# Local Government Energy Audit Report

Frank Hehnly Elementary School

March 15, 2023

*Prepared for:*
Clark Public School District
590 Raritan Rd.
Clark, New Jersey 07066

*Prepared by:*
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# Disclaimer

The goal of this audit report is to identify potential energy efficiency opportunities and help prioritize specific measures for implementation. Most energy conservation measures have received preliminary analysis of feasibility that identifies expected ranges of savings and costs. This level of analysis is usually considered sufficient to establish a basis for further discussion and to help prioritize energy measures.

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

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

Incentive values provided in this report are estimated based of previously run state efficiency programs. Incentive levels are not guaranteed. The NJBPU reserves the right to extend, modify, or terminate programs without prior notice. Please review all available utility program incentives and eligibility requirements prior to selecting and installing any energy conservation measures.

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

# Table of Contents

# ENERGY EFFICIENCY INCENTIVE & REBATE TRANSITION

For the purposes of your LGEA, estimated incentives and rebates are included as placeholders for planning purposes. New Jersey utilities are rolling out their own energy efficiency programs, which your project may be eligible for depending on individual measures, quantities, and size of the building.

In 2018, Governor Murphy signed into law the landmark legislation known as the Clean Energy Act. The law called for a significant overhaul of New Jersey's clean energy systems by building sustainable infrastructure in order to fight climate change and reduce carbon emissions, which will in turn create well-paying local jobs, grow the state's economy, and improve public health while ensuring a cleaner environment for current and future residents.

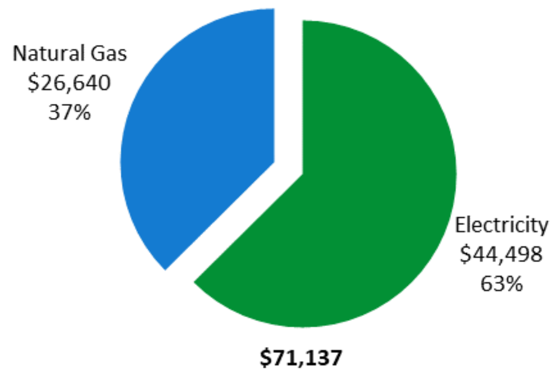
These next generation energy efficiency programs feature new ways of managing and delivering programs historically administered by New Jersey's Clean Energy Program™ (NJCEP). All of the investor-owned gas and electric utility companies will now also offer complementary energy efficiency programs and incentives directly to customers like you. NJCEP will still offer programs for new construction, renewable energy, the Energy Savings Improvement Program (ESIP), and large energy users.

New utility programs are under development. Keep up to date with developments by visiting the NJCEP website.

# 1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Frank Hehnly Elementary 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: $71,137<br>Electricity: 308,321 kWh<br>Natural Gas: 27,284 Therms |  |
| ENERGY STAR® Benchmarking Score | 21 *(1-100 scale)* | This building performs at below the national average. This report contains suggestions about how to improve building performance and reduce energy costs. |



