



# Local Government Energy Audit Report

Group Home

May 15, 2020

*Prepared for:*

City of Clifton  
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Clifton, NJ 07013

*Prepared by:*

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# Disclaimer

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The goal of this audit report is to identify potential energy efficiency opportunities, help prioritize specific measures for implementation, and provide information about financial incentives that may be available. 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 were reviewed 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 installation costs on our experience at similar facilities, pricing from local contractors and vendors, and/or cost estimates from RS Means. Cost estimates include material and labor pricing associated with installation of primary recommended equipment only. Cost estimates do not include demolition or removal of hazardous waste. We encourage the owner of the facility to independently confirm these cost estimates and to obtain multiple estimates when considering measure installations. Actual installation costs can vary widely based on individual measures and conditions. TRC and NJBPU do not guarantee installed cost estimates and shall in no event be held liable should actual installed costs vary from estimates.

New Jersey's Clean Energy Program (NJCEP) incentive values provided in this report are estimates based on program information available at the time of the report. Incentive levels are not guaranteed. The NJBPU reserves the right to extend, modify, or terminate programs without prior notice. Please review all available 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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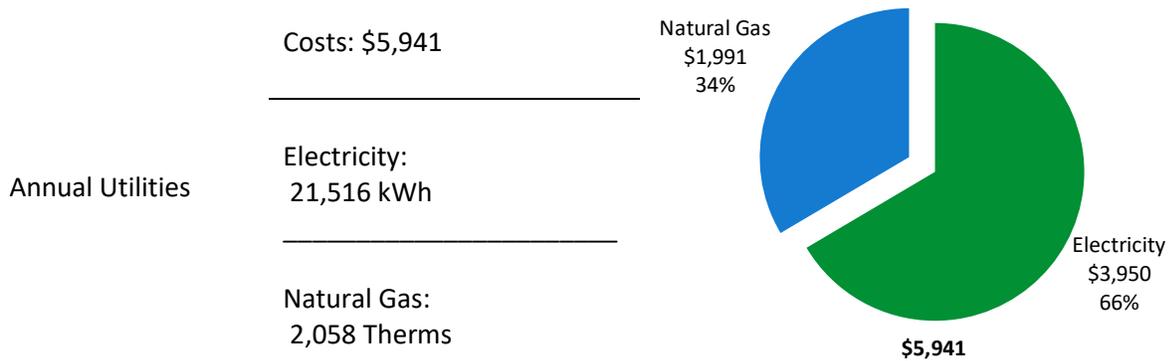
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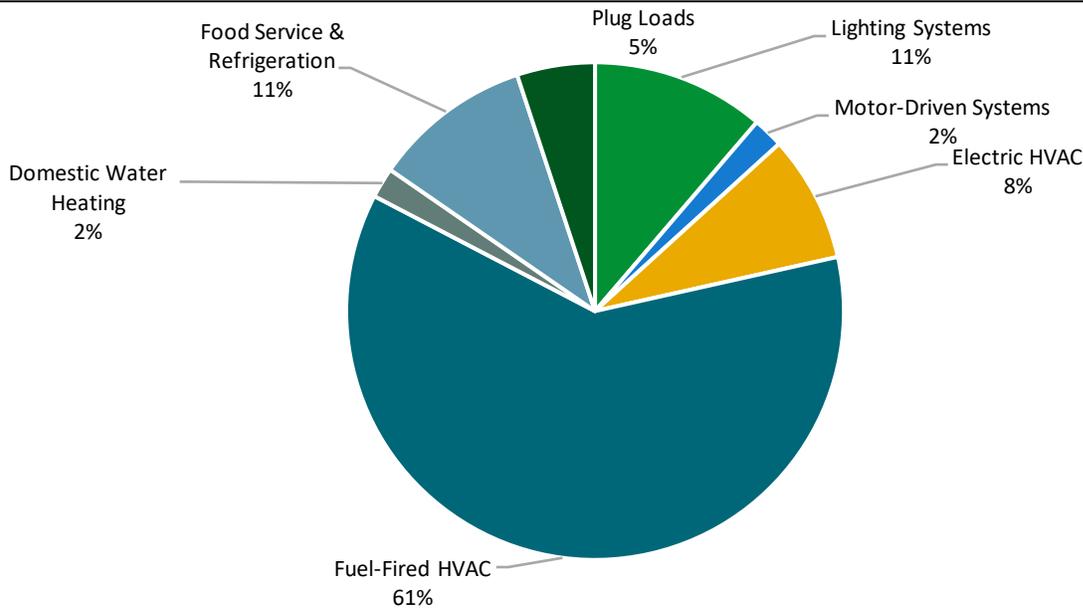
# 1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPB) has sponsored this Local Government Energy Audit (LGEA) report for the Group Home. 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



ENERGY STAR® Benchmarking Score	N/A <i>(1-100 scale)</i>	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.
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*Figure 1 - Energy Use by System*

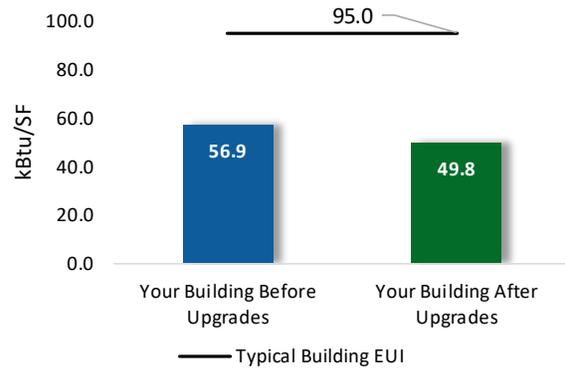
## POTENTIAL IMPROVEMENTS



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.

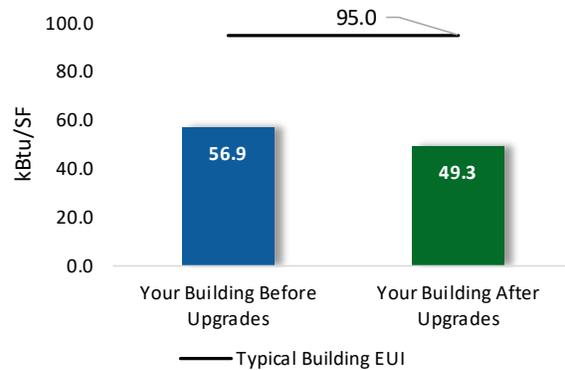
### Scenario 1: Full Package (all evaluated measures)

Installation Cost	\$7,625
Potential Rebates & Incentives <sup>1</sup>	\$1,621
Annual Cost Savings	\$1,468
Annual Energy Savings	Electricity: 7,499 kWh Natural Gas: 94 Therms
Greenhouse Gas Emission Savings	4 Tons
Simple Payback	4.1 Years
Site Energy Savings (all utilities)	13%



### Scenario 2: Cost Effective Package<sup>2</sup>

Installation Cost	\$5,934
Potential Rebates & Incentives	\$1,271
Annual Cost Savings	\$1,407
Annual Energy Savings	Electricity: 7,163 kWh Natural Gas: 95 Therms
Greenhouse Gas Emission Savings	4 Tons
Simple Payback	3.3 Years
Site Energy Savings (all utilities)	12%



### On-site Generation Potential

Photovoltaic	None
Combined Heat and Power	None

<sup>1</sup> Incentives are based on current SmartStart Prescriptive incentives. Other program incentives may apply.

<sup>2</sup> 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 Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO <sub>2</sub> e Emissions Reduction (lbs)
<b>Lighting Upgrades</b>			<b>7,163</b>	<b>4.0</b>	<b>-1</b>	<b>\$1,304</b>	<b>\$5,796</b>	<b>\$1,200</b>	<b>\$4,596</b>	<b>3.5</b>	<b>7,082</b>
ECM 1	Install LED Fixtures	Yes	301	0.0	0	\$55	\$1,449	\$600	\$849	15.3	303
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	1,186	1.0	0	\$215	\$2,144	\$408	\$1,736	8.1	1,165
ECM 3	Retrofit Fixtures with LED Lamps	Yes	5,675	3.0	-1	\$1,034	\$2,203	\$192	\$2,011	1.9	5,614
<b>Lighting Control Measures</b>			<b>336</b>	<b>0.2</b>	<b>0</b>	<b>\$61</b>	<b>\$1,691</b>	<b>\$350</b>	<b>\$1,341</b>	<b>22.0</b>	<b>330</b>
ECM 4	Install Occupancy Sensor Lighting Controls	No	286	0.2	0	\$52	\$1,466	\$350	\$1,116	21.5	281
ECM 5	Install High/Low Lighting Controls	No	50	0.0	0	\$9	\$225	\$0	\$225	24.7	49
<b>HVAC System Improvements</b>			<b>0</b>	<b>0.0</b>	<b>10</b>	<b>\$98</b>	<b>\$131</b>	<b>\$64</b>	<b>\$67</b>	<b>0.7</b>	<b>1,184</b>
ECM 6	Install Pipe Insulation	Yes	0	0.0	10	\$98	\$131	\$64	\$67	0.7	1,184
<b>Domestic Water Heating Upgrade</b>			<b>0</b>	<b>0.0</b>	<b>0</b>	<b>\$5</b>	<b>\$7</b>	<b>\$7</b>	<b>\$0</b>	<b>0.0</b>	<b>56</b>
ECM 7	Install Low-Flow DHW Devices	Yes	0	0.0	0	\$5	\$7	\$7	\$0	0.0	56
<b>TOTALS (COST EFFECTIVE MEASURES)</b>			<b>7,163</b>	<b>4.0</b>	<b>9</b>	<b>\$1,407</b>	<b>\$5,934</b>	<b>\$1,271</b>	<b>\$4,663</b>	<b>3.3</b>	<b>8,322</b>
<b>TOTALS (ALL MEASURES)</b>			<b>7,499</b>	<b>4.3</b>	<b>9</b>	<b>\$1,468</b>	<b>\$7,625</b>	<b>\$1,621</b>	<b>\$6,004</b>	<b>4.1</b>	<b>8,653</b>

\* - All incentives presented in this table are based on NJ SmartStart equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

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

Figure 2 – Evaluated Energy Improvements

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

## 1.1 Planning Your Project

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

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

### Pick Your Installation Approach

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.

