# Local Government Energy Audit Report

## Cornelia F. Bradford School

October 22, 2021

*Prepared for:*

Jersey City Public Schools
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Jersey City, New Jersey 07302

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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.

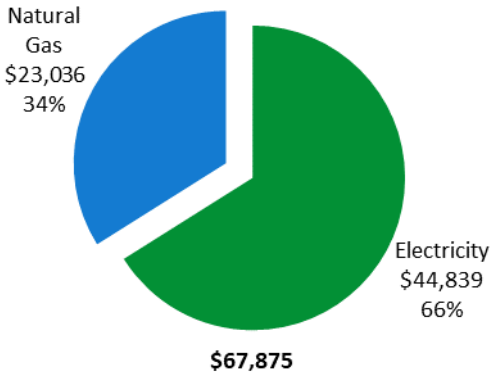
The customer and their respective contractor(s) are responsible to implement energy conservation measures in complete conformance with all applicable local, state, and federal requirements.

# Table of Contents

# 1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Cornelia F. Bradford School. This report provides you with information about your facility's energy use, identifies energy conservation measures (ECMs) that can reduce your energy use, and provides information and assistance to help make changes in your facility. TRC conducted this study as part of a comprehensive effort to assist New Jersey school districts and local governments in controlling their energy costs and to help protect our environment by reducing statewide energy consumption.

## BUILDING PERFORMANCE REPORT

| | | |
|---|---|---|
| Annual Utilities | Costs: $67,875<br>Electricity:<br>276,321 kWh<br>Natural Gas:<br>27,580 Therms |  |
| ENERGY STAR® Benchmarking Score | 78<br>*(1-100 scale)* | Congratulations, your building performs better than the national average. This report has suggestions about how to keep your building running efficiently, further improve performance, and lower your energy bills even more. |

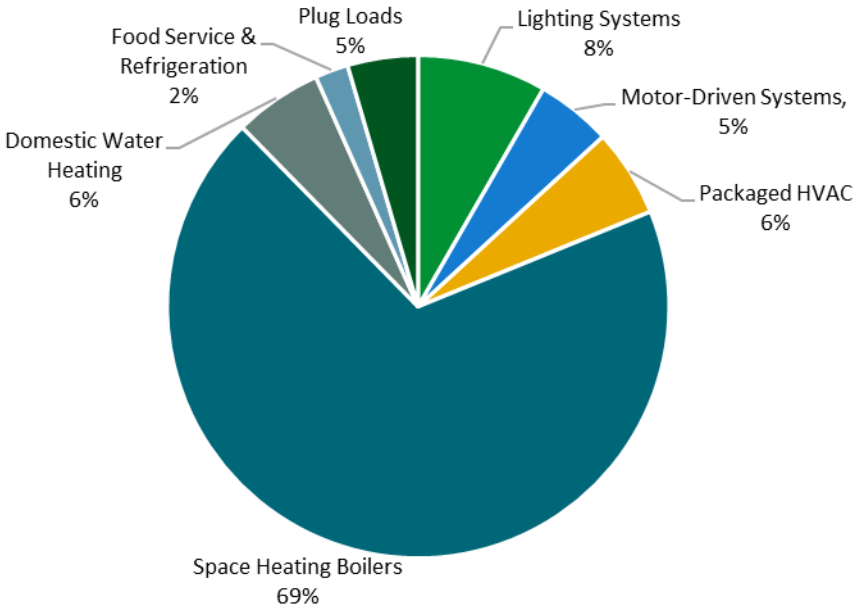


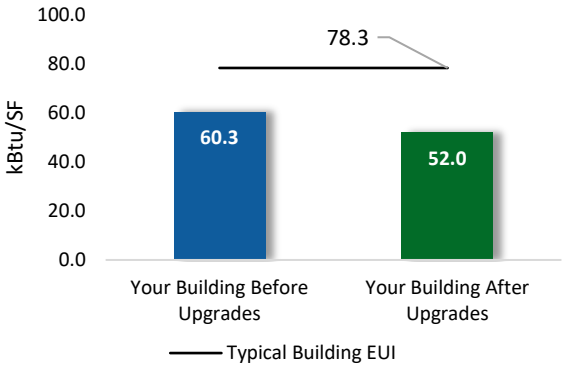

*Figure 1 - Energy Use by System*

## 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.

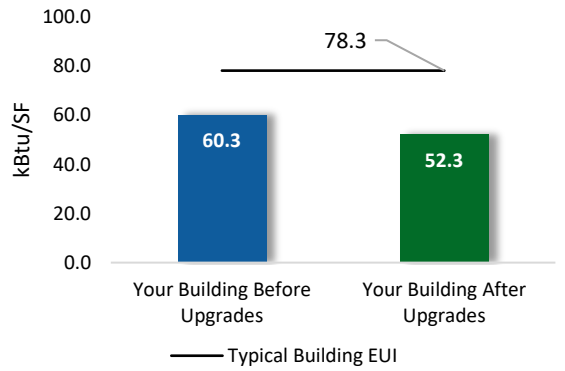
### Scenario 1: Full Package (all evaluated measures)

| | |
|---|---|
| Installation Cost | $102,223 |
| Potential Rebates & Incentives[1] | $12,108 |
| Annual Cost Savings | $10,331 |
| Annual Energy Savings | Electricity: 46,534 kWh<br>Natural Gas: 3,329 Therms |
| Greenhouse Gas Emission Savings | 43 Tons |
| Simple Payback | 8.7 Years |
| Site Energy Savings (all utilities) | 13% |




### Scenario 2: Cost Effective Package[2]

| | |
|---|---|
| Installation Cost | $51,396 |
| Potential Rebates & Incentives | $6,724 |
| Annual Cost Savings | $9,964 |
| Annual Energy Savings | Electricity: 44,854 kWh<br>Natural Gas: 3,216 Therms |
| Greenhouse Gas Emission Savings | 41 Tons |
| Simple Payback | 4.5 Years |
| Site Energy Savings (all utilities) | 13% |




### On-site Generation Potential

| | |
|---|---|
| Photovoltaic | High |
| 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)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | | **28,021** | **4.3** | **-6** | **$4,493** | **$8,747** | **$1,804** | **$6,943** | **1.5** | **27,463** |
| ECM 1 | Install LED Fixtures | Yes | 1,823 | 0.3 | 0 | $292 | $1,586 | $0 | $1,586 | 5.4 | 1,787 |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | Yes | 189 | 0.1 | 0 | $30 | $257 | $40 | $217 | 7.2 | 185 |
| ECM 3 | Retrofit Fixtures with LED Lamps | Yes | 26,009 | 4.0 | -6 | $4,171 | $6,904 | $1,764 | $5,140 | 1.2 | 25,490 |
| **Lighting Control Measures** | | | **9,275** | **1.3** | **-2** | **$1,487** | **$7,441** | **$1,000** | **$6,441** | **4.3** | **9,090** |
| ECM 4 | Install Occupancy Sensor Lighting Controls | Yes | 9,275 | 1.3 | -2 | $1,487 | $7,441 | $1,000 | $6,441 | 4.3 | 9,090 |
| **Motor Upgrades** | | | **48** | **0.0** | **0** | **$8** | **$774** | **$0** | **$774** | **100.0** | **48** |
| ECM 5 | Premium Efficiency Motors | No | 48 | 0.0 | 0 | $8 | $774 | $0 | $774 | 100.0 | 48 |
| **Variable Frequency Drive (VFD) Measures** | | | **8,847** | **2.0** | **0** | **$1,436** | **$10,402** | **$2,000** | **$8,402** | **5.9** | **8,909** |
| ECM 6 | Install VFDs on Boiler Feedwater Pumps | No | 1,632 | 0.8 | 0 | $265 | $6,415 | $200 | $6,215 | 23.5 | 1,643 |
| ECM 7 | Install VFDs on Process Pumps | Yes | 7,215 | 1.2 | 0 | $1,171 | $3,987 | $1,800 | $2,187 | 1.9 | 7,265 |
| **Gas Heating (HVAC/Process) Replacement** | | | **0** | **0.0** | **74** | **$620** | **$51,466** | **$7,184** | **$44,282** | **71.4** | **8,692** |
| ECM 8 | Install High Efficiency Hot Water Boilers | Yes | 0 | 0.0 | 63 | $525 | $7,828 | $2,000 | $5,828 | 11.1 | 7,365 |
| ECM 9 | Install High Efficiency Steam Boilers | No | 0 | 0.0 | 11 | $95 | $43,638 | $5,184 | $38,454 | 406.2 | 1,327 |
| **HVAC System Improvements** | | | **0** | **0.0** | **10** | **$80** | **$63** | **$20** | **$43** | **0.5** | **1,127** |
| ECM 10 | Install Pipe Insulation | Yes | 0 | 0.0 | 10 | $80 | $63 | $20 | $43 | 0.5 | 1,127 |
| **Domestic Water Heating Upgrade** | | | **0** | **0.0** | **7** | **$55** | **$100** | **$100** | **$0** | **0.0** | **778** |
| ECM 11 | Install Low-Flow DHW Devices | Yes | 0 | 0.0 | 7 | $55 | $100 | $100 | $0 | 0.0 | 778 |
| **Food Service & Refrigeration Measures** | | | **343** | **0.0** | **0** | **$56** | **$230** | **$0** | **$230** | **4.1** | **345** |
| ECM 12 | Vending Machine Control | Yes | 343 | 0.0 | 0 | $56 | $230 | $0 | $230 | 4.1 | 345 |
| **Custom Measures** | | | **0** | **0.0** | **251** | **$2,096** | **$23,000** | **$0** | **$23,000** | **11.0** | **29,389** |
| ECM 13 | Semi-automatic Cover for Swimming Pool | Yes | 0 | 0.0 | 251 | $2,096 | $23,000 | $0 | $23,000 | 11.0 | 29,389 |
| **TOTALS (COST EFFECTIVE MEASURES)** | | | **44,854** | **6.9** | **322** | **$9,964** | **$51,396** | **$6,724** | **$44,672** | **4.5** | **82,822** |
| **TOTALS (ALL MEASURES)** | | | **46,534** | **7.7** | **333** | **$10,331** | **$102,223** | **$12,108** | **$90,115** | **8.7** | **85,841** |

* - 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 | |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | x | x | |
| ECM 3 | Retrofit Fixtures with LED Lamps | x | x | |
| ECM 4 | Install Occupancy Sensor Lighting Controls | x | x | |
| ECM 5 | Premium Efficiency Motors | | x | |
| ECM 6 | Install VFDs on Boiler Feedwater Pumps | x | x | |
| ECM 7 | Install VFDs on Process Pumps | x | x | |
| ECM 8 | Install High Efficiency Hot Water Boilers | x | x | |
| ECM 9 | Install High Efficiency Steam Boilers | x | | |
| ECM 10 | Install Pipe Insulation | x | x | |
| ECM 11 | Install Low-Flow DHW Devices | x | x | |
| ECM 12 | Vending Machine Control | | x | |
| ECM 13 | Semi-automatic Cover for Swimming Pool | | | |

*Figure 3 – Funding Options*

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

| | **SmartStart**<br>Flexibility to install at your own pace | **Direct Install**<br>Turnkey installation | **Pay for Performance**<br>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.<br>Average peak demand should be below 200 kW.<br>Not suitable for significant building shell issues. | Mid to large size facilities looking to implement as many measures as possible at one time.<br>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.<br>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.<br>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 (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for Cornelia F. Bradford School. 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 March 25, 2021, TRC performed an energy audit at Cornelia F. Bradford School located in Jersey City, New Jersey. TRC met with custodians on site to review the facility operations and help focus our investigation on specific energy-using systems.

