Local Government Energy Audit Report

Sculpture Studios (Southwest, Middle, Northeast)

July 10, 2024

Prepared for:

Ramapo College of New Jersey
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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.

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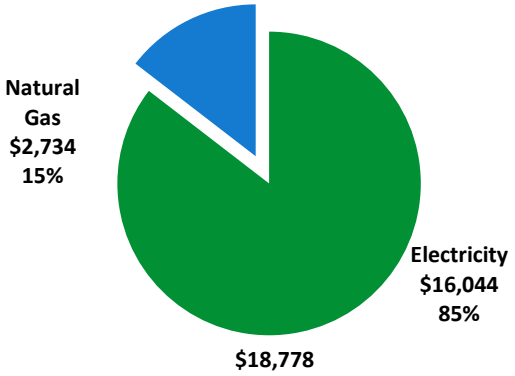
1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Sculpture Studios Southwest, Middle, Northeast. 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: $18,778 Electricity: 129,116 kWh Natural Gas: 358 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.

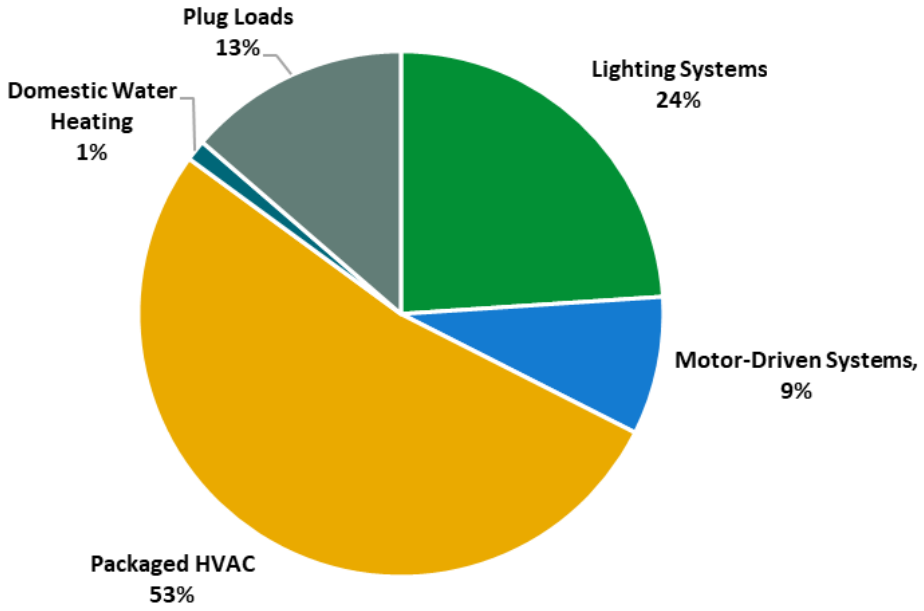


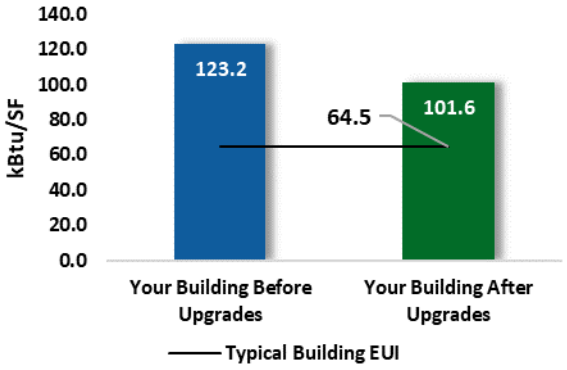
Figure 1 - Energy Use by System

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.

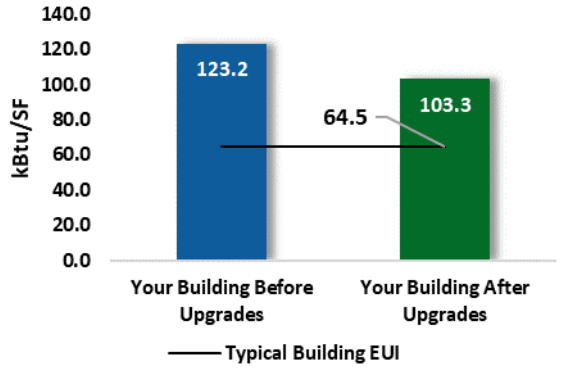
Scenario 1: Full Package (All Evaluated Measures)

Installation Cost	$25,071
Potential Rebates & Incentives[1]	$2,150
Annual Cost Savings	$3,061
Annual Energy Savings	Electricity: 24,684 kWh Natural Gas: -5 Therms
Greenhouse Gas Emission Savings	12 Tons
Simple Payback	7.5 Years
Site Energy Savings (All Utilities)	18%



Scenario 2: Cost Effective Package[2]

Installation Cost	$9,940
Potential Rebates & Incentives	$1,676
Annual Cost Savings	$2,891
Annual Energy Savings	Electricity: 23,595 kWh Natural Gas: -33 Therms
Greenhouse Gas Emission Savings	12 Tons
Simple Payback	2.9 Years
Site Energy Savings (all utilities)	16%



On-site Generation Potential

Photovoltaic	None
Combined Heat and Power	None

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

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

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**20,921**	**2.7**	**-3**	**$2,563**	**$7,481**	**$1,362**	**$6,119**	**2.4**	**20,718**
ECM 1	Install LED Fixtures	Yes	6,561	0.0	0	$815	$3,639	$600	$3,039	3.7	6,607
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	9,225	1.8	-2	$1,123	$2,319	$350	$1,969	1.8	9,064
ECM 3	Retrofit Fixtures with LED Lamps	Yes	5,135	1.0	-1	$625	$1,524	$412	$1,112	1.8	5,047
Lighting Control Measures			**2,572**	**0.5**	**-1**	**$313**	**$2,316**	**$290**	**$2,026**	**6.5**	**2,527**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	2,572	0.5	-1	$313	$2,316	$290	$2,026	6.5	2,527
Unitary HVAC Measures			**1,286**	**0.6**	**1**	**$170**	**$13,373**	**$474**	**$12,899**	**76.0**	**1,389**
ECM 5	Install High Efficiency Air Conditioning Units	No	1,286	0.6	1	$170	$13,373	$474	$12,899	76.0	1,389
HVAC System Improvements			**103**	**0.0**	**0**	**$15**	**$143**	**$24**	**$119**	**7.8**	**128**
ECM 6	Install Pipe Insulation	Yes	103	0.0	0	$15	$143	$24	$119	7.8	128
Custom Measures			**-197**	**0.0**	**2**	**$0**	**$1,757**	**$0**	**$1,757**	**N/A**	**36**
ECM 7	Replace Gas Fired Water Heater with Heat Pump Water Heater	No	-197	0.0	2	$0	$1,757	$0	$1,757	N/A	36
TOTALS (COST EFFECTIVE MEASURES)			**23,595**	**3.2**	**-3**	**$2,891**	**$9,940**	**$1,676**	**$8,264**	**2.9**	**23,373**
TOTALS (ALL MEASURES)			**24,684**	**3.9**	**-1**	**$3,061**	**$25,071**	**$2,150**	**$22,921**	**7.5**	**24,798**

* - 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).

