been estimated as a 12-gallon 6kW unit and is planned on being replaced with a new 12-gallon DHW tank. At the time of the audit both units are operating beyond their rated useful life and are in good condition. The DHW pipes in the roof access room are mostly insulated and the installation of additional 1-inch DHW pipe insulation has been evaluated.

During the site audit it was observed that the safety relief valve on the men's DHW tank located above the ceiling does not have a discharge pipe attached. This is a safety concern; it is recommended to consult with a licensed professional to resolve this.


Roof Access & Above Ceiling DHW Tank

2.9 Plug Load and Vending Machines

Plug loads at Bernardsville Public Library include standard office equipment. Typical office loads include computers, printers, coffee machines, and microwaves. Additional equipment includes an above ceiling humidifier, a water cooler, a toaster oven, and a paper shredder. There are approximately 46 desktops throughout the building.

There is one full sized and one mini sized residential refrigerator present in the facility. Equipment condition and efficiencies vary.

Large Copier & Full-Size Residential Refrigerator Plug Loads

2.10 Water-Using Systems

There are three restrooms with toilets, urinals, and sinks. Faucet flow rates are 2.0 gpm or lower. Toilets are rated at 2.5 gallons per flush (gpf) and urinals are rated at 2.5 gpf.

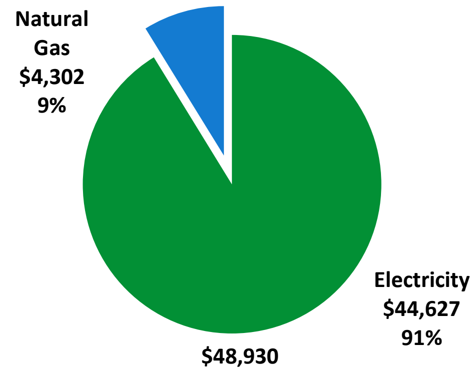
Exterior grounds are watered through an irrigation system. Water leaks were observed at all three junctions where the irrigation system's piping and the water spigots that feed them meet.

Restroom & Kitchen Style Faucet

3 Energy Use and Costs

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

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	340,440 kWh	$44,627
Natural Gas	3,774 Therms	$4,302
Total		**$48,930**



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

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

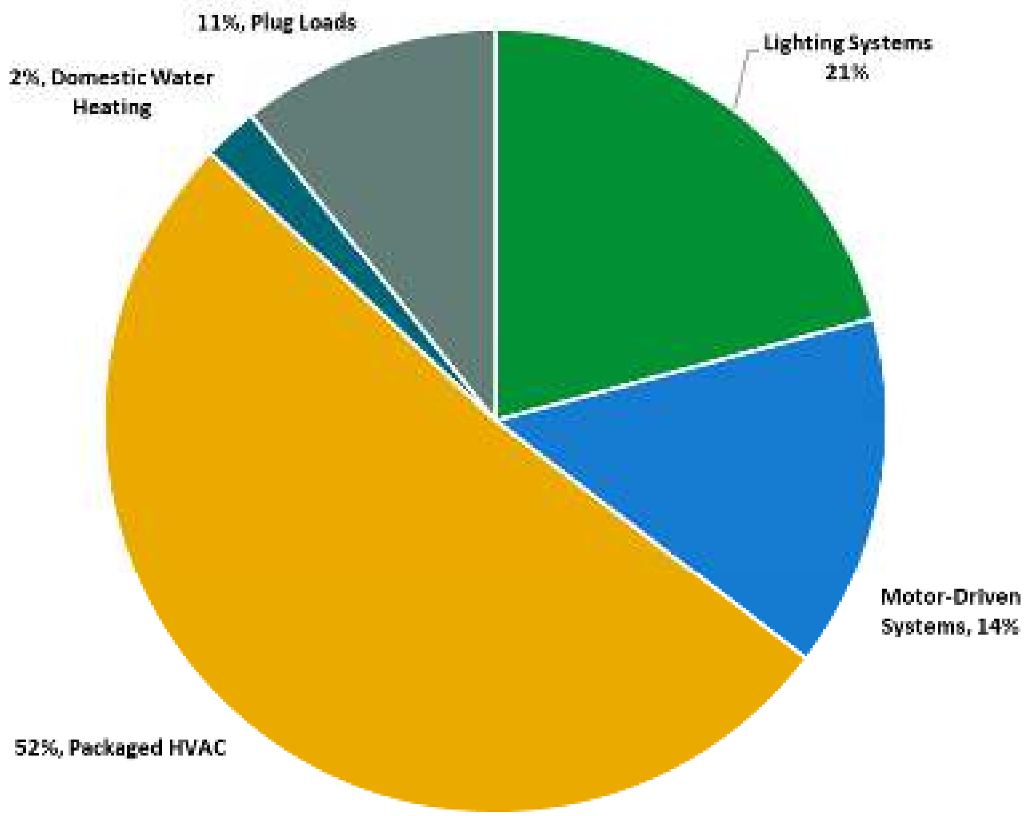
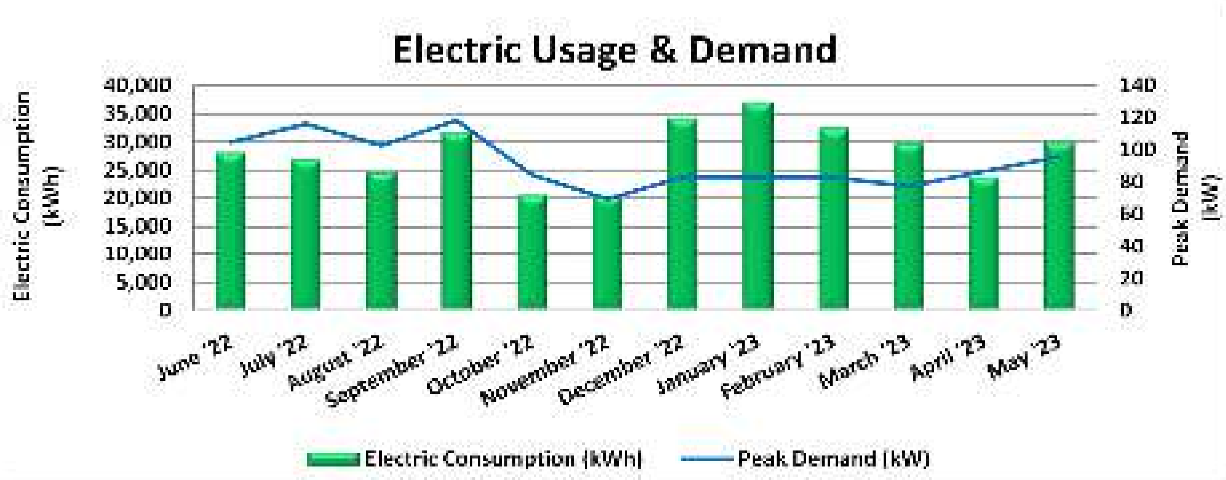


Figure 4 - Energy Balance

3.1 Electricity

JCP&L delivers electricity under rate class.