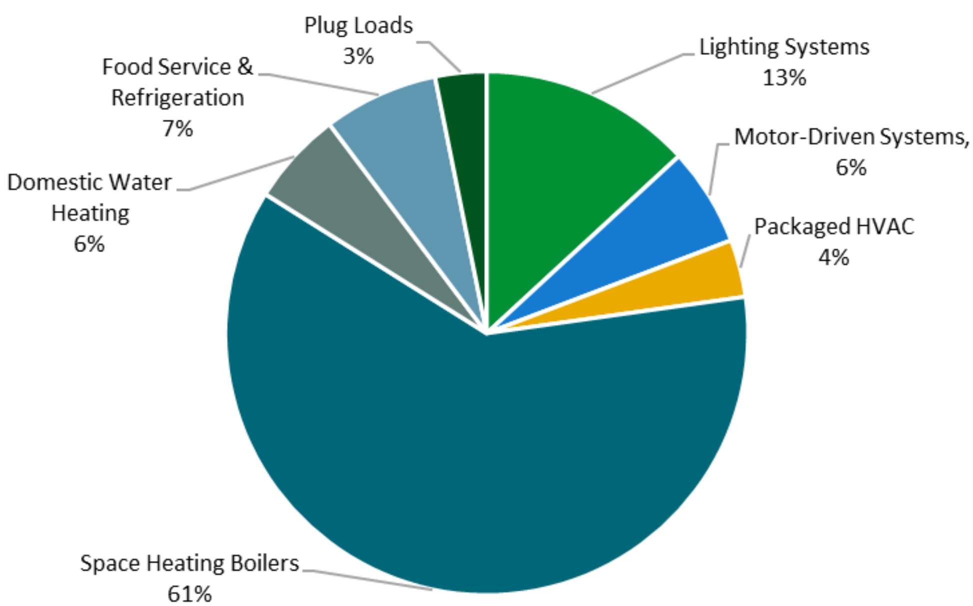


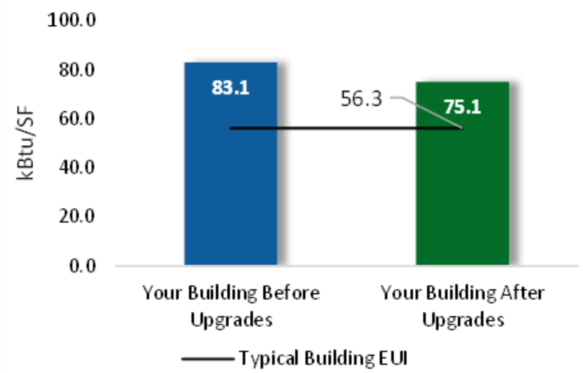

*Figure 1 - Energy Use by System*

## POTENTIAL IMPROVEMENTS

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

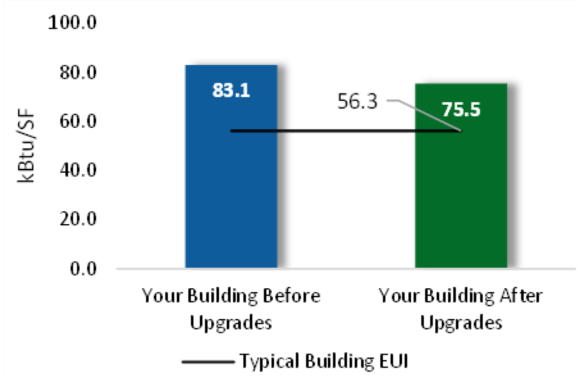
### Scenario 1: Full Package (All Evaluated Measures)

| | |
|---|---|
| Installation Cost | $130,521 |
| Potential Rebates & Incentives[1] | $17,110 |
| Annual Cost Savings | $15,608 |
| Annual Energy Savings | Electricity: 108,782 kWh<br>Natural Gas: -94 Therms |
| Greenhouse Gas Emission Savings | 56 Tons |
| Simple Payback | 7.3 Years |
| Site Energy Savings (All Utilities) | 10% |




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

| | |
|---|---|
| Installation Cost | $61,022 |
| Potential Rebates & Incentives | $14,800 |
| Annual Cost Savings | $14,829 |
| Annual Energy Savings | Electricity: 103,387 kWh<br>Natural Gas: -94 Therms |
| Greenhouse Gas Emission Savings | 52 Tons |
| Simple Payback | 3.1 Years |
| Site Energy Savings (all utilities) | 9% |