Cornelia F. Bradford School is a four-story, 61,684 square foot building built in 1916. Spaces include classrooms and offices as well as a gymnasium, natatorium, auditorium, cafeteria, corridors, stairwells, restrooms, storage rooms, electrical, and mechanical space.

Lighting is provided mainly by linear fluorescent T8 and LED fixtures. Window air conditioning (AC) units and two steam boilers provide heating and cooling to spaces. One hot water boiler provides heating to the pool.

## 2.2 Building Occupancy

The facility is occupied from September through June, with the school year ending for students in June and restarting in September. The building is not occupied during the weekends, and the facility closes at 10:00 PM. During a typical day, the facility is occupied by approximately 55 staff and 811 students.

| Building Name | Weekday/Weekend | Operating Schedule |
|---|---|---|
| Cornelia F. Bradford School | Weekday | 6:00 AM - 10:00 PM |
| | Weekend | Closed |

*Figure 4 - Building Occupancy Schedule*

## 2.3 Building Envelope

Cornelia F. Bradford School is a three-floor building with a basement. Building walls are concrete block over structural steel with a brick facade. The roof is flat and covered with black membrane, and it is in good condition.

The windows are single glazed and have aluminum frames with thermal breaks. The glass-to-frame seals are in fair condition. The operable window weather seals are in fair condition, showing little evidence of excess wear. Most of the exterior doors have aluminum frames and are in fair condition with worn door seals; however, the auditorium exit doors are wood with wooden frames and are in poor condition with signs of wear. Degraded window and door seals increase drafts and outside air infiltration. Overall, the building envelope appears in fair condition.

*Building Walls & Windows*

*Building Windows*


*Entrance & Exit Doors*

*Roof*

## 2.4 Lighting Systems

The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps and 14.5-Watt T8 equivalent LED lamps. Fixture types include 1-lamp, 2-lamp, 3-lamp, 4-lamp, 4-foot long recessed, surface mounted, and pendant fixtures with linear tube lamps. Additionally, there are some eight-foot T12 fixtures with 75W lamps, two-foot T8 fixtures with 17W lamps, compact fluorescent lamps (CFL), high-pressure sodium, and incandescent lamps throughout the building. Typically, incandescent lamps require 150-watts, CFLs draw 25-watts, and high-pressure sodium fixtures are rated at 70 watts. Building exit signs use LED sources. Gymnasium fixtures have manually controlled LED linear tube lamps. Auditorium fixtures have manually controlled LED, CFL, and incandescent lamps. Natatorium fixtures have manually controlled high-pressure sodium lamps. The fixtures are in good condition and interior lighting levels were generally sufficient.

The lighting fixtures are controlled by a mixture of manual wall switches and wall mounted occupancy sensors.

Exterior fixtures are wall mounted with LED lamps. Exterior light fixtures are timer controlled.

*Linear Fluorescent T8 and LED Fixtures*

*Natatorium High Pressure Sodium Fixture & Occupancy Sensors*

*Auditorium Incandescent and CFL Fixtures*

*Exterior Wall Mounted Fixture*

## 2.5 Air Handling Systems

**Unitary Electric HVAC Equipment**

Classes and offices are conditioned by window AC units. These vary in capacity between 0.42 and 3 tons. The units are in good condition and range in efficiency between 8.5 to 12 EER. Most units are not ENERGY STAR® labeled. Larger spaces are not cooled. There is a limited amount of mechanical ventilation at the site.

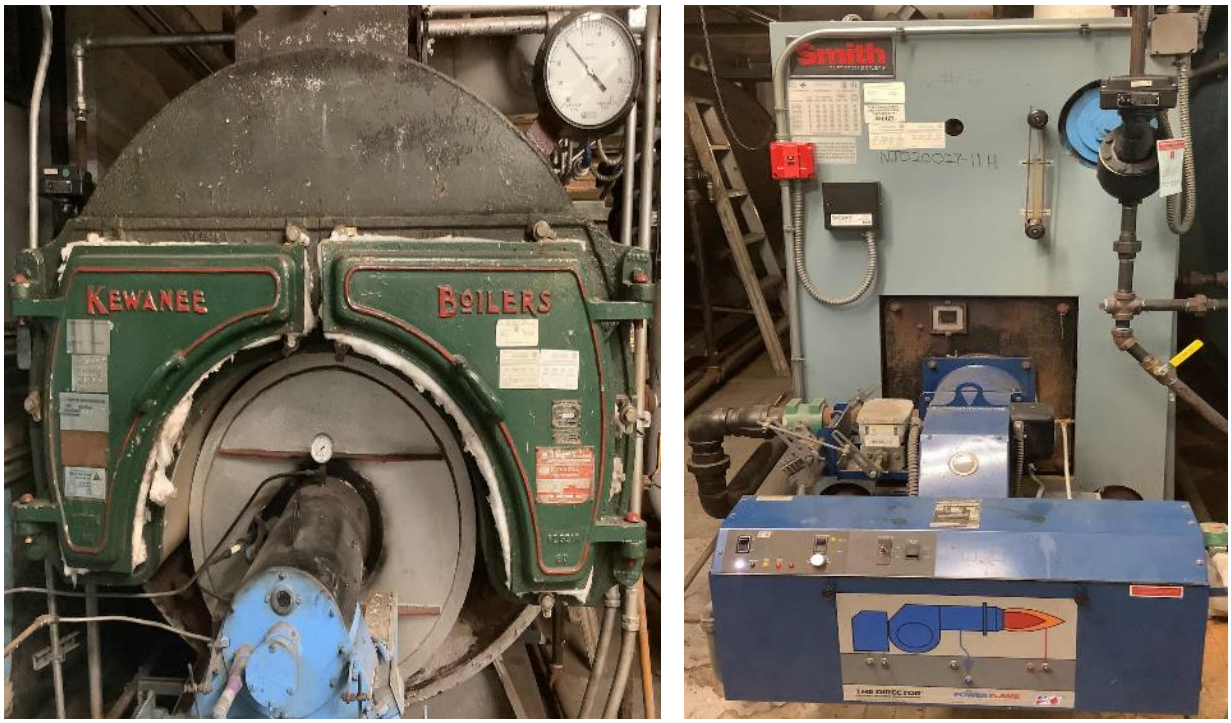

*Window AC Units*

## 2.6 Heating Steam Systems

The building heating system consists of one Kewanee steam boiler with an output capacity of 2,160 MBh, and one Smith steam boiler with an output capacity of 2,766 MBh.

The burners are non-modulating with a nominal efficiency of 80%. The boilers are configured in a lead-lag control scheme. Multiple boilers are required under high load conditions. The boilers provide hot water to cast iron radiators throughout the building. The Kewanee boiler was installed in 1950 and is in poor condition. The Smith boiler was installed in 2010 and is in good condition. There is a service contract in place.

A two-pipe steam distribution system serves the building heating terminals. There are two 3/4 hp and two 2 hp condensate pumps and two 3/4 hp boiler feed water pumps in the storage room behind the boilers. There is approximately five feet of four-inch condensate return pipe with no insulation; insulation should be installed.




*Steam Boilers*


*Condensate Pumps*

## 2.7 Domestic Hot Water

Hot water is produced by a 399 MBh Lochinvar gas-fired boiler with an 82% efficiency rating. The boiler was installed in 1995 and is in fair condition. One 1/12 hp and one 1/6 hp circulation pump distribute water to end uses. The circulation pumps operate continuously.

The domestic hot water pipes are insulated, and the insulation is in good condition.

*Gas-fired Domestic Hot Water Boiler*

## 2.8 Food Service Equipment

The cafeteria has a mix of gas and electric equipment that is used to prepare meals for students and staff. All cooking is done using a convection gas-fired oven. Bulk prepared foods are held in an electric holding cabinet. Equipment 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.


*Gas-fired Convection Oven & Electric Holding Cabinet*

## 2.9 Refrigeration

The cafeteria has one stand-up refrigerator, two stand-up freezers with solid doors, and three refrigerator chests. Other than two of the refrigerator chests, equipment is high efficiency. All units are in good condition.

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


*Stand-Up Refrigerator and Freezer*

## 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 114 computer workstations throughout the facility. Plug loads throughout the building include general café and office equipment. There are classroom typical loads such as smart boards, projectors, and typical office loads such as copiers, printers, microwaves, coffee machines, and mini fridges. There is one residential style refrigerator in the teacher's lounge that is used to store food and drinks. Equipment varies in condition and efficiency.

There is one non-refrigerated vending machine in the teacher's lounge that is not equipped with occupancy-based controls.

*Residential Style Refrigerator & Vending Machine*

## 2.11 Water-Using Systems

There are thirteen restrooms with toilets, urinals, and sinks. Faucet flow rates are at 2.2 gallons per minute (gpm) or higher.

*Typical Restroom Sink*

## 2.12 Pool and Pool Process Systems

Cornelia F. Bradford School has an indoor three lane swimming pool that was empty during the site visit, but it is typically used year-round. The pool surface area is estimated to be about 1,200 square feet and the pool is maintained at a temperature of 85°F. The facility does not employ a pool cover.

The pool heating system uses a dedicated gas fired Raypak hot water boiler with an output capacity of 200 MBh, and it is in good condition. The pool system incorporates one 5 hp filtration pump and other equipment related to water treatment. It is recommended to install a pool cover to conserve energy use associated with heating the pool water.

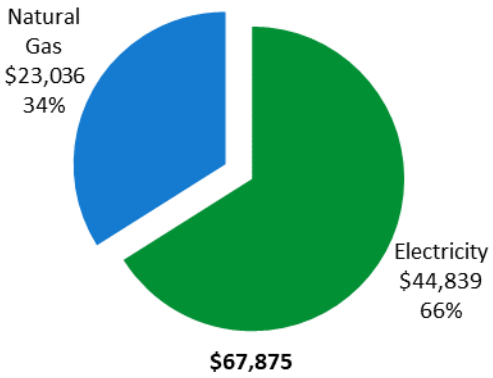
*Swimming Pool*

*Pool Heating & Filtration Systems*

# 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 | 276,321 kWh | $44,839 |
| Natural Gas | 27,580 Therms | $23,036 |
| **Total** | | **$67,875** |




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.