*** - N/A Payback explained in Section 4.5.

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 Sculpture Studios Southwest, Middle, Northeast. 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 March 31, 2023, TRC performed an energy audit at Sculpture Studios Southwest, Middle, Northeast located in Mahwah, New Jersey. TRC met with Bob Cuprys to review the facility operations and help focus our investigation on specific energy-using systems. This report combines the analysis and the measures for all three facilities.

Sculpture Studios Southwest, Middle, and Northeast are single story facilities, with a combined square footage of 3,865, built in 1973.

Sculpture Studios Southwest is a workshop with spaces for housing various equipment.

Sculpture Studios Middle and Northeast include spaces such as classrooms, office, restrooms, additional workshop, and storage space.

2.2 Building Occupancy

The facility is occupied Monday through Friday during regular business hours. There is no weekend usage in any of these buildings.

Sculpture Studios Southwest usually is occupied by two staff and ten students on a typical working day.

Building Name	Weekday/Weekend	Operating Schedule
Sculpture Studios Southwest, Middle, Northeast	Weekday	9:00 AM to 5:00 PM
	Weekend	No Operation

Figure 3 - Building Occupancy Schedule

2.3 Building Envelope

Sculpture Studios Southwest

This building is made of concrete block on one side and a metal cladding exterior on the other. It has a flat roof. The windows appear to be single pane and in poor condition. The exterior door is metal and is in fair condition.

Sculpture Studios Middle

This building has a wooden panel exterior construction with a sloped roof. The roof is made of asphalt shingles. The windows are single pane, and the exterior doors are metal. The building façade is in fair condition.

Sculpture Studios Northeast

This building is a temporary structure with metal cladding exterior construction and a flat roof. The roof has asphalt layering and appears to be in fair condition. The windows are double-paned, and the exterior doors are glass with wooden frame. The building façade looks old.

Sculpture Studios – Southwest – Façade

Sculpture Studios – Southwest - Roof

Sculpture Studios – Southwest - Window

Sculpture Studios – Middle – Façade

Sculpture Studios – Middle – Windows

Sculpture Studios – Middle – Roof

Sculpture Studios – Northeast – Façade

Sculpture Studios – Northeast – Windows

2.4 Lighting Systems

Sculpture Studios, Southwest and Middle

The primary interior lighting system in both buildings use 32-Watt linear fluorescent T8 lamps. There are also several 110-Watt T12 high output fixtures in the Middle workshop. Fixture types include 2-lamp or 3-lamp, 4-foot or 8-foot-long surface mounted fixtures. Typically, T8 fluorescent lamps use electronic ballasts and T12 fluorescent lamps use magnetic ballasts.

The exit signs are 2-Watt LED units. Interior lighting control is provided using wall switches.

Exterior lighting for Southwest consists of pole mounted or wall mounted metal halide fixtures with wattages ranging from 70-Watts to 250-Watts. Middle has three HPS fixtures. The exterior lighting is controlled by wall switches and photocells.

Sculpture Studios – Southwest – T8 fixture

Sculpture Studios – Southwest – Exterior 175-watt MH

Sculpture Studios – Middle – T8 fixture

Sculpture Studios – Middle – Exterior 70-watt MH

Sculpture Studios Northeast

The primary interior lighting uses 32-Watt linear fluorescent 4-foot, 2-lamp T8 fixtures. The exit signs are 2-Watt LED units. Interior lighting control is provided using wall switches.

The exterior lighting consists of 42-Watt compact fluorescent lamp (CFL) fixtures and 250-Watt high-pressure sodium fixtures. The exterior lighting is controlled by wall switches and photocells.

Sculpture Studios – Northeast – typical T8 fixture

Sculpture Studios – Northeast – Exterior 250-watt HPS fixture

2.5 Air Handling Systems

HVAC Equipment

Sculpture Studios Southwest

The building has a 6-ton Trane packaged unit with a heating capacity of 120 MBh. The unit has an EER 11.2 and a furnace efficiency rating of 80 percent. This unit is operating beyond its useful life and has been evaluated for replacement. Space temperatures are controlled by programmable thermostats in the respective zones.

The workshop space has a gas-fired Modine ceiling hung unit heater with a heating capacity of 40 MBh. This unit is not regularly used and serves as backup only.

There are also several electric resistance heaters with built-in controls, serving the restrooms and other smaller spaces.

6-ton Trane Unit

Electric Resistance Units

Programmable Thermostat

Sculpture Studios Middle

A 4-ton Mitsubishi split heat-pump with a heating capacity of 48 MBh provides heating and cooling for the building. The unit has a cooling efficiency of 10.4 EER and a heating efficiency of 10.41 HSPF. Space temperatures are controlled using thermostats in the zones. The unit was installed in 2018 and is in good condition. There is also a furnace with a heating capacity of 30 MBh that provides backup heat. This unit is minimally used.

There are also several electric resistance heaters with built-in controls, serving the restrooms and other smaller spaces.

Heat Pump Unit

Electric Resistance Heaters

Sculpture Studios Northeast

The heating and cooling in this building is provided using a packaged terminal unit with 3-ton cooling capacity and an estimated 10 kW (34.12 MBh) of electric resistance heating capacity. The unit is operating within its useful life. The temperatures are controlled using thermostats.

Packaged Terminal Unit

2.6 Domestic Hot Water

Sculpture Studios Southwest

Hot water is produced by a 30 gallon, 35.5 MBh gas-fired storage water heater with an efficiency rating of 80 percent. The unit was installed in 2012 and the unit is in good condition.

Southwest Gas-fired DHW

Sculpture Studios Middle

Hot water is produced by a 15-gallon, 1.5 kW electric storage water heater. The unit is operating beyond its useful life.