The potential ECMs identified for this building likely qualify for multiple incentive and funding programs. Based on current program rules and requirements, your measures are likely to qualify for the following programs:

Energy Conservation Measure		SmartStart	Direct Install	Pay For Performance
ECM 1	Install LED Fixtures	X	X	
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	X	X	
ECM 3	Retrofit Fixtures with LED Lamps	X	X	
ECM 4	Install Occupancy Sensor Lighting Controls	X	X	
ECM 5	Install High/Low Lighting Controls		X	
ECM 6	Install Pipe Insulation	X	X	
ECM 7	Install Low-Flow DHW Devices	X	X	

*Figure 3 – Funding Options*



## New Jersey's Clean Energy Programs At-A-Glance

	<b>SmartStart</b> Flexibility to install at your own pace	<b>Direct Install</b> Turnkey installation	<b>Pay for Performance</b> Whole building upgrades
<b>Who should use it?</b>	Buildings installing individual measures or small group of measures.	Small to mid-size facilities that can bundle multiple measures together.  Average peak demand should be below 200 kW.  Not suitable for significant building shell issues.	Mid to large size facilities looking to implement as many measures as possible at one time.  Peak demand should be over 200 kW.
<b>How does it work?</b>	Use in-house staff or your preferred contractor.	Pre-approved contractors pass savings along to you via reduced material and labor costs.	Whole-building approach to energy upgrades designed to reduce energy use by at least 15%. The more you save, the higher the incentives.
<b>What are the Incentives?</b>	Fixed incentives for specific energy efficiency measures.	Incentives pay up to 70% of eligible costs, up to \$125,000 per project.  You pay the remaining 30% directly to the contractor.	Up to 25% of installation cost, calculated based on level of energy savings per square foot.
<b>How do I participate?</b>	Submit an application for the specific equipment to be installed.	Contact a participating contractor in your region.	Contact a pre-qualified Partner to develop your Energy Reduction Plan and set your energy savings targets.

Take the next step by visiting [www.njcleanenergy.com](http://www.njcleanenergy.com) for program details, applications, and to contact a qualified contractor.

### *Individual Measures with SmartStart*

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 SmartStart 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 is required for some SmartStart incentives, so only after receiving pre-approval should you proceed with ECM installation.

### *Turnkey Installation with Direct Install*

The Direct Install program provides turnkey installation of multiple measures through an authorized network of participating contractors. This program can provide substantially higher incentives than SmartStart, up to 70% of the cost of selected measures. Direct Install contractors will assess and verify individual measure eligibility and, in most cases, they perform the installation work. The Direct Install program is available to sites with an average peak demand of less than 200 kW.

### *Whole Building Approach with Pay for Performance*

Pay for Performance can be a good option for medium to large sized facilities to achieve deep energy savings. Pay for Performance 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. Many facilities pursuing an Energy Savings Improvement Program (ESIP) loan also use this program. Pay for Performance works for larger customers with a peak demand over 200 kW. The minimum installed scope of work must include at least two unique measures resulting in at least 15% energy savings, where lighting cannot make up the majority of the savings.

## **More Options from Around the State**

### *Financing and Planning Support with the Energy Savings Improvement Program (ESIP)*

For larger facilities with limited capital availability to implement ECMs, project financing may be available through the ESIP. Supported directly by the NJBPU, ESIP provides government agencies with project development, design, and implementation support services, as well as, attractive financing for implementing ECMs. You have already taken the first step as an LGEA customer, because this report is required to participate in ESIP.

### *Resiliency with Return on Investment through Combined Heat & Power (CHP)*

The CHP program provides incentives for combined heat and power (aka cogeneration) and waste heat to power projects. Combined heat and power systems generate power on-site and recover heat from the generation system to meet on-site thermal loads. Waste heat to power systems use waste heat to generate power. You will work with a qualified developer who will design a system that meets your building's heating and cooling needs.

### *Ongoing Electric Savings with Demand Response*

The Demand Response Energy Aggregator program reduces electric loads at commercial facilities when wholesale electricity prices are high or when the reliability of the electric grid is threatened due to peak power demand. By enabling commercial facilities to reduce electric demand during times of peak demand, the grid is made more reliable and overall transmission costs are reduced for all ratepayers. Curtailment service providers provide regular payments to medium and large consumers of electric power for their participation in demand response (DR) programs. Program participation is voluntary, and facilities receive payments regardless of whether they are called upon to curtail their load during times of peak demand.

## 2 EXISTING CONDITIONS

The New Jersey Board of Public Utilities (NJBP) has sponsored this Local Government Energy Audit (LGEA) Report for the Group Home. 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. This report also contains valuable information on financial incentives from New Jersey’s Clean Energy Program (NJCEP) for implementing 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 February 11, 2020, TRC performed an energy audit at Group Home located in Clifton, New Jersey. TRC met with Jodi Neumann to review the facility operations and help focus our investigation on specific energy-using systems.

Group Home is a 3-story, 4,893 square foot building built in 1910. The building is used for overnights. First floor includes a kitchen, lounge areas, an office, restrooms and mechanical space. There is a basement with work out equipment and storage space. The second floor is comprised of bedrooms and restrooms. There is an unconditioned attic that is primarily used for storage. The remainder of the facility is heated and cooled.

Recent improvements include: Over the last five years the facility has upgraded its HVAC systems and equipment.

General Note: This site is operated by a 501c Non-Profit Organization, Clifton Adult Opportunity Center (CAOC). This organization pays all their own utilities and handles all maintenance activities. The building is owned by the City of Clifton. The CAOC is participating under the City’s current LGEA application.

### 2.2 Building Occupancy

The facility is occupied year-round. Typical weekday occupancy is 2 staff. The number of overnight occupants varies.

Building Name	Weekday/Weekend	Operating Schedule
Group Home	Weekday	8:00 PM - 8:00 AM
	Weekend	Some Use

Figure 4 - Building Occupancy Schedule

## 2.3 Building Envelope

The building is of typical residential construction. The roof is pitched and is built up from wooden trusses. Windows are either single or double pane with wooden frames. The glass-to-frame seals are in fair condition and there are limited weather seals. Windows in general are showing evidence of excessive wear. Exterior doors are glass with vinyl frames and are in fair condition with worn door seals. Degraded window and door seals increase drafts and outside air infiltration.



*Building Façade*



*Window*

## 2.4 Lighting Systems

The primary interior lighting system uses incandescent and compact fluorescent general screw in lamps. There are a few T12 fixtures located in the basement and multipurpose room. A restroom has LED lamp fixtures. Most fixtures are in good condition. Lighting is controlled by manual wall switches. Interior lighting levels were generally sufficient. Exit signs are LED. Exterior building mounted lighting includes high pressure sodium lamp fixtures, incandescent lamps, and an LED lamp fixture. These fixtures are controlled by wall switches.



*Incandescent lamp fixture*



*LED lamp fixtures*



*U-bend T12 lamp Recessed Troffer Fixture*



*U-bend T12 lamp Recessed Troffer Fixtures*



*Incandescent lamp fixture*

## 2.5 Air Handling Systems

### **Split Systems**

The first floor is conditioned by a split air-conditioning (AC) system. The outdoor condensing unit is 3-tons in cooling capacity. Equipment is in good condition, with an energy efficiency rating of 12 EER.

A split air-source heat pump (HP) serves the second floor. The system has a cooling capacity of 0.75-tons and a heating capacity of 12 Mbh. This system is in good condition and highly efficient with an energy efficiency rating of 13 EER and a coefficient of performance of 3 (COP).

These systems are controlled by programmable thermostats. At the time of the audit, thermostats were set to 72°F. Per discussions with facility staff, they are scheduled for a temperature setback to 65°F by 2:00 PM and the temperature is increased back to 70°F when the building is occupied. On weekends, thermostats are set to maintain 70°F.



*Outdoor Condensing Units*



*Programmable Thermostats*

### **Air Handling Unit**

An air handling unit in the building attic serves the second floor. It is equipped with a refrigerant coil. This system has a fractional horsepower supply fan motor. Cooling is provided by an outdoor condensing unit that is 3-tons in cooling capacity. The equipment is in good condition with an energy efficiency rating of 12 EER.



*Outdoor Condensing Unit*



*Programmable Thermostat*

### **Fan Coil Unit**

The multipurpose room in the basement of the building is heated by a fan coil unit. This fan coil unit is in good condition and equipped with electric resistance heating and a ½ hp supply fan motor. The heating capacity is approximately 9.6 kW.



*Fan Coil Unit*

## 2.6 Heating Hot Water System

A Weil McLain 139 Mbh condensing hot water boiler serves the majority of the building heating load. The burner is fully modulating with a nominal efficiency of 94%. The hydronic distribution system serves baseboard radiators throughout the facility. There are five fractional horsepower circulation pump motors. The pipes are uninsulated. The system has an outdoor air reset schedule; however, the exact control logic is unknown.



*Condensing Hot Water Boiler*



*Baseboard Radiator*



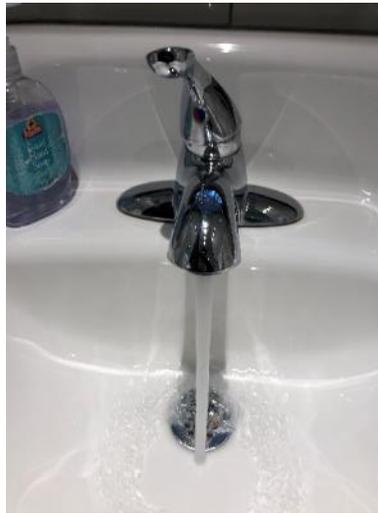
*Circulation Pump Motors*



*Uninsulated Piping*

## 2.7 Domestic Hot Water

Hot water is produced with a 40 gallon 40 MBh gas-fired storage tank water heater with an 80% efficiency. Pipes are not fully insulated.



*High Flow Sink Aerator*

## 2.8 Food Service Equipment

The kitchen has a gas oven which is used to prepare food as needed. Equipment is high efficiency and is in good condition. There is a dishwasher on site but staff reported it is not used.

Visit [https://www.energystar.gov/products/commercial\\_food\\_service\\_equipment](https://www.energystar.gov/products/commercial_food_service_equipment) for the latest information on high efficiency food service equipment.