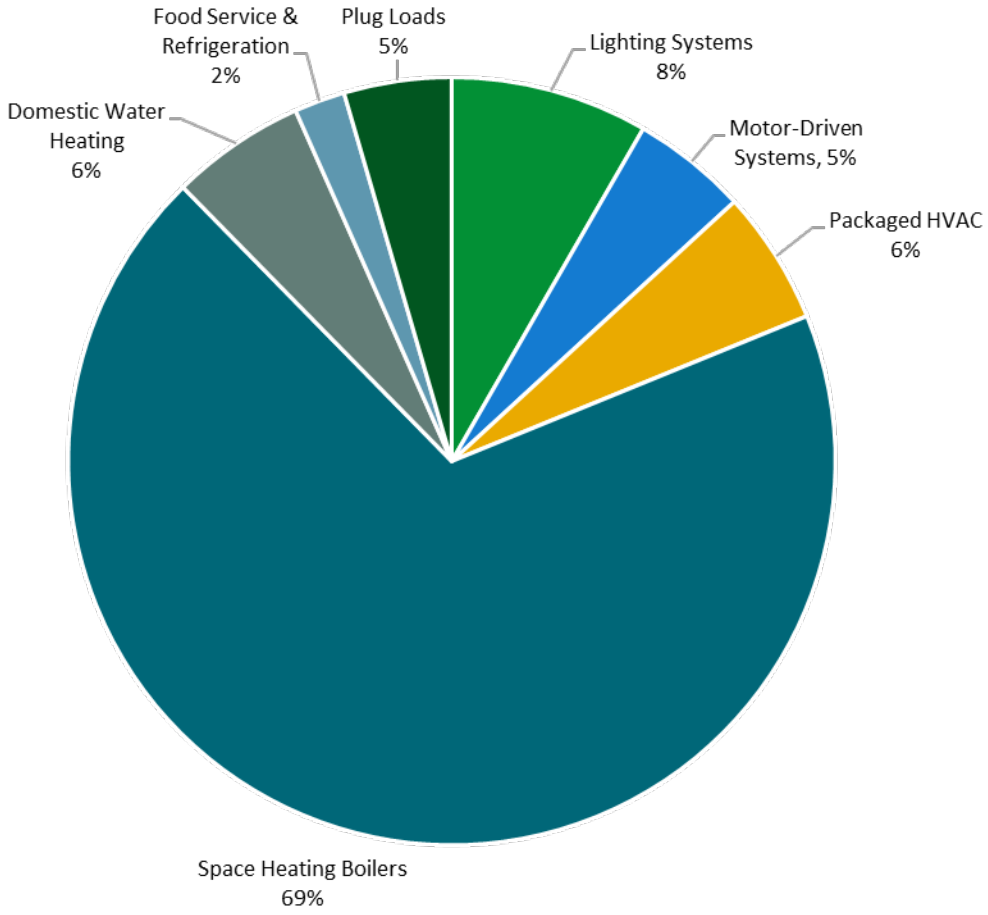
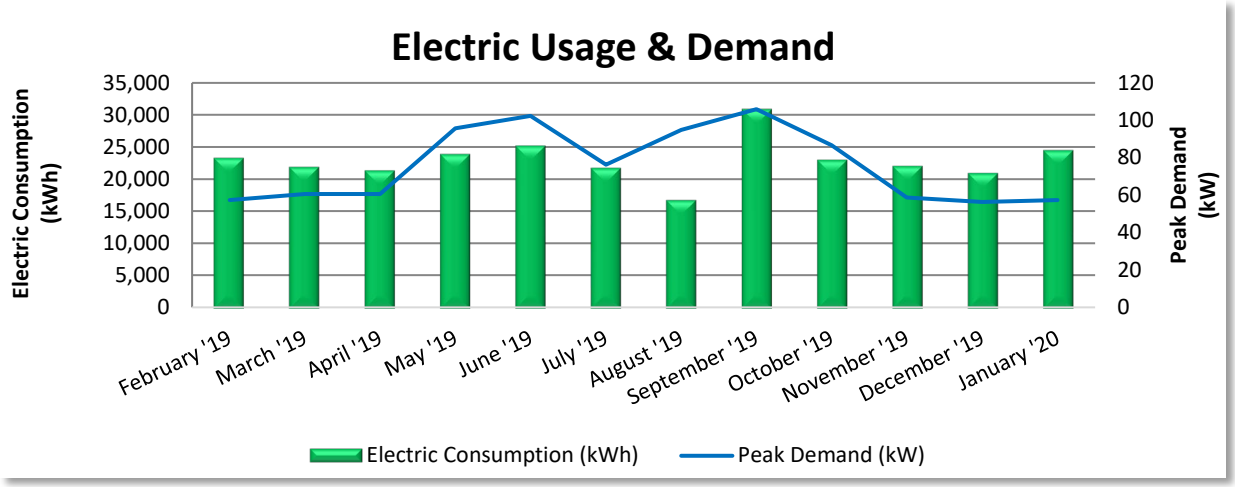



*Figure 5 - Energy Balance*

## 3.1 Electricity

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



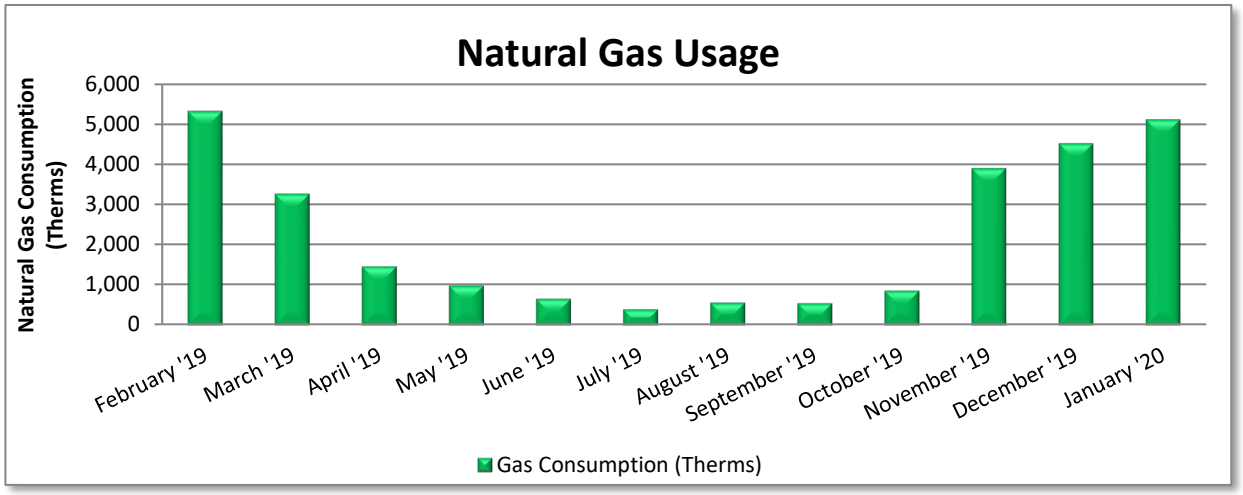

| Electric Billing Data | | | | | |
|---|---|---|---|---|---|
| **Period Ending** | **Days in Period** | **Electric Usage (kWh)** | **Demand (kW)** | **Demand Cost** | **Total Electric Cost** |
| 3/7/19 | 29 | 23,354 | 57 | $226 | $3,742 |
| 4/4/19 | 28 | 21,966 | 61 | $239 | $3,602 |
| 5/6/19 | 32 | 21,416 | 61 | $239 | $3,620 |
| 6/5/19 | 30 | 23,950 | 96 | $1,322 | $4,834 |
| 7/5/19 | 30 | 25,244 | 102 | $1,409 | $4,661 |
| 8/5/19 | 31 | 21,841 | 76 | $1,050 | $3,962 |
| 9/4/19 | 30 | 16,837 | 95 | $1,306 | $3,758 |
| 10/3/19 | 29 | 30,933 | 106 | $416 | $3,806 |
| 11/1/19 | 29 | 23,041 | 87 | $341 | $3,282 |
| 12/4/19 | 33 | 22,144 | 59 | $232 | $3,067 |
| 1/6/20 | 33 | 21,044 | 56 | $222 | $3,087 |
| 2/6/20 | 31 | 24,551 | 57 | $226 | $3,419 |
| **Totals** | **365** | **276,321** | **106** | **$7,227** | **$44,839** |
| **Annual** | **365** | **276,321** | **106** | **$7,227** | **$44,839** |

Notes:

- Peak demand of 106 kW occurred in September '19.
- Average demand over the past 12 months was 76 kW.
- The average electric cost over the past 12 months was $0.162/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.
- There was a drop in electricity usage for August ’19, which corresponds with reduced summer occupancy.

## 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** |
| 3/6/19 | 28 | 5,308 | $4,678 |
| 4/4/19 | 29 | 3,264 | $2,119 |
| 5/6/19 | 32 | 1,467 | $1,024 |
| 6/5/19 | 30 | 991 | $734 |
| 7/5/19 | 30 | 665 | $532 |
| 8/5/19 | 31 | 398 | $365 |
| 9/4/19 | 30 | 567 | $449 |
| 10/3/19 | 29 | 550 | $450 |
| 11/1/19 | 29 | 861 | $1,400 |
| 12/4/19 | 33 | 3,897 | $3,450 |
| 1/6/20 | 33 | 4,511 | $3,806 |
| 2/6/20 | 31 | 5,103 | $4,030 |
| **Totals** | **365** | **27,580** | **$23,036** |
| **Annual** | **365** | **27,580** | **$23,036** |

Notes:

- The average gas cost for the past 12 months is $0.835/therm, which is the blended rate used throughout the analysis.
- The reduced (but significant) natural gas consumption during summer months reflects usage for the swimming pool hot water boiler, domestic hot water, and food service equipment.

## 3.3 Benchmarking

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

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

| **Benchmarking Score** | **78** |
|---|---|

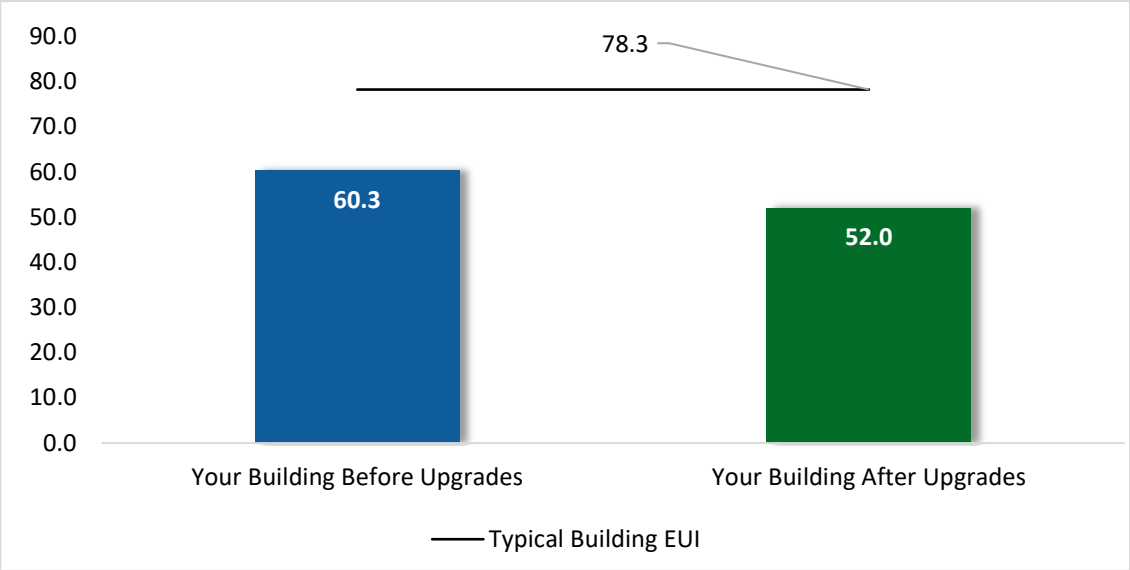



*Figure 6 - Energy Use Intensity Comparison*[3]

Congratulations, your building performs better than the national average. This report has suggestions about how to keep your building running efficiently, further improve performance, and lower your energy bills even more.

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 website[4].