Southwest Gas-fired DHW

2.7 Plug Load and Vending Machines

The Southwest and Middle buildings have a substantial quantity of process equipment including a kiln, cutting equipment, blast system, welding equipment, saws, and power drills that make over 80 percent of the total plug load. The rest of the plug load consists of office and café equipment including desktops, televisions, coffee machines, fans, and microwaves.

These facilities require more plug-in power than most facilities of similar size. Use of the process equipment, however, is a requirement for fulfilling the mission of this building complex. This report makes suggestions for energy efficient best practices for standard office plug loads.

Kiln

Saw and Cutting equipment

Television

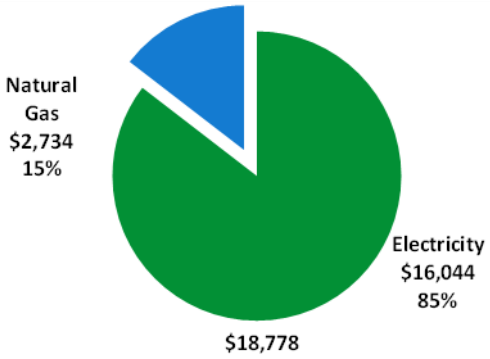
2.8 Water-Using Systems

The faucet flow rates are at 2.2 gallons per minute (gpm) or higher. Toilets are rated at 1.6 gallons per flush (gpf) and urinals are rated at 1.0 gpf.

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	129,116 kWh	$16,044
Natural Gas	358 Therms	$2,734
Total		**$18,778**



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.

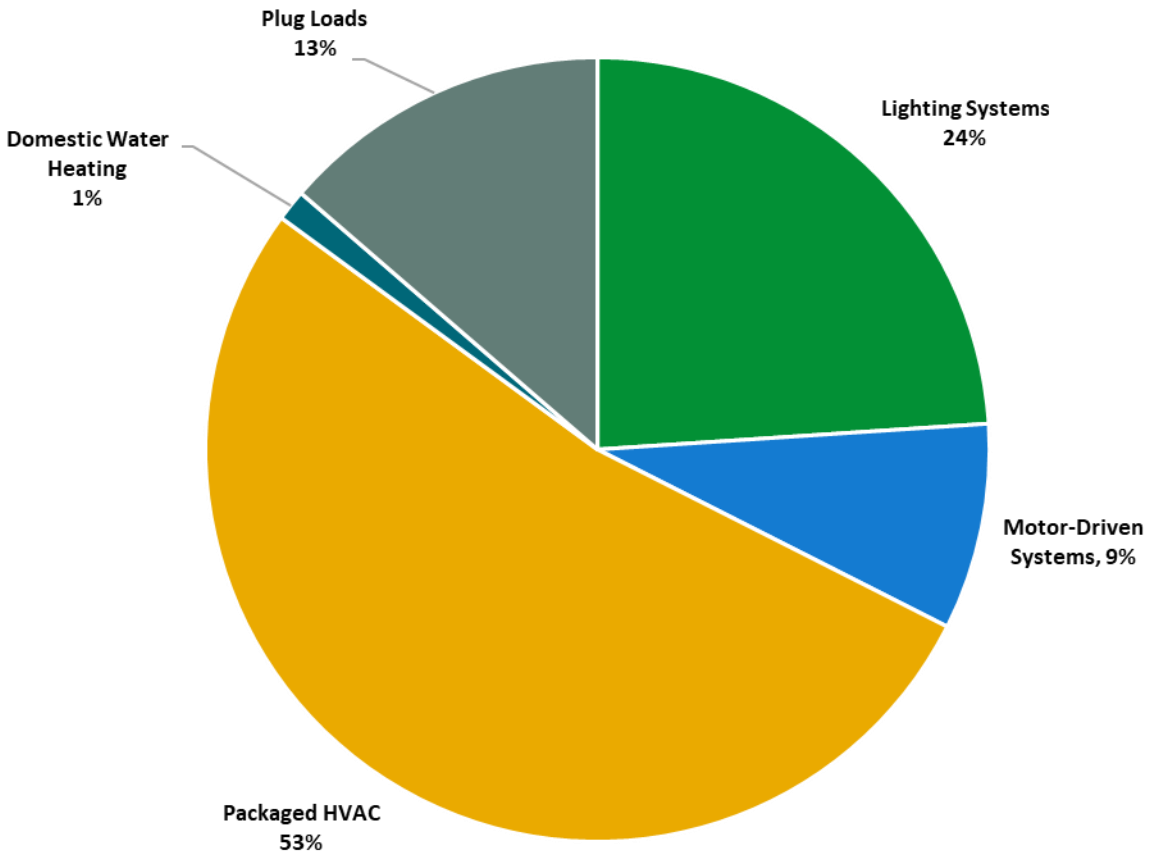
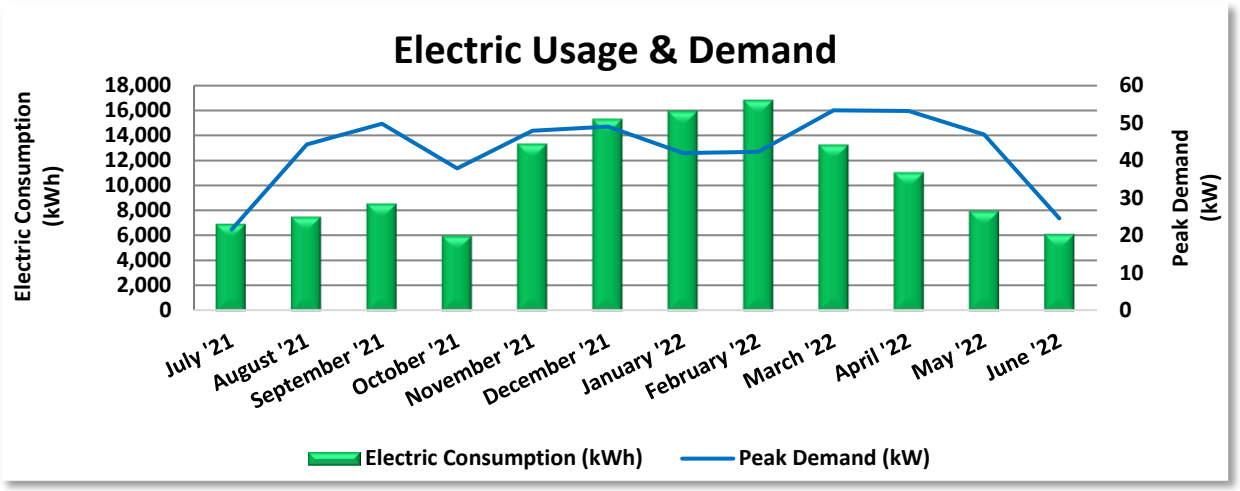


Figure 4 - Energy Balance

3.1 Electricity

Rockland Electric delivers electricity under rate class Electric Small C&I Gen Serv SEC-RE-DEL-PJM, with electric production provided by Direct Energy, a third-party supplier.