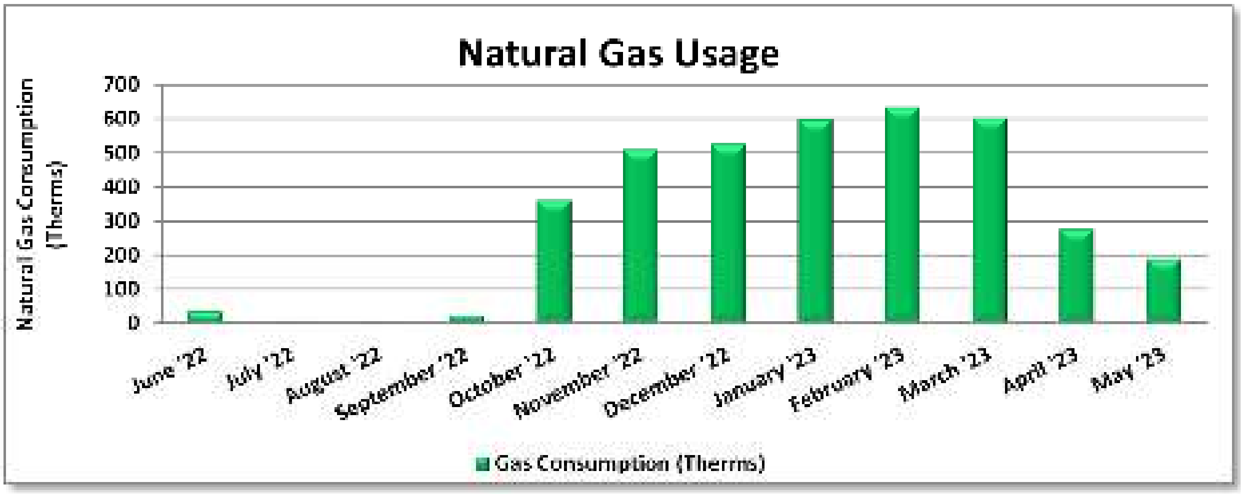
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
6/21/22	34	28,160	105	$831	$3,512
7/21/22	30	27,040	116	$920	$3,677
8/22/22	32	24,640	103	$814	$3,333
9/21/22	30	31,840	119	$939	$4,279
10/20/22	29	20,640	85	$624	$2,881
11/17/22	28	20,480	70	$513	$2,759
12/19/22	32	34,240	83	$615	$4,299
1/20/23	32	37,120	83	$613	$4,590
2/17/23	28	32,480	83	$613	$4,106
3/20/23	31	29,880	78	$572	$3,933
4/19/23	30	23,840	87	$641	$3,268
5/18/23	29	30,080	96	$708	$3,991
Totals	**365**	**340,440**	**119**	**$8,401**	**$44,627**
Annual	**365**	**340,440**	**119**	**$8,401**	**$44,627**

Notes:

- Peak demand of 119 kW occurred in September '22.
- Average demand over the past 12 months was 92 kW.
- The average electric cost over the past 12 months was $0.131/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.



Gas Billing Data			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
6/24/22	30	36	$52
7/26/22	32	9	$27
8/24/22	29	8	$26
9/23/22	30	24	$41
10/24/22	31	362	$386
11/22/22	29	510	$541
12/27/22	35	526	$560
1/25/23	29	597	$788
2/24/23	30	634	$732
3/28/23	32	603	$634
4/26/23	29	277	$304
5/25/23	29	188	$213
Totals	**365**	**3,774**	**$4,302**
Annual	**365**	**3,774**	**$4,302**

Notes:

- The average gas cost for the past 12 months is $1.140/therm, which is the blended rate used throughout the analysis.
- The two RTUs which serve as the gas pre-heat system for the VAVs are the only gas consuming equipment present at the library

3.3 Benchmarking

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

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

Benchmarking Score	N/A

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

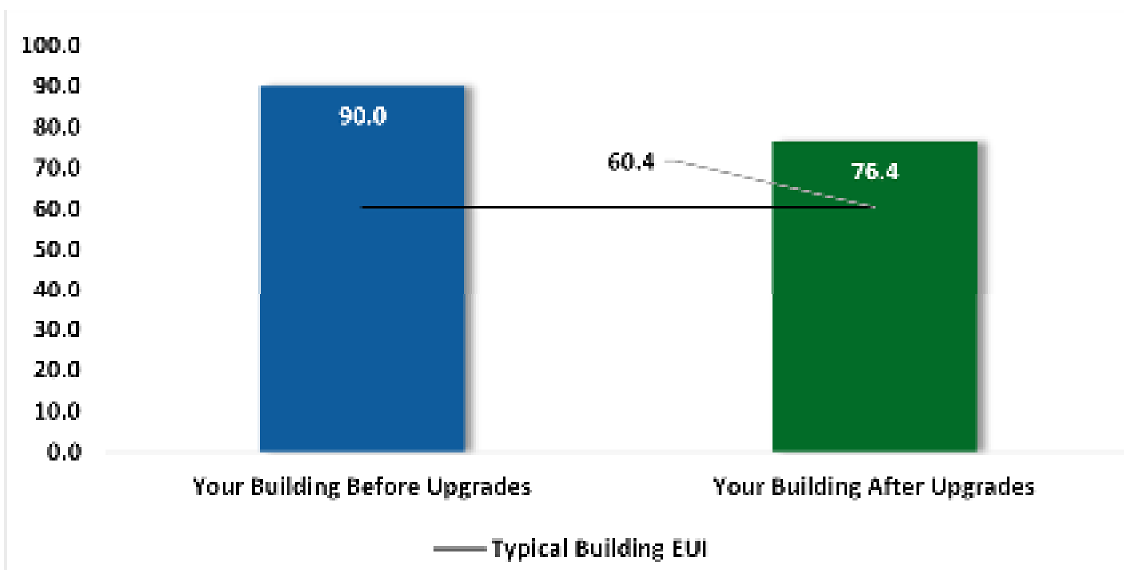


Figure 5 - Energy Use Intensity Comparison[3]

Energy use intensity (EUI) measures energy consumption per square foot and is the standard metric for comparing buildings' energy performance. A lower EUI means better performance and less energy consumed. 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.

[3] Based on all evaluated ECMs

Tracking Your Energy Performance

Keeping track of your energy use on a monthly basis is one of the best ways to keep energy costs in check. Update your utility information in Portfolio Manager regularly, so that you can keep track of your building's performance.

We have created a Portfolio Manager account for your facility and have already entered the monthly utility data shown above for you. Account login information for your account will be sent via email.

Free online training is available to help you use ENERGY STAR Portfolio Manager to track your building's performance at: https://www.energystar.gov/buildings/training.

For more information on ENERGY STAR and Portfolio Manager, visit their website.

4 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)
Lighting Upgrades			**44,776**	**11.6**	**-9**	**$5,762**	**$14,493**	**$3,036**	**$11,457**	**2.0**	**43,985**
ECM 1	Retrofit Fixtures with LED Lamps	Yes	44,776	11.6	-9	$5,762	$14,493	$3,036	$11,457	2.0	43,985
Lighting Control Measures			**15,480**	**4.0**	**-3**	**$1,992**	**$12,498**	**$1,635**	**$10,863**	**5.5**	**15,203**
ECM 2	Install Occupancy Sensor Lighting Controls	Yes	15,480	4.0	-3	$1,992	$12,498	$1,635	$10,863	5.5	15,203
Variable Frequency Drive (VFD) Measures			**9,977**	**3.1**	**0**	**$1,308**	**$11,114**	**$1,800**	**$9,314**	**7.1**	**10,047**
ECM 3	Install VFD on Variable Air Volume (VAV) Fans	Yes	9,977	3.1	0	$1,308	$11,114	$1,800	$9,314	7.1	10,047
HVAC System Improvements			**1,011**	**0.0**	**0**	**$133**	**$119**	**$20**	**$99**	**0.7**	**1,018**
ECM 4	Install Pipe Insulation	Yes	1,011	0.0	0	$133	$119	$20	$99	0.7	1,018
Domestic Water Heating Upgrade			**556**	**0.0**	**0**	**$73**	**$57**	**$22**	**$35**	**0.5**	**560**
ECM 5	Install Low-Flow DHW Devices	Yes	556	0.0	0	$73	$57	$22	$35	0.5	560
TOTALS			**71,801**	**18.6**	**-13**	**$9,267**	**$38,282**	**$6,513**	**$31,768**	**3.4**	**70,813**

* - 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).