### On-site Generation Potential

| | |
|---|---|
| Photovoltaic | None |
| Combined Heat and Power | None |

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

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

| # | Energy Conservation Measure | Cost Effective? | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated M&L Cost ($) | Estimated Incentive ($)* | Estimated Net M&L Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | | **80,327** | **24.1** | **-17** | **$11,429** | **$37,625** | **$10,039** | **$27,586** | **2.4** | **78,922** |
| ECM 1 | Install LED Fixtures | Yes | 187 | 0.2 | 0 | $27 | $417 | $50 | $367 | 13.8 | 184 |
| ECM 2 | Retrofit Fixtures with LED Lamps | Yes | 80,140 | 23.9 | -17 | $11,402 | $37,208 | $9,989 | $27,219 | 2.4 | 78,739 |
| **Lighting Control Measures** | | | **3,292** | **0.8** | **-1** | **$468** | **$5,800** | **$2,250** | **$3,550** | **7.6** | **3,235** |
| ECM 3 | Install Occupancy Sensor Lighting Controls | Yes | 1,825 | 0.5 | 0 | $260 | $3,550 | $395 | $3,155 | 12.2 | 1,793 |
| ECM 4 | Install High/Low Lighting Controls | Yes | 1,468 | 0.3 | 0 | $209 | $2,250 | $1,855 | $395 | 1.9 | 1,442 |
| **Variable Frequency Drive (VFD) Measures** | | | **18,155** | **3.9** | **0** | **$2,620** | **$17,245** | **$2,400** | **$14,845** | **5.7** | **18,282** |
| ECM 5 | Install VFDs on Constant Volume (CV) Fans | Yes | 9,163 | 2.4 | 0 | $1,322 | $7,768 | $400 | $7,368 | 5.6 | 9,228 |
| ECM 6 | Install VFDs on Heating Water Pumps | Yes | 8,992 | 1.4 | 0 | $1,298 | $9,476 | $2,000 | $7,476 | 5.8 | 9,055 |
| **Unitary HVAC Measures** | | | **5,395** | **6.8** | **0** | **$779** | **$69,499** | **$2,310** | **$67,189** | **86.3** | **5,432** |
| ECM 7 | Install High Efficiency Air Conditioning Units | No | 5,395 | 6.8 | 0 | $779 | $69,499 | $2,310 | $67,189 | 86.3 | 5,432 |
| **Domestic Water Heating Upgrade** | | | **0** | **0.0** | **8** | **$79** | **$122** | **$61** | **$61** | **0.8** | **944** |
| ECM 8 | Install Low-Flow DHW Devices | Yes | 0 | 0.0 | 8 | $79 | $122 | $61 | $61 | 0.8 | 944 |
| **Food Service & Refrigeration Measures** | | | **1,612** | **0.2** | **0** | **$233** | **$230** | **$50** | **$180** | **0.8** | **1,623** |
| ECM 9 | Vending Machine Control | Yes | 1,612 | 0.2 | 0 | $233 | $230 | $50 | $180 | 0.8 | 1,623 |
| **TOTALS (COST EFFECTIVE MEASURES)** | | | **103,387** | **29.0** | **-9** | **$14,829** | **$61,022** | **$14,800** | **$46,222** | **3.1** | **103,007** |
| **TOTALS (ALL MEASURES)** | | | **108,782** | **35.8** | **-9** | **$15,608** | **$130,521** | **$17,110** | **$113,411** | **7.3** | **108,439** |

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

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

*Figure 2 – Evaluated Energy Improvements*

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

## 1.1 Planning Your Project

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

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

### Pick Your Installation Approach

Utility-run energy efficiency programs, such as 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.

For details on these programs please visit New Jersey's Clean Energy Program website or contact your utility provider.

## 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 and Power (CHP)*

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

*Successor Solar Incentive Program (SuSI)*

New Jersey is committed to supporting solar energy. Solar projects help the state reach the renewable goals outlined in the state's Energy Master Plan. The SuSI program is used to register and certify solar projects in New Jersey. Rebates are not available, but certified solar projects are able to earn one SREC II (Solar Renewable Energy Certificates II) for each megawatt-hour of solar electricity produced from a qualifying solar facility.

*Ongoing Electric Savings with Demand Response*

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

*Large Energy User Program (LEUP)*

LEUP designed to promote self-investment in energy efficiency and combined heat and power or fuel cell projects. It incentivizes owners/users of buildings to upgrade or install energy conserving measures in existing buildings to help offset the capital costs associated with the project. The efficiency upgrades are customized to meet the requirements of the customers' existing facilities, while advancing the State's energy efficiency, conservation, and greenhouse gas reduction goals.

# 2 Existing Conditions

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for Frank Hehnly Elementary 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.

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 August 26, 2022, TRC performed an energy audit at Frank Hehnly Elementary School located in Clark, New Jersey. TRC met with Facility Staff to review the facility operations and help focus our investigation on specific energy-using systems.

Frank Hehnly Elementary School, located at 590 Raritan Rd, is a public elementary school serving students from kindergarten to fifth grades in Clark Township. The building is a two-story, 45,497 square foot school building built in 1970. Spaces include classrooms, multipurpose room, offices, corridors, faculty room, commercial kitchen, storage, and mechanical space.

The facility lighting system consists mainly of linear fluorescent lamps. The building is 100% heated by two hydronic boilers and some spaces are cooled by various direct expansion split systems and window air conditioners.

Facility concerns include old split system air conditioners (ACs) which are operating beyond their useful life and are in fair to poor condition, which results in high maintenance costs, and high electric bills.


*Building Aerial View*

## 2.2 Building Occupancy

The school operates on a 10-month schedule, from September to June. The gymnasiums and locker rooms are used after classes for sports and other events. The entire facility is shut down around 11:00 PM after the cleaning process.