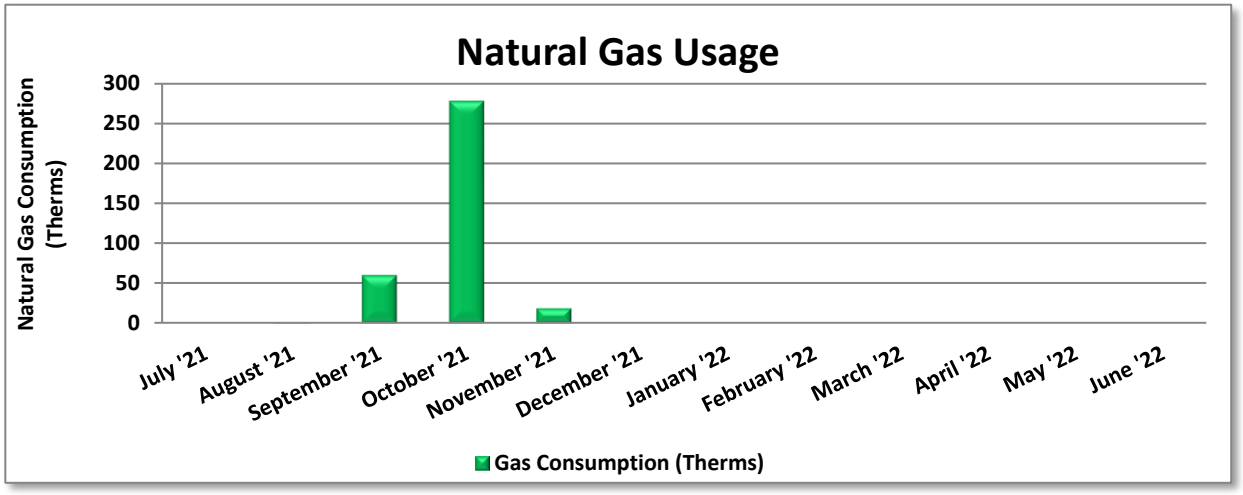
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
7/28/21	30	6,950	22	$68	$736
8/27/21	30	7,519	44	$60	$795
9/28/21	32	8,555	50	$60	$901
10/27/21	29	6,006	38	$39	$642
11/29/21	33	13,309	48	$89	$1,410
12/29/21	30	15,298	49	$75	$1,622
1/28/22	30	15,916	42	$93	$2,199
2/28/22	31	16,806	42	$97	$2,324
3/29/22	29	13,231	53	$118	$1,827
4/27/22	29	11,041	53	$117	$1,533
5/25/22	28	7,983	47	$83	$1,101
6/27/22	33	6,148	25	$86	$910
Totals	**364**	**128,762**	**53**	**$986**	**$16,000**
Annual	**365**	**129,116**	**53**	**$988**	**$16,044**

Notes:

- Peak demand of 53 kW occurred in March '22.
- Average demand over the past 12 months was 43 kW.
- The average electric cost over the past 12 months was $0.124/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.

3.2 Natural Gas

PSE&G delivers natural gas under rate class Large Volume Gas (LVG), with natural gas supply provided by UGI, a third-party supplier.



Gas Billing Data			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
7/30/21	30	0	$158
8/27/21	28	1	$158
9/28/21	32	60	$193
10/28/21	30	278	$341
11/20/21	23	19	$388
12/29/21	39	0	$389
1/28/22	30	0	$224
3/2/22	33	0	$224
3/31/22	29	0	$167
5/2/22	32	0	$164
6/1/22	30	0	$164
6/30/22	29	0	$164
Totals	**365**	**358**	**$2,734**
Annual	**365**	**358**	**$2,734**

Notes:

- The average gas cost for the past 12 months is $1.228/therm, which is the blended rate used throughout the analysis.

3.3 Benchmarking

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

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

Benchmarking Score	**N/A**

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

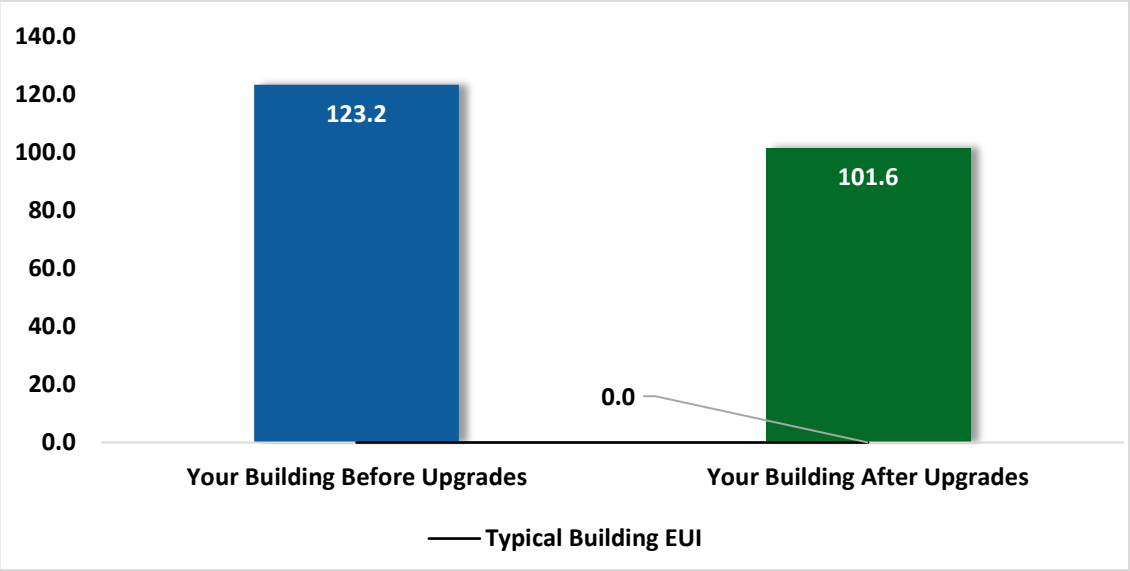


Figure 5 - Energy Use Intensity Comparison[3]