*Stove*

## 2.9 Plug Load & Vending Machines

You may wish to consider paying particular attention to minimizing your plug load usage. This report makes suggestions for ECMs in this area as well as Energy Efficient Best Practices.

There is one computer in the office. Plug loads throughout the building include general café and office equipment. There are a few residential style refrigerators throughout the building. These are in good condition. There are also several clothes washing/drying machines. These vary in condition and efficiency.



*Clothes washer/dryer*



*Café equipment*



*Refrigerator*

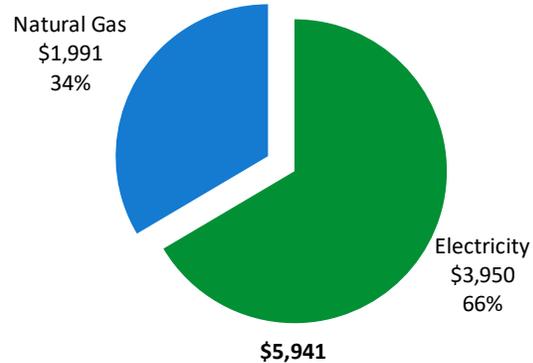
## 2.10 Water-Using Systems

There are restrooms with toilets and sinks. Faucet flow rates are at 2.2 gallons per minute (gpm) and considered high flow devices.

### 3 ENERGY USE AND COSTS

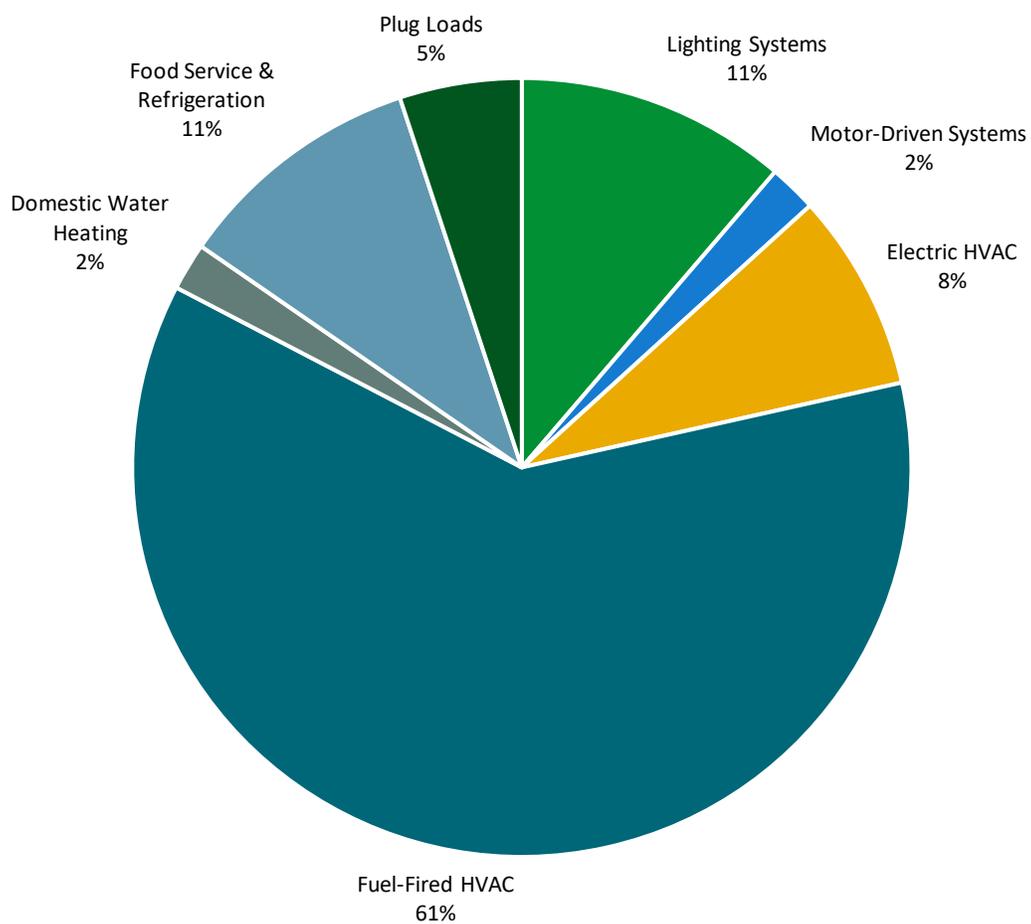
Twelve months of utility billing data are used to develop annual energy consumption and cost data. This information creates a profile of the annual energy consumption and energy costs.

Utility Summary		
Fuel	Usage	Cost
Electricity	21,516 kWh	\$3,950
Natural Gas	2,058 Therms	\$1,991
<b>Total</b>		<b>\$5,941</b>



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.

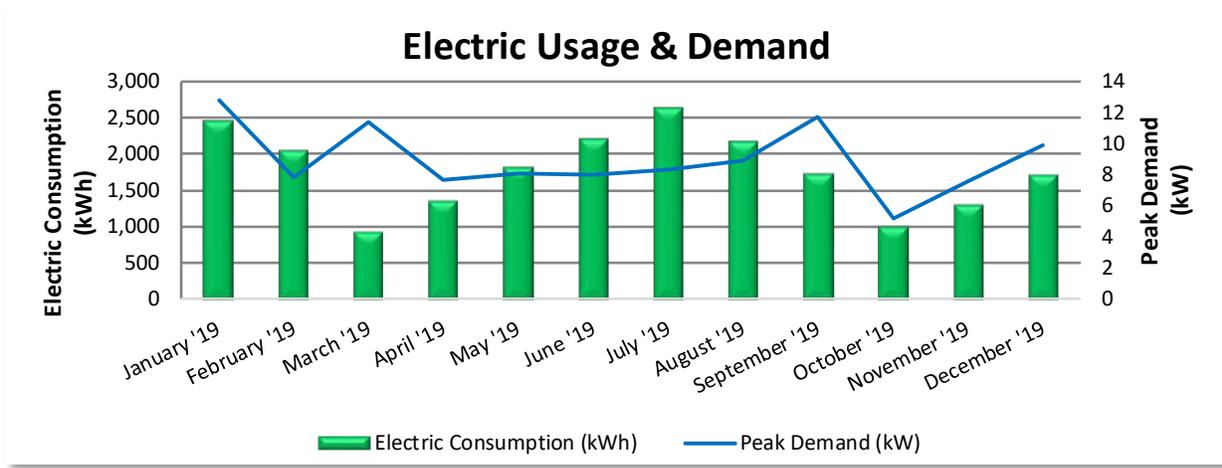
The energy auditor collects information regarding equipment operating hours, capacity, efficiency, and other operational parameters from facility staff, drawings, and on-site observations. This information is used as the inputs to calculate the existing conditions energy use for the site. The calculated 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 5 - Energy Balance*

### 3.1 Electricity

PSE&G supplies and delivers electricity under rate class General Lighting & Power.



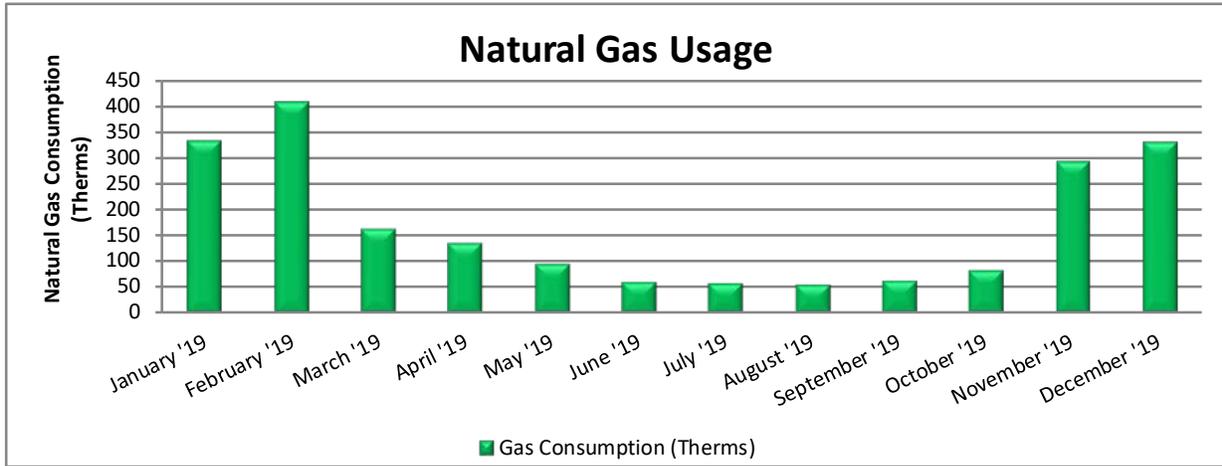
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
2/6/19	28	2,466	13	\$50	\$393
3/11/19	33	2,064	8	\$31	\$359
4/8/19	28	942	11	\$45	\$271
5/8/19	30	1,368	8	\$30	\$293
6/10/19	33	1,836	8	\$120	\$401
7/9/19	29	2,220	8	\$103	\$399
8/8/19	30	2,640	8	\$114	\$421
9/6/19	29	2,190	9	\$123	\$385
10/7/19	31	1,740	12	\$46	\$285
11/5/19	29	1,014	5	\$20	\$214
12/6/19	31	1,314	8	\$30	\$242
1/9/20	34	1,722	10	\$39	\$286
<b>Totals</b>	<b>365</b>	<b>21,516</b>	<b>13</b>	<b>\$751</b>	<b>\$3,950</b>
<b>Annual</b>	<b>365</b>	<b>21,516</b>	<b>13</b>	<b>\$751</b>	<b>\$3,950</b>

Notes:

- Peak demand of 13 kW occurred in January '19.
- Average demand over the past 12 months was 9 kW.
- The average electric cost over the past 12 months was \$0.184/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.

### 3.2 Natural Gas

PSE&G supplies and delivers natural gas under rate class General Service Gas Heating.



Gas Billing Data				
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost	TRC Estimated Usage?
2/6/19	28	332	\$344	No
3/11/19	33	406	\$391	No
4/8/19	28	162	\$148	No
5/8/19	30	134	\$123	No
6/10/19	33	93	\$90	No
7/9/19	29	58	\$62	No
8/8/19	30	56	\$58	Yes
9/6/19	29	53	\$55	No
10/7/19	31	63	\$64	No
11/5/19	29	81	\$82	No
12/6/19	31	291	\$272	No
1/9/20	34	328	\$301	No
<b>Totals</b>	<b>365</b>	<b>2,058</b>	<b>\$1,991</b>	
<b>Annual</b>	<b>365</b>	<b>2,058</b>	<b>\$1,991</b>	

Notes:

- The average gas cost for the past 12 months is \$0.967/therm, which is the blended rate used throughout the analysis.