Figure 6 – All Evaluated ECMs

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**44,776**	**11.6**	**-9**	**$5,762**	**$14,493**	**$3,036**	**$11,457**	**2.0**	**43,985**
ECM 1	Retrofit Fixtures with LED Lamps	44,776	11.6	-9	$5,762	$14,493	$3,036	$11,457	2.0	43,985
Lighting Control Measures		**15,480**	**4.0**	**-3**	**$1,992**	**$12,498**	**$1,635**	**$10,863**	**5.5**	**15,203**
ECM 2	Install Occupancy Sensor Lighting Controls	15,480	4.0	-3	$1,992	$12,498	$1,635	$10,863	5.5	15,203
Variable Frequency Drive (VFD) Measures		**9,977**	**3.1**	**0**	**$1,308**	**$11,114**	**$1,800**	**$9,314**	**7.1**	**10,047**
ECM 3	Install VFD on Variable Air Volume (VAV) Fans	9,977	3.1	0	$1,308	$11,114	$1,800	$9,314	7.1	10,047
HVAC System Improvements		**1,011**	**0.0**	**0**	**$133**	**$119**	**$20**	**$99**	**0.7**	**1,018**
ECM 4	Install Pipe Insulation	1,011	0.0	0	$133	$119	$20	$99	0.7	1,018
Domestic Water Heating Upgrade		**556**	**0.0**	**0**	**$73**	**$57**	**$22**	**$35**	**0.5**	**560**
ECM 5	Install Low-Flow DHW Devices	556	0.0	0	$73	$57	$22	$35	0.5	560
TOTALS		**71,801**	**18.6**	**-13**	**$9,267**	**$38,282**	**$6,513**	**$31,768**	**3.4**	**70,813**

* - 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).

Figure 7 – Cost Effective ECMs

4.1 Lighting

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**44,776**	**11.6**	**-9**	**$5,762**	**$14,493**	**$3,036**	**$11,457**	**2.0**	**43,985**
ECM 1	Retrofit Fixtures with LED Lamps	44,776	11.6	-9	$5,762	$14,493	$3,036	$11,457	2.0	43,985

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

ECM 1: Retrofit Fixtures with LED Lamps

Replace linear fluorescent, CFL, or halogen incandescent lamps with LED lamps. Many LED tubes are direct replacements for existing fluorescent tubes and can be installed while leaving the fluorescent fixture ballast in place. LED lamps can be used in existing fixtures as a direct replacement for most other lighting technologies. Be sure to specify replacement lamps that are compatible with existing dimming controls, where applicable. In some circumstances, you may need to upgrade your dimming system for optimum performance.

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

Affected Building Areas: The admin office, the career center area, the children's restroom, the community room, the director's office, the electrical room, the exterior wall sconces, fiction section, junior fiction section, junior holidays section, the kitchen, local history, the main entrance, the main hall, the men's restroom, non-fiction section, the programming librarian office, the quiet reading room, the rotunda, the server room, the small meeting room, the staff kitchen, the story room, tech services, and the women's restroom.

4.2 Lighting Controls

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**15,480**	**4.0**	**-3**	**$1,992**	**$12,498**	**$1,635**	**$10,863**	**5.5**	**15,203**
ECM 2	Install Occupancy Sensor Lighting Controls	15,480	4.0	-3	$1,992	$12,498	$1,635	$10,863	5.5	15,203

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

ECM 2: Install Occupancy Sensor Lighting Controls

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

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

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

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

Affected Building Areas: The admin office, the circulation alcove, the circulation area, the community room, the community room vestibule, the director's office, fiction section, junior fiction section, the kitchen, local history, the main entrance, the main hall, the men's restroom, music CD section, non-fiction section, the programming librarian office, the quiet reading room, the rotunda, the small meeting room, the staff kitchen, the story room, tech services, the women's restroom, and world languages.

4.3 Variable Frequency Drives (VFD)

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**9,977**	**3.1**	**0**	**$1,308**	**$11,114**	**$1,800**	**$9,314**	**7.1**	**10,047**
ECM 3	Install VFD on Variable Air Volume (VAV) Fans	9,977	3.1	0	$1,308	$11,114	$1,800	$9,314	7.1	10,047

Variable frequency drives control motors for fans, pumps, and process equipment based on the actual output required of the driven equipment. Energy savings result from more efficient control of motor energy usage when equipment operates at partial load. The magnitude of energy savings depends on the estimated amount of time that the motor would operate at partial load. For equipment with proposed VFDs, we have included replacing the controlled motor with a new inverter duty rated motor to conservatively account for the cost of an inverter duty rated motor.

ECM 3: Install VFD on Variable Air Volume (VAV) Fans

Replace existing air volume control devices on variable volume fans, such as inlet vanes and variable pitch fan blades, with VFDs. Inlet guide vanes and variable pitch fan blades are an inefficient means of controlling the air volume compared to VFDs. The existing volume control device will be removed or permanently disabled, and the control signal will be redirected to the VFD to determine proper fan motor speed.

Energy savings result from using a more efficient control device to regulate the air flow provided by the fan. Additional maintenance savings may result from this measure. VFDs are solid state electronic devices, which generally require less maintenance than mechanical air volume control devices.

Affected Air Handlers: Exhaust fans for RTU-1 and RTU-2.

4.4 HVAC Improvements

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
HVAC System Improvements		**1,011**	**0.0**	**0**	**$133**	**$119**	**$20**	**$99**	**0.7**	**1,018**
ECM 4	Install Pipe Insulation	1,011	0.0	0	$133	$119	$20	$99	0.7	1,018

ECM 4: Install Pipe Insulation

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

Affected Systems: The DHW tank in the roof access room.

4.5 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**556**	**0.0**	**0**	**$73**	**$57**	**$22**	**$35**	**0.5**	**560**
ECM 5	Install Low-Flow DHW Devices	556	0.0	0	$73	$57	$22	$35	0.5	560

ECM 5: 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.

4.6 Measures for Future Consideration

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

Bernardsville 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.

Retro-Commissioning Study

Due to the complexity of today's HVAC systems and controls, a thorough analysis and rebalance of heating, ventilation, and cooling systems should periodically be conducted. There are indications at this site that systems may not be operating correctly or as efficiently as they could be. One important tool available to building operators to ensure proper system operation is retro-commissioning.

Retro-commissioning is a common practice recommended by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) to be implemented every few years. We recommend that you contact a reputable engineering firm that specializes in energy control systems and retro-commissioning. Ask them to propose a scope of work and an outline of the procedures and processes to be implemented, including a schedule and the roles of all responsible parties.

Once goals and responsibilities are established, the objective of the investigation process is to understand how the building is currently operating, identify the issues, and determine the most cost-effective way to improve performance. The retro-commissioning agent will review building documentation, interview building occupants, and inspect and test the equipment. Information is then compiled into a report and shared with facility staff, who will select which recommendations to implement after reviewing the findings.

The implementation phase puts the selected processes into place. Typical measures may include sensor calibration, equipment schedule changes, damper linkage repair and similar relatively low-cost adjustments—although more expensive sophisticated programming and building control system upgrades may be warranted. Approved measures may be implemented by the agent, the building staff, or by subcontractors. Typically, a combination of these individuals makes up the retro-commissioning team.

After the approved measures are implemented, the team will verify that the changes are working as expected. Baseline and post-case measurements will allow building staff to monitor equipment and ensure that the benefits are maintained.

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.