Energy use intensity (EUI) measures energy consumption per square foot and is the standard metric for comparing buildings' energy performance. A lower EUI means better performance and less energy consumed. 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			**20,921**	**2.7**	**-3**	**$2,563**	**$7,481**	**$1,362**	**$6,119**	**2.4**	**20,718**
ECM 1	Install LED Fixtures	Yes	6,561	0.0	0	$815	$3,639	$600	$3,039	3.7	6,607
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	9,225	1.8	-2	$1,123	$2,319	$350	$1,969	1.8	9,064
ECM 3	Retrofit Fixtures with LED Lamps	Yes	5,135	1.0	-1	$625	$1,524	$412	$1,112	1.8	5,047
Lighting Control Measures			**2,572**	**0.5**	**-1**	**$313**	**$2,316**	**$290**	**$2,026**	**6.5**	**2,527**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	2,572	0.5	-1	$313	$2,316	$290	$2,026	6.5	2,527
Unitary HVAC Measures			**1,286**	**0.6**	**1**	**$170**	**$13,373**	**$474**	**$12,899**	**76.0**	**1,389**
ECM 5	Install High Efficiency Air Conditioning Units	No	1,286	0.6	1	$170	$13,373	$474	$12,899	76.0	1,389
HVAC System Improvements			**103**	**0.0**	**0**	**$15**	**$143**	**$24**	**$119**	**7.8**	**128**
ECM 6	Install Pipe Insulation	Yes	103	0.0	0	$15	$143	$24	$119	7.8	128
Custom Measures			**-197**	**0.0**	**2**	**$0**	**$1,757**	**$0**	**$1,757**	**N/A**	**36**
ECM 7	Replace Gas Fired Water Heater with Heat Pump Water Heater	No	-197	0.0	2	$0	$1,757	$0	$1,757	N/A	36
TOTALS			**24,684**	**3.9**	**-1**	**$3,061**	**$25,071**	**$2,150**	**$22,921**	**7.5**	**24,798**

* - 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).

*** - N/A Payback explained in Section 4.5.

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		**20,921**	**2.7**	**-3**	**$2,563**	**$7,481**	**$1,362**	**$6,119**	**2.4**	**20,718**
ECM 1	Install LED Fixtures	6,561	0.0	0	$815	$3,639	$600	$3,039	3.7	6,607
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	9,225	1.8	-2	$1,123	$2,319	$350	$1,969	1.8	9,064
ECM 3	Retrofit Fixtures with LED Lamps	5,135	1.0	-1	$625	$1,524	$412	$1,112	1.8	5,047
Lighting Control Measures		**2,572**	**0.5**	**-1**	**$313**	**$2,316**	**$290**	**$2,026**	**6.5**	**2,527**
ECM 4	Install Occupancy Sensor Lighting Controls	2,572	0.5	-1	$313	$2,316	$290	$2,026	6.5	2,527
HVAC System Improvements		**103**	**0.0**	**0**	**$15**	**$143**	**$24**	**$119**	**7.8**	**128**
ECM 6	Install Pipe Insulation	103	0.0	0	$15	$143	$24	$119	7.8	128
TOTALS		**23,595**	**3.2**	**-3**	**$2,891**	**$9,940**	**$1,676**	**$8,264**	**2.9**	**23,373**

* - 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		**20,921**	**2.7**	**-3**	**$2,563**	**$7,481**	**$1,362**	**$6,119**	**2.4**	**20,718**
ECM 1	Install LED Fixtures	6,561	0.0	0	$815	$3,639	$600	$3,039	3.7	6,607
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	9,225	1.8	-2	$1,123	$2,319	$350	$1,969	1.8	9,064
ECM 3	Retrofit Fixtures with LED Lamps	5,135	1.0	-1	$625	$1,524	$412	$1,112	1.8	5,047

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: Install LED Fixtures

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

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

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

Affected Building Areas: exterior fixtures

ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

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

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

Affected Building Areas: all areas with fluorescent fixtures with T12 tubes. Note: high output lamp configuration may require specialty LED lamps as compared to standard F40 fluorescent tubes.

ECM 3: Retrofit Fixtures with LED Lamps

Replace fluorescent, HID, or 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: all areas with fluorescent fixtures with T8 tubes and CFLs

4.2 Lighting Controls

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**2,572**	**0.5**	**-1**	**$313**	**$2,316**	**$290**	**$2,026**	**6.5**	**2,527**
ECM 4	Install Occupancy Sensor Lighting Controls	2,572	0.5	-1	$313	$2,316	$290	$2,026	6.5	2,527

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 4: Install Occupancy Sensor Lighting Controls

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

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

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

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

Affected Building Areas: offices, restrooms, workshops, and some storage areas

4.3 Unitary HVAC

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Unitary HVAC Measures		**1,286**	**0.6**	**1**	**$170**	**$13,373**	**$474**	**$12,899**	**76.0**	**1,389**
ECM 5	Install High Efficiency Air Conditioning Units	1,286	0.6	1	$170	$13,373	$474	$12,899	76.0	1,389

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

ECM 5: Install High Efficiency Air Conditioning Units

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

Affected Units: 6-ton packaged unit serving the Southwest building

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		**103**	**0.0**	**0**	**$15**	**$143**	**$24**	**$119**	**7.8**	**128**
ECM 6	Install Pipe Insulation	103	0.0	0	$15	$143	$24	$119	7.8	128

ECM 6: Install Pipe Insulation

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

Affected Systems: domestic hot water piping (both systems)

4.5 Custom Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Custom Measures		**-197**	**0.0**	**2**	**$0**	**$1,757**	**$0**	**$1,757**	**N/A**	**36**
ECM 7	Replace Gas Fired Water Heater with Heat Pump Water Heater	-197	0.0	2	$0	$1,757	$0	$1,757	N/A	36

ECM 7: Replace Gas Fired Water Heater with Heat Pump Water Heater

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

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

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

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

** Note: Uniform Energy Factor (UEF): The newest measure of water heater overall efficiency. The higher the UEF value is, the more efficient the water heater. UEF is determined by the Department of Energy's test method outlined in 10 CFR Part 430, Subpart B, Appendix E.*[4]

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

HPWH reject cold air. As such, they need to be installed in an unconditioned space of about 750 cubic feet with good ventilation[5]. Ideal locations are garages, large enclosed, unconditioned storage areas, or areas with excess heat such as a furnace or boiler room. The HPWH will also produce condensate so accommodations for draining the condensate need to be provided.