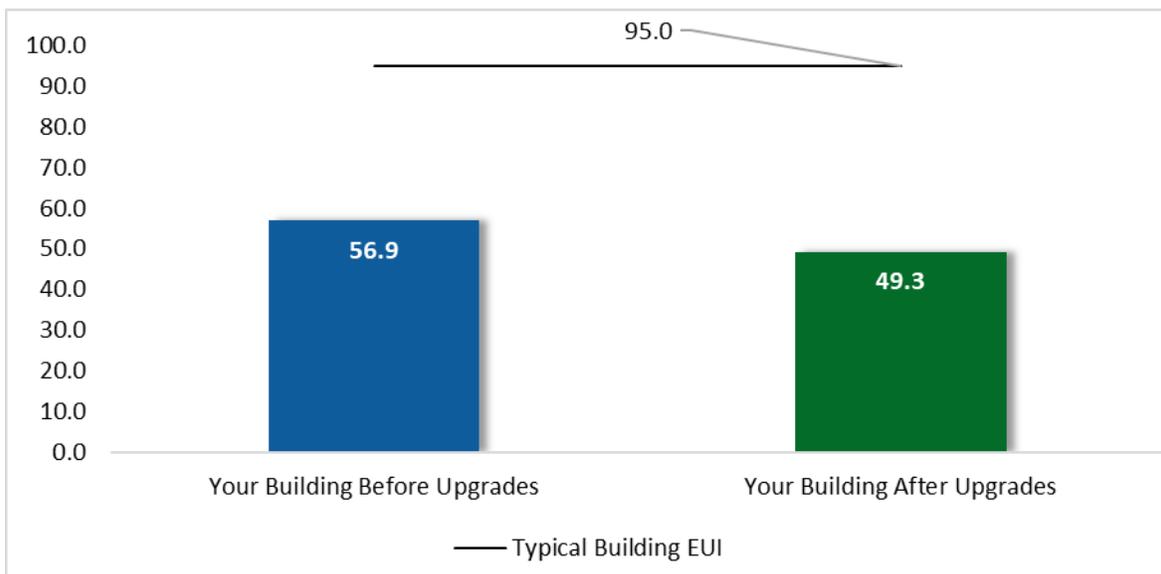
### 3.3 Benchmarking

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.

<b>Benchmarking Score</b>	<b>N/A</b>
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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 6 - Energy Use Intensity Comparison<sup>3</sup>*

Energy use intensity (EUI) measures energy consumption per square foot and is the standard metric for comparing buildings' energy performance. A lower EUI means better performance and less energy consumed. A number of factors can cause a building to vary from the "typical" energy usage. Local weather conditions, building age and insulation levels, equipment efficiency, daily occupancy hours, changes in occupancy throughout the year, equipment operating hours, and occupant behavior all contribute to a building's energy use and the benchmarking score.

<sup>3</sup> Based on all evaluated ECMs

## **Tracking Your Energy Performance**

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

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

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

For more information on ENERGY STAR® and Portfolio Manager®, visit their website<sup>4</sup>.

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<sup>4</sup> <https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1>.

## 4 ENERGY CONSERVATION MEASURES

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The goal of this audit report is to identify and evaluate potential energy efficiency improvements, provide information about the cost effectiveness of those improvements, and recognize potential financial incentives from NJBPU. Most energy conservation measures have received preliminary analysis of feasibility which identifies expected ranges of savings and costs. This level of analysis is typically sufficient to demonstrate project cost-effectiveness and help prioritize energy measures.

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

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

Financial incentives are based on the current NJCEP prescriptive SmartStart program. A higher level of investigation may be necessary to support any SmartStart Custom, Pay for Performance, or Direct Install incentive applications. Some measures and proposed upgrades may be eligible for higher incentives than those shown below through other NJCEP programs described in a following section of this report.

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 Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO <sub>2</sub> e Emissions Reduction (lbs)
<b>Lighting Upgrades</b>			<b>7,163</b>	<b>4.0</b>	<b>-1</b>	<b>\$1,304</b>	<b>\$5,796</b>	<b>\$1,200</b>	<b>\$4,596</b>	<b>3.5</b>	<b>7,082</b>
ECM 1	Install LED Fixtures	Yes	301	0.0	0	\$55	\$1,449	\$600	\$849	15.3	303
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	1,186	1.0	0	\$215	\$2,144	\$408	\$1,736	8.1	1,165
ECM 3	Retrofit Fixtures with LED Lamps	Yes	5,675	3.0	-1	\$1,034	\$2,203	\$192	\$2,011	1.9	5,614
<b>Lighting Control Measures</b>			<b>336</b>	<b>0.2</b>	<b>0</b>	<b>\$61</b>	<b>\$1,691</b>	<b>\$350</b>	<b>\$1,341</b>	<b>22.0</b>	<b>330</b>
ECM 4	Install Occupancy Sensor Lighting Controls	No	286	0.2	0	\$52	\$1,466	\$350	\$1,116	21.5	281
ECM 5	Install High/Low Lighting Controls	No	50	0.0	0	\$9	\$225	\$0	\$225	24.7	49
<b>HVAC System Improvements</b>			<b>0</b>	<b>0.0</b>	<b>10</b>	<b>\$98</b>	<b>\$131</b>	<b>\$64</b>	<b>\$67</b>	<b>0.7</b>	<b>1,184</b>
ECM 6	Install Pipe Insulation	Yes	0	0.0	10	\$98	\$131	\$64	\$67	0.7	1,184
<b>Domestic Water Heating Upgrade</b>			<b>0</b>	<b>0.0</b>	<b>0</b>	<b>\$5</b>	<b>\$7</b>	<b>\$7</b>	<b>\$0</b>	<b>0.0</b>	<b>56</b>
ECM 7	Install Low-Flow DHW Devices	Yes	0	0.0	0	\$5	\$7	\$7	\$0	0.0	56
<b>TOTALS</b>			<b>7,499</b>	<b>4.3</b>	<b>9</b>	<b>\$1,468</b>	<b>\$7,625</b>	<b>\$1,621</b>	<b>\$6,004</b>	<b>4.1</b>	<b>8,653</b>

\* - All incentives presented in this table are based on NJ SmartStart equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

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

Figure 7 – All Evaluated ECMs

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO <sub>2</sub> e Emissions Reduction (lbs)
<b>Lighting Upgrades</b>		<b>7,163</b>	<b>4.0</b>	<b>-1</b>	<b>\$1,304</b>	<b>\$5,796</b>	<b>\$1,200</b>	<b>\$4,596</b>	<b>3.5</b>	<b>7,082</b>
ECM 1	Install LED Fixtures	301	0.0	0	\$55	\$1,449	\$600	\$849	15.3	303
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	1,186	1.0	0	\$215	\$2,144	\$408	\$1,736	8.1	1,165
ECM 3	Retrofit Fixtures with LED Lamps	5,675	3.0	-1	\$1,034	\$2,203	\$192	\$2,011	1.9	5,614
<b>HVAC System Improvements</b>		<b>0</b>	<b>0.0</b>	<b>10</b>	<b>\$98</b>	<b>\$131</b>	<b>\$64</b>	<b>\$67</b>	<b>0.7</b>	<b>1,184</b>
ECM 6	Install Pipe Insulation	0	0.0	10	\$98	\$131	\$64	\$67	0.7	1,184
<b>Domestic Water Heating Upgrade</b>		<b>0</b>	<b>0.0</b>	<b>0</b>	<b>\$5</b>	<b>\$7</b>	<b>\$7</b>	<b>\$0</b>	<b>0.0</b>	<b>56</b>
ECM 7	Install Low-Flow DHW Devices	0	0.0	0	\$5	\$7	\$7	\$0	0.0	56
<b>TOTALS</b>		<b>7,163</b>	<b>4.0</b>	<b>9</b>	<b>\$1,407</b>	<b>\$5,934</b>	<b>\$1,271</b>	<b>\$4,663</b>	<b>3.3</b>	<b>8,322</b>

\* - All incentives presented in this table are based on NJ SmartStart equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

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

Figure 8 – 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 Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO <sub>2</sub> e Emissions Reduction (lbs)
<b>Lighting Upgrades</b>		<b>7,163</b>	<b>4.0</b>	<b>-1</b>	<b>\$1,304</b>	<b>\$5,796</b>	<b>\$1,200</b>	<b>\$4,596</b>	<b>3.5</b>	<b>7,082</b>
ECM 1	Install LED Fixtures	301	0.0	0	\$55	\$1,449	\$600	\$849	15.3	303
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	1,186	1.0	0	\$215	\$2,144	\$408	\$1,736	8.1	1,165
ECM 3	Retrofit Fixtures with LED Lamps	5,675	3.0	-1	\$1,034	\$2,203	\$192	\$2,011	1.9	5,614

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

### **ECM 1: Install LED Fixtures**

Replace existing fixtures containing high pressure sodium 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 fixture(s).

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:** the basement and multipurpose room with fluorescent fixtures with T12 tubes.

### **ECM 3: Retrofit Fixtures with LED Lamps**

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

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

**Affected building areas:** all areas with compact fluorescent and incandescent lamps.

## 4.2 Lighting Controls

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO <sub>2</sub> e Emissions Reduction (lbs)
<b>Lighting Control Measures</b>		<b>336</b>	<b>0.2</b>	<b>0</b>	<b>\$61</b>	<b>\$1,691</b>	<b>\$350</b>	<b>\$1,341</b>	<b>22.0</b>	<b>330</b>
ECM 4	Install Occupancy Sensor Lighting Controls	286	0.2	0	\$52	\$1,466	\$350	\$1,116	21.5	281
ECM 5	Install High/Low Lighting Controls	50	0.0	0	\$9	\$225	\$0	\$225	24.7	49

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**

We evaluated the installation of occupancy sensors to control lighting fixtures in areas that are frequently unoccupied, even for short periods. This measure is not considered cost effective based on the payback period. The facility is already doing a great job in turning off the lights.

