



Local Government Energy Audit Report

Paul Rafalides School (PS #33)

October 22, 2021

Prepared for:

Jersey City Public Schools (SDIJCTY)

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Prepared by:

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Disclaimer

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 for technical accuracy. Actual, achieved energy savings depend on behavioral factors and other uncontrollable variables and, therefore, estimates of final energy savings are not guaranteed. TRC and the New Jersey Board of Public Utilities (NJBPU) shall in no event be liable should the actual energy savings vary.

TRC bases estimated material and labor costs primarily on RS Means cost manuals as well as on our experience at similar facilities. This approach is based on standard cost estimating manuals and is vendor neutral. Cost estimates include material and labor pricing associated with one for one equipment replacements. Cost estimates do not include demolition or removal of hazardous waste. The actual implementation costs for energy savings projects are anticipated to be significantly higher based on the specific conditions at your site(s). We strongly recommend that you work with your design engineer or contractor to develop actual project costs for your specific scope of work for the installation of high efficiency equipment. We encourage you to obtain multiple estimates when considering measure installations. Actual installation costs can vary widely based on selected products and installers. TRC and NJBPU do not guarantee cost estimates and shall in no event be held liable should actual installed costs vary from these material and labor estimates.

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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Table of Contents

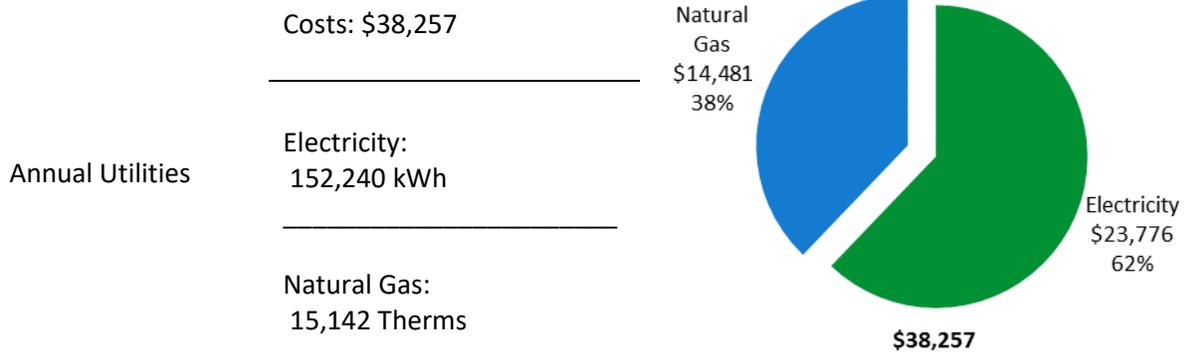
1	Executive Summary.....	1
1.1	Planning Your Project	4
	Pick Your Installation Approach	4
	More Options from Around the State.....	6
2	Existing Conditions.....	7
2.1	Site Overview.....	7
2.2	Building Occupancy	7
2.3	Building Envelope	8
2.4	Lighting Systems.....	9
2.5	Air Handling Systems	10
	Unit Ventilators	10
	Unitary Electric HVAC Equipment	10
2.6	Steam Heating Systems.....	10
2.7	Domestic Hot Water	11
2.8	Food Service Equipment.....	12
2.9	Refrigeration.....	13
2.10	Plug Load & Vending Machines.....	13
2.11	Water-Using Systems	13
3	Energy Use and Costs	14
3.1	Electricity	16
3.2	Natural Gas.....	17
3.3	Benchmarking.....	18
	Tracking Your Energy Performance.....	19
4	Energy Conservation Measures	20
4.1	Lighting	23
	ECM 1: Install LED Fixtures	23
	ECM 2: Retrofit Fixtures with LED Lamps.....	23
4.2	Lighting Controls.....	24
	ECM 3: Install Occupancy Sensor Lighting Controls	24
	ECM 4: Install High/Low Lighting Controls	24
4.3	Variable Frequency Drives (VFD).....	25
	ECM 5: Install Boiler Draft Fan VFDs	25
4.4	Gas-Fired Heating	25
	ECM 6: Install High Efficiency Steam Boilers	25
4.5	Unitary HVAC Measures.....	26
	ECM 7: Install Pipe Insulation.....	26
4.6	Domestic Water Heating	26

ECM 8: Install Low-Flow DHW Devices.....	26
5 Energy Efficient Best Practices.....	27
Energy Tracking with ENERGY STAR® Portfolio Manager®.....	27
Doors and Windows.....	27
Lighting Maintenance.....	27
Lighting Controls.....	28
Fans to Reduce Cooling Load.....	28
Thermostat Schedules and Temperature Resets.....	28
Steam Trap Repair and Replacement.....	28
Boiler Maintenance.....	28
Label HVAC Equipment.....	28
Optimize HVAC Equipment Schedules.....	29
Water Heater Maintenance.....	29
Refrigeration Equipment Maintenance.....	30
Plug Load Controls.....	30
Computer Monitor Replacement.....	30
Computer Power Management Software.....	30
Water Conservation.....	31
Procurement Strategies.....	31
6 On-site Generation.....	32
6.1 Solar Photovoltaic.....	33
6.2 Combined Heat and Power.....	35
7 Project Funding and Incentives.....	36
7.1 SmartStart.....	37
7.2 Direct Install.....	38
7.3 Pay for Performance - Existing Buildings.....	39
7.4 Combined Heat and Power.....	40
7.5 Energy Savings Improvement Program.....	41
7.6 Transition Incentive (TI) Program.....	42
8 Project Development.....	43
9 Energy Purchasing and Procurement Strategies.....	44
9.1 Retail Electric Supply Options.....	44
9.2 Retail Natural Gas Supply Options.....	44
Appendix A: Equipment Inventory & Recommendations.....	A-1
Appendix B: ENERGY STAR® Statement of Energy Performance.....	B-1
Appendix C: Glossary.....	C-1

1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBP) has sponsored this Local Government Energy Audit (LGEA) report for Paul Rafalides School (PS#33). 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 47
(1-100 scale)

This building performs at or below the national average. This report contains suggestions about how to improve building performance and reduce energy costs.

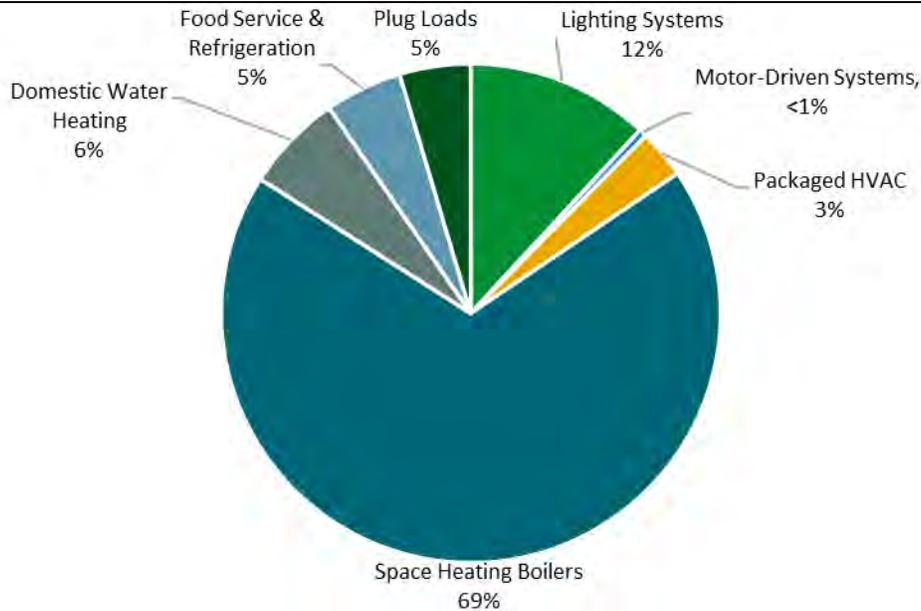


Figure 1 - Energy Use by System

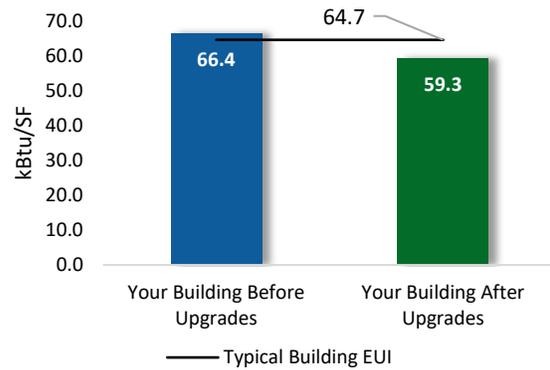
POTENTIAL IMPROVEMENTS



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

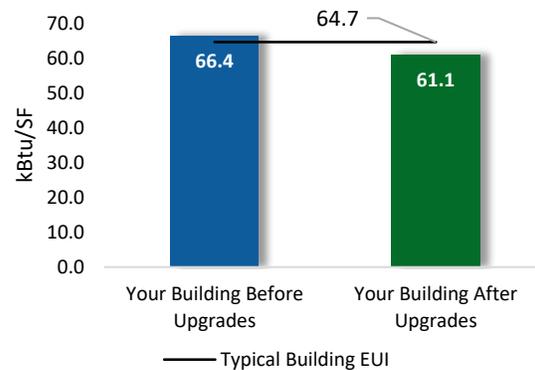
Scenario 1: Full Package (all evaluated measures)