Building Insulation

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

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

An insulating material's resistance to conductive heat flow is measured or rated in terms of its thermal resistance or R-value—the higher the R-value, the greater the insulating effectiveness. The R-value depends on the type of insulation, its thickness, and its density. Installing more (and thicker) insulation increases the R-value and the resistance to heat flow.

Consider using a thermal camera to conduct a study of building heat loss to better understand where insulation will provide the greatest benefit.

Install Roof or Ceiling Insulation

Installing ceiling or roof insulation as a thermal barrier between the conditioned space and the roof will improve thermal comfort in the building and reduce the heating energy use. Commonly used insulation materials include fiberglass, cellulose, rigid foam, and polystyrene. Insulation can be blown in, applied as a layer, or sprayed on, depending on the type of material. Install insulation to levels that meet or exceed the current adopted building and energy code.

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[4] . 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.

[4] 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.

Motor Maintenance

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

Fans to Reduce Cooling Load

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

Economizer Maintenance

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

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

AC System Evaporator/Condenser Coil Cleaning

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

HVAC Filter Cleaning and Replacement

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

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.

Optimize HVAC Equipment Schedules

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

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

Water Heater Maintenance

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

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

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

Water Conservation

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

For more information regarding water conservation go to the EPA's WaterSense website[5] or download a copy of EPA's "WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities"[6] to get ideas for creating a water management plan and best practices for a wide range of water using systems.

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

If the facility has detached buildings with a master water meter for the entire campus, check for unnatural wet areas in the lawn or water seeping in the foundation at water pipe penetrations through the

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

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

foundation. Periodically check overnight meter readings when the facility is unoccupied, and there is no other scheduled water usage.

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

Procurement Strategies

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

6 ON-SITE GENERATION

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

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

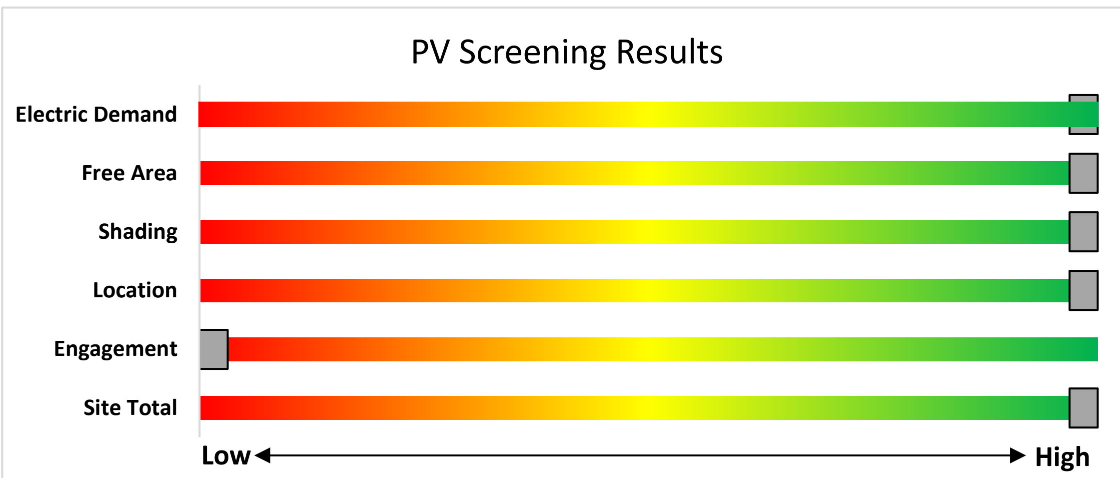
6.1 Solar Photovoltaic

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

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

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

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



Potential	High	
System Potential	92	kW DC STC
Electric Generation	109,606	kWh/yr
Displaced Cost	$14,370	/yr
Installed Cost	$239,200	

Figure 8 - 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**: www.njcleanenergy.com/whysolar
- **NJ Solar Market FAQs**: www.njcleanenergy.com/renewable-energy/program-updates-and-background-information/solar-transition/solar-market-faqs.
- **Approved Solar Installers in the NJ Market**: www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/?id=60&start=1

6.2 Combined Heat and Power

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

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

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

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

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

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

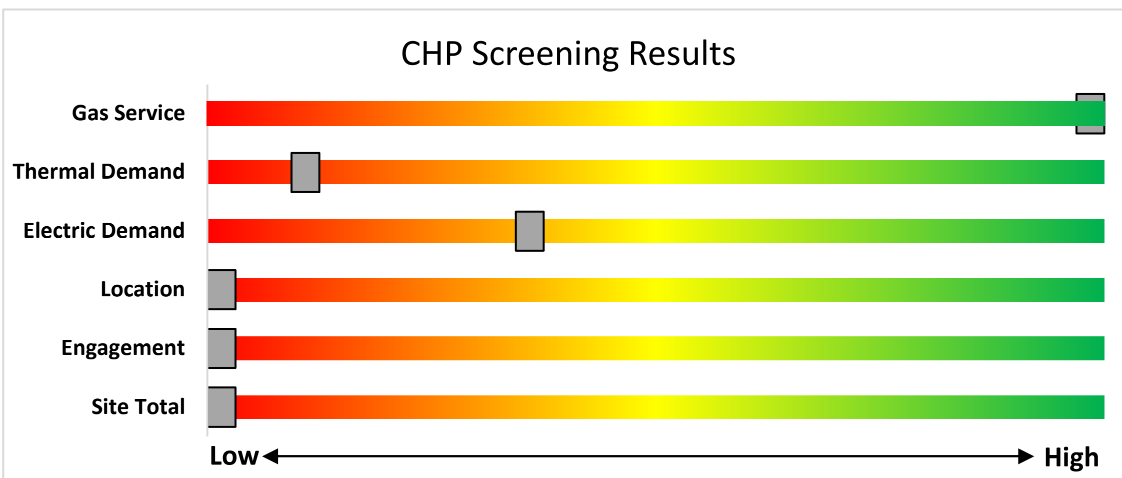


Figure 9 - Combined Heat and Power Screening

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

7 ELECTRIC VEHICLES (EV)

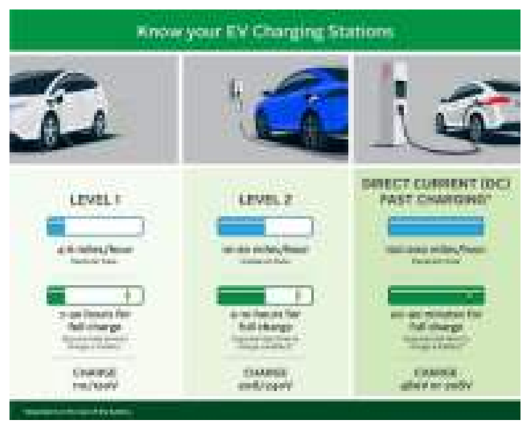
All electric vehicles (EVs) have an electric motor instead of an internal combustion engine. EVs function by plugging into a charge point, taking electricity from the grid, and then storing it in rechargeable batteries. Although electricity production may contribute to air pollution, the U.S. EPA categorizes 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.

7.1 Electric Vehicle 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.

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.