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

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

Switching from a gas fired water heater to a HPWH has the potential to reduce the sites overall greenhouse gas emissions. If the electricity for the HPWH is provided by an on-site photovoltaic (PV) system then there are essentially no greenhouse gas (GHG) emissions. A 2016 study conducted at Cornell [6]calculated the kg of methane (CH_4) and carbon dioxide (CO_2) produced per GJ of water heated. The study compared HPWH to gas and electric fired, storage and tankless water heaters. The study also considered electricity produced from natural gas and coal fired electric plants. In all cases the study found that HPWHs produced less methane than all of the other water heaters. The study also found that HPWH produced less carbon dioxide than electric resistance water heaters but more carbon dioxide than tankless gas water heaters and about the same amount of carbon dioxide as storage gas water heaters. The summary tables provide the reduction in CO2 equivalent emissions based on the typical New Jersey electric utility.

This measure payback has been computed as “N/A”, not applicable, because the cost of operating the proposed system is about the same as the existing due to the relative cost of electricity to natural gas. At this site the cost per Btu for natural gas is significantly lower than for electricity. Therefore, even though this measure will result in a net energy savings in terms of Btu at this site it will increase the overall cost for providing domestic hot water. This measure is only evaluated if the sites have any future electrification plans.

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

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

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[7]. 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.

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.

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

Thermostat Schedules and Temperature Resets

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

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.

Furnace Maintenance

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

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[8] or download a copy of EPA's "WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities"[9] to get ideas for creating a water management plan and best practices for a wide range of water using systems.

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

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

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

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

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

Procurement Strategies

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

6 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.

6.1 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.

6.2 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 Fuel Cells with Heat Recovery	>3 MW	$350		
Waste Heat to Power*	<1 MW	$1,000	30%	$2 million
	> 1MW	$500		$3 million

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

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

How to Participate

You 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.

7 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.

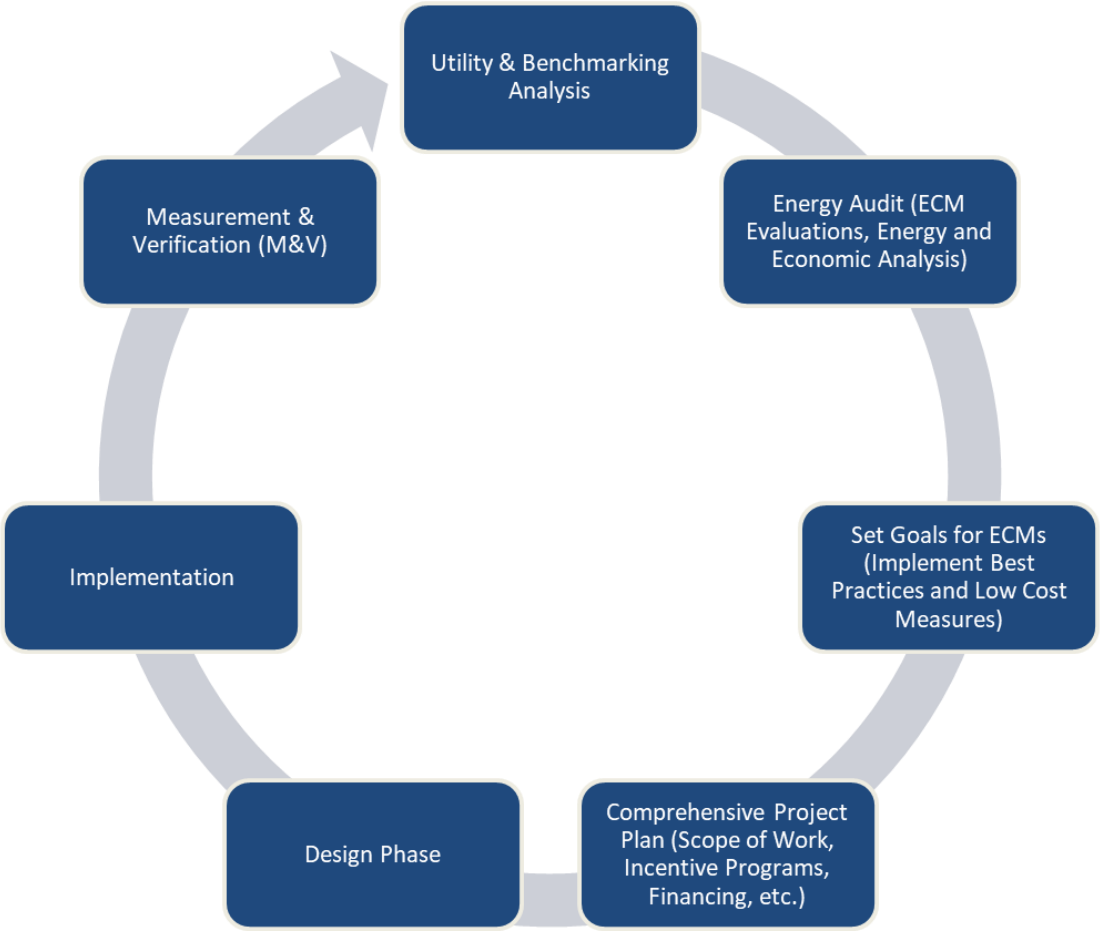


Figure 8 – Project Development Cycle

8 Energy Purchasing and Procurement Strategies

8.1 Retail Electric Supply Options

Energy deregulation in New Jersey has increased energy buyers' options by separating the function of electricity distribution from that of electricity supply. 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[10].

8.2 Retail Natural Gas Supply Options

The natural gas market in New Jersey is also deregulated. Most customers that remain with the utility for natural gas service pay rates that are market based and 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[11].