Installation Cost	\$147,367
Potential Rebates & Incentives ¹	\$18,974
Annual Cost Savings	\$8,456
Annual Energy Savings	Electricity: 51,478 kWh Natural Gas: 436 Therms
Greenhouse Gas Emission Savings	28 Tons
Simple Payback	15.2 Years
Site Energy Savings (all utilities)	11%



Scenario 2: Cost Effective Package²

Installation Cost	\$28,233
Potential Rebates & Incentives	\$6,522
Annual Cost Savings	\$7,833
Annual Energy Savings	Electricity: 50,634 kWh Natural Gas: -78 Therms
Greenhouse Gas Emission Savings	25 Tons
Simple Payback	2.8 Years
Site Energy Savings (all utilities)	8%



On-site Generation Potential

Photovoltaic	None
Combined Heat and Power	None

¹ Incentives are based on current SmartStart Prescriptive incentives. Other program incentives may apply.

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

#	Energy Conservation Measure	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated M&L Cost (\$)	Estimated Incentive (\$)*	Estimated Net M&L Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Lighting Upgrades			39,281	8.8	-8	\$6,058	\$14,355	\$3,814	\$10,541	1.7	38,615
ECM 1	Install LED Fixtures	Yes	858	0.0	0	\$134	\$525	\$100	\$425	3.2	864
ECM 2	Retrofit Fixtures with LED Lamps	Yes	38,423	8.8	-8	\$5,924	\$13,829	\$3,714	\$10,115	1.7	37,751
Lighting Control Measures			11,353	2.6	-2	\$1,750	\$13,829	\$2,670	\$11,159	6.4	11,154
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	9,631	2.3	-2	\$1,485	\$11,804	\$1,445	\$10,359	7.0	9,462
ECM 4	Install High/Low Lighting Controls	Yes	1,722	0.2	0	\$265	\$2,025	\$1,225	\$800	3.0	1,692
Variable Frequency Drive (VFD) Measures			844	0.6	0	\$132	\$6,204	\$300	\$5,904	44.8	850
ECM 5	Install Boiler Draft Fan VFDs	No	844	0.6	0	\$132	\$6,204	\$300	\$5,904	44.8	850
Gas Heating (HVAC/Process) Replacement			0	0.0	51	\$491	\$112,930	\$12,152	\$100,778	205.2	6,013
ECM 6	Install High Efficiency Steam Boilers	No	0	0.0	51	\$491	\$112,930	\$12,152	\$100,778	205.2	6,013
HVAC System Improvements			0	0.0	2	\$20	\$35	\$24	\$11	0.5	241
ECM 7	Install Pipe Insulation	Yes	0	0.0	2	\$20	\$35	\$24	\$11	0.5	241
Domestic Water Heating Upgrade			0	0.0	1	\$5	\$14	\$14	\$0	0.0	65
ECM 8	Install Low-Flow DHW Devices	Yes	0	0.0	1	\$5	\$14	\$14	\$0	0.0	65
TOTALS (COST EFFECTIVE MEASURES)			50,634	11.3	-8	\$7,833	\$28,233	\$6,522	\$21,710	2.8	50,075
TOTALS (ALL MEASURES)			51,478	11.9	44	\$8,456	\$147,367	\$18,974	\$128,392	15.2	56,938

* - 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 Fixtures with LED Lamps	X	X	
ECM 3	Install Occupancy Sensor Lighting Controls	X	X	
ECM 4	Install High/Low Lighting Controls	X	X	
ECM 5	Install Boiler Draft Fan VFDs	X	X	
ECM 6	Install High Efficiency Steam Boilers	X		
ECM 7	Install Pipe Insulation	X	X	
ECM 8	Install Low-Flow DHW Devices	X	X	

Figure 3 – Funding Options



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

	SmartStart Flexibility to install at your own pace	Direct Install Turnkey installation	Pay for Performance Whole building upgrades
Who should use it?	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.
How does it work?	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.
What are the Incentives?	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.	Incentives are paid out in three installments. The first installment is meant to help offset the costs of the initial engineering study. The subsequent incentives are paid based on the level of energy savings up to 50% of the total project cost. See Section 7.3 for all incentive details.
How do I participate?	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 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 Paul Rafalides School (PS#33). 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 23, 2021, TRC performed an energy audit at Paul Rafalides School (PS#33) located in Jersey City, New Jersey. TRC met with Eddie Martinez to review the facility operations and help focus our investigation on specific energy-using systems.

Paul Rafalides School (PS #33) is a 3-story, 30,607 square foot building built in 1909. Spaces include classrooms, a library, cafeteria, corridors, stairwells, offices, a kitchen, and mechanical spaces.

2.2 Building Occupancy

The facility is occupied 10 months out of the year. Typical weekday occupancy is 48 staff and 432 students.

Building Name	Weekday/Weekend	Operating Schedule
Paul Rafalides School (PS#33)	Weekday	School Hours: 9:00 AM - 5:00 PM Custodian Hours: 6:00 AM - 10:00 PM
	Weekend	N/A

Figure 4 - Building Occupancy Schedule

2.3 Building Envelope

Building walls are brick with a brick facade. The roof is sloped with a flat section in the middle of the rear extension, and it is in fair condition

The windows are double paned and have aluminum frames. The glass-to-frame seals are in fair condition. The operable window weather seals are in fair condition, showing little evidence of excessive wear. Exterior doors have aluminum frames and are in good condition with undamaged door seals. Degraded window and door seals increase drafts and outside air infiltration.



Facade



Doors



Windows

2.4 Lighting Systems

The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. Additionally, there are some compact fluorescent lamps (CFL), mainly in storage areas. Typically, T8 fluorescent lamps use electronic ballasts. Fixture types include 2- or 4-lamp, 4-foot-long fixtures and 2-foot fixtures with U-bend tube lamps. Most fixtures are in fair condition. Gymnasium fixtures have manually controlled high bay LED lamps. All exit signs are LED. Interior lighting levels were generally sufficient. Interior lighting fixtures are controlled by wall switches.



Hallway Fixture



Classroom Fixtures

Exterior fixtures include wall packs with metal halide lamps. Exterior fixtures are photocell controlled.



Exterior Fixture

2.5 Air Handling Systems

Unit Ventilators

The cafeteria and gym have unit ventilators equipped with supply fan motors and hot water coils.

Unitary Electric HVAC Equipment

Classrooms are cooled with window air conditioning (AC) units. These vary in capacity between 0.67 and 1.25 tons and range in efficiency between 9.80 EER and 11.80 EER. The units are in fair condition.



Window AC

2.6 Steam Heating Systems

Two HB Smith 3,038 MBh gas-fired steam boilers serve the building heating load. The burners are non-modulating with a nominal efficiency of 82.6%. Each boiler has a heat timer (R) controller. The heat timer senses outdoor temperature, indoor temperature, and heating system temperature, and using a time clock, heat is provided to the building during the day and set back at night. The boilers are original to the building and are in poor condition.

With the help of a heat exchanger, the boilers are configured in a constant flow steam distribution. The boilers provide steam to the unit ventilators and to baseboard radiators serving classrooms and offices throughout the building.



Steam Boiler

2.7 Domestic Hot Water

Hot water is produced by a 50 gallon 40 MBh gas-fired storage water heater with an 80% efficiency rating. The domestic hot water pipes are not insulated.



DHW Heater

2.8 Food Service Equipment

The kitchen has electric equipment that is used to prepare meals for students and staff. Most cooking is done using an electric convection oven. Bulk prepared foods are held in an electric holding cabinet. Equipment is not high efficiency and is in fair condition.

Visit https://www.energystar.gov/products/commercial_food_service_equipment for the latest information on high efficiency food service equipment.



Convection Oven

2.9 Refrigeration

The kitchen has several stand-up refrigerators with solid doors. There are a few freezer chests as well. All equipment is standard and is in fair condition.

Visit https://www.energystar.gov/products/commercial_food_service_equipment for the latest information on high efficiency food service equipment.



Stand-up Refrigerator

2.10 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 are approximately 90 computer workstations throughout the facility. Plug loads throughout the building include general café and office equipment. There are classroom typical loads such as smart projectors.

There are several residential style refrigerators throughout the building that are used to store perishables. These vary in condition and efficiency.