During a typical day, the facility is occupied by 558 students and 40 staff. It should be noted that the energy and economic analysis for this building is based on the use of the building during the utility billing period, and that results will vary based on changes to building use patterns.

| Building Name | Weekday/Weekend | Operating Schedule |
|---|---|---|
| Frank Hehnely Elementary School - General | Weekday | 6:00 AM - 11:00 PM |
| | Weekend | Closed |
| Frank Hehnly Elementary School - Classes | Weekday | 7:30 AM - 2:35 PM |
| | Weekend | Closed |

***Figure 3 - Building Occupancy Schedule***

## 2.3 Building Envelope

Building walls are concrete masonry units (CMU) over structural steel with a brick veneer façade, with gypsum drywall painted CMU interior finish. The main flat roof is supported with steel trusses and a reinforced concrete deck and finished with an insulated layer and a covering of a membrane that is in fair condition. Some sections of the roof are built up with gravel pebbles finish. The newer addition has a pitched roof with a standing seam metal cladding that is in good condition. Additionally, there is another building section with a pitched finished with asphalt shingles.

Windows throughout the facility are double paned glass with aluminum frames. The glass-to-frame seals are in good condition. The operable window weather seals are in good condition, showing little signs of excessive wear. The main entrance doors are glass with aluminum frames. Exit doors are constructed of metal. Exterior doors are in good condition.

*Building Walls and Roofs*


*Building Windows and Pitched Roof*


*Flat Pebbles and Pitched Standing Seam Metal Roofs*

## 2.4 Lighting Systems

The interior lighting system mainly uses 32-Watt linear fluorescent T8 lamps. Linear fluorescent fixture types include 2-lamp, 3-lamp, or 4-lamps, on 4-foot-long troffer, recessed, surfaced mounted fixtures. The stage has several incandescent lamps that are used when needed. The cafetorium is lit with high output linear fluorescent T5 lamps. There are few LED panel fixtures in the restrooms. All remaining spaces are lit with linear fluorescent lamps.

Most fixtures are in good condition. All exit signs are LED units. Interior lighting levels were generally sufficient. Lighting fixtures are controlled by manual wall switches and occupancy sensors that are either ceiling or wall mounted.

Exterior lighting consists of wall mounted LED fixtures that are controlled by photocells.

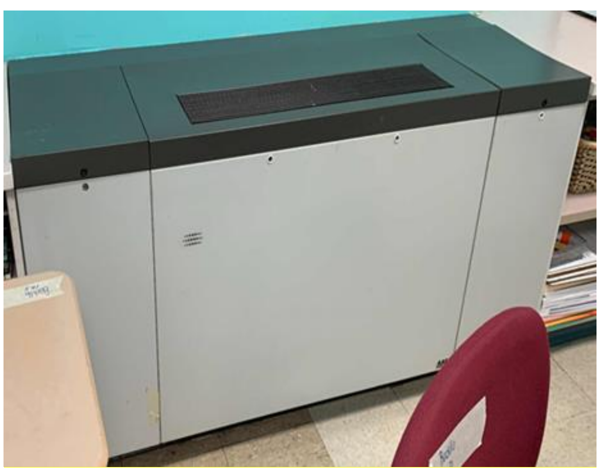
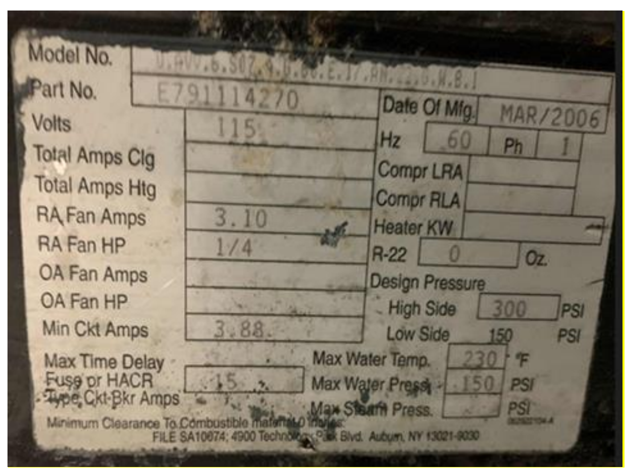


*Linear T8 and Incandescent Lamps*

## 2.5 Air Handling Systems

**Unit Ventilators**

Unit ventilators are equipped with supply fan motors and pneumatically controlled outside air dampers with hot water heating coils connected to the hot water distribution system. They provide heating and ventilation to classrooms. They appear in fair and good condition.