[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)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | | **28,021** | **4.3** | **-6** | **$4,493** | **$8,747** | **$1,804** | **$6,943** | **1.5** | **27,463** |
| ECM 1 | Install LED Fixtures | Yes | 1,823 | 0.3 | 0 | $292 | $1,586 | $0 | $1,586 | 5.4 | 1,787 |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | Yes | 189 | 0.1 | 0 | $30 | $257 | $40 | $217 | 7.2 | 185 |
| ECM 3 | Retrofit Fixtures with LED Lamps | Yes | 26,009 | 4.0 | -6 | $4,171 | $6,904 | $1,764 | $5,140 | 1.2 | 25,490 |
| **Lighting Control Measures** | | | **9,275** | **1.3** | **-2** | **$1,487** | **$7,441** | **$1,000** | **$6,441** | **4.3** | **9,090** |
| ECM 4 | Install Occupancy Sensor Lighting Controls | Yes | 9,275 | 1.3 | -2 | $1,487 | $7,441 | $1,000 | $6,441 | 4.3 | 9,090 |
| **Motor Upgrades** | | | **48** | **0.0** | **0** | **$8** | **$774** | **$0** | **$774** | **100.0** | **48** |
| ECM 5 | Premium Efficiency Motors | No | 48 | 0.0 | 0 | $8 | $774 | $0 | $774 | 100.0 | 48 |
| **Variable Frequency Drive (VFD) Measures** | | | **8,847** | **2.0** | **0** | **$1,436** | **$10,402** | **$2,000** | **$8,402** | **5.9** | **8,909** |
| ECM 6 | Install VFDs on Boiler Feedwater Pumps | No | 1,632 | 0.8 | 0 | $265 | $6,415 | $200 | $6,215 | 23.5 | 1,643 |
| ECM 7 | Install VFDs on Process Pumps | Yes | 7,215 | 1.2 | 0 | $1,171 | $3,987 | $1,800 | $2,187 | 1.9 | 7,265 |
| **Gas Heating (HVAC/Process) Replacement** | | | **0** | **0.0** | **74** | **$620** | **$51,466** | **$7,184** | **$44,282** | **71.4** | **8,692** |
| ECM 8 | Install High Efficiency Hot Water Boilers | Yes | 0 | 0.0 | 63 | $525 | $7,828 | $2,000 | $5,828 | 11.1 | 7,365 |
| ECM 9 | Install High Efficiency Steam Boilers | No | 0 | 0.0 | 11 | $95 | $43,638 | $5,184 | $38,454 | 406.2 | 1,327 |
| **HVAC System Improvements** | | | **0** | **0.0** | **10** | **$80** | **$63** | **$20** | **$43** | **0.5** | **1,127** |
| ECM 10 | Install Pipe Insulation | Yes | 0 | 0.0 | 10 | $80 | $63 | $20 | $43 | 0.5 | 1,127 |
| **Domestic Water Heating Upgrade** | | | **0** | **0.0** | **7** | **$55** | **$100** | **$100** | **$0** | **0.0** | **778** |
| ECM 11 | Install Low-Flow DHW Devices | Yes | 0 | 0.0 | 7 | $55 | $100 | $100 | $0 | 0.0 | 778 |
| **Food Service & Refrigeration Measures** | | | **343** | **0.0** | **0** | **$56** | **$230** | **$0** | **$230** | **4.1** | **345** |
| ECM 12 | Vending Machine Control | Yes | 343 | 0.0 | 0 | $56 | $230 | $0 | $230 | 4.1 | 345 |
| **Custom Measures** | | | **0** | **0.0** | **251** | **$2,096** | **$23,000** | **$0** | **$23,000** | **11.0** | **29,389** |
| ECM 13 | Semi-automatic Cover for Swimming Pool | Yes | 0 | 0.0 | 251 | $2,096 | $23,000 | $0 | $23,000 | 11.0 | 29,389 |
| **TOTALS** | | | **46,534** | **7.7** | **333** | **$10,331** | **$102,223** | **$12,108** | **$90,115** | **8.7** | **85,841** |

* - 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)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | **28,021** | **4.3** | **-6** | **$4,493** | **$8,747** | **$1,804** | **$6,943** | **1.5** | **27,463** |
| ECM 1 | Install LED Fixtures | 1,823 | 0.3 | 0 | $292 | $1,586 | $0 | $1,586 | 5.4 | 1,787 |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | 189 | 0.1 | 0 | $30 | $257 | $40 | $217 | 7.2 | 185 |
| ECM 3 | Retrofit Fixtures with LED Lamps | 26,009 | 4.0 | -6 | $4,171 | $6,904 | $1,764 | $5,140 | 1.2 | 25,490 |
| **Lighting Control Measures** | | **9,275** | **1.3** | **-2** | **$1,487** | **$7,441** | **$1,000** | **$6,441** | **4.3** | **9,090** |
| ECM 4 | Install Occupancy Sensor Lighting Controls | 9,275 | 1.3 | -2 | $1,487 | $7,441 | $1,000 | $6,441 | 4.3 | 9,090 |
| **Variable Frequency Drive (VFD) Measures** | | **7,215** | **1.2** | **0** | **$1,171** | **$3,987** | **$1,800** | **$2,187** | **1.9** | **7,265** |
| ECM 7 | Install VFDs on Process Pumps | 7,215 | 1.2 | 0 | $1,171 | $3,987 | $1,800 | $2,187 | 1.9 | 7,265 |
| **Gas Heating (HVAC/Process) Replacement** | | **0** | **0.0** | **63** | **$525** | **$7,828** | **$2,000** | **$5,828** | **11.1** | **7,365** |
| ECM 8 | Install High Efficiency Hot Water Boilers | 0 | 0.0 | 63 | $525 | $7,828 | $2,000 | $5,828 | 11.1 | 7,365 |
| **HVAC System Improvements** | | **0** | **0.0** | **10** | **$80** | **$63** | **$20** | **$43** | **0.5** | **1,127** |
| ECM 10 | Install Pipe Insulation | 0 | 0.0 | 10 | $80 | $63 | $20 | $43 | 0.5 | 1,127 |
| **Domestic Water Heating Upgrade** | | **0** | **0.0** | **7** | **$55** | **$100** | **$100** | **$0** | **0.0** | **778** |
| ECM 11 | Install Low-Flow DHW Devices | 0 | 0.0 | 7 | $55 | $100 | $100 | $0 | 0.0 | 778 |
| **Food Service & Refrigeration Measures** | | **343** | **0.0** | **0** | **$56** | **$230** | **$0** | **$230** | **4.1** | **345** |
| ECM 12 | Vending Machine Control | 343 | 0.0 | 0 | $56 | $230 | $0 | $230 | 4.1 | 345 |
| **Custom Measures** | | **0** | **0.0** | **251** | **$2,096** | **$23,000** | **$0** | **$23,000** | **11.0** | **29,389** |
| ECM 13 | Semi-automatic Cover for Swimming Pool | 0 | 0.0 | 251 | $2,096 | $23,000 | $0 | $23,000 | 11.0 | 29,389 |
| **TOTALS** | | **44,854** | **6.9** | **322** | **$9,964** | **$51,396** | **$6,724** | **$44,672** | **4.5** | **82,822** |

* - 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)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | **28,021** | **4.3** | **-6** | **$4,493** | **$8,747** | **$1,804** | **$6,943** | **1.5** | **27,463** |
| ECM 1 | Install LED Fixtures | 1,823 | 0.3 | 0 | $292 | $1,586 | $0 | $1,586 | 5.4 | 1,787 |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | 189 | 0.1 | 0 | $30 | $257 | $40 | $217 | 7.2 | 185 |
| ECM 3 | Retrofit Fixtures with LED Lamps | 26,009 | 4.0 | -6 | $4,171 | $6,904 | $1,764 | $5,140 | 1.2 | 25,490 |

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

### ECM 1: Install LED Fixtures

Replace existing fixtures containing high intensity discharge (HID) lamps with new LED light fixtures. This measure saves energy by installing LEDs which use less power than other technologies with a comparable light output.

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

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

**Affected building areas:** natatorium HID fixtures.

### ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

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

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

**Affected building areas**: cafeteria storage room fluorescent fixtures with T12 tubes.

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

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

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

**Affected building areas:** all areas with fluorescent fixtures with T8 tubes, auditorium incandescent and CFL fixtures.

## 4.2 Lighting Controls

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated M&L Cost ($) | Estimated Incentive ($)* | Estimated Net M&L Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Control Measures** | | **9,275** | **1.3** | **-2** | **$1,487** | **$7,441** | **$1,000** | **$6,441** | **4.3** | **9,090** |
| ECM 4 | Install Occupancy Sensor Lighting Controls | 9,275 | 1.3 | -2 | $1,487 | $7,441 | $1,000 | $6,441 | 4.3 | 9,090 |

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

**ECM 4: Install Occupancy Sensor Lighting Controls**

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

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

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

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

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

## 4.3 Motors

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated M&L Cost ($) | Estimated Incentive ($)* | Estimated Net M&L Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Motor Upgrades** | | **48** | **0.0** | **0** | **$8** | **$774** | **$0** | **$774** | **100.0** | **48** |
| ECM 5 | Premium Efficiency Motors | 48 | 0.0 | 0 | $8 | $774 | $0 | $774 | 100.0 | 48 |

## ECM 5: Premium Efficiency Motors

We evaluated replacing standard efficiency motors with IHP 2014 efficiency motors. This evaluation assumes that existing motors will be replaced with motors of equivalent size and type. In some cases, additional savings may be possible by downsizing motors to better meet the motor's current load requirements.

**Affected motor:**

| Location | Area(s)/System(s) Served | Motor Quantity | Motor Application | HP Per Motor | Additional Motor Description |
|---|---|---|---|---|---|
| Boiler Room | Boiler #1 | 1 | Combustion Air Fan | 3.0 | Combustion Air Fan |

Savings are based on the difference between baseline and proposed efficiencies and the assumed annual operating hours. The base case motor energy consumption is estimated using the efficiencies found on nameplates or estimated based on the age of the motor and our best estimates of motor run hours. Efficiencies of proposed motor upgrades are obtained from the current *New Jersey's Clean Energy Program Protocols to Measure Resource Savings*.

# 4.4 Variable Frequency Drives (VFD)

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated M&L Cost ($) | Estimated Incentive ($)* | Estimated Net M&L Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Variable Frequency Drive (VFD) Measures** | | **8,847** | **2.0** | **0** | **$1,436** | **$10,402** | **$2,000** | **$8,402** | **5.9** | **8,909** |
| ECM 6 | Install VFDs on Boiler Feedwater Pumps | 1,632 | 0.8 | 0 | $265 | $6,415 | $200 | $6,215 | 23.5 | 1,643 |
| ECM 7 | Install VFDs on Process Pumps | 7,215 | 1.2 | 0 | $1,171 | $3,987 | $1,800 | $2,187 | 1.9 | 7,265 |

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

## ECM 6: Install VFDs on Boiler Feedwater Pumps

We evaluated installing VFDs to control boiler feedwater pumps. The existing level control valve will need to be maintained fully open and its control signal used by the VFD to modulate the feedwater speed.

Energy savings result from reducing the pump motor speed (and power) at reduced feedwater flow. The magnitude of energy savings is based on the estimated amount of time that the pumping system will operate at reduced load.

**ECM 7: Install VFDs on Process Pumps**

Consider installing a VFD to control the pool filtration pump. Regulations require that pool water be circulated through filtering systems so that that pool water is regularly replaced by filtered water, measured by "turnover". The turnover rate of a swimming pool is the amount of time it takes for the pumping and filtration systems to cycle all of the water in the pool one time, meaning all of the water in the pool has been filtered and cleaned. In cases where the turnover is higher than required by state laws or local ordinance, variable speed drives can often be used to control the speed of the circulation pumps, saving energy. In some jurisdictions the turnover rate can be reduced when the pool is not occupied for a significant period of time.

A pool expert can measure the turnover and evaluate whether the filtration system can accommodate reduced flow. Typically, a simple timeclock and VFD can be used to operate the pool filter at low speed when the pool is not in use for an extended period and then return the filter pump to full speed while the pool is in use. Energy savings accrue from the hours the pump can be operated at reduced speed.