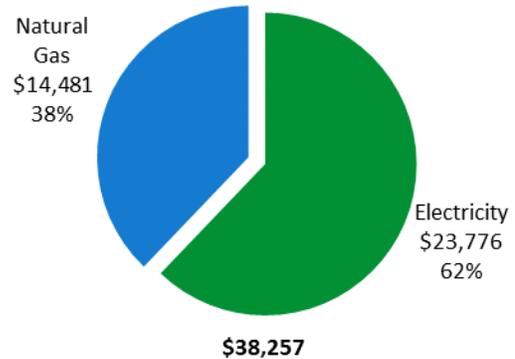
2.11 Water-Using Systems

There are restrooms with toilets, urinals, and sinks. Faucet flow rates are at 1.5 gallons per minute (gpm) or higher.

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	152,240 kWh	\$23,776
Natural Gas	15,142 Therms	\$14,481
Total		\$38,257



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.

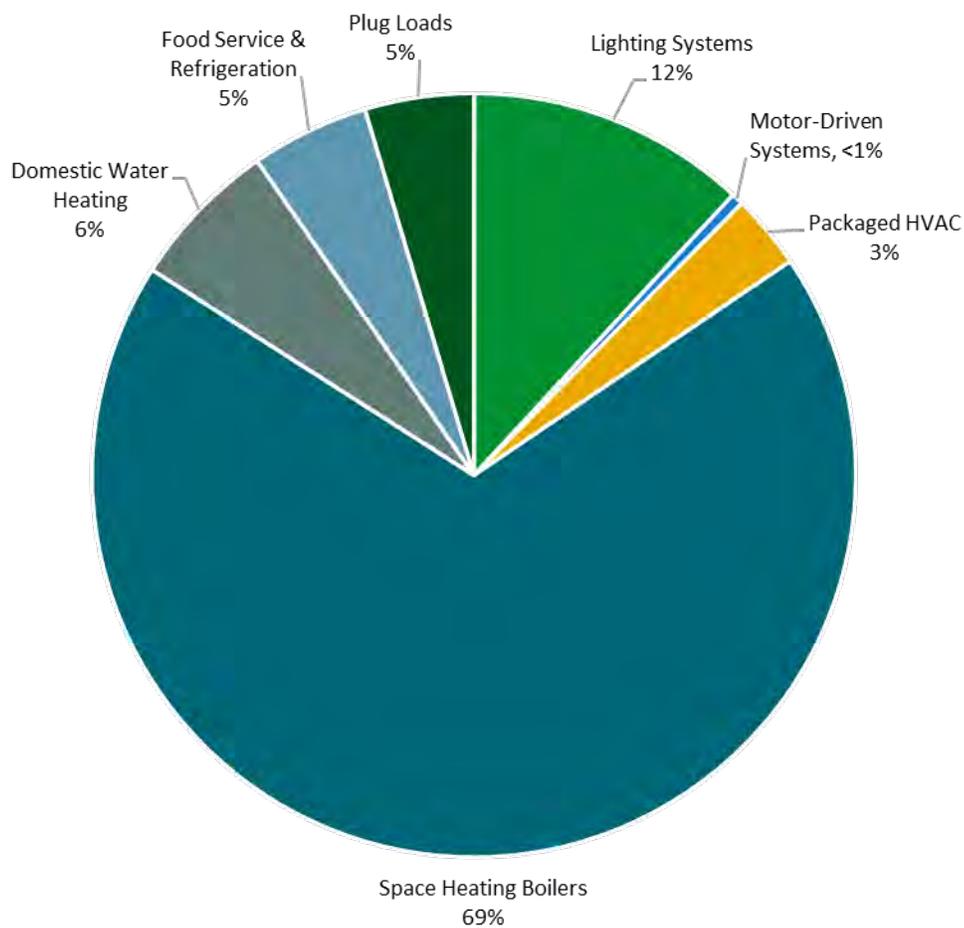
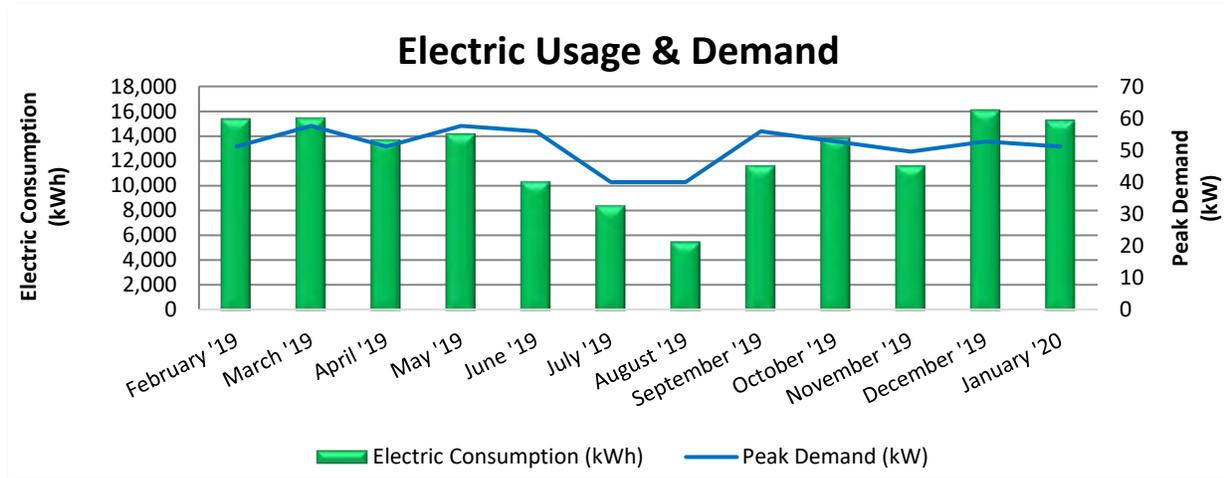


Figure 5 - Energy Balance

3.1 Electricity

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



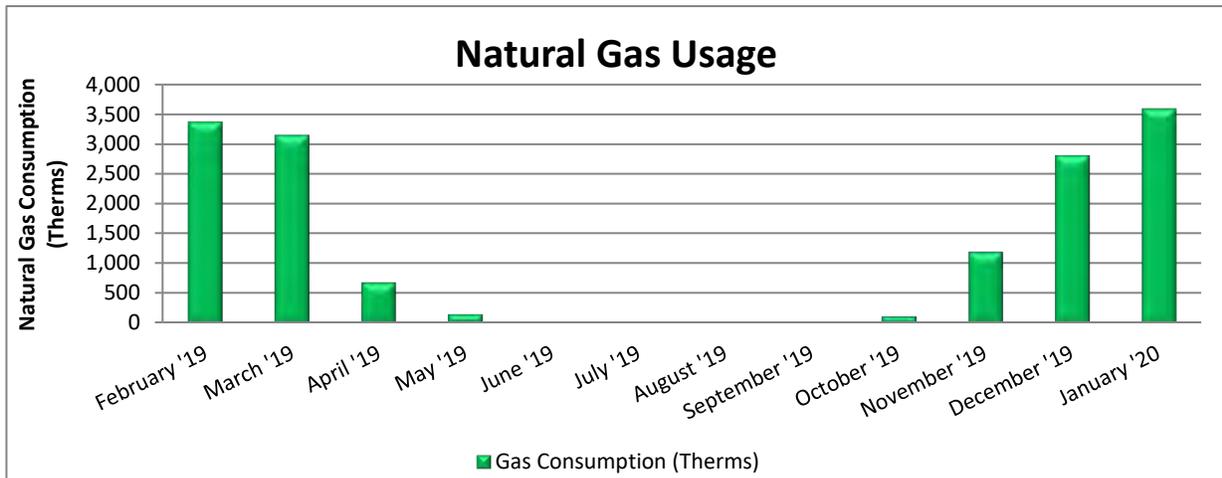
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
2/21/19	29	15,440	51	202	1,982
3/23/19	30	15,520	58	227	2,336
4/23/19	31	13,760	51	202	2,071
5/23/19	30	14,240	58	226	2,224
6/21/19	29	10,400	56	771	2,261
7/23/19	32	8,480	40	551	1,829
8/21/19	29	5,600	40	551	1,580
9/20/19	30	11,680	56	771	2,142
10/23/19	33	13,920	53	208	1,793
11/19/19	27	11,680	50	195	1,620
12/20/19	31	16,160	53	208	1,966
1/23/20	34	15,360	51	202	1,971
Totals	365	152,240	58	\$4,314	\$23,776
Annual	365	152,240	58	\$4,314	\$23,776

Notes:

- Peak demand of 58 kW occurred in March '19.
- Average demand over the past 12 months was 51 kW.
- The average electric cost over the past 12 months was \$0.156/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.

3.2 Natural Gas

PSE&G delivers natural gas under rate class Large Volume Gas (LVG).