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:** basement, lounge areas, multipurpose room, and office.

### **ECM 5: Install High/Low Lighting Controls**

We evaluated the installation occupancy sensors to provide dual level lighting control for lighting fixtures in spaces that are infrequently occupied but may require some level of continuous lighting for safety or security reasons. This measure is not considered cost effective based on the payback period. The facility is already doing a great job in turning off the lights.

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

The controller lowers the light level by dimming the fixture output. Therefore, the controlled fixtures need to have a dimmable ballast or driver. This will need to be considered when selecting retrofit lamps and bulbs for the areas proposed for high/low control.

This measure provides energy savings by reducing the light fixture power draw when reduced light output is appropriate.

**Affected building areas:** hallway.

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

## 4.3 HVAC Improvements

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO <sub>2</sub> e Emissions Reduction (lbs)
<b>HVAC System Improvements</b>		<b>0</b>	<b>0.0</b>	<b>10</b>	<b>\$98</b>	<b>\$131</b>	<b>\$64</b>	<b>\$67</b>	<b>0.7</b>	<b>1,184</b>
ECM 6	Install Pipe Insulation	0	0.0	10	\$98	\$131	\$64	\$67	0.7	1,184

### **ECM 6: Install Pipe Insulation**

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

**Affected systems:** heating hot water and domestic hot water systems.

## 4.4 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO <sub>2</sub> e Emissions Reduction (lbs)
<b>Domestic Water Heating Upgrade</b>		<b>0</b>	<b>0.0</b>	<b>0</b>	<b>\$5</b>	<b>\$7</b>	<b>\$7</b>	<b>\$0</b>	<b>0.0</b>	<b>56</b>
ECM 7	Install Low-Flow DHW Devices	0	0.0	0	\$5	\$7	\$7	\$0	0.0	56

### **ECM 7: Install Low-Flow DHW Devices**

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

Device	Flow Rate
Faucet aerators (lavatory)	0.5 gpm
Faucet aerator (kitchen)	1.5 gpm
Showerhead	2.0 gpm
Pre-rinse spray valve (kitchen)	1.28 gpm

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

## 4.5 Measures for Future Consideration

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

City of Clifton may wish to consider the Energy Savings Improvement Program (ESIP). With interest in implementing comprehensive, largescale and/or complex system wide projects, these measures may be pursued during development of a future energy savings plan. We recommend that you work with your energy service company (ESCO) and/or design team to evaluate these measures further, develop firm costs, savings estimates and detailed implementation plans. Other modernization or capital improvement funds may be leveraged for these types of refurbishments. As you plan for capital upgrades, be sure to consider the energy impact of the building systems and controls being specified.

### **Ozone Laundry System**

The facility includes a laundry room with a clothes washer and dryer. There may be an opportunity for energy savings by installing an ozone laundry system. An ozone system utilizes O<sub>3</sub> and cold water to purify and clean clothes. Cleaning clothes without the use of hot water saves on energy consumption required to produce domestic hot water, water and chemical cost savings and increases the life of the clothes being cleaned. The actual frequency and use of the laundry machines should be investigated further to determine the cost effectiveness and feasibility of this measure.

### **Upgrade to a Heat Pump System**

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

Electric resistance heat, including electric furnaces and baseboard heaters can be inexpensive to install but often expensive to run. Facilities with these systems can save substantial energy at a moderate cost by installing a heat pump when they replace a central air conditioner. Even in buildings without central air-conditioning, there are opportunities to save energy when an existing electric furnace needs to be replaced, as well as opportunities to install ductless electric heat pumps in buildings with baseboard electric heaters. Electric heat pumps have high coefficient of performance (COP) ratings and are substantially more efficient than traditional electric heating systems. Further investigation is required to determine whether installing a heat pump system is a cost-effective solution when replacing existing electrical heating systems.

## **Window Replacements**

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

## 5 ENERGY EFFICIENT BEST PRACTICES

A whole building maintenance plan will extend equipment life; improve occupant comfort, health, and safety; and reduce energy and maintenance costs. You may already be doing some of these things— see our list below for potential additions to your maintenance plan. Be sure to consult with qualified equipment specialists for details on proper maintenance and system operation.

### **Energy Tracking with ENERGY STAR® Portfolio Manager®**



You've heard it before - you can't manage what you don't measure. ENERGY STAR® Portfolio Manager® is an online tool that you can use to measure and track energy and water consumption, as well as greenhouse gas emissions<sup>5</sup>. 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 and thus providing energy savings and increased occupant comfort.

### **Doors and Windows**

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

### **Lighting Maintenance**



- Clean lamps, reflectors and lenses of dirt, dust, oil, and smoke buildup every six to twelve months. Light levels decrease over time due to lamp aging, lamp and ballast failure, and buildup of dirt and dust. Together, this can reduce total light output by up to 60% while still drawing full power.
- In addition to routine cleaning, developing a maintenance schedule can ensure that maintenance is performed regularly, and it can reduce the overall cost of fixture re-lamping and re-ballasting. Group re-lamping and re-ballasting maintains lighting levels and minimizes the number of site visits by a lighting technician or contractor, decreasing the overall cost of maintenance.

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<sup>5</sup> <https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager>.

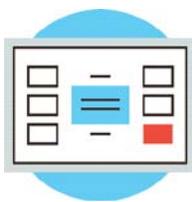
## **Motor Maintenance**

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

## **Fans to Reduce Cooling Load**

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

## **Thermostat Schedules and Temperature Resets**



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

## **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.

## **Boiler Maintenance**

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

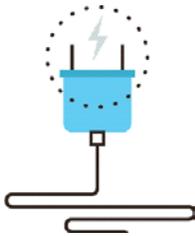
## **Water Heater Maintenance**

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.

## **Plug Load Controls**



Reducing plug loads is a common way to decrease your electrical use. Limiting the energy use of plug loads can include increasing occupant awareness, removing under-used equipment, installing hardware controls, and using software controls. Consider enabling the most aggressive power settings on existing devices or install load sensing or occupancy sensing (advanced) power strips<sup>6</sup>. Your local utility may offer incentives or rebates for this equipment.

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<sup>6</sup> For additional information refer to “Assessing and Reducing Plug and Process Loads in Office Buildings” <http://www.nrel.gov/docs/fy13osti/54175.pdf>, or “Plug Load Best Practices Guide” <http://www.advancedbuildings.net/plug-load-best-practices-guide-offices>.

## **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<sup>7</sup> or download a copy of EPA's "WaterSense® at Work: Best Management Practices for Commercial and Institutional Facilities"<sup>8</sup> to get ideas for creating a water management plan and best practices for a wide range of water using systems.

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

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

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

## **Procurement Strategies**

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

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<sup>7</sup> <https://www.epa.gov/watersense>.

<sup>8</sup> <https://www.epa.gov/watersense/watersense-work-0>.

## 6 ON-SITE GENERATION

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

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

## 6.1 Solar Photovoltaic

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

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

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

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

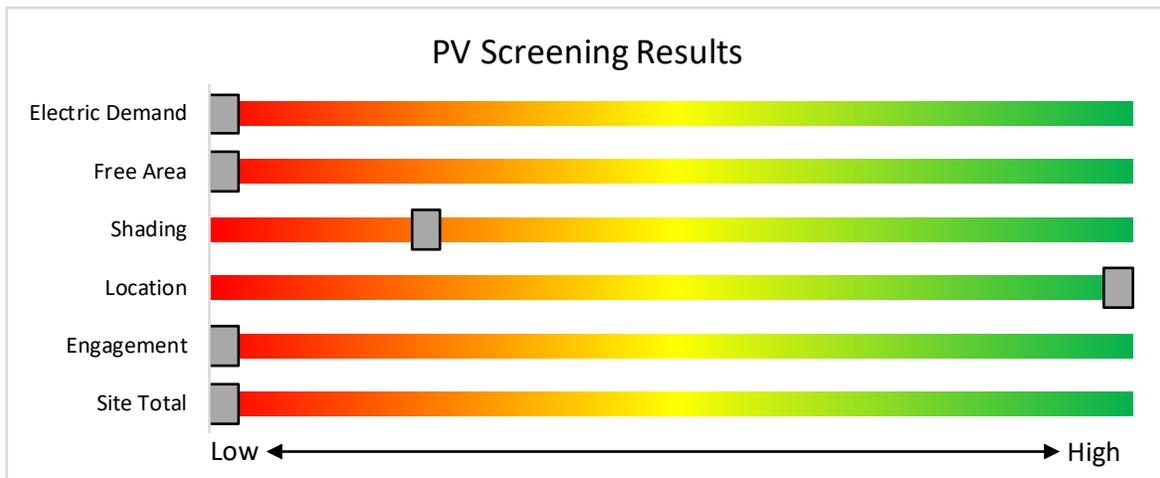


Figure 9 - Photovoltaic Screening

## 6.2 Combined Heat and Power

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

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

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

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

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

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

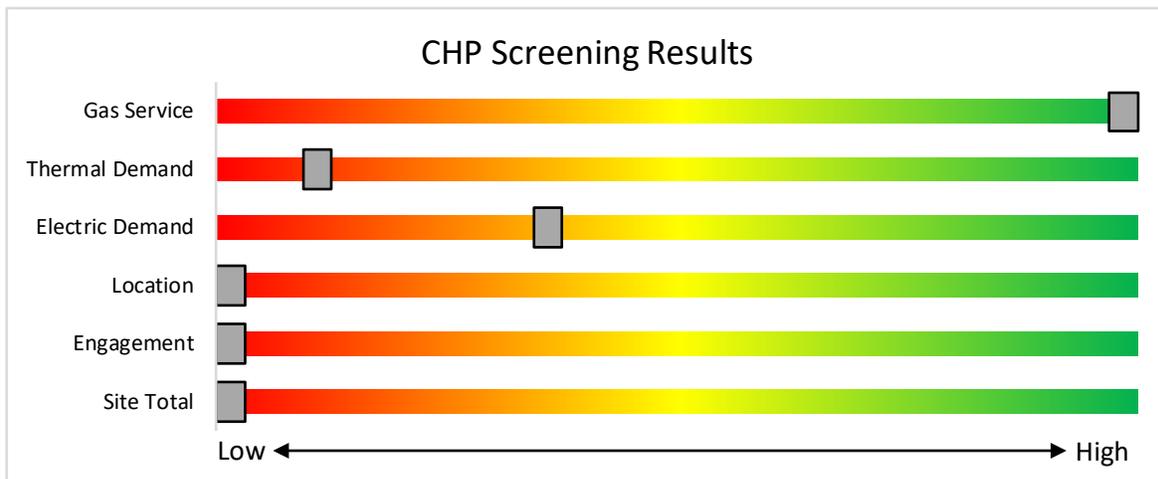


Figure 10 - Combined Heat and Power Screening

## 7 PROJECT FUNDING AND INCENTIVES

Ready to improve your building’s performance? New Jersey’s Clean Energy Programs can help. Pick the program that works best for you. Incentive programs that may apply to this facility are identified in the Executive Summary. This section provides an overview of currently available New Jersey’s Clean Energy Programs.