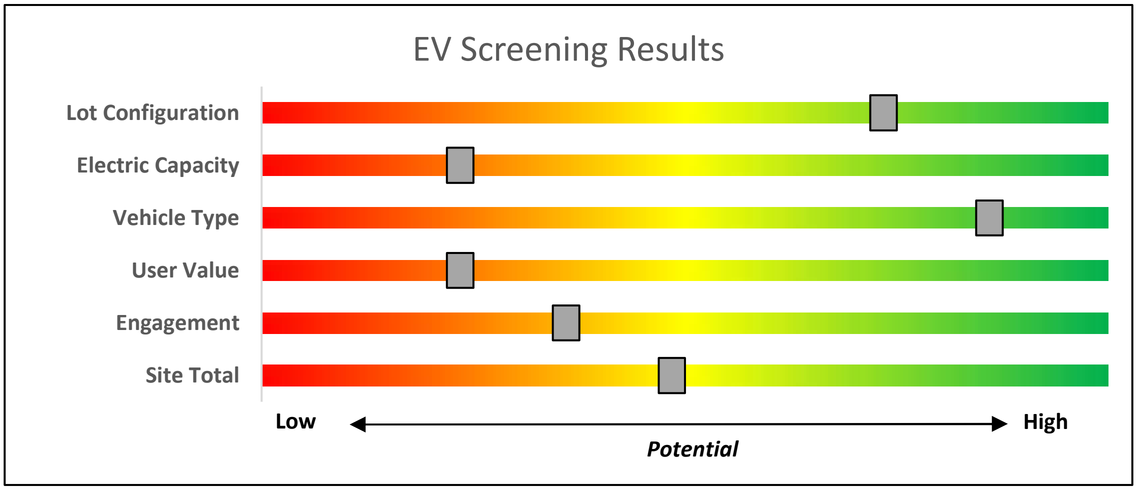


Figure 10 – EV Charger Screening

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) or Public Service Electric & Gas Company (PSE&G), 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 or PSE&G, up to 90% of the combined charger purchase and installation costs. Please check ACE or PSE&G program eligibility requirements before purchasing EV charging equipment, as additional conditions on types of eligible chargers may apply for utility incentives.

Both Jersey Central Power & Light (JCP&L) and Rockland Electric (RECO) have filed proposals for EV charging programs. BPU staff is currently reviewing those proposals.

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

8 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.

8.1 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.

8.2 New Jersey's Clean Energy Programs

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 that annually contribute at least $200,000 to the NJCEP aggregate of all buildings/sites. This equates to roughly $5 million in 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 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

Eligible Technologies	Size (Installed Rated Capacity)[1]	Incentive ($/kW)	% of Total Cost Cap per Project[3]	$ Cap per Project[3]
Powered by non-renewable or renewable fuel source[4]	≤500 kW	$2,000	30-40%[2]	$2 million
Gas Internal Combustion Engine	>500 kW - 1 MW	$1,000		
Gas Combustion Turbine	> 1 MW - 3 MW	$550	30%	$3 million
Microturbine	>3 MW	$350		
Fuel Cells with Heat Recovery				
Waste Heat to Power*	<1 MW	$1,000	30%	$2 million
	> 1MW	$500		$3 million

*Waste Heat to Power: Powered by non-renewable fuel source, heat recovery or other mechanical recovery from existing equipment utilizing new electric generation equipment (e.g. steam turbine).

Check the NJCEP website for details on program availability, current incentive levels, and requirements.

How to Participate

You 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 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 Program

The Competitive Solar Incentive (CSI) Program will provide competitively set incentives for grid supply projects and net metered non-residential projects greater than 5MW (dc). The program is currently under development. For updates, please continue to check the Solar Proceedings page on the New Jersey's Clean Energy Program website.

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 photovoltaics 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 into 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.

9 PROJECT DEVELOPMENT

Energy conservation measures (ECMs) have been identified for your site, and their energy and economic analyses are provided within this LGEA report. 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.

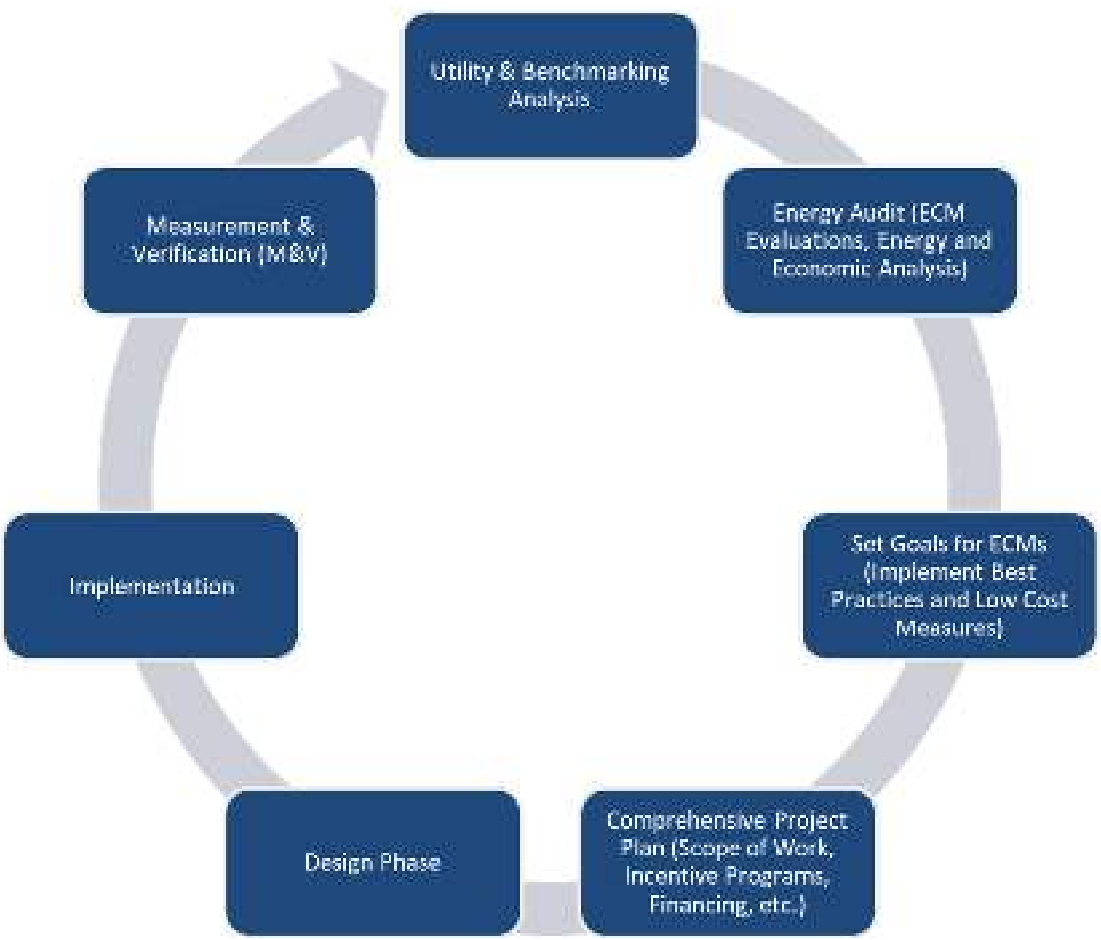


Figure 11 – Project Development Cycle

10 Energy Purchasing and Procurement Strategies

10.1 Retail Electric Supply Options

Energy deregulation in New Jersey has increased energy buyers' options by separating the function of electricity distribution from that of electricity supply. 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[7].

10.2 Retail Natural Gas Supply Options

The natural gas market in New Jersey is also deregulated. Most customers that remain with the utility for natural gas service pay rates that are market based and 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[8].