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

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

APPENDIX A: EQUIPMENT INVENTORY & RECOMMENDATIONS

Lighting Inventory & Recommendations

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Exterior 1	2	Metal Halide: (1) 175W Lamp	Photocell		215	4,380	1	Fixture Replacement	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	53	4,380	0.0	1,419	0	$176	$769	$100	3.8
Exterior 1	1	Metal Halide: (1) 70W Lamp	Photocell		95	4,380	1	Fixture Replacement	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	21	4,380	0.0	324	0	$40	$206	$50	3.9
Exterior 1	2	Metal Halide: (1) 150W Lamp	Wall Switch		190	4,380	1	Fixture Replacement	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	45	4,380	0.0	1,270	0	$158	$692	$100	3.7
Exterior 1	1	Metal Halide: (1) 250W Lamp	Photocell		295	4,380	1	Fixture Replacement	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	75	4,380	0.0	964	0	$120	$471	$50	3.5
Exterior 1	2	Metal Halide: (1) 70W Lamp	Photocell		95	4,380	1	Fixture Replacement	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	21	4,380	0.0	648	0	$81	$412	$100	3.9
Mechanical 1	2	Linear Fluorescent - EST12: 4' T12 (34W) - 2L	Wall Switch	S	72	3,430	2, 4	Relamp & Reballast	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,367	0.1	392	0	$48	$254	$40	4.5
Restroom - Male 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,430	3	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	3,430	0.0	187	0	$23	$55	$15	1.7
Storage 1	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Storage 1	2	Linear Fluorescent - EST12: 4' T12 (34W) - 2L	Wall Switch	S	72	3,430	2, 4	Relamp & Reballast	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,367	0.1	392	0	$48	$254	$20	4.9
Workshop 1	5	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	5	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Workshop 1	1	LED - Fixtures: Wall Pack	Wall Switch	S	30	3,430		None	No	1	LED - Fixtures: Wall Pack	Wall Switch	30	3,430	0.0	0	0	$0	$0	$0	0.0
Workshop 1	5	Linear Fluorescent - EST12: 4' T12 (34W) - 2L	Wall Switch	S	72	3,430	2, 4	Relamp & Reballast	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,367	0.2	981	0	$119	$614	$85	4.4
Workshop 1	6	Linear Fluorescent - EST12: 4' T12 (34W) - 2L	Wall Switch	S	72	3,430	2, 4	Relamp & Reballast	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,367	0.2	1,177	0	$143	$683	$95	4.1
Workshop 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	3,430	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,430	0.0	125	0	$15	$37	$10	1.7
Workshop 1	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,430	3, 4	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,367	0.2	951	0	$116	$489	$95	3.4
Workshop 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	3,430	3	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	3,430	0.0	187	0	$23	$55	$15	1.7
Electrical Room 1	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	3,430	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,367	0.1	317	0	$39	$189	$40	3.9
Exterior 1	3	High-Pressure Sodium: (1) 70W Lamp	Photocell		95	4,380	1	Fixture Replacement	No	3	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	21	4,380	0.0	972	0	$121	$618	$150	3.9
Office - Enclosed 1	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch		114	3,430	3, 4	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,367	0.1	558	0	$68	$262	$60	3.0
Restroom - Female 1	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	3,430	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,367	0.1	317	0	$39	$189	$40	3.9
Restroom - Male 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	3,430	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,430	0.0	125	0	$15	$37	$10	1.7
Storage 1	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	3,430	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,367	0.1	317	0	$39	$189	$20	4.4
Workshop 1	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Workshop 1	10	Linear Fluorescent - T12HO: 8' T12HO (110W) - 2L	Wall Switch		252	3,430	2, 4	Relamp & Reballast	Yes	10	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	2,367	1.5	7,634	-2	$929	$1,557	$235	1.4
Classroom 1	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0

	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
Classroom 1	20	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch		62	3,430	3, 4	Relamp	Yes	20	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,367	0.6	3,169	-1	$386	$1,270	$270	2.6
Exterior 1	2	Compact Fluorescent: (1) 42W Biaxial Plug-In Lamp	Wall Switch		42	4,380	3	Relamp	No	2	LED Lamps: PL-L (Biax) Lamps	Wall Switch	30	4,380	0.0	105	0	$13	$27	$2	1.9
Exterior 1	1	High-Pressure Sodium: (1) 250W Lamp	Photocell		295	4,380	1	Fixture Replacement	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	75	4,380	0.0	964	0	$120	$471	$50	3.5

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
Exterior 2	Various	1	Supply Fan	1.0	70.0%	No	Trane	YHC072E4EhA0F	B	3,000		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Workshop 1	Workshop 1	1	Other	1.5	84.5%	No				300		No	84.5%	No		0.0	0	0	$0	$0	$0	0.0
Exterior 2	Various	1	Exhaust Fan	0.8	70.0%	No				3,000		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical 1	Various	1	Air Compressor	1.0	85.5%	No	Baldor	3313T-01	W	1,200		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Exterior 1	Various	1	Exhaust Fan	0.5	70.0%	No				3,000		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Interior	Various	1	Supply Fan	0.3	70.0%	No			W	3,000		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior 1	Various	1	Supply Fan	1.0	84.5%	No			W	3,000		No	84.5%	No		0.0	0	0	$0	$0	$0	0.0
Exterior 1	Various	1	Return Fan	0.8	70.0%	No				3,000		No	70.0%	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
Mechanical 1	Mechanical 1	1	Electric Resistance Heat		17.32		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Restroom - Male 1	Restroom - Male 1	1	Electric Resistance Heat		17.32		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Workshop 1	Workshop 1	1	Electric Resistance Heat		25.59		1 COP	T.P.I Corpration	P3P5107CA1N	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior 2	Various	1	Package Unit	6.00	120.00	11.20	0.8 AFUE	Trane	YHC072E4EhA0F	B	5	Yes	1	Package Unit	6.00	120.00	14.00	0.82 Et	0.6	1,286	1	$170	$13,373	$474	76.0
Workshop 1	Workshop 1	1	Unit Heater		40.00		0.8 AFUE	Modine	PAE 50AK	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior 1	Workshop 1	1	Forced Air Furnace		30.00		0.8 AFUE	Unknown	Unknown	W		No							0.0	0	0	$0	$0	$0	0.0
Electrical Room 1	Electrical Room 1	1	Electric Resistance Heat		5.12		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Office - Enclosed 1	Office - Enclosed 1	1	Electric Resistance Heat		5.12		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Restroom - Female 1	Restroom - Female 1	1	Electric Resistance Heat		5.12		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Restroom - Male 1	Restroom - Male 1	1	Electric Resistance Heat		5.12		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Storage 1	Storage 1	1	Electric Resistance Heat		5.12		1 COP			W		No							0.0	0	0	$0	$0	$0	0.0
Exterior 1	Exterior 1	1	Split-System	4.00	48.00	10.40	10.4066 HSPF	Mitsubishi	MXZ8C48	W		No							0.0	0	0	$0	$0	$0	0.0
Exterior 1	Exterior 1	1	Package Unit	3.00	34.12	14.00	1 COP	Unknown	Unknown	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
Mechanical 1	Restrooms	6	4	1.00	0.0	0	0	$3	$48	$8	15.4
Restroom Male 1	Restroom Male 1	6	8	0.75	0.0	103	0	$13	$95	$16	6.2