## 4.5 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)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Gas Heating (HVAC/Process) Replacement** | | **0** | **0.0** | **74** | **$620** | **$51,466** | **$7,184** | **$44,282** | **71.4** | **8,692** |
| ECM 8 | Install High Efficiency Hot Water Boilers | 0 | 0.0 | 63 | $525 | $7,828 | $2,000 | $5,828 | 11.1 | 7,365 |
| ECM 9 | Install High Efficiency Steam Boilers | 0 | 0.0 | 11 | $95 | $43,638 | $5,184 | $38,454 | 406.2 | 1,327 |

**ECM 8: Install High Efficiency Hot Water Boilers**

Replace the inefficient hot water pool boiler with a high efficiency hot water boiler. Energy savings results from improved combustion efficiency and reduced standby losses at low loads.

The most notable efficiency improvement is condensing hydronic boilers which can achieve over 90% efficiency under the proper conditions. Condensing hydronic boilers typically operate at efficiencies between 85% and 87% (comparable to other high efficiency boilers) when the return water temperature is above 130°F. The boiler efficiency increases as the return water temperature drops below 130°F. Condensing hydronic boilers are a good candidate for pool heating applications because return water temperatures are below 130°F.

For the purposes of this analysis, we evaluated the replacement of the boiler on a one-for-one basis with equipment of the same capacity. We recommend that you work with your mechanical design team to select a boiler that is sized appropriately for the heating load. In many cases installing multiple modular boilers rather than one or two large boilers will result in higher overall plant efficiency while providing additional system redundancy.

## ECM 9: Install High Efficiency Steam Boilers

We evaluated replacing the older inefficient steam boiler with a high efficiency steam boiler. 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 the boiler on a one-for-one basis with equipment of the same capacity. We recommend that you work with your mechanical design team to select a boiler that is sized appropriately for the heating load. In many cases installing multiple modular boilers rather than one or two large boilers will result in higher overall plant efficiency while providing additional system redundancy.

Replacing the boiler has a long payback based on energy savings and may not be justifiable based simply on energy considerations. However, the boiler has reached the end of its 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 a boiler that exceeds the minimum efficiency required by building codes.

# 4.6 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)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **HVAC System Improvements** | | **0** | **0.0** | **10** | **$80** | **$63** | **$20** | **$43** | **0.5** | **1,127** |
| ECM 10 | Install Pipe Insulation | 0 | 0.0 | 10 | $80 | $63 | $20 | $43 | 0.5 | 1,127 |

## ECM 10: Install Pipe Insulation

Install insulation on steam 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:** steam system piping around the condensate pumps.

## 4.7 Domestic Water Heating

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated M&L Cost ($) | Estimated Incentive ($)* | Estimated Net M&L Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Domestic Water Heating Upgrade** | | **0** | **0.0** | **7** | **$55** | **$100** | **$100** | **$0** | **0.0** | **778** |
| ECM 11 | Install Low-Flow DHW Devices | 0 | 0.0 | 7 | $55 | $100 | $100 | $0 | 0.0 | 778 |

### ECM 11: Install Low-Flow DHW Devices

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

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

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

## 4.8 Food Service & Refrigeration Measures

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated M&L Cost ($) | Estimated Incentive ($)* | Estimated Net M&L Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Food Service & Refrigeration Measures** | | **343** | **0.0** | **0** | **$56** | **$230** | **$0** | **$230** | **4.1** | **345** |
| ECM 12 | Vending Machine Control | 343 | 0.0 | 0 | $56 | $230 | $0 | $230 | 4.1 | 345 |

### ECM 12: Vending Machine Control

Vending machines operate continuously, even during unoccupied hours. Install occupancy sensor controls to reduce energy use. These controls power down vending machines when the vending machine area has been vacant for some time, and they power up the machines at necessary regular intervals or when the surrounding area is occupied. Energy savings are dependent on the vending machine and activity level in the area surrounding the machines.

## 4.9 Custom Measures

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated M&L Cost ($) | Estimated Incentive ($)* | Estimated Net M&L Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Custom Measures** | | **0** | **0.0** | **251** | **$2,096** | **$23,000** | **$0** | **$23,000** | **11.0** | **29,389** |
| ECM 13 | Semi-automatic Cover for Swimming Pool | 0 | 0.0 | 251 | $2,096 | $23,000 | $0 | $23,000 | 11.0 | 29,389 |

### ECM 13: Semi-automatic Cover for Swimming Pool

Install a pool cover to reduce the energy use associated with conditioning the natatorium space as well as heating the pool water. Consider installing a retractable pool cover which will reduce pool water evaporation during unoccupied periods of time. Evaporation occurs when the pool water is heated to a temperature above the temperature of the air. Natatorium's have high ventilation loads to control humidity. Reducing evaporation from the pool surface will result in water savings, reduced chemical treatment, pool water heating energy and ventilation savings due to lower humidity levels when the cover is in place. Implementation of this measure would require installation of a pool cover, reel system and control system. Installation of these systems are contingent on there being adequate space located around the pool for mounting.

# 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 emissions[5] . Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

## Weatherization

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

## Doors and Windows

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

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

## Lighting Maintenance

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

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

## Lighting Controls

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

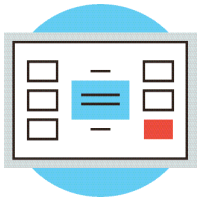
## Motor Maintenance

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

## Fans to Reduce Cooling Load

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

## Thermostat Schedules and Temperature Resets



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

## AC System Evaporator/Condenser Coil Cleaning

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

## 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.

## Water Heater Maintenance

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

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

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

## Water Conservation


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

For more information regarding water conservation go to the EPA's WaterSense® website[6] or download a copy of EPA's "WaterSense® at Work: Best Management Practices for Commercial and Institutional Facilities"[7] 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.

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

[7] 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.

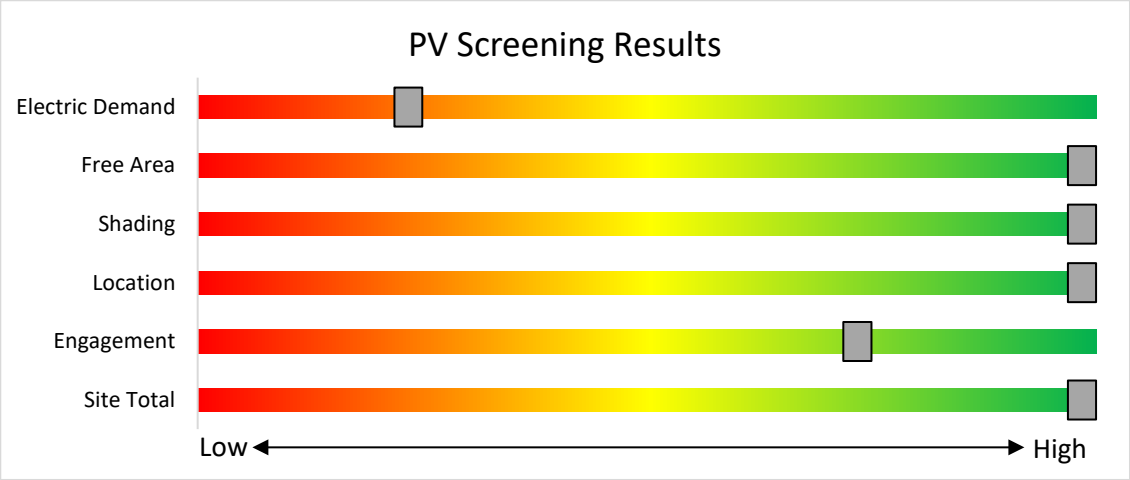
## 6.1 Solar Photovoltaic

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 high potential for installing a PV array.

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

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




| | | |
|---|---|---|
| **Potential** | High | |
| **System Potential** | 76 | kW DC STC |
| **Electric Generation** | 90,545 | kWh/yr |
| **Displaced Cost** | $14,690 | /yr |
| **Installed Cost** | $197,600 | |

*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.

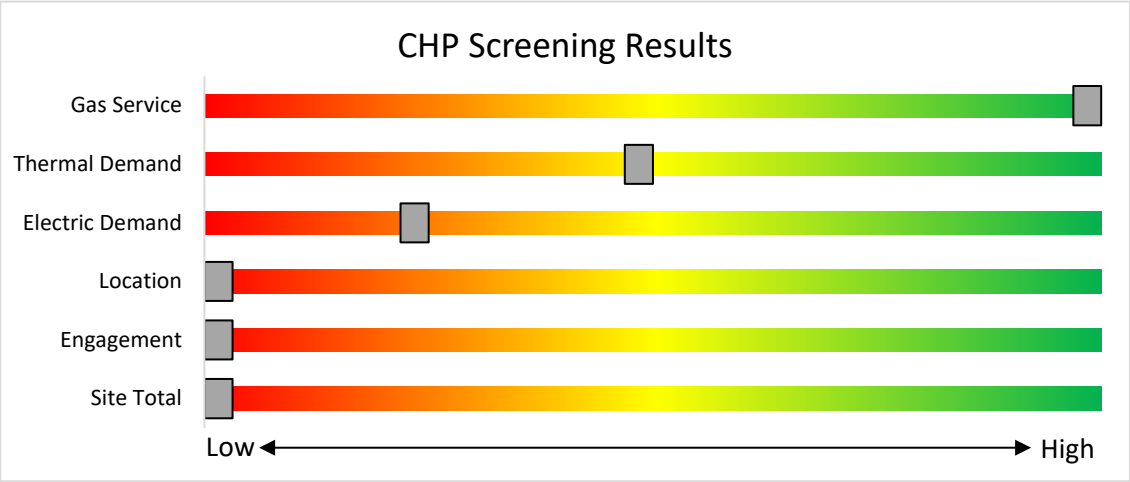



*Figure 10 - Combined Heat and Power Screening*

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**<br>*Flexibility to install at your own pace* | **Direct Install**<br>*Turnkey installation* | **Pay for Performance**<br>*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.<br>Average peak demand should be below 200 kW.<br>Not suitable for significant building shell issues. | Mid to large size facilities looking to implement as many measures as possible at one time.<br>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.<br>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.<br>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. | | | |

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

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

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

**How to Participate**

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

## 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 x 0.85 = $129.20/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.