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

[8] 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
Admin 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
Admin Area	1	LED - Fixtures: Downlight Recessed	Wall Switch	S	13	3,300		None	No	1	LED - Fixtures: Downlight Recessed	Wall Switch	13	3,300	0.0	0	0	$0	$0	$0	0.0
Admin Office	4	Compact Fluorescent: (3) 34W Biaxial Plug-In Lamps	Wall Switch	S	102	3,300	1, 2	Relamp	Yes	4	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	72	2,277	0.2	746	0	$96	$420	$47	3.9
Main Hall	2	Compact Fluorescent: (3) 34W Biaxial Plug-In Lamps	Wall Switch	S	102	3,300	1	Relamp	No	2	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	72	3,300	0.1	214	0	$28	$75	$6	2.5
Children's Restroom	1	Linear Fluorescent - T8: 3' T8 (25W) - 2L	Wall Switch	S	48	2,500	1	Relamp	No	1	LED - Linear Tubes: (2) 3' Lamps	Wall Switch	21	2,500	0.0	73	0	$9	$37	$10	2.8
Children's Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,500	1	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,500	0.0	89	0	$11	$37	$10	2.3
Circulation Alcove	2	LED - Fixtures: Downlight Recessed	Wall Switch	S	13	1,500	2	None	Yes	2	LED - Fixtures: Downlight Recessed	Occupancy Sensor	13	1,035	0.0	13	0	$2	$116	$20	57.1
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	16	LED - Fixtures: Downlight Recessed	Wall Switch	S	13	3,300	2	None	Yes	16	LED - Fixtures: Downlight Recessed	Occupancy Sensor	13	2,277	0.1	230	0	$30	$540	$70	15.9
Community Room	1	Compact Fluorescent: (1) 26W BR30 Screw-In Lamp	Wall Switch	S	26	2,500	1	Relamp	No	1	LED Lamps: BR30 Lamps	Wall Switch	19	2,500	0.0	19	0	$2	$24	$3	8.6
Community Room	15	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	2,500	1, 2	Relamp	Yes	15	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	1,725	0.3	861	0	$111	$758	$125	5.7
Community Room	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Community Room	26	Halogen Incandescent: (1) 72W PAR38 Screw-In Lamp	Wall Switch	S	72	2,500	1, 2	Relamp	Yes	26	LED Lamps: PAR38 Lamps	Occupancy Sensor	11	1,725	1.5	4,522	-1	$582	$1,325	$148	2.0
Community Room Vestibule	4	LED - Fixtures: Downlight Recessed	Wall Switch	S	13	2,500	2	None	Yes	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	13	1,725	0.0	44	0	$6	$270	$35	42.0
Director Office	4	Compact Fluorescent: (3) 34W Biaxial Plug-In Lamps	Wall Switch	S	102	2,800	1, 2	Relamp	Yes	4	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	72	1,932	0.2	633	0	$81	$420	$47	4.6
Electrical Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,000	1	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,000	0.0	71	0	$9	$37	$10	2.9
Exterior Wall Scone	8	Compact Fluorescent: (1) 26W Double Biaxial Plug-In Lamp	Timeclock		26	4,380	1	Relamp	No	8	LED Lamps: GX23 (Plug-In) Lamps	Timeclock	19	4,380	0.0	245	0	$32	$100	$8	2.9
Exterior Wall Scone	2	Compact Fluorescent: (4) 26W Double Biaxial Plug-In Lamps	Timeclock		104	4,380	1	Relamp	No	2	LED Lamps: GX23 (Plug-In) Lamps	Timeclock	73	4,380	0.0	272	0	$36	$100	$8	2.6
Fiction	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
Fiction	72	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,300	1, 2	Relamp	Yes	72	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,277	2.7	10,775	-2	$1,386	$3,979	$895	2.2
J Fiction	8	Compact Fluorescent: (3) 34W Biaxial Plug-In Lamps	Wall Switch	S	102	3,300	1, 2	Relamp	Yes	8	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	72	2,277	0.4	1,492	0	$192	$570	$59	2.7
J Holidays	2	Compact Fluorescent: (3) 34W Biaxial Plug-In Lamps	Wall Switch	S	102	3,300	1	Relamp	No	2	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	72	3,300	0.1	214	0	$28	$75	$6	2.5
J Holidays	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
Ken's Closet	1	LED Lamps: (2) 15W Biax Lamps	Wall Switch	S	30	2,700		None	No	1	LED Lamps: (2) 15W Biax Lamps	Wall Switch	30	2,700	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	LED - Fixtures: Downlight Recessed	Wall Switch	S	13	2,300		None	No	1	LED - Fixtures: Downlight Recessed	Wall Switch	13	2,300	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	2,300	1, 2	Relamp	Yes	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,587	0.0	109	0	$14	$153	$30	8.7
Local History	6	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	2,200	1, 2	Relamp	Yes	6	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	1,518	0.1	303	0	$39	$465	$71	10.1
Local History	3	LED - Fixtures: Downlight Recessed	Wall Switch	S	13	2,200		None	No	3	LED - Fixtures: Downlight Recessed	Wall Switch	13	2,200	0.0	0	0	$0	$0	$0	0.0
Mail Nook	1	LED - Fixtures: Downlight Recessed	Wall Switch	S	13	1,500		None	No	1	LED - Fixtures: Downlight Recessed	Wall Switch	13	1,500	0.0	0	0	$0	$0	$0	0.0
Main Entrance	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Main Entrance	5	LED - Fixtures: Downlight Recessed	Wall Switch	S	13	3,300		None	No	5	LED - Fixtures: Downlight Recessed	Wall Switch	13	3,300	0.0	0	0	$0	$0	$0	0.0
Main Entrance	10	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	3,300	1, 2	Relamp	Yes	10	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	2,277	0.2	784	0	$101	$453	$85	3.6
Main Hall	32	Compact Fluorescent: (1) 36W Biaxial Plug-In Lamp	Wall Switch	S	36	3,300	1, 2	Relamp	Yes	32	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	26	2,277	0.5	2,060	0	$265	$1,210	$137	4.0
Main Hall	76	Compact Fluorescent: (1) 40W Biaxial Plug-In Lamp	Wall Switch	S	40	3,300	1, 2	Relamp	Yes	76	LED Lamps: PL-L (Biax) Lamps	Occupancy Sensor	28	2,277	1.4	5,601	-1	$721	$2,376	$251	2.9
Main Hall	2	Compact Fluorescent: (1) 26W Double Biaxial Plug-In Lamp	Wall Switch	S	26	3,300	1	Relamp	No	2	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	19	3,300	0.0	50	0	$6	$25	$2	3.6
Main Hall	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
Main Hall	54	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,300	1, 2	Relamp	Yes	54	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,277	3.0	12,122	-3	$1,560	$4,038	$950	2.0
Men's Restroom	2	LED - Fixtures: Downlight Recessed	Wall Switch	S	13	3,100	2	None	Yes	2	LED - Fixtures: Downlight Recessed	Occupancy Sensor	13	2,139	0.0	27	0	$3	$270	$35	67.7
Men's Restroom	2	Linear Fluorescent - T8: 3' T8 (25W) - 2L	Wall Switch	S	48	3,100	1	Relamp	No	2	LED - Linear Tubes: (2) 3' Lamps	Wall Switch	21	3,100	0.0	181	0	$23	$73	$20	2.3
Men's Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,100	1	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,100	0.1	221	0	$28	$73	$20	1.9
Music CD	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
Music CD	4	LED - Fixtures: Downlight Recessed	Wall Switch	S	13	3,300	2	None	Yes	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	13	2,277	0.0	57	0	$7	$270	$35	31.8
Non-Fiction	2	Compact Fluorescent: (2) 26W A19 Screw-In Lamps	Wall Switch	S	52	3,300	1	Relamp	No	2	LED Lamps: A19 Lamps	Wall Switch	37	3,300	0.0	107	0	$14	$69	$4	4.7
Non-Fiction	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
Non-Fiction	6	Linear Fluorescent - T8: 3' T8 (25W) - 1L	Wall Switch	S	27	3,300	1	Relamp	No	6	LED - Linear Tubes: (1) 3' Lamp	Wall Switch	11	3,300	0.1	353	0	$45	$110	$30	1.8
Non-Fiction	80	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,300	1, 2	Relamp	Yes	80	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,277	3.0	11,972	-3	$1,540	$4,541	$1,010	2.3
Norms Closet	1	LED Lamps: (2) 15W Biax Lamps	Wall Switch	S	30	2,700		None	No	1	LED Lamps: (2) 15W Biax Lamps	Wall Switch	30	2,700	0.0	0	0	$0	$0	$0	0.0
Programming Librarian Office	2	Compact Fluorescent: (3) 34W Biaxial Plug-In Lamps	Wall Switch	S	102	2,800	1, 2	Relamp	Yes	2	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	72	1,932	0.1	316	0	$41	$191	$26	4.1
Programming Librarian Office Closet	2	LED Lamps: (2) 15W Biax Lamps	Wall Switch	S	30	200		None	No	2	LED Lamps: (2) 15W Biax Lamps	Wall Switch	30	200	0.0	0	0	$0	$0	$0	0.0
Quiet Reading Room	2	Compact Fluorescent: (2) 26W A19 Screw-In Lamps	Wall Switch	S	52	2,500	1	Relamp	No	2	LED Lamps: A19 Lamps	Wall Switch	37	2,500	0.0	81	0	$10	$69	$4	6.2