Gas Billing Data			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
2/21/19	29	3,381	\$3,109
3/22/19	29	3,159	\$2,905
4/23/19	32	684	\$541
5/22/19	29	153	\$226
6/21/19	30	18	\$148
7/23/19	32	2	\$138
8/21/19	29	1	\$138
9/20/19	30	16	\$146
10/21/19	31	113	\$212
11/19/19	29	1,198	\$1,449
12/20/19	31	2,815	\$2,524
1/23/20	34	3,603	\$2,947
Totals	365	15,142	\$14,481
Annual	365	15,142	\$14,481

Notes:

- The average gas cost for the past 12 months is \$0.956/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.

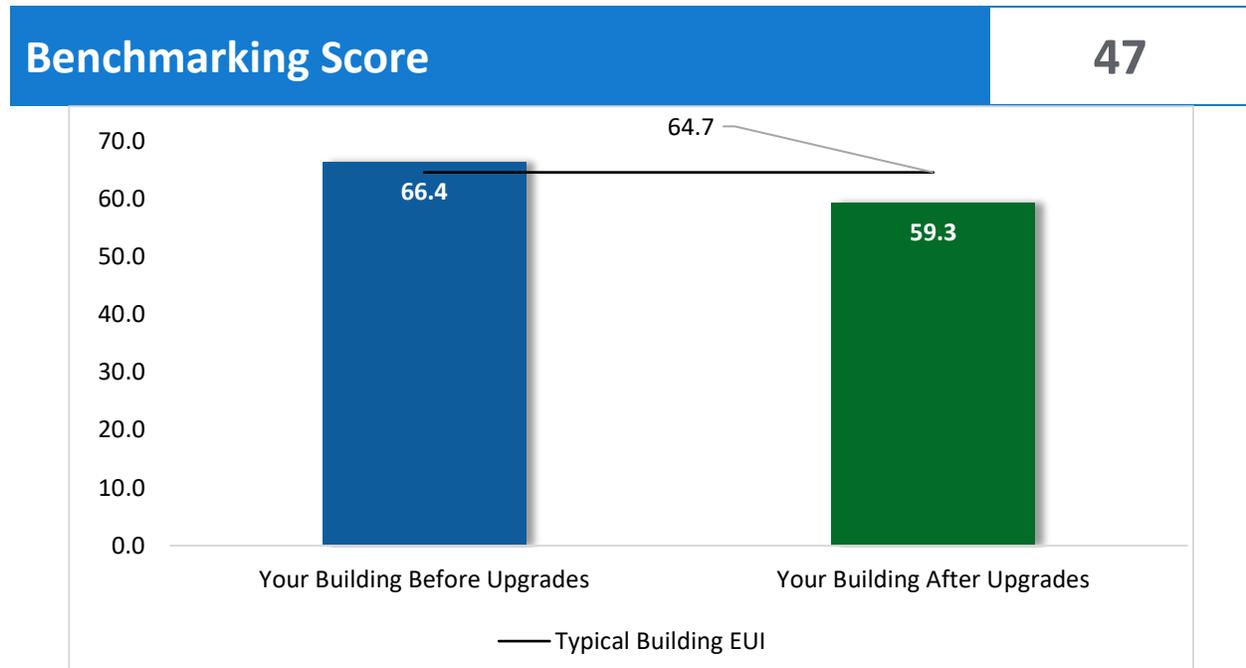


Figure 6 - Energy Use Intensity Comparison³

This building performs at, or below the national average. This report contains suggestions about how to improve building performance and reduce energy costs.

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

³ Based on all evaluated ECMs

Tracking Your Energy Performance

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

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

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

For more information on ENERGY STAR® and Portfolio Manager®, visit their website⁴.

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

4 ENERGY CONSERVATION MEASURES

The goal of this audit report is to identify and evaluate potential energy efficiency improvements, 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 M&L Cost (\$)	Estimated Incentive (\$)*	Estimated Net M&L Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Lighting Upgrades			39,281	8.8	-8	\$6,058	\$14,355	\$3,814	\$10,541	1.7	38,615
ECM 1	Install LED Fixtures	Yes	858	0.0	0	\$134	\$525	\$100	\$425	3.2	864
ECM 2	Retrofit Fixtures with LED Lamps	Yes	38,423	8.8	-8	\$5,924	\$13,829	\$3,714	\$10,115	1.7	37,751
Lighting Control Measures			11,353	2.6	-2	\$1,750	\$13,829	\$2,670	\$11,159	6.4	11,154
ECM 3	Install Occupancy Sensor Lighting Controls	Yes	9,631	2.3	-2	\$1,485	\$11,804	\$1,445	\$10,359	7.0	9,462
ECM 4	Install High/Low Lighting Controls	Yes	1,722	0.2	0	\$265	\$2,025	\$1,225	\$800	3.0	1,692
Variable Frequency Drive (VFD) Measures			844	0.6	0	\$132	\$6,204	\$300	\$5,904	44.8	850
ECM 5	Install Boiler Draft Fan VFDs	No	844	0.6	0	\$132	\$6,204	\$300	\$5,904	44.8	850
Gas Heating (HVAC/Process) Replacement			0	0.0	51	\$491	\$112,930	\$12,152	\$100,778	205.2	6,013
ECM 6	Install High Efficiency Steam Boilers	No	0	0.0	51	\$491	\$112,930	\$12,152	\$100,778	205.2	6,013
HVAC System Improvements			0	0.0	2	\$20	\$35	\$24	\$11	0.5	241
ECM 7	Install Pipe Insulation	Yes	0	0.0	2	\$20	\$35	\$24	\$11	0.5	241
Domestic Water Heating Upgrade			0	0.0	1	\$5	\$14	\$14	\$0	0.0	65
ECM 8	Install Low-Flow DHW Devices	Yes	0	0.0	1	\$5	\$14	\$14	\$0	0.0	65
TOTALS			51,478	11.9	44	\$8,456	\$147,367	\$18,974	\$128,392	15.2	56,938

* - 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 M&L Cost (\$)	Estimated Incentive (\$)*	Estimated Net M&L Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Lighting Upgrades		39,281	8.8	-8	\$6,058	\$14,355	\$3,814	\$10,541	1.7	38,615
ECM 1	Install LED Fixtures	858	0.0	0	\$134	\$525	\$100	\$425	3.2	864
ECM 2	Retrofit Fixtures with LED Lamps	38,423	8.8	-8	\$5,924	\$13,829	\$3,714	\$10,115	1.7	37,751
Lighting Control Measures		11,353	2.6	-2	\$1,750	\$13,829	\$2,670	\$11,159	6.4	11,154
ECM 3	Install Occupancy Sensor Lighting Controls	9,631	2.3	-2	\$1,485	\$11,804	\$1,445	\$10,359	7.0	9,462
ECM 4	Install High/Low Lighting Controls	1,722	0.2	0	\$265	\$2,025	\$1,225	\$800	3.0	1,692
HVAC System Improvements		0	0.0	2	\$20	\$35	\$24	\$11	0.5	241
ECM 7	Install Pipe Insulation	0	0.0	2	\$20	\$35	\$24	\$11	0.5	241
Domestic Water Heating Upgrade		0	0.0	1	\$5	\$14	\$14	\$0	0.0	65
ECM 8	Install Low-Flow DHW Devices	0	0.0	1	\$5	\$14	\$14	\$0	0.0	65
TOTALS		50,634	11.3	-8	\$7,833	\$28,233	\$6,522	\$21,710	2.8	50,075

* - 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 M&L Cost (\$)	Estimated Incentive (\$)*	Estimated Net M&L Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Lighting Upgrades		39,281	8.8	-8	\$6,058	\$14,355	\$3,814	\$10,541	1.7	38,615
ECM 1	Install LED Fixtures	858	0.0	0	\$134	\$525	\$100	\$425	3.2	864
ECM 2	Retrofit Fixtures with LED Lamps	38,423	8.8	-8	\$5,924	\$13,829	\$3,714	\$10,115	1.7	37,751

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 metal halide 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 Fixtures with LED Lamps

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

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

Affected building areas: all areas with fluorescent fixtures with T8 tubes and CFL lamps.

4.2 Lighting Controls

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated M&L Cost (\$)	Estimated Incentive (\$)*	Estimated Net M&L Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Lighting Control Measures		11,353	2.6	-2	\$1,750	\$13,829	\$2,670	\$11,159	6.4	11,154
ECM 3	Install Occupancy Sensor Lighting Controls	9,631	2.3	-2	\$1,485	\$11,804	\$1,445	\$10,359	7.0	9,462
ECM 4	Install High/Low Lighting Controls	1,722	0.2	0	\$265	\$2,025	\$1,225	\$800	3.0	1,692

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 3: Install Occupancy Sensor Lighting Controls

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

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

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

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

Affected building areas: offices, classrooms, gymnasium, library, and restrooms.

ECM 4: Install High/Low Lighting Controls

Install 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.

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: hallways and stairwells.