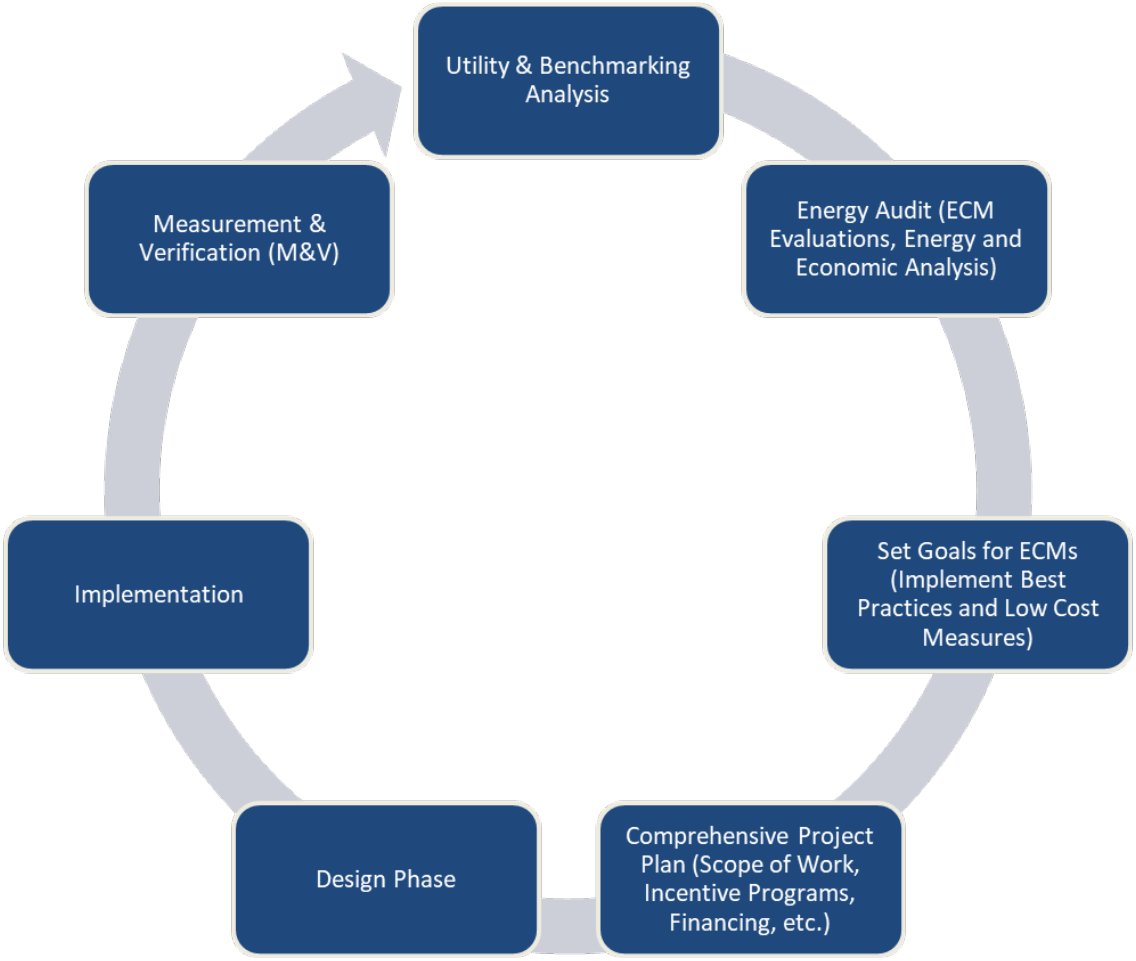



*Figure 11 – Project Development Cycle*

# 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 website[8].

## 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 website[9].

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

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

# APPENDIX A: EQUIPMENT INVENTORY & RECOMMENDATIONS

## Lighting Inventory & Recommendations

| | Existing Conditions | | | | | | Proposed Conditions | | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Fixture Quantity | Fixture Description | Control System | Light Level | Watts per Fixture | Annual Operating Hours | ECM # | Fixture Recommendation | Add Controls? | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Estimated M&L Cost ($) | Total Incentives | Simple Payback w/ Incentives in Years |
| Classroom 101 | 9 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,640 | 3 | Relamp | No | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,640 | 0.3 | 1,331 | 0 | $213 | $657 | $180 | 2.2 |
| Storage 101 | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 1,100 | 3, 4 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 759 | 0.0 | 92 | 0 | $15 | $189 | $20 | 11.4 |
| Classroom 102 | 9 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,640 | 3 | Relamp | No | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,640 | 0.3 | 1,331 | 0 | $213 | $657 | $180 | 2.2 |
| Classroom 103 | 9 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,640 | 3 | Relamp | No | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,640 | 0.3 | 1,331 | 0 | $213 | $657 | $180 | 2.2 |
| Classroom 104 | 9 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,640 | 3 | Relamp | No | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,640 | 0.3 | 1,331 | 0 | $213 | $657 | $180 | 2.2 |
| Classroom 105 | 9 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,640 | 3 | Relamp | No | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,640 | 0.3 | 1,331 | 0 | $213 | $657 | $180 | 2.2 |
| Storage 105a | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | S | 93 | 1,100 | 3 | Relamp | No | 1 | LED - Linear Tubes: (3) 4' Lamps | Wall Switch | 44 | 1,100 | 0.0 | 54 | 0 | $9 | $55 | $15 | 4.6 |
| Auditorium | 10 | Incandescent: (2) 150W Screw-in Lamps | Wall Switch | S | 300 | 3,520 | 3, 4 | Relamp | Yes | 10 | LED Lamps: A19 Lamps | Occupancy Sensor | 45 | 2,429 | 1.3 | 9,467 | -2 | $1,518 | $615 | $55 | 0.4 |
| Auditorium | 5 | Compact Fluorescent: (1) 25W G25 Screw-In Lamp | Wall Switch | S | 25 | 3,520 | 3, 4 | Relamp | Yes | 5 | LED Lamps: G25 Lamps | Occupancy Sensor | 18 | 2,429 | 0.0 | 221 | 0 | $36 | $396 | $45 | 9.9 |
| Auditorium | 6 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 6 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Auditorium | 2 | Incandescent: (1) 150W Screw-in Lamps | Wall Switch | S | 150 | 3,520 | 3, 4 | Relamp | Yes | 2 | LED Lamps: A19 Lamps | Occupancy Sensor | 23 | 2,429 | 0.1 | 944 | 0 | $151 | $150 | $22 | 0.8 |
| Auditorium | 15 | LED Lamps: (1) 9.5W A19 Screw-In Lamp | Wall Switch | S | 10 | 3,520 | 4 | None | Yes | 15 | LED Lamps: (1) 9.5W A19 Screw-In Lamp | Occupancy Sensor | 10 | 2,429 | 0.0 | 155 | 0 | $25 | $270 | $35 | 9.4 |
| Basement Hallway | 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 |
| Basement Hallway | 4 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | S | 29 | 4,380 | 4 | None | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 3,022 | 0.0 | 158 | 0 | $25 | $225 | $140 | 3.4 |
| Bathroom 102 | 1 | Linear Fluorescent - T8: 2' T8 (17W) - 3L | Wall Switch | S | 53 | 3,520 | 3 | Relamp | No | 1 | LED - Linear Tubes: (3) 2' Lamps | Wall Switch | 26 | 3,520 | 0.0 | 97 | 0 | $16 | $49 | $9 | 2.6 |
| Bathroom 103 | 1 | Linear Fluorescent - T8: 2' T8 (17W) - 3L | Occupancy Sensor | S | 53 | 2,640 | 3 | Relamp | No | 1 | LED - Linear Tubes: (3) 2' Lamps | Occupancy Sensor | 26 | 2,640 | 0.0 | 73 | 0 | $12 | $49 | $9 | 3.4 |
| Bathroom 104 | 1 | Linear Fluorescent - T8: 2' T8 (17W) - 3L | Occupancy Sensor | S | 53 | 2,640 | 3 | Relamp | No | 1 | LED - Linear Tubes: (3) 2' Lamps | Occupancy Sensor | 26 | 2,640 | 0.0 | 73 | 0 | $12 | $49 | $9 | 3.4 |
| Bathroom 105 | 1 | Linear Fluorescent - T8: 2' T8 (17W) - 2L | Wall Switch | S | 33 | 3,520 | 3 | Relamp | No | 1 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 3,520 | 0.0 | 56 | 0 | $9 | $33 | $6 | 2.9 |
| Boiler Room | 3 | LED Lamps: (1) 9.5W A19 Screw-In Lamp | Wall Switch | S | 10 | 3,520 | | None | No | 3 | LED Lamps: (1) 9.5W A19 Screw-In Lamp | Wall Switch | 10 | 3,520 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Boiler Room | 3 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | S | 29 | 3,520 | | None | No | 3 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 3,520 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 201 | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | S | 58 | 2,640 | | None | No | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,640 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 202 | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | S | 58 | 2,640 | | None | No | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,640 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 203 | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | S | 58 | 2,640 | | None | No | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,640 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 204 | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | S | 58 | 2,640 | | None | No | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,640 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 205 | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | S | 58 | 2,640 | | None | No | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,640 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

| | Existing Conditions | | | | | | Proposed Conditions | | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Fixture Quantity | Fixture Description | Control System | Light Level | Watts per Fixture | Annual Operating Hours | ECM # | Fixture Recommendation | Add Controls? | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Estimated M&L Cost ($) | Total Incentives | Simple Payback w/ Incentives in Years |
| Exterior Lighting | 7 | LED - Fixtures: Security | Timeclock | | 20 | 4,380 | | None | No | 7 | LED - Fixtures: Security | Timeclock | 20 | 4,380 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Main Hallway | 5 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 5 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Main Hallway | 11 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 4,380 | 3 | Relamp | No | 11 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 4,380 | 0.2 | 1,590 | 0 | $255 | $402 | $110 | 1.1 |
| Main Office | 9 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,640 | 3 | Relamp | No | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,640 | 0.3 | 1,331 | 0 | $213 | $657 | $180 | 2.2 |
| Principals Office | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | S | 93 | 2,640 | 3 | Relamp | No | 4 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,640 | 0.1 | 523 | 0 | $84 | $219 | $60 | 1.9 |
| Security Office | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | S | 93 | 2,640 | 3 | Relamp | No | 2 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,640 | 0.0 | 261 | 0 | $42 | $110 | $30 | 1.9 |
| Storage - Small Group | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | S | 93 | 1,100 | 3 | Relamp | No | 1 | LED - Linear Tubes: (3) 4' Lamps | Wall Switch | 44 | 1,100 | 0.0 | 54 | 0 | $9 | $55 | $15 | 4.6 |
| Stage | 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 |
| Stage Bathroom | 1 | Linear Fluorescent - T8: 2' T8 (17W) - 2L | Occupancy Sensor | S | 33 | 2,640 | 3 | Relamp | No | 1 | LED - Linear Tubes: (2) 2' Lamps | Occupancy Sensor | 17 | 2,640 | 0.0 | 42 | 0 | $7 | $33 | $6 | 3.9 |
| Stage Hallway | 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 |
| Stage Hallway | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 4,380 | 3 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 4,380 | 0.0 | 145 | 0 | $23 | $37 | $10 | 1.1 |
| Bathroom - Stairs 1 | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 2,640 | 3 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,640 | 0.0 | 87 | 0 | $14 | $37 | $10 | 1.9 |
| Bathroom - Stairs 2 | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 2,640 | 3 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,640 | 0.0 | 87 | 0 | $14 | $37 | $10 | 1.9 |
| Stairs 1 | 1 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 1 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Stairs 1 | 7 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | | 62 | 4,380 | 3 | Relamp | No | 7 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 4,380 | 0.1 | 1,012 | 0 | $162 | $256 | $70 | 1.1 |
| Stairs 2 | 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 |
| Stairs 2 | 7 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | | 62 | 4,380 | 3 | Relamp | No | 7 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 4,380 | 0.1 | 1,012 | 0 | $162 | $256 | $70 | 1.1 |
| Stairs 3 | 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 |
| Stairs 3 | 8 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | | 62 | 4,380 | 3 | Relamp | No | 8 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 4,380 | 0.1 | 1,156 | 0 | $185 | $292 | $80 | 1.1 |
| 2nd Floor Hallway | 5 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 5 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| 2nd Floor Hallway | 11 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 4,380 | 3 | Relamp | No | 11 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 4,380 | 0.2 | 1,590 | 0 | $255 | $402 | $110 | 1.1 |
| Classroom ESL | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | S | 29 | 2,640 | | None | No | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,640 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Corridor - Teachers Lounge | 1 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 1 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Corridor - Teachers Lounge | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | S | 29 | 4,380 | | None | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 4,380 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Office 201c | 2 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | S | 29 | 3,520 | 4 | None | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,429 | 0.0 | 63 | 0 | $10 | $116 | $20 | 9.5 |