	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
Quiet Reading Room	2	Compact Fluorescent: (1) 26W Double Biaxial Plug-In Lamp	Wall Switch	S	26	2,500	1	Relamp	No	2	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	19	2,500	0.0	38	0	$5	$25	$2	4.7
Quiet Reading Room	4	LED - Fixtures: Downlight Recessed	Wall Switch	S	13	2,500	2	None	Yes	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	13	1,725	0.0	44	0	$6	$270	$35	42.0
Roof Access	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,500		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,500	0.0	0	0	$0	$0	$0	0.0
Rotunda	12	Compact Fluorescent: (1) 26W Double Biaxial Plug-In Lamp	Wall Switch	S	26	3,300	1, 2	Relamp	Yes	12	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	19	2,277	0.1	551	0	$71	$420	$47	5.3
Rotunda	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
Rotunda	4	LED Lamps: (4) 10W A19 Screw-In Lamps	Wall Switch	S	40	3,300	2	None	Yes	4	LED Lamps: (4) 10W A19 Screw-In Lamps	Occupancy Sensor	40	2,277	0.0	177	0	$23	$270	$35	10.3
Server Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,500	1	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,500	0.0	53	0	$7	$37	$10	3.9
Small Meeting Room	4	Compact Fluorescent: (3) 34W Biaxial Plug-In Lamps	Wall Switch	S	102	2,200	1, 2	Relamp	Yes	4	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	72	1,518	0.2	497	0	$64	$420	$47	5.8
Staff Kitchen	3	Compact Fluorescent: (3) 34W Biaxial Plug-In Lamps	Wall Switch	S	102	2,300	1, 2	Relamp	Yes	3	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	72	1,587	0.1	390	0	$50	$383	$44	6.7
Story Room	5	Compact Fluorescent: (3) 34W Biaxial Plug-In Lamps	Wall Switch	S	102	2,500	1, 2	Relamp	Yes	5	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	72	1,725	0.2	706	0	$91	$458	$50	4.5
Tech Services	13	Compact Fluorescent: (3) 34W Biaxial Plug-In Lamps	Wall Switch	S	102	3,300	1, 2	Relamp	Yes	13	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	72	2,277	0.6	2,424	-1	$312	$758	$74	2.2
Tech Services	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
Women's Restroom	2	LED - Fixtures: Downlight Recessed	Wall Switch	S	13	3,100		None	No	2	LED - Fixtures: Downlight Recessed	Wall Switch	13	3,100	0.0	0	0	$0	$0	$0	0.0
Women's Restroom	2	Linear Fluorescent - T8: 3' T8 (25W) - 2L	Wall Switch	S	48	3,100	1	Relamp	No	2	LED - Linear Tubes: (2) 3' Lamps	Wall Switch	21	3,100	0.0	181	0	$23	$73	$20	2.3
Women's Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,100	1, 2	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,139	0.1	281	0	$36	$343	$55	8.0
World Languages	4	LED - Fixtures: Downlight Recessed	Wall Switch	S	13	3,300	2	None	Yes	4	LED - Fixtures: Downlight Recessed	Occupancy Sensor	13	2,277	0.0	57	0	$7	$270	$35	31.8

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
Roof	Exhaust Fan 1	1	Exhaust Fan	0.5	70.0%	No	Penn Ventilation	FX14B	W	2,500		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	RTU-1 Supply Fan	1	Supply Fan	15.0	90.2%	Yes			W	3,000		No	90.2%	No		0.0	0	0	$0	$0	$0	0.0
Roof	RTU-1 Exhuast Fan	1	Exhaust Fan	5.0	87.5%	No			W	3,000	3	No	89.5%	Yes	1	1.5	4,989	0	$654	$5,557	$900	7.1
Roof	RTU-2 Supply Fan	1	Supply Fan	15.0	90.2%	Yes			W	3,000		No	90.2%	No		0.0	0	0	$0	$0	$0	0.0
Roof	RTU-2 Exhuast Fan	1	Exhaust Fan	5.0	87.5%	No			W	3,000	3	No	89.5%	Yes	1	1.5	4,989	0	$654	$5,557	$900	7.1
Local History	Humidifier	1	Supply Fan	0.3	65.0%	No			W	2,000		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
Community Room	VAV-1	1	Electric Resistance Heat		5.11		1 COP	Trane	VCEF VAV Box	W		No							0.0	0	0	$0	$0	$0	0.0
Community Room	VAV-2	1	Electric Resistance Heat		5.11		1 COP	Trane	VCEF VAV Box	W		No							0.0	0	0	$0	$0	$0	0.0
Story Room	VAV-3	1	Electric Resistance Heat		5.11		1 COP	Trane	VCEF VAV Box	W		No							0.0	0	0	$0	$0	$0	0.0
Small Meeting Room	VAV-4	1	Electric Resistance Heat		5.11		1 COP	Trane	VCEF VAV Box	W		No							0.0	0	0	$0	$0	$0	0.0
Young Adult Area	VAV-5	1	Electric Resistance Heat		5.11		1 COP	Trane	VCEF VAV Box	W		No							0.0	0	0	$0	$0	$0	0.0
Junior Non-Fiction	VAV-6	1	Electric Resistance Heat		5.11		1 COP	Trane	VCEF VAV Box	W		No							0.0	0	0	$0	$0	$0	0.0
Periodicals	VAV-7	1	Electric Resistance Heat		5.11		1 COP	Trane	VCEF VAV Box	W		No							0.0	0	0	$0	$0	$0	0.0
Technical Services	VAV-8	1	Electric Resistance Heat		5.11		1 COP	Trane	VCEF VAV Box	W		No							0.0	0	0	$0	$0	$0	0.0
Entrance	VAV-10	1	Electric Resistance Heat		5.11		1 COP	Trane	VCEF VAV Box	W		No							0.0	0	0	$0	$0	$0	0.0
Circulation Desk	VAV-11	1	Electric Resistance Heat		5.11		1 COP	Trane	VCEF VAV Box	W		No							0.0	0	0	$0	$0	$0	0.0
Directors Office	VAV-12	1	Electric Resistance Heat		5.11		1 COP	Trane	VCEF VAV Box	W		No							0.0	0	0	$0	$0	$0	0.0
Quiet Room	VAV-13	1	Electric Resistance Heat		5.11		1 COP	Trane	VCEF VAV Box	W		No							0.0	0	0	$0	$0	$0	0.0
Non-Fiction	VAV-14	1	Electric Resistance Heat		5.11		1 COP	Trane	VCEF VAV Box	W		No							0.0	0	0	$0	$0	$0	0.0
Non-Fiction	VAV-15	1	Electric Resistance Heat		5.11		1 COP	Trane	VCEF VAV Box	W		No							0.0	0	0	$0	$0	$0	0.0
Local History	VAV-16	1	Electric Resistance Heat		5.11		1 COP	Trane	VCEF VAV Box	W		No							0.0	0	0	$0	$0	$0	0.0
Kitchen	VAV-17	1	Electric Resistance Heat		5.11		1 COP	Trane	VCEF VAV Box	W		No							0.0	0	0	$0	$0	$0	0.0
Roof	RTU-1	1	Package Unit	40.00	283.00	14.70	0.8 Et	Trane	SFHLF40EHP45C 5AD7001A0Z	W		No							0.0	0	0	$0	$0	$0	0.0
Roof	RTU-2	1	Package Unit	40.00	283.00	14.70	0.8 Et	Trane	SFHLF40EHP45C 5AD7001A0Z	W		No							0.0	0	0	$0	$0	$0	0.0
Director Office	Electric Resistance Heat Baseboard	1	Electric Resistance Heat		6.80		1 COP	Marley Engineered Products		W		No							0.0	0	0	$0	$0	$0	0.0
Fiction	Electric Resistance Heat Baseboard	5	Electric Resistance Heat		6.80		1 COP	Marley Engineered Products		W		No							0.0	0	0	$0	$0	$0	0.0