4.3 Variable Frequency Drives (VFD)

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated M&L Cost (\$)	Estimated Incentive (\$)*	Estimated Net M&L Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		844	0.6	0	\$132	\$6,204	\$300	\$5,904	44.8	850
ECM 5	Install Boiler Draft Fan VFDs	844	0.6	0	\$132	\$6,204	\$300	\$5,904	44.8	850

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

ECM 5: Install Boiler Draft Fan VFDs

We evaluated replacing the existing volume control devices on boiler draft fans, such as inlet vanes or dampers, with VFDs. Inlet vanes or dampers are an inefficient means of controlling the air volume compared to VFDs. The existing volume control device will be removed or permanently disabled, and the control signal will be redirected to the VFD to determine proper fan motor speed.

Energy savings result from reducing the draft fan speed (and power) when conditions allow for reduced combustion air flow.

Additional maintenance savings may result from this measure. VFDs are solid state electronic devices, which generally requires less maintenance than mechanical air volume control devices.

4.4 Gas-Fired Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated M&L Cost (\$)	Estimated Incentive (\$)*	Estimated Net M&L Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Gas Heating (HVAC/Process) Replacement		0	0.0	51	\$491	\$112,930	\$12,152	\$100,778	205.2	6,013
ECM 6	Install High Efficiency Steam Boilers	0	0.0	51	\$491	\$112,930	\$12,152	\$100,778	205.2	6,013

ECM 6: Install High Efficiency Steam Boilers

We evaluated replacing the older inefficient steam boilers with high efficiency steam boilers. Energy savings results from improved combustion efficiency and reduced standby losses at low loads.

For the purposes of this analysis, we evaluated the replacement of boilers on a one-for-one basis with equipment of the same capacity. We recommend that you work with your mechanical design team to select boilers that are sized appropriately for the heating load.

Replacing the boilers has a long payback based on energy savings and may not be justifiable based simply on energy considerations. However, the boilers have reached the end of their normal useful life. Typically, the marginal cost of purchasing high efficiency boilers can be justified by the marginal savings from the improved efficiency. When the boiler is eventually replaced, consider purchasing boilers that exceed the minimum efficiency required by building codes.

4.5 Unitary HVAC Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated M&L Cost (\$)	Estimated Incentive (\$)*	Estimated Net M&L Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
HVAC System Improvements		0	0.0	2	\$20	\$35	\$24	\$11	0.5	241
ECM 7	Install Pipe Insulation	0	0.0	2	\$20	\$35	\$24	\$11	0.5	241

ECM 7: Install Pipe Insulation

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

Affected Systems: domestic hot water piping.

4.6 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated M&L Cost (\$)	Estimated Incentive (\$)*	Estimated Net M&L Cost (\$)	Simple Payback Period (yrs)**	CO ₂ e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		0	0.0	1	\$5	\$14	\$14	\$0	0.0	65
ECM 8	Install Low-Flow DHW Devices	0	0.0	1	\$5	\$14	\$14	\$0	0.0	65

ECM 8: 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.

5 ENERGY EFFICIENT BEST PRACTICES

A whole building maintenance plan will extend equipment life; improve occupant comfort, health, and safety; and reduce energy and maintenance costs.

Operation and maintenance (O&M) plans enhance the operational efficiency of HVAC and other energy intensive systems and could save between 5 to 20% of the energy usage in your building without substantial capital investment. A successful plan includes your records of energy usage trends and costs, building equipment lists, current maintenance practices, planned capital upgrades, and incorporates your ideas for improved building operation. Your plan will address goals for energy-efficient operation, provide detail on how to reach the goals, and will outline procedures for measuring and reporting whether goals have been achieved.

You may already be doing some of these things— see our list below for potential additions to your maintenance plan. Be sure to consult with qualified equipment specialists for details on proper maintenance and system operation.

Energy Tracking with ENERGY STAR® Portfolio Manager®



You've heard it before - you can't manage what you don't measure. ENERGY STAR® Portfolio Manager® is an online tool that you can use to measure and track energy and water consumption, as well as greenhouse gas emissions⁵. Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

Doors and Windows

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

Lighting Maintenance



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

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

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

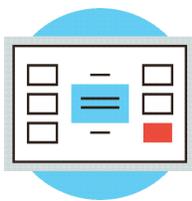
Lighting Controls

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

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.

Steam Trap Repair and Replacement

Steam traps are a crucial part of delivering heat from the boiler to the space heating units. Steam traps are automatic valves that remove condensate from the system. If the traps fail closed, condensate can build up in the steam supply side of the trap which reduces the flow in the steam lines and thermal capacity of the radiators. Or they may fail open, allowing steam into the condensate return lines resulting in wasted energy, water and hammering. Losses can be significantly reduced by testing and replacing equipment as they start to fail. Repair or replace traps that are blocked or allowing steam to pass. Inspect steam traps as part of a regular steam system maintenance plan.

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.

Label HVAC Equipment

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

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

Optimize HVAC Equipment Schedules

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

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

Water Heater Maintenance

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

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

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

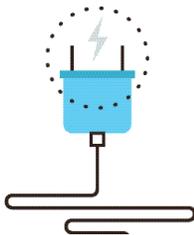
Refrigeration Equipment Maintenance

Preventative maintenance keeps commercial refrigeration equipment running reliably and efficiently. Commercial refrigerators and freezers are mission-critical equipment that can cost a fortune when they go down. Even when they appear to be working properly, refrigeration units can be consuming too much energy. Have walk-in refrigeration and freezer and other commercial systems serviced at least annually. This practice will allow systems to perform to their highest capabilities and will help identify system issues if they exist.

Maintaining your commercial refrigeration equipment can save between 5 and 10% on energy costs. When condenser coils are dirty, your commercial refrigerators and freezers work harder to maintain the temperature inside. Worn gaskets, hinges, door handles or faulty seals cause cold air to leak from the unit, forcing the unit to run longer and use more electricity.

Regular cleaning and maintenance also help your commercial refrigeration equipment to last longer.

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 strips⁶. Your local utility may offer incentives or rebates for this equipment.

Computer Monitor Replacement

ENERGY STAR[®] labeled computer monitors can be up to 25% more efficient than standard monitors. ENERGY STAR[®] rated monitors have power consumption requirements for different operating modes such as on, idle, and sleep.

Computer Power Management Software

Many computers consume power during nights, weekends, and holidays. Screen savers are commonly confused as a power management strategy. This contributes to avoidable, excessive electrical energy consumption. There are innovative power management software packages available that are designed to deliver significant energy saving and provide ongoing tracking measurements. A central power management platform helps enforce energy savings policies as well as identify and eliminate underutilized devices.

⁶ 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® website⁷ or download a copy of EPA's "WaterSense® at Work: Best Management Practices for Commercial and Institutional Facilities"⁸ 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.

⁷ <https://www.epa.gov/watersense>.

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

6 ON-SITE GENERATION

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

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

6.1 Solar Photovoltaic

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

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

This facility does not appear to meet the minimum criteria for a cost-effective solar PV installation. To be cost-effective, a solar PV array needs certain minimum criteria, such as sufficient and sustained electric demand 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.

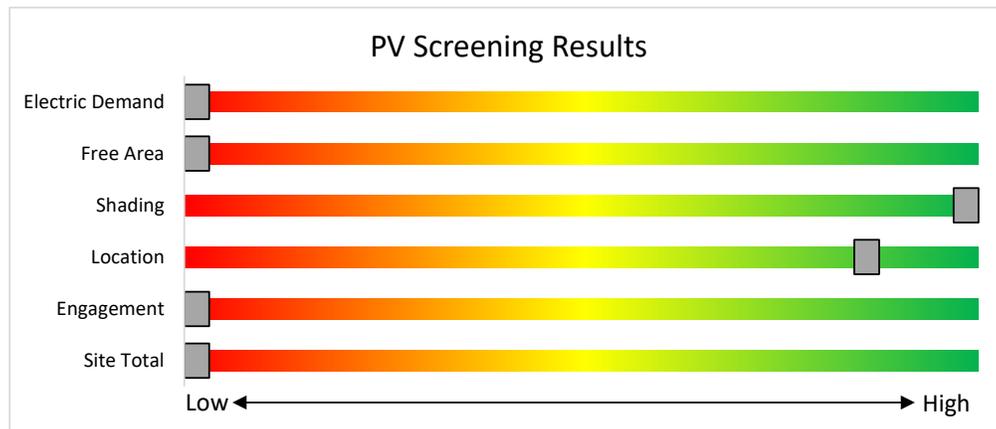


Figure 9 - Photovoltaic Screening

Transition Incentive (TI) Program

The TI program is a bridge between the Legacy SREC Program and a to-be determined Successor Incentive Program. The program is used to register the intent to install solar projects in New Jersey. Rebates are not available for solar projects, but owners of solar projects *must* register their projects prior to the start of construction to establish the project's eligibility to earn TRECs (Transition Incentive Renewable Energy Certificates). The Transition Incentive is structured as a factorized renewable energy certificate. The factors allow the TI Program to provide differentiated financial incentives for different types of solar installation.