	<b>SmartStart</b> <i>Flexibility to install at your own pace</i>	<b>Direct Install</b> <i>Turnkey installation</i>	<b>Pay for Performance</b> <i>Whole building upgrades</i>
<b>Who should use it?</b>	Buildings installing individual measures or small group of measures.	Small to mid-size facilities that can bundle multiple measures together.  Average peak demand should be below 200 kW.  Not suitable for significant building shell issues.	Mid to large size facilities looking to implement as many measures as possible at one time.  Peak demand should be over 200 kW.
<b>How does it work?</b>	Use in-house staff or your preferred contractor.	Pre-approved contractors pass savings along to you via reduced material and labor costs.	Whole-building approach to energy upgrades designed to reduce energy use by at least 15%. The more you save, the higher the incentives.
<b>What are the Incentives?</b>	Fixed incentives for specific energy efficiency measures.	Incentives pay up to 70% of eligible costs, up to \$125,000 per project.  You pay the remaining 30% directly to the contractor.	Up to 25% of installation cost, calculated based on level of energy savings per square foot.
<b>How do I participate?</b>	Submit an application for the specific equipment to be installed.	Contact a participating contractor in your region.	Contact a pre-qualified Partner to develop your Energy Reduction Plan and set your energy savings targets.
<p>Take the next step by visiting <a href="http://www.njcleanenergy.com">www.njcleanenergy.com</a> for program details, applications, and to contact a qualified contractor.</p>			

## 7.1 SmartStart



SmartStart 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.

SmartStart routinely adds, removes, or modifies incentives from year-to-year for various energy efficient equipment based on market trends and new technologies.

### **Equipment with Prescriptive Incentives Currently Available:**

*Electric Chillers*

*Electric Unitary HVAC*

*Gas Cooling*

*Gas Heating*

*Gas Water Heating*

*Ground Source Heat Pumps*

*Lighting*

*Lighting Controls*

*Refrigeration Doors*

*Refrigeration Controls*

*Refrigerator/Freezer Motors*

*Food Service Equipment*

*Variable Frequency Drives*

### **Incentives**

The SmartStart Prescriptive program provides fixed incentives for specific energy efficiency measures. Prescriptive incentives vary by equipment type.

SmartStart Custom provides incentives for more unique or specialized technologies or systems that are not addressed through prescriptive incentives. Custom incentives are calculated at \$0.16/kWh and \$1.60/therm based on estimated annual savings. Incentives are capped at 50% of the total installed incremental project cost, or a project cost buy down to a one-year payback (whichever is less). Program incentives are capped at \$500,000 per electric account and \$500,000 per natural gas account, per fiscal year.

### **How to Participate**

Submit an application for the specific equipment to be installed. Many applications are designed as rebates, although others require application approval prior to installation. You can work with your preferred contractor or use internal staff to install measures.

Visit [www.njcleanenergy.com/SSB](http://www.njcleanenergy.com/SSB) for a detailed program description, instructions for applying, and applications.

## 7.2 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 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, up to \$125,000 per project. Each entity is limited to incentives up to \$250,000 per fiscal year.

### How to Participate

To participate in Direct Install, you will need to contact the participating contractor assigned to the region of the state where your facility is located. A complete list of Direct Install program partners is provided on the Direct Install website linked below. 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 program, subject to program caps and eligibility, while the remaining 30% of the cost is paid to the contractor by the customer.

Detailed program descriptions and applications can be found at: [www.njcleanenergy.com/DI](http://www.njcleanenergy.com/DI).

## 7.3 Pay for Performance - Existing Buildings



Pay for Performance works for larger customers with a peak demand over 200 kW. The minimum installed scope of work must include at least two unique measures that results in at least 15% source energy savings, and lighting cannot make up the majority of the savings. P4P is a generally a good option for medium-to-large sized facilities looking to implement as many

measures as possible under a single project to achieve deep energy savings. This program 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.

Based on the site building and utility data provided, the facility does not meet the requirements of the current P4P program.

### Incentives

Incentives are based on estimated and achieved energy savings ranging from \$0.18-\$0.22/kWh and \$1.80-\$2.50/therm, capped at the lesser of 50% total project cost, or \$1 million per electric account and \$1 million per natural gas account, per fiscal year, not to exceed \$2 million per project. An incentive of \$0.15/square foot is also available to offset the cost of developing the Energy Reduction Plan (see below) contingent on the project moving forward with measure installation.

### How to Participate

Contact one of the pre-approved consultants and contractors (“Partners”). Under direct contract to you, they will help further evaluate the measures identified in this report through development of the energy reduction plan), assist you in implementing selected measures, and verify actual savings one year after the installation. Your Partner will also help you apply for incentives.

Approval of the final scope of work is required by the program prior to installation. Installation can be done by the contractor of your choice (some P4P Partners are also contractors) or by internal staff, but the Partner remains involved throughout construction to ensure compliance with the program requirements.

Detailed program descriptions, instructions for applying, applications and list of Partners can be found at: [www.njcleanenergy.com/P4P](http://www.njcleanenergy.com/P4P).

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

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

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

### How to Participate

You work with a qualified developer or consulting firm to complete the CHP application. Once the application is approved the project can be installed. Information about the CHP program can be found at: [www.njcleanenergy.com/CHP](http://www.njcleanenergy.com/CHP).

## 7.5 Energy Savings Improvement Program

The Energy Savings Improvement Program (ESIP) serves New Jersey's government agencies by financing energy projects. An ESIP is a type of performance contract, whereby school districts, counties, municipalities, housing authorities and other public and state entities enter in to contracts to help finance building energy upgrades. Annual payments are lower than the savings projected from the ECMs, ensuring that ESIP projects are cash flow positive for the life of the contract.

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

### How to Participate

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

- (1) Use an energy services company or "ESCO."
- (2) Use independent engineers and other specialists, or your own qualified staff, to provide and manage the requirements of the program through bonds or lease obligations.
- (3) Use a hybrid approach of the two options described above where the ESCO is used for some services and independent engineers, or other specialists or qualified staff, are used to deliver other requirements of the program.

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

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

## 7.6 SREC Registration Program

The SREC (Solar Renewable Energy Certificate) Registration Program (SRP) is used to register the intent to install solar projects in New Jersey. Rebates are not available for solar projects, but owners of solar projects *must* register their projects prior to the start of construction to establish the project's eligibility to earn SRECs. Registration of the intent to participate in New Jersey's solar marketplace provides market participants with information about the pipeline of anticipated new solar capacity and insight into future SREC pricing.

After the registration is accepted, construction is complete, and final paperwork has been submitted and is deemed complete, the project is issued a New Jersey certification number, which enables it to generate New Jersey SRECs. SREC's are generated once the solar project has been authorized to be energized by the Electric Distribution Company (EDC).

Each time a solar installation generates 1,000 kilowatt-hours (kWh) of electricity, an SREC is earned. Solar project owners report the energy production to the SREC Tracking System. This reporting allows SREC's to be placed in the customer's electronic account. SRECs can then be sold on the SREC Tracking System, providing revenue for the first 15 years of the project's life.

Electricity suppliers, the primary purchasers of SRECs, are required to pay a Solar Alternative Compliance Payment (SACP) if they do not meet the requirements of New Jersey's Solar Renewable Portfolio Standard. Purchasing SRECs can help them meet those requirements. As SRECs are traded in a competitive market, the price may vary significantly. The actual price of an SREC during a trading period fluctuates depending on supply and demand.

Information about the SRP can be found at: [www.njcleanenergy.com/srec](http://www.njcleanenergy.com/srec).

## 8 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

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### 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. So, though you may choose a different company from which to buy your electric power, responsibility for your facility's interconnection to the grid and repair to local power distribution will still reside with the traditional utility company serving your region.

If your facility is not purchasing electricity from a third-party supplier, consider shopping for a reduced rate from third-party electric suppliers. If your facility already buys electricity from a third-party supplier, review and compare prices at the end of each contract year.

A list of licensed third-party electric suppliers is available at the NJBPU website<sup>9</sup>.

### 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 that fluctuate monthly. The utility provides basic gas supply service (BGSS) to customers who choose not to buy from a third-party supplier for natural gas commodity.

A customer's decision about whether to buy natural gas from a retail supplier typically depends on whether a customer prefers budget certainty and/or longer-term rate stability. Customers can secure longer-term fixed prices by signing up for service through a third-party retail natural gas supplier. Many larger natural gas customers may seek the assistance of a professional consultant to assist in their procurement process.

If your facility does not already purchase natural gas from a third-party supplier, consider shopping for a reduced rate from third-party natural gas suppliers. If your facility already purchases natural gas from a third-party supplier, review and compare prices at the end of each contract year.

A list of licensed third-party natural gas suppliers is available at the NJBPU website<sup>10</sup>.

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<sup>9</sup> [www.state.nj.us/bpu/commercial/shopping.html](http://www.state.nj.us/bpu/commercial/shopping.html).

<sup>10</sup> [www.state.nj.us/bpu/commercial/shopping.html](http://www.state.nj.us/bpu/commercial/shopping.html).