| | Existing Conditions | | | | | | Proposed Conditions | | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Fixture Quantity | Fixture Description | Control System | Light Level | Watts per Fixture | Annual Operating Hours | ECM # | Fixture Recommendation | Add Controls? | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Estimated M&L Cost ($) | Total Incentives | Simple Payback w/ Incentives in Years |
| Office 204c | 2 | LED - Linear Tubes: (3) 4' Lamps | Wall Switch | S | 44 | 3,520 | 4 | None | Yes | 2 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,429 | 0.0 | 95 | 0 | $15 | $116 | $20 | 6.3 |
| Office 202a | 2 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | S | 29 | 3,520 | 4 | None | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,429 | 0.0 | 63 | 0 | $10 | $116 | $20 | 9.5 |
| Restroom - Male 2nd Floor | 4 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | S | 44 | 2,640 | | None | No | 4 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,640 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Restroom - Teachers Lounge | 1 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | S | 29 | 2,640 | | None | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,640 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Server Room 205a | 2 | LED - Linear Tubes: (3) 4' Lamps | Wall Switch | S | 44 | 3,520 | 4 | None | Yes | 2 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,429 | 0.0 | 95 | 0 | $15 | $116 | $20 | 6.3 |
| Storage 203a | 2 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | S | 29 | 1,100 | 4 | None | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 759 | 0.0 | 20 | 0 | $3 | $116 | $0 | 36.6 |
| Teachers Lounge | 6 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | S | 58 | 3,520 | 4 | None | Yes | 6 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,429 | 0.1 | 380 | 0 | $61 | $270 | $35 | 3.9 |
| 3rd Floor Hallway/Computer Lab | 4 | Exit Signs: LED - 2 W Lamp | None | | 6 | 8,760 | | None | No | 4 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| 3rd Floor Hallway/Computer Lab | 58 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | S | 29 | 2,640 | | None | No | 58 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,640 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 301 | 9 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | S | 58 | 3,520 | 4 | None | Yes | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,429 | 0.1 | 570 | 0 | $91 | $270 | $35 | 2.6 |
| Classroom 302 | 12 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | S | 58 | 3,520 | 4 | None | Yes | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,429 | 0.1 | 759 | 0 | $122 | $270 | $35 | 1.9 |
| Classroom 303 | 12 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | S | 58 | 3,520 | 4 | None | Yes | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,429 | 0.1 | 759 | 0 | $122 | $270 | $35 | 1.9 |
| Classroom 304 | 9 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | S | 58 | 3,520 | 4 | None | Yes | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,429 | 0.1 | 570 | 0 | $91 | $270 | $35 | 2.6 |
| Classroom 306 | 9 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | S | 58 | 3,520 | 4 | None | Yes | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,429 | 0.1 | 570 | 0 | $91 | $270 | $35 | 2.6 |
| Classroom 307 | 8 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | S | 58 | 3,520 | 4 | None | Yes | 8 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,429 | 0.1 | 506 | 0 | $81 | $270 | $35 | 2.9 |
| Classroom 308 | 9 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | S | 58 | 3,520 | 4 | None | Yes | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,429 | 0.1 | 570 | 0 | $91 | $270 | $35 | 2.6 |
| Classroom 309 | 5 | LED - Linear Tubes: (3) 4' Lamps | Wall Switch | S | 44 | 3,520 | 4 | None | Yes | 5 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,429 | 0.0 | 237 | 0 | $38 | $270 | $35 | 6.2 |
| Library 305 | 9 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | S | 58 | 3,520 | 4 | None | Yes | 9 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,429 | 0.1 | 570 | 0 | $91 | $270 | $35 | 2.6 |
| Office 304c | 2 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | S | 58 | 3,520 | 4 | None | Yes | 2 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,429 | 0.0 | 127 | 0 | $20 | $116 | $20 | 4.7 |
| Office 306c | 2 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | S | 58 | 3,520 | 4 | None | Yes | 2 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,429 | 0.0 | 127 | 0 | $20 | $116 | $20 | 4.7 |
| Restroom - Male 3rd Floor | 2 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | S | 44 | 2,640 | | None | No | 2 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,640 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Boiler Pump Room / Storage | 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 |
| Boiler Pump Room / Storage | 5 | LED Lamps: (1) 9.5W A19 Screw-In Lamp | Wall Switch | S | 10 | 3,520 | 4 | None | Yes | 5 | LED Lamps: (1) 9.5W A19 Screw-In Lamp | Occupancy Sensor | 10 | 2,429 | 0.0 | 52 | 0 | $8 | $270 | $0 | 32.5 |
| Boiler Pump Room / Storage | 4 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | S | 29 | 3,520 | 4 | None | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,429 | 0.0 | 127 | 0 | $20 | $270 | $0 | 13.3 |
| Cafeteria | 22 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | S | 29 | 2,640 | | None | No | 22 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,640 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

| | Existing Conditions | | | | | | Proposed Conditions | | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Fixture Quantity | Fixture Description | Control System | Light Level | Watts per Fixture | Annual Operating Hours | ECM # | Fixture Recommendation | Add Controls? | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Estimated M&L Cost ($) | Total Incentives | Simple Payback w/ Incentives in Years |
| Gymnasium | 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 |
| Gymnasium | 36 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | S | 29 | 3,520 | 4 | None | Yes | 36 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,429 | 0.2 | 1,139 | 0 | $183 | $810 | $105 | 3.9 |
| Office - Custodian | 2 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | S | 29 | 3,520 | 4 | None | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,429 | 0.0 | 63 | 0 | $10 | $116 | $20 | 9.5 |
| Pool | 10 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | S | 29 | 3,520 | 4 | None | Yes | 10 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,429 | 0.0 | 316 | 0 | $51 | $270 | $35 | 4.6 |
| Pool | 7 | High-Pressure Sodium: (1) 70W Lamp | Wall Switch | S | 95 | 3,520 | 1, 4 | Fixture Replacement | Yes | 7 | LED - Fixtures: Wall Sconces | Occupancy Sensor | 21 | 2,429 | 0.3 | 1,984 | 0 | $318 | $1,856 | $35 | 5.7 |
| Restroom - Boiler Room | 1 | Linear Fluorescent - T8: 2' T8 (17W) - 1L | Wall Switch | S | 22 | 3,520 | 3 | Relamp | No | 1 | LED - Linear Tubes: (1) 2' Lamp | Wall Switch | 9 | 3,520 | 0.0 | 48 | 0 | $8 | $16 | $3 | 1.7 |
| Restroom - Female Basement | 6 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | S | 29 | 3,520 | 4 | None | Yes | 6 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,429 | 0.0 | 190 | 0 | $30 | $270 | $35 | 7.7 |
| Restroom - Male Basement | 4 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | S | 29 | 3,520 | 4 | None | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,429 | 0.0 | 127 | 0 | $20 | $270 | $35 | 11.6 |
| Storage - Cafeteria | 2 | Linear Fluorescent - T12: 8' T12 (75W) - 2L | Wall Switch | S | 158 | 1,100 | 2, 4 | Relamp & Reballast | Yes | 2 | LED - Linear Tubes: (2) 8' Lamps | Occupancy Sensor | 72 | 759 | 0.1 | 238 | 0 | $38 | $373 | $40 | 8.7 |

## Motor Inventory & Recommendations

| | | Existing Conditions | | | | | | | | | Proposed Conditions | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | Motor Quantity | Motor Application | HP Per Motor | Full Load Efficiency | VFD Control? | Manufacturer | Model | Remaining Useful Life | Annual Operating Hours | ECM # | Install High Efficiency Motors? | Full Load Efficiency | Install VFDs? | Number of VFDs | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Estimated M&L Cost ($) | Total Incentives | Simple Payback w/ Incentives in Years |
| Boiler Pump Room / Storage | Condensate System | 2 | Condensate Pump | 2.0 | 84.0% | No | Franklin Electric | | W | 2,745 | | No | 84.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Boiler Pump Room / Storage | Boiler Feed Water | 2 | Boiler Feed Water Pump | 0.8 | 77.0% | No | Skidmore | | W | 2,745 | 6 | No | 81.1% | Yes | 2 | 0.8 | 1,632 | 0 | $265 | $6,415 | $200 | 23.5 |
| Boiler Pump Room / Storage | Pool Filter Pump | 1 | Other | 5.0 | 85.5% | No | Pentair | | W | 8,760 | 7 | No | 86.5% | Yes | 1 | 1.2 | 7,215 | 0 | $1,171 | $3,987 | $1,800 | 1.9 |
| Boiler Pump Room / Storage | Condensate System | 2 | Condensate Pump | 0.8 | 77.0% | No | Century | | W | 2,745 | | No | 77.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Boiler Room | Pool Boiler | 1 | Other | 0.8 | 77.0% | No | Century | | W | 2,745 | | No | 77.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Office - Custodian | Domestic Hot Water | 1 | DHW Circulation Pump | 0.2 | 60.0% | No | Armstrong | | W | 8,760 | | No | 60.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Office - Custodian | Domestic Hot Water | 1 | DHW Circulation Pump | 0.1 | 60.0% | No | Bell & Gossett | | W | 8,760 | | No | 60.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Boiler Room | Boiler #2 | 1 | Combustion Air Fan | 1.5 | 82.5% | No | Marathon | | W | 1,360 | | No | 82.5% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Boiler Room | Boiler #1 | 1 | Combustion Air Fan | 3.0 | 84.0% | No | Gordon Piatt | | B | 1,360 | 5 | Yes | 85.5% | No | | 0.0 | 48 | 0 | $8 | $774 | $0 | 100.0 |
| Cafeteria | Cafeteria | 3 | Ventilation Fan | 0.3 | 65.0% | No | | | W | 2,745 | | No | 65.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Pool | Pool | 1 | Exhaust Fan | 0.5 | 70.0% | No | | | W | 2,745 | | No | 70.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Office - Custodian | Office - Custodian | 1 | Fan Coil Unit | 0.1 | 89.5% | No | | | W | 2,745 | | No | 89.5% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