Get more information about solar power in New Jersey or find a qualified solar installer who can help you decide if solar is right for your building:

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

6.2 Combined Heat and Power

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

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

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

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

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

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

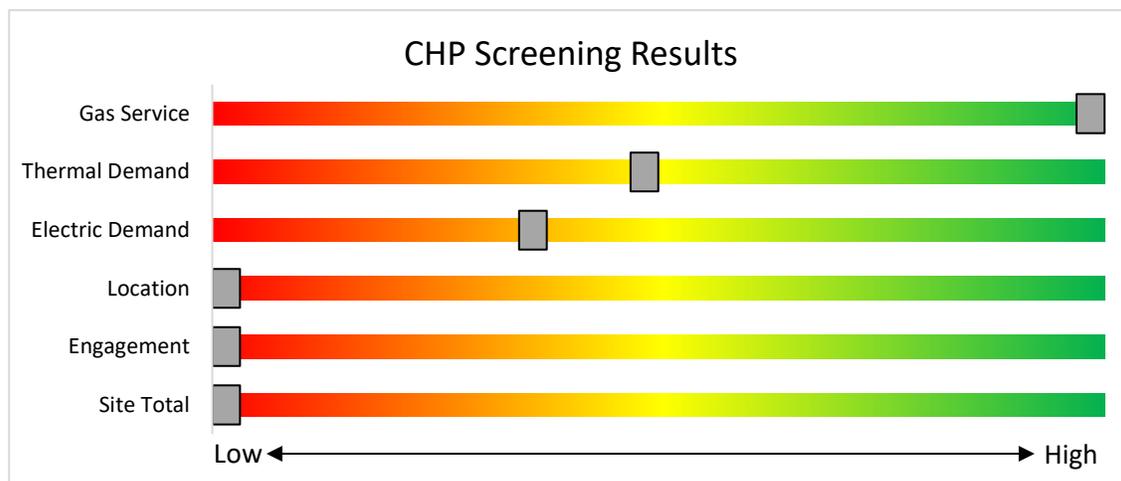


Figure 10 - Combined Heat and Power Screening

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

7 PROJECT FUNDING AND INCENTIVES

Ready to improve your building’s performance? 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.

	SmartStart <i>Flexibility to install at your own pace</i>	Direct Install <i>Turnkey installation</i>	Pay for Performance <i>Whole building upgrades</i>
Who should use it?	Buildings installing individual measures or small group of measures.	<p>Small to mid-size facilities that can bundle multiple measures together.</p> <p>Average peak demand should be below 200 kW.</p> <p>Not suitable for significant building shell issues.</p>	<p>Mid to large size facilities looking to implement as many measures as possible at one time.</p> <p>Peak demand should be over 200 kW.</p>
How does it work?	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.
What are the Incentives?	Fixed incentives for specific energy efficiency measures.	<p>Incentives pay up to 70% of eligible costs, up to \$125,000 per project.</p> <p>You pay the remaining 30% directly to the contractor.</p>	<p>Incentives are paid out in three installments. The first installment is meant to help offset the costs of the initial engineering study. The subsequent incentives are paid based on the level of energy savings up to 50% of the total project cost.</p> <p>See Section 7.3 for all incentive details.</p>
How do I participate?	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 for program details, applications, and to contact a qualified contractor.

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 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.

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.

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

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

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

How to Participate

You 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.

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.

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 Transition Incentive (TI) Program

The TI program is a bridge between the Legacy SREC Program and a to-be determined Successor Incentive Program. The program is used to register the intent to install solar projects in New Jersey. Rebates are not available for solar projects, but owners of solar projects *must* register their projects prior to the start of construction to establish the project’s eligibility to earn TRECs (Transition Incentive Renewable Energy Certificates). The Transition Incentive is structured as a factorized renewable energy certificate. The factors allow the TI Program to provide differentiated financial incentives for different types of solar installations. NJBPU calculates the value of a Transition Renewable Energy Certificate (TREC) by multiplying the base compensation rate (\$152/MWh) by the project’s assigned factor (i.e. $\$152 \times 0.85 = \$129.20/\text{MWh}$). The TREC factors are defined based on the chart below:

Project Type	Factor
Subsection (t): landfill, brownfield, areas of historic fill	1.00
Grid supply (Subsection (r)) rooftop	1.00
Net metered non-residential rooftop and carport	1.00
Community solar	0.85
Grid supply (Subsection (r)) ground mount	0.60
Net metered residential ground mount	0.60
Net metered residential rooftop and carport	0.60
Net metered non-residential ground mount	0.60

After the registration is accepted, construction is complete, and final paperwork has been submitted and is deemed complete, the project is issued a New Jersey certification number, which enables it to generate New Jersey TRECs.

Eligible projects may generate TRECs for 15 years following the commencement of commercial operations (also referred to as the “Transition Incentive Qualification Life”). After 15 years, projects may be eligible for a New Jersey Class I REC.

TRECs will be used by the identified compliance entities to satisfy a compliance obligation tied to a new Transition Incentive Renewable Portfolio Standard (“TI-RPS”), which will exist in parallel with, and completely separate from, the existing Solar RPS for Legacy SRECs. The TI-RPS is a carve-out of the current Class I RPS requirement. The creation of TRECs is based upon metered generation supplied to PJM-EIS General Attribute Tracking System (“GATS”) by the owners of eligible facilities or their agents. GATS would create one TREC for each MWh of energy produced from a qualified facility.

TRECs will be purchased monthly by a TREC Administrator who will allocate the TRECs to the Load Serving Entities (BGS Providers and Third-Party Suppliers) annually based on their market share of retail electricity sold during the relevant Energy Year.

Solar projects help the State of New Jersey reach renewable energy goals outlined in the state’s Energy Master Plan. The Transition Incentive Program online portal is now open to new applications effective May 1, 2020. There are instructions on “How and When to Transfer my SRP Registration to the Transition Incentive Program”. If you are considering installing solar photovoltaics on your building, visit the following link for more information:

<https://www.njcleanenergy.com/renewable-energy/programs/transition-incentive-program>

8 PROJECT DEVELOPMENT

Energy conservation measures (ECMs) have been identified for your site and their energy and economic analyses are provided within this LGEA report. The next steps with project development are to set goals and create a comprehensive project plan. The graphic below provides an overview of the process flow for a typical energy efficiency or renewable energy project. We recommend implementing as many ECMs as possible prior to undertaking a feasibility study for a renewable project. The cyclical nature of this process flow demonstrates the ongoing work required to continually improve building energy efficiency over time. If your building(s) scope of work is relatively simple to implement or small in scope, the measurement and verification (M&V) step may not be required. It should be noted through a typical project cycle, there will be changes in costs based on specific scopes of work, contractor selections, design considerations, construction, etc. The estimated costs provided throughout this LGEA report demonstrate the unburdened turn-key material and labor cost only. There will be contingencies and additional costs at the time of implementation. We recommend comprehensive project planning includes the review of multiple bids for project work, incorporate potential operational & maintenance (O&M) cost savings and maximize your incentive potential.