# APPENDIX A: EQUIPMENT INVENTORY & RECOMMENDATIONS

## Lighting Inventory & Recommendations

Location	Existing Conditions						Proposed Conditions						Energy Impact & Financial Analysis								
	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Basement	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
Basement	4	Linear Fluorescent - T12: 2' T12 (20W) - 2L	Wall Switch	S	50	520	2, 4	Relamp & Reballast	Yes	4	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	359	0.1	86	0	\$16	\$529	\$118	26.3
Kitchen	4	Incandescent: (1) 60W Screw in Lamp	Wall Switch	S	60	1,040	3	Relamp	No	4	LED Lamps: Incandescent: (1) 60W Screw in Lamp Equivalent	Wall Switch	9	1,040	0.2	229	0	\$42	\$69	\$8	1.5
Kitchen	1	Incandescent: (4) 60W Screw in Lamps	Wall Switch	S	240	1,040	3	Relamp	No	1	LED Lamps: Incandescent: (4) 60W Screw in Lamps Equivalent	Wall Switch	36	1,040	0.2	229	0	\$42	\$17	\$2	0.4
Lounge	1	Compact Fluorescent: (1) 13W Screw in Lamp	Wall Switch	S	13	1,040	3, 4	Relamp	Yes	1	LED Lamps: Compact Fluorescent: (1) 13W Screw in Lamp Equivalent	Occupancy Sensor	9	718	0.0	8	0	\$1	\$69	\$8	44.0
Lounge	2	Compact Fluorescent: (1) 23W Screw in Lamp	Wall Switch	S	23	1,040	3, 4	Relamp	Yes	2	LED Lamps: Compact Fluorescent: (1) 23W Screw in Lamp Equivalent	Occupancy Sensor	16	718	0.0	27	0	\$5	\$304	\$74	47.2
Lounge	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	\$0	\$0	\$0	0.0
Lounge	2	Incandescent: (1) 60W Screw in Lamp	Wall Switch	S	60	1,040	3, 4	Relamp	Yes	2	LED Lamps: Incandescent: (1) 60W Screw in Lamp Equivalent	Occupancy Sensor	9	718	0.1	121	0	\$22	\$34	\$4	1.4
Lounge	2	Incandescent: (3) 60W Screw in Lamps	Wall Switch	S	180	1,040	3, 4	Relamp	Yes	2	LED Lamps: Incandescent: (3) 60W Screw in Lamps Equivalent	Occupancy Sensor	27	718	0.3	363	0	\$66	\$304	\$74	3.5
Lounge	1	Incandescent: (4) 60W Screw in Lamps	Wall Switch	S	240	1,040	3, 4	Relamp	Yes	1	LED Lamps: Incandescent: (4) 60W Screw in Lamps Equivalent	Occupancy Sensor	36	718	0.2	242	0	\$44	\$52	\$6	1.0
Lounge	1	LED Lamps: (1) 9W Screw in Lamp	Wall Switch	S	9	1,040	4	None	Yes	1	LED Lamps: (1) 9W Screw in Lamp	Occupancy Sensor	9	718	0.0	3	0	\$1	\$0	\$0	0.0
Mechanical 1	2	Incandescent: (1) 100W Screw in Lamp	Wall Switch	S	100	520	3	Relamp	No	2	LED Lamps: Incandescent: (1) 100W Screw in Lamp Equivalent	Wall Switch	15	520	0.2	95	0	\$17	\$34	\$4	1.8
Multipurpose 1	18	U-Bend Fluorescent - T12: U T12 (40W) - 2L	Wall Switch	S	88	1,040	2, 4	Relamp & Reballast	Yes	18	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	718	1.0	1,319	0	\$239	\$2,425	\$500	8.0
Office	1	Incandescent: (4) 60W Screw in Lamps	Wall Switch	S	240	1,040	3, 4	Relamp	Yes	1	LED Lamps: Incandescent: (4) 60W Screw in Lamps Equivalent	Occupancy Sensor	36	718	0.2	242	0	\$44	\$150	\$4	3.3
Restroom - Unisex 1	1	LED - Fixtures: Downlight Recessed	Wall Switch	S	10	1,040		None	No	1	LED - Fixtures: Downlight Recessed	Wall Switch	10	1,040	0.0	0	0	\$0	\$0	\$0	0.0
Restroom - Unisex 1	2	LED Lamps: (4) 5W Screw in Lamps	Wall Switch	S	20	1,040		None	No	2	LED Lamps: (4) 5W Screw in Lamps	Wall Switch	20	1,040	0.0	0	0	\$0	\$0	\$0	0.0
Restroom - Unisex 2	1	Compact Fluorescent: (1) 13W Screw in Lamp	Wall Switch	S	13	1,040	3	Relamp	No	1	LED Lamps: Compact Fluorescent: (1) 13W Screw in Lamp Equivalent	Wall Switch	9	1,040	0.0	4	0	\$1	\$69	\$8	74.7
Restroom - Unisex 3	1	Incandescent: (2) 40W Screw in Lamps	Wall Switch	S	80	1,040	3	Relamp	No	1	LED Lamps: Incandescent: (2) 40W Screw in Lamps Equivalent	Wall Switch	12	1,040	0.1	76	0	\$14	\$34	\$4	2.2
Restroom - Unisex 3	1	Incandescent: (2) 40W Screw in Lamps	Wall Switch	S	80	1,040	3	Relamp	No	1	LED Lamps: Incandescent: (2) 40W Screw in Lamps Equivalent	Wall Switch	12	1,040	0.1	76	0	\$14	\$34	\$4	2.2
Storage 1	2	Incandescent: (1) 60W Screw in Lamp	Wall Switch	S	60	1,040	3	Relamp	No	2	LED Lamps: Incandescent: (1) 60W Screw in Lamp Equivalent	Wall Switch	9	1,040	0.1	115	0	\$21	\$69	\$8	2.9
Bedroom	2	Incandescent: (1) 40W Screw in Lamps	Wall Switch	S	40	1,040	3	Relamp	No	2	LED Lamps: Incandescent: (1) 40W Screw in Lamps Equivalent	Wall Switch	6	1,040	0.1	76	0	\$14	\$46	\$0	3.3
Bedroom	1	Incandescent: (3) 40W Screw in Lamps	Wall Switch	S	120	1,040	3	Relamp	No	1	LED Lamps: Incandescent: (3) 40W Screw in Lamps Equivalent	Wall Switch	18	1,040	0.1	115	0	\$21	\$23	\$0	1.1
Bedroom (1)	2	Incandescent: (1) 40W Screw in Lamps	Wall Switch	S	40	1,040	3	Relamp	No	2	LED Lamps: Incandescent: (1) 40W Screw in Lamps Equivalent	Wall Switch	6	1,040	0.1	76	0	\$14	\$139	\$0	10.0
Bedroom (1)	1	Incandescent: (3) 40W Screw in Lamps	Wall Switch	S	120	1,040	3	Relamp	No	1	LED Lamps: Incandescent: (3) 40W Screw in Lamps Equivalent	Wall Switch	18	1,040	0.1	115	0	\$21	\$23	\$0	1.1
Bedroom (2)	2	Incandescent: (1) 40W Screw in Lamps	Wall Switch	S	40	1,040	3	Relamp	No	2	LED Lamps: Incandescent: (1) 40W Screw in Lamps Equivalent	Wall Switch	6	1,040	0.1	76	0	\$14	\$139	\$0	10.0

Location	Existing Conditions						Proposed Conditions						Energy Impact & Financial Analysis								
	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Bedroom (2)	1	Incandescent: (3) 40W Screw in Lamps	Wall Switch	S	120	1,040	3	Relamp	No	1	LED Lamps: Incandescent: (3) 40W Screw in Lamps Equivalent	Wall Switch	18	1,040	0.1	115	0	\$21	\$23	\$0	1.1
Bedroom (3)	2	Incandescent: (1) 40W Screw in Lamps	Wall Switch	S	40	1,040	3	Relamp	No	2	LED Lamps: Incandescent: (1) 40W Screw in Lamps Equivalent	Wall Switch	6	1,040	0.1	76	0	\$14	\$139	\$0	10.0
Bedroom (3)	1	Incandescent: (3) 40W Screw in Lamps	Wall Switch	S	120	1,040	3	Relamp	No	1	LED Lamps: Incandescent: (3) 40W Screw in Lamps Equivalent	Wall Switch	18	1,040	0.1	115	0	\$21	\$23	\$0	1.1
Bedroom (4)	2	Incandescent: (1) 40W Screw in Lamps	Wall Switch	S	40	1,040	3	Relamp	No	2	LED Lamps: Incandescent: (1) 40W Screw in Lamps Equivalent	Wall Switch	6	1,040	0.1	76	0	\$14	\$139	\$0	10.0
Bedroom (4)	1	Incandescent: (3) 40W Screw in Lamps	Wall Switch	S	120	1,040	3	Relamp	No	1	LED Lamps: Incandescent: (3) 40W Screw in Lamps Equivalent	Wall Switch	18	1,040	0.1	115	0	\$21	\$23	\$0	1.1
Hall	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
Hall	4	Incandescent: (2) 40W Screw in Lamps	Wall Switch	S	80	3,120	3, 5	Relamp	Yes	4	LED Lamps: Incandescent: (2) 40W Screw in Lamps Equivalent	High/Low Control	12	2,153	0.3	967	0	\$175	\$427	\$32	2.2
Restroom - Unisex 3 (1)	2	Incandescent: (2) 40W Screw in Lamps	Wall Switch	S	80	1,040	3	Relamp	No	2	LED Lamps: Incandescent: (2) 40W Screw in Lamps Equivalent	Wall Switch	12	1,040	0.1	153	0	\$28	\$101	\$16	3.1
Restroom - Unisex 3 (1)	1	Incandescent: (2) 40W Screw in Lamps	Wall Switch	S	80	1,040	3	Relamp	No	1	LED Lamps: Incandescent: (2) 40W Screw in Lamps Equivalent	Wall Switch	12	1,040	0.1	76	0	\$14	\$50	\$8	3.1
Attic	1	Incandescent: (1) 60W Screw in Lamp	Wall Switch	S	60	390	3	Relamp	No	1	LED Lamps: Incandescent: (1) 60W Screw in Lamp Equivalent	Wall Switch	9	390	0.0	21	0	\$4	\$34	\$4	7.8
Attic	2	Incandescent: (1) 60W Screw in Lamp	Wall Switch	S	60	390	3	Relamp	No	2	LED Lamps: Incandescent: (1) 60W Screw in Lamp Equivalent	Wall Switch	9	390	0.1	43	0	\$8	\$34	\$4	3.9
Attic (1)	3	Incandescent: (1) 60W Screw in Lamp	Wall Switch	S	60	390	3	Relamp	No	3	LED Lamps: Incandescent: (1) 60W Screw in Lamp Equivalent	Wall Switch	9	390	0.1	64	0	\$12	\$52	\$6	3.9
Attic (1)	3	Incandescent: (1) 60W Screw in Lamp	Wall Switch	S	60	390	3	Relamp	No	3	LED Lamps: Incandescent: (1) 60W Screw in Lamp Equivalent	Wall Switch	9	390	0.1	64	0	\$12	\$52	\$6	3.9
Exterior	3	Incandescent: (1) 43W Screw in Lamp	Wall Switch		43	3,120	3	Relamp	No	3	LED Lamps: Incandescent: (1) 43W Screw in Lamp Equivalent	Wall Switch	6	3,120	0.0	346	0	\$64	\$70	\$0	1.1
Exterior	4	Incandescent: (3) 40W Screw in Lamp	Wall Switch		120	3,120	3	Relamp	No	4	LED Lamps: Incandescent: (3) 40W Screw in Lamp Equivalent	Wall Switch	18	3,120	0.0	1,273	0	\$234	\$303	\$48	1.1
Exterior	3	High-Pressure Sodium: (1) 35W Lamp	Wall Switch		46	3,120	1	Fixture Replacement	No	3	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	14	3,120	0.0	301	0	\$55	\$1,449	\$600	15.3
Exterior	1	LED Lamps: 7W Screw in Lamp	Wall Switch		7	3,120		None	No	1	LED Lamps: 7W Screw in Lamp	Wall Switch	7	3,120	0.0	0	0	\$0	\$0	\$0	0.0