DHW Inventory & Recommendations

		Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Manufacturer	Model	Remaining Useful Life	ECM #	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical 1	Storage water heater	1	Storage Tank Water Heater (≤ 50 Gal)	AO Smith	GCVL 30 300	W		No						0.0	0	0	$0	$0	$0	0.0
Restroom Male 1	Restroom Male 1	1	Storage Tank Water Heater (≤ 50 Gal)	AO Smith	ELJF 15 910	B		No						0.0	0	0	$0	$0	$0	0.0

Plug Load Inventory

	Existing Conditions					
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Sculpture Studios SW	1	Kiln	23,600	No		
Sculpture Studios SW	1	Kiln	11,600	No		
Sculpture Studios SW	1	Other	500	No		
Sculpture Studios SW	1	Other	500	No		
Sculpture Studios SW	1	Plasma cutting system	200	No		
Sculpture Studios SW	1	Other	1,000	No		
Sculpture Studios SW	1	Other	200	No		
Sculpture Studios SW	1	Blast system	90	No		
Sculpture Studios SW	1	Plasma table	400	No		
Sculpture Studios SW	2	Welders	8,000	No		
Sculpture Studios SW	1	Saw	1,200	No		
Sculpture Studios SW	1	Power drill	1,200	No		
Sculpture Studios Middle	1	Coffee Machine	200	No		
Sculpture Studios Middle	2	Desktop	145	No		
Sculpture Studios Middle	2	Fan (Ceiling)	80	No		
Sculpture Studios Middle	1	Microwave	900	No		
Sculpture Studios Middle	1	Water Cooler	500	No		
Sculpture Studios NE	1	Television	100	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.

ENERGY STAR® Statement of Energy Performance

LEARN MORE AT energystar.gov

N/A

ENERGY STAR® Score[1]

Ramapo College - Sculpture Studios - Southwest

Primary Property Type: College/University
Gross Floor Area (ft²): 1,550
Built: 1980

For Year Ending: May 31, 2022
Date Generated: June 27, 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
Ramapo College - Sculpture Studios - Southwest 505 Ramapo Valley Road Mahwah, New Jersey 07430	Ramapo College of New Jersey 505 Ramapo Valley Road Mahwah, NJ 07430 (201) 684-7666	Mike Cunningham 505 Ramapo Valley Road Mahwah, NJ 07430 (201) 684-7666 mcunning@ramapo.edu

Property ID: 26333883

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
206.7 kBtu/ft²

Source EUI
538.4 kBtu/ft²

Annual Energy by Fuel

Natural Gas (kBtu)	35,784 (11%)
Electric - Grid (kBtu)	284,633 (89%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	69.3
National Median Source EUI (kBtu/ft²)	180.6
% Diff from National Median Source EUI	198%

Annual Emissions

Total (Location-Based) GHG Emissions (Metric Tons CO2e/year)	11

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)

ENERGY STAR® Statement of Energy Performance

LEARN MORE AT energystar.gov

N/A

ENERGY STAR® Score[1]

Ramapo College - Sculpture Studios - Middle

Primary Property Type: College/University
Gross Floor Area (ft²): 1,460
Built: 1980

For Year Ending: May 31, 2022
Date Generated: June 27, 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
Ramapo College - Sculpture Studios - Middle 505 Ramapo Valley Road Mahwah, New Jersey 07430	Ramapo College of New Jersey 505 Ramapo Valley Road Mahwah, NJ 07430 (201) 684-7666	Mike Cunningham 505 Ramapo Valley Road Mahwah, NJ 07430 (201) 684-7666 mcunning@ramapo.edu

Property ID: 26333884

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
59.5 kBtu/ft²

Source EUI
166.7 kBtu/ft²

Annual Energy by Fuel		
Electric - Grid (kBtu)	86,934	(100%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	64.5
National Median Source EUI (kBtu/ft²)	180.6
% Diff from National Median Source EUI	-8%
Annual Emissions	
Total (Location-Based) GHG Emissions (Metric Tons CO2e/year)	3

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)

ENERGY STAR® Statement of Energy Performance

Ramapo College - Sculpture Studios - Northeast

N/A

ENERGY STAR® Score[1]

Primary Property Type: College/University
Gross Floor Area (ft²): 855
Built: 1980

For Year Ending: May 31, 2022
Date Generated: June 27, 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
Ramapo College - Sculpture Studios - Northeast 505 Ramapo Valley Road Mahwah, New Jersey 07430	Ramapo College of New Jersey 505 Ramapo Valley Road Mahwah, NJ 07430 (201) 684-7666	Mike Cunningham 505 Ramapo Valley Road Mahwah, NJ 07430 (201) 684-7666 mcunning@ramapo.edu

Property ID: 26333885

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
78.4 kBtu/ft²

Source EUI
219.7 kBtu/ft²

Annual Energy by Fuel

Electric - Grid (kBtu)	67,072 (100%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	64.5
National Median Source EUI (kBtu/ft²)	180.6
% Diff from National Median Source EUI	22%

Annual Emissions

Total (Location-Based) GHG Emissions (Metric Tons CO2e/year)	2

Signature & Stamp of Verifying Professional

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

LP Signature: _____ Date: _____

Licensed Professional

____ _____
,
(____)____-_____
_____

Professional Engineer or Registered Architect Stamp (if applicable)

APPENDIX C: GLOSSARY

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

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

SEER	*Seasonal energy efficiency ratio:* a measure of efficiency in terms of annual cooling energy provided divided by total electric input.
SEP	*Statement of energy performance:* a summary document from the ENERGY STAR Portfolio Manager.
Simple Payback	The amount of time needed to recoup the funds expended in an investment or to reach the break-even point between investment and savings.
SREC (II)	*Solar renewable energy credit*: a credit you can earn from the state for energy produced from a photovoltaic array.
T5, T8, T12	A reference to a linear lamp diameter. The number represents increments of $1/8^{th}$ 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.