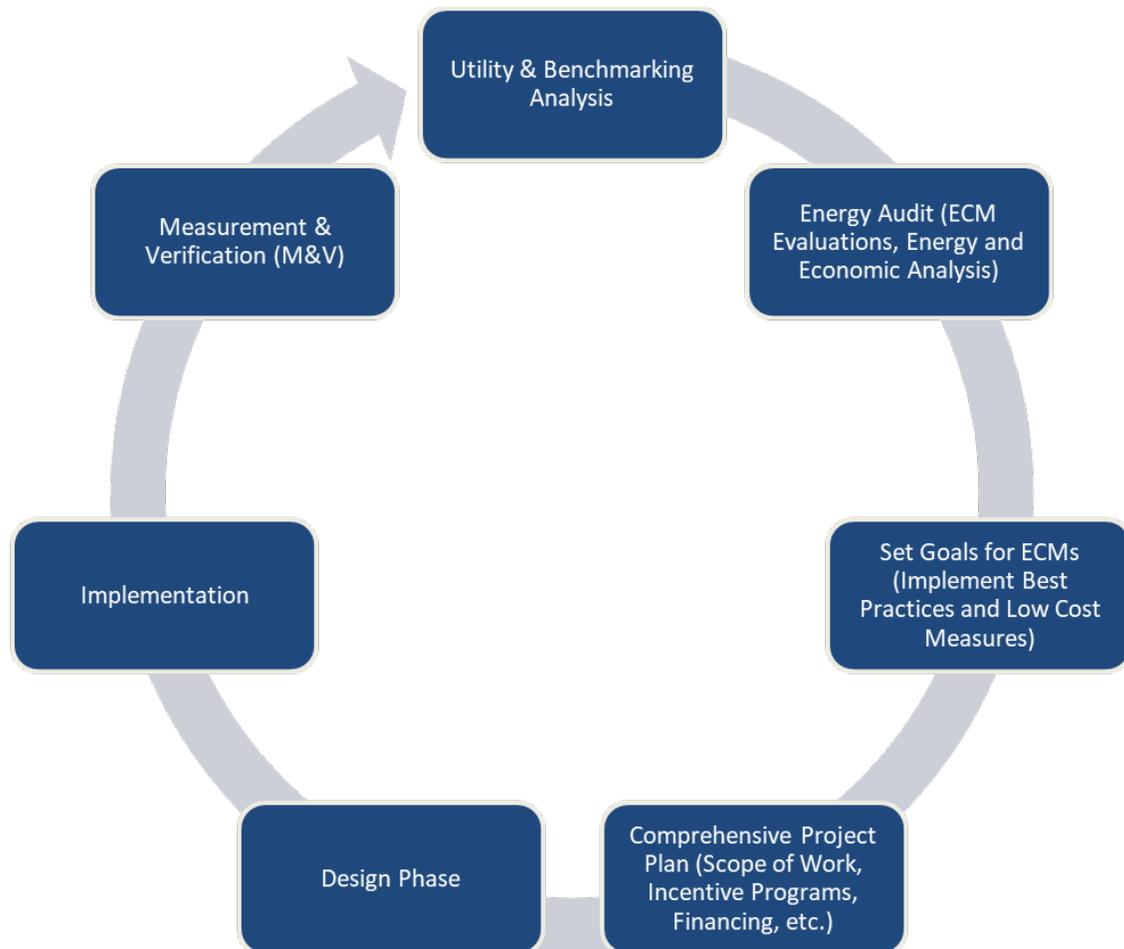


Figure 11 – Project Development Cycle

9 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

9.1 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 website⁹.

9.2 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 website¹⁰.

⁹ www.state.nj.us/bpu/commercial/shopping.html.

¹⁰ 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	Estimated M&L Cost (\$)	Total Incentives	Simple Payback w/ Incentives in Years
1st Floor Hall	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,840	2, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	4,030	0.1	809	0	\$125	\$335	\$135	1.6
Classroom 1	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.5	2,245	0	\$346	\$1,197	\$250	2.7
Classroom 2	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.5	2,245	0	\$346	\$1,197	\$250	2.7
Classroom 3	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.7	2,993	-1	\$461	\$1,416	\$310	2.4
Classroom 4	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	2,700	2, 3	Relamp	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,863	0.6	2,637	-1	\$407	\$1,146	\$275	2.1
Classroom 7	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.6	2,619	-1	\$404	\$1,307	\$280	2.5
Exterior lighting	2	Metal Halide: (1) 100W Lamp	Photocell		128	4,380	1	Fixture Replacement	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	30	4,380	0.0	858	0	\$134	\$525	\$100	3.2
Main lobby	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	\$0	\$0	\$0	0.0
Main lobby	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,863	0.1	499	0	\$77	\$371	\$40	4.3
Office - 3A	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	249	0	\$38	\$189	\$40	3.9
Office - 9A	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.2	748	0	\$115	\$489	\$95	3.4
Office - Nurse	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.2	748	0	\$115	\$489	\$95	3.4
Storage 1	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	600	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	414	0.1	83	0	\$13	\$380	\$30	27.3
Teachers Lounge	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,863	0.1	466	0	\$72	\$560	\$75	6.7
2nd Floor 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
2nd Floor Hall	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,840	2, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	4,030	0.1	809	0	\$125	\$335	\$135	1.6
Classroom 5	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.6	2,619	-1	\$404	\$1,307	\$280	2.5
Classroom 6	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.6	2,619	-1	\$404	\$1,307	\$280	2.5
Classroom 8	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.6	2,619	-1	\$404	\$1,307	\$280	2.5
Classroom 9	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.6	2,619	-1	\$404	\$1,307	\$280	2.5
Office - 7A	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	499	0	\$77	\$416	\$75	4.4
Office - 8A	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	249	0	\$38	\$189	\$40	3.9
Office - 8B	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	499	0	\$77	\$416	\$75	4.4
Office - Guidance	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	249	0	\$38	\$189	\$40	3.9
Principals Office	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	499	0	\$77	\$416	\$75	4.4

Location	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost (\$)	Total Incentives	Simple Payback w/ Incentives in Years
Principals Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	249	0	\$38	\$189	\$40	3.9
3rd Floor 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
3rd Floor Hall	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,840	2, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	4,030	0.1	809	0	\$125	\$335	\$135	1.6
Classroom 10	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.7	2,993	-1	\$461	\$1,416	\$310	2.4
Library 1	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	\$0	\$0	\$0	0.0
Library 1	27	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	27	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.8	3,367	-1	\$519	\$1,526	\$340	2.3
Library 1	27	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	27	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.8	3,367	-1	\$519	\$1,526	\$340	2.3
Library 1	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.5	1,995	0	\$308	\$854	\$195	2.1
Office - 10A	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.2	748	0	\$115	\$489	\$95	3.4
Teachers Lounge	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	499	0	\$77	\$416	\$75	4.4
Basement 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
Basement Hall	12	LED - Fixtures: Ceiling Mount	Wall Switch	S	12	5,840	4	None	Yes	12	LED - Fixtures: Ceiling Mount	High/Low Control	12	4,030	0.0	287	0	\$44	\$450	\$420	0.7
Basement Hall	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,840	2, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	4,030	0.1	539	0	\$83	\$298	\$90	2.5
Boiler Room	8	Compact Fluorescent: (1) 25W Triple Biaxial Plug-In Lamp	Wall Switch	S	25	1,000	2	Relamp	No	8	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	18	1,000	0.0	62	0	\$9	\$100	\$8	9.7
Boiler Room	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	\$0	\$0	\$0	0.0
Cafeteria	6	LED - Fixtures: Ceiling Mount	Wall Switch	S	12	2,700	3	None	Yes	6	LED - Fixtures: Ceiling Mount	Occupancy Sensor	12	1,863	0.0	66	0	\$10	\$270	\$35	23.0
Cafeteria	20	LED - Linear Tubes: (1) 2' Lamp	Wall Switch	S	15	2,700	3	None	Yes	20	LED - Linear Tubes: (1) 2' Lamp	Occupancy Sensor	15	1,863	0.1	276	0	\$43	\$540	\$70	11.0
Custodial Office	5	Compact Fluorescent: (1) 25W Triple Biaxial Plug-In Lamp	Wall Switch	S	25	2,700	2, 3	Relamp	Yes	5	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	18	1,863	0.0	187	0	\$29	\$333	\$40	10.2
Gymnasium 1	12	LED - Linear Tubes: (1) 2' Lamp	Wall Switch	S	11	2,700	3	None	Yes	12	LED - Linear Tubes: (1) 2' Lamp	Occupancy Sensor	11	1,863	0.0	122	0	\$19	\$270	\$35	12.5
Kitchen 1	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	249	0	\$38	\$343	\$20	8.4
Restroom - Boys Basement	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	374	0	\$58	\$380	\$65	5.5
Restroom - Girls Bsement	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	374	0	\$58	\$380	\$65	5.5
Stairs 1	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	\$0	\$0	\$0	0.0
Stairs 1	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,840	2, 4	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	4,030	0.2	1,618	0	\$250	\$444	\$270	0.7
Stairs 2	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

Location	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost (\$)	Total Incentives	Simple Payback w/ Incentives in Years
Stairs 2	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	5,840	2, 4	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	4,030	0.2	1,618	0	\$250	\$444	\$270	0.7
Mezzanine Storage	1	Compact Fluorescent: (1) 25W Triple Biaxial Plug-In Lamp	Wall Switch	S	25	600	2	Relamp	No	1	LED Lamps: GX23 (Plug-In) Lamps	Wall Switch	18	600	0.0	5	0	\$1	\$13	\$1	16.1
Mezzanine Storage	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
Restroom - boys by stairs	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,700	0.0	98	0	\$15	\$37	\$10	1.8
Restroom - Girls by stairs	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2, 3	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	249	0	\$38	\$343	\$20	8.4

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?	Manufacturer	Model	Remaining Useful Life	Annual Operating Hours	ECM #	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost (\$)	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Boiler Room	1	Combustion Air Fan	1.0	82.6%	No	Marathon	Unknown	W	1,246	5	No	82.6%	Yes	1	0.3	422	0	\$66	\$3,102	\$150	44.8
Boiler Room	Boiler Room	1	Combustion Air Fan	1.0	82.6%	No	Dayton	5K659C	W	1,246	5	No	82.6%	Yes	1	0.3	422	0	\$66	\$3,102	\$150	44.8
Boiler Room	Boiler Room	2	Process Pump	1.0	82.6%	No	Unknown	Unknown	W	365		No	82.6%	No		0.0	0	0	\$0	\$0	\$0	0.0
Cafeteria and Gym	Cafeteria and Gym	2	Supply Fan	0.2	68.5%	No	Unknown	Unknown	W	3,000		No	68.5%	No		0.0	0	0	\$0	\$0	\$0	0.0