### Motor Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions							Proposed Conditions					Energy Impact & Financial Analysis						
		Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	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	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Room	Space Heating	5	Heating Hot Water Pump	0.0	60.0%	No		1,373		No	60.0%	No		0.0	0	0	\$0	\$0	\$0	0.0
Mechanical Room	Circulation Pump	1	Water Supply Pump	0.1	60.0%	No		1,373		No	60.0%	No		0.0	0	0	\$0	\$0	\$0	0.0
Multipurpose Room	FCU	1	Supply Fan	0.5	60.0%	No		1,830		No	60.0%	No		0.0	0	0	\$0	\$0	\$0	0.0
Attic	AHU	1	Supply Fan	0.1	60.0%	No		2,745		No	60.0%	No		0.0	0	0	\$0	\$0	\$0	0.0

### Electric HVAC Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions					Proposed Conditions								Energy Impact & Financial Analysis					
		System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	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/EER)	Heating Mode Efficiency (COP)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives
Exterior	Serves 2nd Floor	1	Split-System AC	3.00		W		No						0.0	0	0	\$0	\$0	\$0	0.0
Exterior	Serves 1st floor	1	Split-System AC	3.00		W		No						0.0	0	0	\$0	\$0	\$0	0.0
Exterior	Serves 2nd floor	1	Split-System Air-Source HP	0.75	12.00	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Multipurpose Room	FCU	1	Electric Resistance Heat		32.76	W		No						0.0	0	0	\$0	\$0	\$0	0.0

### Fuel Heating Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions				Proposed Conditions							Energy Impact & Financial Analysis						
		System Quantity	System Type	Output Capacity per Unit (MBh)	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Room	Space Heating	1	Condensing Hot Water Boiler	139	W		No						0.0	0	0	\$0	\$0	\$0	0.0

### Pipe Insulation Recommendations

Location	Area(s)/System(s) Affected	Recommendation Inputs			Energy Impact & Financial Analysis						
		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	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Room	Domestic Hot Water	6	6	1.50	0.0	0	2	\$19	\$43	\$24	1.0
Mechanical Room	Space Heating	6	10	2.00	0.0	0	8	\$79	\$88	\$40	0.6

### DHW Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions				Proposed Conditions						Energy Impact & Financial Analysis						
		System Quantity	System Type	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	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Room	Domestic Hot Water	1	Storage Tank Water Heater (≤ 50 Gal)	W		No						0.0	0	0	\$0	\$0	\$0	0.0

### Low-Flow Device Recommendations

Location	Recommendation Inputs					Energy Impact & Financial Analysis						
	ECM #	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Restroom	7	1	Faucet Aerator (Lavatory)	2.20	0.50	0.0	0	0	\$5	\$7	\$7	0.0

### Cooking Equipment Inventory & Recommendations

Location	Existing Conditions				Proposed Conditions		Energy Impact & Financial Analysis						
	Quantity	Equipment Type		High Efficiency Equipment?	ECM #	Install High Efficiency Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Gas Convection Oven (Full Size)		Yes		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?
Basement	1	Commercial Clothes Dryer	1,200	No
Lounge	1	Commercial Clothes Dryer	1,200	No
Kitchen	1	Commercial Dishwasher	1,500	No
Basement	1	Commercial Washing Machine	1,200	No
Lounge	1	Commercial Washing Machine	1,200	No
Office	1	Computer Monitor	120	Yes
Kitchen	1	Microwave Oven	1,200	Yes
Office	2	Printer	50	Yes
Basement	1	Refrigerator	890	Yes
Kitchen	1	Refrigerator	890	Yes
Basement	1	Television	90	Yes
Lounge	1	Television	60	Yes
Kitchen	1	Toaster	500	Yes
Kitchen	2	Coffee Maker	900	Yes
Group Home	5	Ceiling Fan	5	No

# APPENDIX B: ENERGY STAR® STATEMENT OF ENERGY PERFORMANCE

EUI is presented in terms of *site energy* and *source energy*. Site energy is the amount of fuel and electricity consumed by a building as reflected in utility bills. Source energy includes fuel consumed to generate electricity consumed at the site, factoring in electric production and distribution losses for the region.

## ENERGY STAR® Statement of Energy Performance

LEARN MORE AT [energystar.gov](http://energystar.gov)

# N/A

**ENERGY STAR® Score<sup>1</sup>**

**Group Home (City of Clifton)**

Primary Property Type: Other - Lodging/Residential  
 Gross Floor Area (ft<sup>2</sup>): 4,893  
 Built: 1900

For Year Ending: December 31, 2019  
 Date Generated: March 04, 2020

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		
<b>Property Address</b> Group Home (City of Clifton) 900 Clifton Avenue Clifton, New Jersey 07013	<b>Property Owner</b> City of Clifton 900 Clifton Avenue Clifton, NJ 07013 (973) 470-5854	<b>Primary Contact</b> Dominick Villano 900 Clifton Avenue Clifton, NJ 07013 (973) 470-5854 dvillano@cliftonnj.org
<b>Property ID:</b> 10171663		

Energy Consumption and Energy Use Intensity (EUI)			
<b>Site EUI</b> 56.9 kBtu/ft <sup>2</sup>	<b>Annual Energy by Fuel</b>		<b>National Median Comparison</b>
	Electric - Grid (kBtu)	73,424 (28%)	National Median Site EUI (kBtu/ft <sup>2</sup> )
	Natural Gas (kBtu)	205,112 (74%)	National Median Source EUI (kBtu/ft <sup>2</sup> )
		% Diff from National Median Source EUI	-40%
<b>Source EUI</b> 86 kBtu/ft <sup>2</sup>			<b>Annual Emissions</b>
		Greenhouse Gas Emissions (Metric Tons CO <sub>2</sub> e/year)	18

### 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
<b>Blended Rate</b>	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.
<b>Btu</b>	<i>British thermal unit</i> : a unit of energy equal to the amount of heat required to increase the temperature of one pound of water by one-degree Fahrenheit.
<b>CHP</b>	<i>Combined heat and power</i> . Also referred to as cogeneration.
<b>COP</b>	<i>Coefficient of performance</i> : a measure of efficiency in terms of useful energy delivered divided by total energy input.
<b>Demand Response</b>	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.
<b>DCV</b>	<i>Demand control ventilation</i> : a control strategy to limit the amount of outside air introduced to the conditioned space based on actual occupancy need.
<b>US DOE</b>	<i>United States Department of Energy</i>
<b>EC Motor</b>	<i>Electronically commutated motor</i>
<b>ECM</b>	<i>Energy conservation measure</i>
<b>EER</b>	<i>Energy efficiency ratio</i> : a measure of efficiency in terms of cooling energy provided divided by electric input.
<b>EUI</b>	<i>Energy Use Intensity</i> : measures energy consumption per square foot and is a standard metric for comparing buildings' energy performance.
<b>Energy Efficiency</b>	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.
<b>ENERGY STAR®</b>	ENERGY STAR® is the government-backed symbol for energy efficiency. The ENERGY STAR® program is managed by the EPA.
<b>EPA</b>	<i>United States Environmental Protection Agency</i>
<b>Generation</b>	The process of generating electric power from sources of primary energy (e.g., natural gas, the sun, oil).
<b>GHG</b>	<i>Greenhouse gas</i> 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.
<b>gpf</b>	<i>Gallons per flush</i>

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

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<b>SEER</b>	<i>Seasonal energy efficiency ratio</i> : a measure of efficiency in terms of annual cooling energy provided divided by total electric input.
<b>SEP</b>	<i>Statement of energy performance</i> : a summary document from the ENERGY STAR® Portfolio Manager®.
<b>Simple Payback</b>	The amount of time needed to recoup the funds expended in an investment or to reach the break-even point between investment and savings.
<b>SREC</b>	<i>Solar renewable energy credit</i> : a credit you can earn from the state for energy produced from a photovoltaic array.
<b>T5, T8, T12</b>	A reference to a linear lamp diameter. The number represents increments of 1/8 <sup>th</sup> of an inch.
<b>Temperature Setpoint</b>	The temperature at which a temperature regulating device (thermostat, for example) has been set.
<b>therm</b>	100,000 Btu. Typically used as a measure of natural gas consumption.
<b>tons</b>	A unit of cooling capacity equal to 12,000 Btu/hr.
<b>Turnkey</b>	Provision of a complete product or service that is ready for immediate use
<b>VAV</b>	<i>Variable air volume</i>
<b>VFD</b>	<i>Variable frequency drive</i> : a controller used to vary the speed of an electric motor.
<b>WaterSense®</b>	The symbol for water efficiency. The WaterSense® program is managed by the EPA.
<b>Watt (W)</b>	Unit of power commonly used to measure electricity use.

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