## Packaged HVAC Inventory & Recommendations

| | | Existing Conditions | | | | | | | | | Proposed Conditions | | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | System Quantity | System Type | Cooling Capacity per Unit (Tons) | Heating Capacity per Unit (MBh) | Cooling Mode Efficiency (SEER/IEER/EER) | Heating Mode Efficiency | Manufacturer | Model | Remaining Useful Life | ECM # | Install High Efficiency System? | System Quantity | System Type | Cooling Capacity per Unit (Tons) | Heating Capacity per Unit (MBh) | Cooling Mode Efficiency (SEER/IEER/EER) | Heating Mode Efficiency | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Estimated M&L Cost ($) | Total Incentives | Simple Payback w/ Incentives in Years |
| Classroom 101 | Classroom 101 | 1 | Window AC | 3.00 | | 8.50 | | Friedrich | SL36N30 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 102 | Classroom 102 | 1 | Window AC | 3.00 | | 8.50 | | Friedrich | SL36N30 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 103 | Classroom 103 | 1 | Window AC | 3.00 | | 8.50 | | Friedrich | SL36N30 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 104 | Classroom 104 | 1 | Window AC | 3.00 | | 8.50 | | Friedrich | SL36N30 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 105 | Classroom 105 | 1 | Window AC | 3.00 | | 8.50 | | Friedrich | SL36N30 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 201 | Classroom 201 | 1 | Window AC | 1.00 | | 12.00 | | LG | LW1216ER | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 202 | Classroom 202 | 1 | Window AC | 3.00 | | 8.50 | | Friedrich | SL36N30 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 203 | Classroom 203 | 1 | Window AC | 2.33 | | 9.00 | | Frigidaire | FFRA2822R2 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 204 | Classroom 204 | 1 | Window AC | 1.00 | | 12.00 | | LG | LW1216ER | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 205 | Classroom 205 | 1 | Window AC | 1.19 | | 11.80 | | GE | AEL14AVL2 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Main Office | Main Office | 1 | Window AC | 1.26 | | 10.70 | | Frigidaire | LRA157MT1 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Principals Office | Principals Office | 1 | Window AC | 1.26 | | 10.70 | | Frigidaire | FAS155M1A1 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Security Office | Security Office | 1 | Window AC | 1.26 | | 10.70 | | Unknown | | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom ESL | Classroom ESL | 1 | Window AC | 0.96 | | 10.00 | | Panasonic | CW-1206FU | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Office - 201c | Office - 201c | 1 | Window AC | 0.42 | | 9.70 | | Haier | HWF05XCL-E | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Office - 204c | Office - 204c | 1 | Window AC | 0.42 | | 9.70 | | Haier | HWF05XCL-E | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Office 202a | Office 202a | 1 | Window AC | 0.42 | | 9.70 | | Haier | HWF05XCL-E | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Teachers Lounge | Teachers Lounge | 1 | Window AC | 1.02 | | 10.80 | | Soleus Air | GB-WAC-12ESE-C | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 301 | Classroom 301 | 1 | Window AC | 3.00 | | 8.50 | | Friedrich | SL36N30 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 302 | Classroom 302 | 1 | Window AC | 1.54 | | 10.70 | | Frigidaire | FFRH1822R21 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

| | | Existing Conditions | | | | | | | | | Proposed Conditions | | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | System Quantity | System Type | Cooling Capacity per Unit (Tons) | Heating Capacity per Unit (MBh) | Cooling Mode Efficiency (SEER/IEER/EER) | Heating Mode Efficiency | Manufacturer | Model | Remaining Useful Life | ECM # | Install High Efficiency System? | System Quantity | System Type | Cooling Capacity per Unit (Tons) | Heating Capacity per Unit (kBtu/hr) | Cooling Mode Efficiency (SEER/EER) | Heating Mode Efficiency | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Estimated M&L Cost ($) | Total Incentives | Simple Payback w/ Incentives in Years |
| Classroom 303 | Classroom 303 | 1 | Window AC | 3.00 | | 8.50 | | Friedrich | SL36N30 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 304 | Classroom 304 | 1 | Window AC | 3.00 | | 8.50 | | Friedrich | SL36N30 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 306 | Classroom 306 | 1 | Window AC | 1.52 | | 11.20 | | GE | AEL18DSQ1 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 307 | Classroom 307 | 1 | Window AC | 3.00 | | 8.50 | | Friedrich | SL36N30 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 308 | Classroom 308 | 1 | Window AC | 3.00 | | 8.50 | | Friedrich | SL36N30 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Classroom 309 | Classroom 309 | 1 | Window AC | 0.42 | | 11.10 | | Frigidaire | FFRA0511R112 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Library 305 | Library 305 | 1 | Window AC | 3.00 | | 8.50 | | Friedrich | SL36N30 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Office - 304c | Office - 304c | 1 | Window AC | 0.50 | | 9.70 | | GE | ASQ06LLS1 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Cafeteria | Cafeteria / Kitchen | 1 | Window AC | 1.00 | | 12.00 | | LG | LW1216ER | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Office - Custodian | Office - Custodian | 1 | Window AC | 1.52 | | 11.20 | | GE | AEL18DSQ1 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Storage - Cafeteria | Storage - Cafeteria | 1 | Window AC | 3.00 | | 8.50 | | Friedrich | SL36N30 | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

## Space Heating Boiler Inventory & Recommendations

| | | Existing Conditions | | | | | | Proposed Conditions | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | 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 | Heating System | 1 | Forced Draft Steam Boiler | 2,160 | Kewanee | LW800 Series | B | 9 | Yes | 1 | Forced Draft Steam Boiler | 2,160 | 81.00% | Et | 0.0 | 0 | 11 | $95 | $43,638 | $5,184 | 406.2 |
| Boiler Room | Heating System | 1 | Forced Draft Steam Boiler | 2,766 | Smith | 28A-S/W-14 | W | | No | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Boiler Room | Pool Heating System | 1 | Non-Condensing Hot Water Boiler | 200 | Raypak | 206A | W | 8 | Yes | 1 | Condensing Hot Water Boiler | 200 | 93.00% | AFUE | 0.0 | 0 | 63 | $525 | $7,828 | $2,000 | 11.1 |

## Pipe Insulation Recommendations

| | | Recommendation Inputs | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Affected | ECM # | Length of Uninsulated Pipe (ft) | Pipe Diameter (in) | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Estimated M&L Cost ($) | Total Incentives | Simple Payback w/ Incentives in Years |
| Boiler Pump Room / Storage | Vacuum/Air Pump | 10 | 5 | 4.00 | 0.0 | 0 | 10 | $80 | $63 | $20 | 0.5 |

## DHW Inventory & Recommendations

| | | Existing Conditions | | | | | Proposed Conditions | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | System Quantity | System Type | Manufacturer | Model | Remaining Useful Life | ECM # | Replace? | System Quantity | System Type | Fuel Type | System Efficiency | Efficiency Units | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Estimated M&L Cost ($) | Total Incentives | Simple Payback w/ Incentives in Years |
| Office - Custodian | Domestic Hot Water | 1 | Boiler | Lochivar | RWN399 | W | | No | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

## Low-Flow Device Recommendations

| | Recommedation Inputs | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | ECM # | Device Quantity | Device Type | Existing Flow Rate (gpm) | Proposed Flow Rate (gpm) | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Estimated M&L Cost ($) | Total Incentives | Simple Payback w/ Incentives in Years |
| Cornelia F. Bradford School | 11 | 14 | Faucet Aerator (Lavatory) | 2.20 | 0.50 | 0.0 | 0 | 7 | $55 | $100 | $100 | 0.0 |

## Commercial Refrigerator/Freezer Inventory & Recommendations

| | Existing Conditions | | | | | Proposed Conditions | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | 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 | Refrigerator Chest | Powers | 780 | No | | No | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Cafeteria | 1 | Refrigerator Chest | Beverage Air | SMF34 | Yes | | No | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Cafeteria | 1 | Refrigerator Chest | Powers | 569 | No | | No | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Cafeteria | 1 | Stand-Up Freezer, Solid Door (16 - 30 cu. ft.) | Continental | 1FE | Yes | | No | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Cafeteria | 1 | Stand-Up Freezer, Solid Door (31 - 50 cu. ft.) | Turbo Air | | Yes | | No | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Cafeteria | 1 | Stand-Up Refrigerator, Solid Door (31 - 50 cu. ft.) | Turbo Air | | Yes | | No | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

## Cooking Equipment Inventory & Recommendations

| | Existing Conditions | | | | | Proposed Conditions | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Quantity | Equipment Type | Manufacturer | Model | High Efficiency Equipement? | 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 |
| Cafeteria | 1 | Gas Convection Oven (Full Size) | Blodgett | | No | | No | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Cafeteria | 1 | Insulated Food Holding Cabinet (Full Size) | Cres Cor | | 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 |
| Cornelia F. Bradford School | 3 | Coffee Machine | 500 | No | | |
| Cornelia F. Bradford School | 114 | Desktop | 120 | Yes | | |
| Cornelia F. Bradford School | 3 | Microwave | 1,000 | No | | |
| Cornelia F. Bradford School | 1 | Paper Shredder | 146 | No | | |
| Cornelia F. Bradford School | 39 | Printer (Medium/Small) | 450 | Yes | | |
| Cornelia F. Bradford School | 2 | Printer/Copier (Large) | 600 | Yes | | |
| Cornelia F. Bradford School | 1 | Projector | 240 | No | | |
| Cornelia F. Bradford School | 5 | Refrigerator (Mini) | 175 | No | | |
| Cornelia F. Bradford School | 1 | Refrigerator (Residential) | 340 | No | | |
| Cornelia F. Bradford School | 1 | Serving Table (Chilled/Heated) | 3,400 | No | | |
| Cornelia F. Bradford School | 36 | Smart Board | 215 | Yes | | |
| Cornelia F. Bradford School | 18 | Television | 224 | No | | |
| Cornelia F. Bradford School | 6 | Water Cooler | 192 | No | | |
| Cornelia F. Bradford School | 1 | Server | 1,500 | No | | |

## Vending Machine Inventory & Recommendations

| | Existing Conditions | | Proposed Conditions | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Quantity | Vending Machine Type | ECM # | Install Controls? | 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 |
| Teacher's Lounge | 1 | Non-Refrigerated | 12 | Yes | 0.0 | 343 | 0 | $56 | $230 | $0 | 4.1 |

## Semi-automatic Cover for Swimming Pool Recommendation

| Existing Conditions | | | | Proposed Conditions | | | Energy Impact & Financial Analysis | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Description | Pool Heating System | Evaporation Heat Loss (MMBtu/yr) | Evaporation Water Loss (gal/yr) | Description | Evaporation Heat Loss (MMBtu) | Evaporation Water Loss (gal/yr) | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Estimated M&L Cost ($) | Base Incentives | Enhanced Incentives | Total Incentives | Total Net Cost | Payback w/o Incentives in Years | Simple Payback w/ Incentives in Years |
| Swimming Pool | Boiler | 463 | 42,381 | Semi-automatic Cover for Swimming Pool | 212 | 19,425 | 0 | 0 | 251 | $2,096 | $23,000 | $0 | $0 | $0 | $23,000 | 10.97 | 10.97 |

# 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

**78**

ENERGY STAR® Score[1]

### Cornelia F. Bradford School (PS #16)

**Primary Property Type:** K-12 School
**Gross Floor Area (ft²):** 61,684
**Built:** 1916

**For Year Ending:** January 31, 2020
**Date Generated:** April 26, 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 | Property Owner | Primary Contact |
|---|---|---|
| Cornelia F. Bradford School (PS #16)<br>96 Susses Street<br>Jersey City, New Jersey 07302 | Jersey City Public Schools<br>346 Claremont Avenue<br>Jersey City, NJ 07305<br>(201) 915-6074 | Regina Robinson<br>346 Claremont Avenue<br>Jersey City, NJ 07305<br>(201) 915-6074<br>rrobinson@jcboe.org |

**Property ID:** 13060667

### Energy Consumption and Energy Use Intensity (EUI)

**Site EUI**
60.3 kBtu/ft²

**Source EUI**
89.7 kBtu/ft²

| Annual Energy by Fuel | |
|---|---|
| Natural Gas (kBtu) | 2,790,415 (75%) |
| Electric - Grid (kBtu) | 929,429 (25%) |

| National Median Comparison | |
|---|---|
| National Median Site EUI (kBtu/ft²) | 78.3 |
| National Median Source EUI (kBtu/ft²) | 116.4 |
| % Diff from National Median Source EUI | -23% |
| **Annual Emissions** | |
| Greenhouse Gas Emissions (Metric Tons CO2e/year) | 237 |

### Signature & Stamp of Verifying Professional

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

LP Signature: _____ Date: _____

**Licensed Professional**

____ _____
,
(___)___-_____
_____

**Professional Engineer or Registered Architect Stamp (if applicable)**

# APPENDIX C: GLOSSARY

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

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

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