Packaged 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)	Cooling Mode Efficiency (SEER/IEER/EER)	Heating Mode Efficiency	Manufacturer	Model	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/IEER/EER)	Heating Mode Efficiency	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost (\$)	Total Incentives
Classroom 4	Classroom 4	1	Window AC	1.25		11.80		Frigidaire	FFRE1533S10	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Office - Nurse	Office - Nurse	1	Window AC	0.98		11.40		Unknown	Unknown	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Classroom 5	Classroom 5	1	Window AC	1.25		11.80		Frigidaire	FFRE1533S10	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Classroom 6	Classroom 6	1	Window AC	1.25		11.80		Frigidaire	FFRE1533S10	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Office - 7A	Office - 7A	1	Window AC	1.25		11.80		Frigidaire	FFRE1533S10	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Office - 8A	Office - 8A	1	Window AC	1.25		11.80		Frigidaire	FFRE1533S10	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Office - Guidance	Office - Guidance	1	Window AC	1.25		11.80		Frigidaire	FFRE1533S10	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Principals Office	Principals Office	1	Window AC	1.25		11.80		Frigidaire	FFRE1533S10	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Classroom 10	Classroom 10	1	Window AC	1.25		11.80		Frigidaire	FFRE1533S10	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Library 1	Library 1	1	Window AC	0.67		9.80		Sunbeam	Unknown	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Library 1	Library 1	3	Window AC	1.25		11.80		Unknown	Unknown	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Teachers Lounge	Teachers Lounge	1	Window AC	0.98		9.80		GE	AGV10ABG1	W		No						0.0	0	0	\$0	\$0	\$0	0.0

Space Heating Boiler 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)	Manufacturer	Model	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	Estimated M&L Cost (\$)	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Whole Building	1	Forced Draft Steam Boiler	3,038	HB Smith	4357-2H	B	6	Yes	1	Forced Draft Steam Boiler	3,038	81.00%	Et	0.0	0	26	\$246	\$56,465	\$6,076	205.2
Boiler Room	Whole Building	1	Forced Draft Steam Boiler	3,038	HB Smith	4375-1-H	B	6	Yes	1	Forced Draft Steam Boiler	3,038	81.00%	Et	0.0	0	26	\$246	\$56,465	\$6,076	205.2

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	Estimated M&L Cost (\$)	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Building	7	6	0.75	0.0	0	2	\$20	\$35	\$24	0.5

DHW Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions					Proposed Conditions						Energy Impact & Financial Analysis						
		System Quantity	System Type	Manufacturer	Model	Remaining Useful Life	ECM #	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost (\$)	Total Incentives
Boiler Room	DHW	1	Storage Tank Water Heater (≤ 50 Gal)	AO Smith	GCG 50 400	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	Estimated M&L Cost (\$)	Total Incentives	Simple Payback w/ Incentives in Years
Restroom - boys by stairs	8	1	Faucet Aerator (Lavatory)	1.50	0.50	0.0	0	0	\$3	\$7	\$7	0.0
Restroom - Girls by stairs	8	1	Faucet Aerator (Lavatory)	1.50	0.50	0.0	0	0	\$3	\$7	\$7	0.0

Commercial Refrigerator/Freezer Inventory & Recommendations

Location	Existing Conditions					Proposed Conditions		Energy Impact & Financial Analysis							
	Quantity	Refrigerator/ Freezer Type	Manufacturer	Model	ENERGY STAR Qualified?	ECM #	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost (\$)	Total Incentives	Simple Payback w/ Incentives in Years	
Cafeteria	1	Freezer Chest	Unknown	Unknown	No		No	0.0	0	0	\$0	\$0	\$0	0.0	
kitchen	1	Freezer Chest	Powers	Unknown	No		No	0.0	0	0	\$0	\$0	\$0	0.0	
kitchen	1	Stand-Up Refrigerator, Solid Door (31 - 50 cu. ft.)	Unknown	Unknown	No		No	0.0	0	0	\$0	\$0	\$0	0.0	
kitchen	1	Stand-Up Refrigerator, Solid Door (31 - 50 cu. ft.)	Unknown	Unknown	No		No	0.0	0	0	\$0	\$0	\$0	0.0	

Cooking Equipment Inventory & Recommendations

Location	Existing Conditions					Proposed Conditions		Energy Impact & Financial Analysis							
	Quantity	Equipment Type	Manufacturer	Model	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	Estimated M&L Cost (\$)	Total Incentives	Simple Payback w/ Incentives in Years	
Kitchen	1	Electric Convection Oven (Half Size)	Blogget	Unknown	No		No	0.0	0	0	\$0	\$0	\$0	0.0	
Kitchen	1	Insulated Food Holding Cabinet (Full Size)	Unknown	Unknown	No		No	0.0	0	0	\$0	\$0	\$0	0.0	

Plug Load Inventory

Existing Conditions						
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified ?	Manufacturer	Model
Various	90	Desktop	200	No	Various	Various
Various	8	Fan (Portable)	100	No	Various	Various
Various	4	Microwave	1,000	No	Various	Various
Various	2	Paper Shredder	300	No	Various	Various
Various	27	Printer (Medium/Small)	200	No	Various	Various
Various	8	Printer/Copier (Large)	600	No	Various	Various
Various	12	Projector	500	No	Various	Various
Various	5	Refrigerator (Mini)	153	No	Various	Various
Various	2	Refrigerator (Residential)	199	No	Various	Various
Various	8	Water Cooler	500	No	Various	Various

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

47

**ENERGY STAR®
Score¹**

Dr. Paul Rafalides School (PS #33)

Primary Property Type: K-12 School
Gross Floor Area (ft²): 30,607
Built: 1909

For Year Ending: December 31, 2019
Date Generated: June 30, 2021

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information		
Property Address Dr. Paul Rafalides School (PS #33) 362 Union Street Jersey City, New Jersey 07304	Property Owner Jersey City Public Schools 346 Claremont Avenue Jersey City, NJ 07305 (201) 915-6074	Primary Contact Regina Robinson 346 Claremont Avenue Jersey City, NJ 07305 (201) 915-6074 rrobinson@jcboe.org
Property ID: 13060845		

Energy Consumption and Energy Use Intensity (EUI)			
Site EUI 66.4 kBtu/ft²	Annual Energy by Fuel		National Median Comparison
	Electric - Grid (kBtu)	519,443 (26%)	National Median Site EUI (kBtu/ft²) 64.7
	Natural Gas (kBtu)	1,514,183 (74%)	National Median Source EUI (kBtu/ft²) 96.8
			% Diff from National Median Source EUI 3%
Source EUI 99.5 kBtu/ft²			Annual Emissions
			Greenhouse Gas Emissions (Metric Tons CO2e/year) 130

Signature & Stamp of Verifying Professional

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

LP Signature: _____ Date: _____

Licensed Professional

() - _____



Professional Engineer or Registered Architect Stamp (if applicable)

APPENDIX C: GLOSSARY

TERM	DEFINITION
Blended Rate	Used to calculate fiscal savings associated with measures. The blended rate is calculated by dividing the amount of your bill by the total energy use. For example, if your bill is \$22,217.22, and you used 266,400 kilowatt-hours, your blended rate is 8.3 cents per kilowatt-hour.
Btu	<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.
CHP	<i>Combined heat and power</i> . Also referred to as cogeneration.
COP	<i>Coefficient of performance</i> : a measure of efficiency in terms of useful energy delivered divided by total energy input.
Demand Response	Demand response reduces or shifts electricity usage at or among participating buildings/sites during peak energy use periods in response to time-based rates or other forms of financial incentives.
DCV	<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.
US DOE	<i>United States Department of Energy</i>
EC Motor	<i>Electronically commutated motor</i>
ECM	<i>Energy conservation measure</i>
EER	<i>Energy efficiency ratio</i> : a measure of efficiency in terms of cooling energy provided divided by electric input.
EUI	<i>Energy Use Intensity</i> : measures energy consumption per square foot and is a standard metric for comparing buildings' energy performance.
Energy Efficiency	Reducing the amount of energy necessary to provide comfort and service to a building/area. Achieved through the installation of new equipment and/or optimizing the operation of energy use systems. Unlike conservation, which involves some reduction of service, energy efficiency provides energy reductions without sacrifice of service.
ENERGY STAR®	ENERGY STAR® is the government-backed symbol for energy efficiency. The ENERGY STAR® program is managed by the EPA.
EPA	<i>United States Environmental Protection Agency</i>
Generation	The process of generating electric power from sources of primary energy (e.g., natural gas, the sun, oil).
GHG	<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.
gpf	<i>Gallons per flush</i>

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

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