		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 (kBtu/hr)	Cooling Mode Efficiency (SEER/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
Local History	Electric Resistance Heat Baseboard	1	Electric Resistance Heat		6.80		1 COP	Marley Engineered Products		W		No							0.0	0	0	$0	$0	$0	0.0
Men's Restroom	Electric Resistance Heat Baseboard	1	Electric Resistance Heat		6.80		1 COP	Marley Engineered Products		W		No							0.0	0	0	$0	$0	$0	0.0
Non-Fiction	Electric Resistance Heat Baseboard	5	Electric Resistance Heat		6.80		1 COP	Marley Engineered Products		W		No							0.0	0	0	$0	$0	$0	0.0
Quiet Reading Room	Electric Resistance Heat Baseboard	3	Electric Resistance Heat		6.80		1 COP	Marley Engineered Products		W		No							0.0	0	0	$0	$0	$0	0.0
Rotunda	Electric Resistance Heat Baseboard	5	Electric Resistance Heat		6.80		1 COP	Marley Engineered Products		W		No							0.0	0	0	$0	$0	$0	0.0
Small Meeting Room	Electric Resistance Heat Baseboard	1	Electric Resistance Heat		6.80		1 COP	Marley Engineered Products	2548WCSA	W		No							0.0	0	0	$0	$0	$0	0.0
Staff Kitchen	Electric Resistance Heat Baseboard	3	Electric Resistance Heat		6.80		1 COP	Marley Engineered Products		W		No							0.0	0	0	$0	$0	$0	0.0
Tech Services	Electric Resistance Heat Baseboard	3	Electric Resistance Heat		6.80		1 COP	Marley Engineered Products		W		No							0.0	0	0	$0	$0	$0	0.0
Women's Restroom	Electric Resistance Heat Baseboard	1	Electric Resistance Heat		6.80		1 COP	Marley Engineered Products		W		No							0.0	0	0	$0	$0	$0	0.0

Pipe Insulation Recommendations

		Recommendation Inputs			Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	ECM #	Length of Uninsulated Pipe (ft)	Pipe Diameter (in)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Roof Access	DHW Tank	4	10	1.00	0.0	1,011	0	$133	$119	$20	0.7

DHW Inventory & Recommendations

		Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Manufacturer	Model	Remaining Useful Life	ECM #	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Roof Access	DHW	1	Storage Tank Water Heater (≤ 50 Gal)	A.O Smith	DEL 15 102	B		No						0.0	0	0	$0	$0	$0	0.0
Men's Restroom	DHW	1	Storage Tank Water Heater (≤ 50 Gal)			B		No						0.0	0	0	$0	$0	$0	0.0

Low-Flow Device Recommendations

	Recommedation Inputs					Energy Impact & Financial Analysis						
Location	ECM #	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	5	1	Faucet Aerator (Kitchen)	2.00	1.50	0.0	41	0	$5	$7	$2	1.0
Roof Access	5	1	Faucet Aerator (Kitchen)	2.00	1.50	0.0	41	0	$5	$7	$2	1.0
Staff Kitchen	5	1	Faucet Aerator (Kitchen)	1.80	1.50	0.0	25	0	$3	$7	$2	1.6
Tech Services	5	1	Faucet Aerator (Kitchen)	1.80	1.50	0.0	25	0	$3	$7	$2	1.6
Men's Restroom	5	2	Faucet Aerator (Lavatory)	1.80	0.50	0.0	213	0	$28	$14	$7	0.3
Women's Restroom	5	2	Faucet Aerator (Lavatory)	1.80	0.50	0.0	213	0	$28	$14	$7	0.3

Plug Load Inventory

	Existing Conditions					
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Bernardsville Library	1	Coffee Machine	900	No		
Bernardsville Library	46	Desktop	250	No		
Bernardsville Library	1	Laptop	45	No		
Bernardsville Library	2	Microwave	1,000	No		
Bernardsville Library	1	Paper Shredder	150	No		
Bernardsville Library	5	Printer (Medium/Small)	155	No		
Bernardsville Library	2	Printer/Copier (Large)	600	No		
Bernardsville Library	1	Refrigerator (Mini)	150	No		
Bernardsville Library	1	Refrigerator (Residential)	220	No		
Bernardsville Library	2	Toaster Oven	1,000	No		
Bernardsville Library	1	Water Cooler	90	No		
Bernardsville Library	1	Above Ceiling Humidifier	6,000	No		
Bernardsville Library	1	Server	650	No		
Bernardsville Library	1	Laminator	1,000	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.

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ENERGY STAR® Statement of Energy Performance

N/A

ENERGY STAR® Score[1]

Bernardsville Public Library

Primary Property Type: Library
Gross Floor Area (ft²): 17,100
Built: 1998

For Year Ending: April 30, 2023
Date Generated: November 02, 2023

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
Bernardsville Public Library 1 Anderson Hill Road Bernardsville, New Jersey 07924	Bernardsville Public Library 1 Anderson Hill Road Bernardsville, NJ 07924 (908) 766-0118	Joanne Askey 1 Anderson Hill Road Bernardsville, NJ 07924 (908) 766-0118 ext. 15 jaskey@bernardsvillelibrary.org

Property ID: 28511278

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
90.1 kBtu/ft²

Source EUI
214.2 kBtu/ft²

Annual Energy by Fuel

Natural Gas (kBtu)	372,765 (24%)
Electric - Grid (kBtu)	1,168,492 (76%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	60.4
National Median Source EUI (kBtu/ft²)	143.6
% Diff from National Median Source EUI	49%

Annual Emissions

Total (Location-Based) GHG Emissions (Metric Tons CO2e/year)	125

Signature & Stamp of Verifying Professional

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

LP Signature: ____________________ Date: __________

Licensed Professional

____

(___) ___ - ____

____

Professional Engineer or Registered Architect Stamp
(if applicable)

APPENDIX C: GLOSSARY

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

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

SEER	*Seasonal energy efficiency ratio:* a measure of efficiency in terms of annual cooling energy provided divided by total electric input.
SEP	*Statement of energy performance:* a summary document from the ENERGY STAR Portfolio Manager.
Simple Payback	The amount of time needed to recoup the funds expended in an investment or to reach the break-even point between investment and savings.
SREC (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.