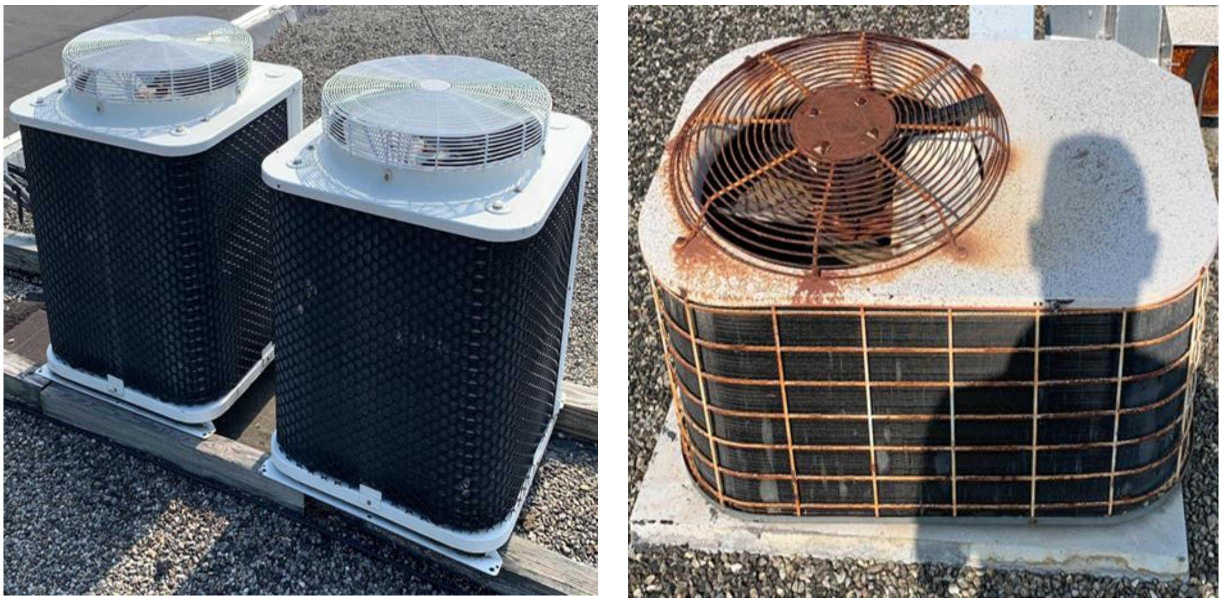




*Unit Ventilator*

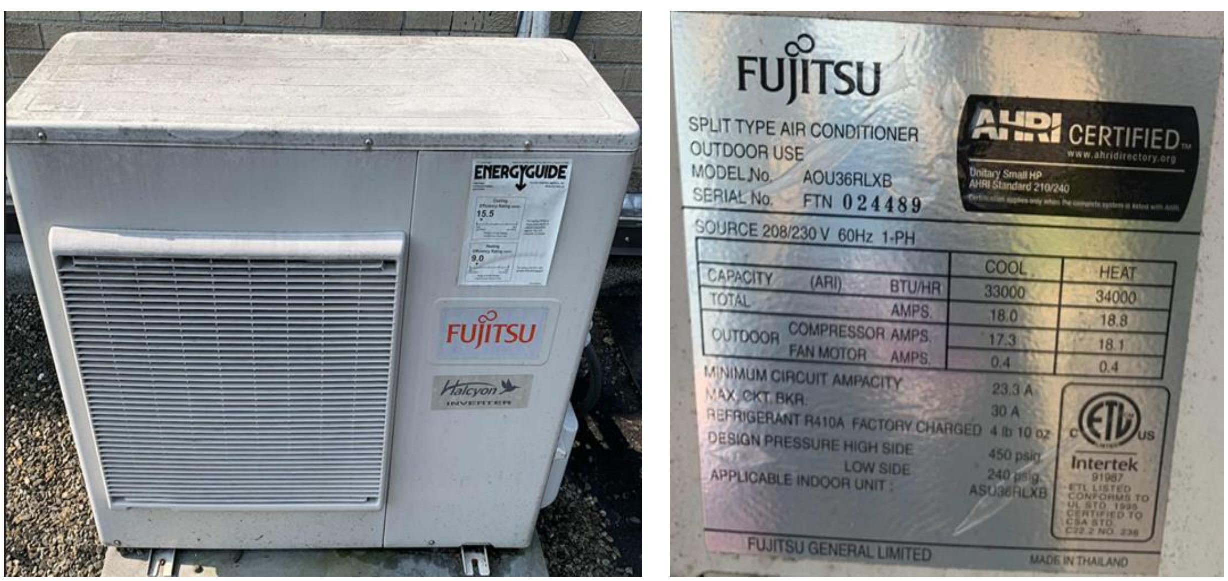
## Unitary Electric HVAC Equipment

Some classrooms and offices use window AC units that appear in fair condition and have been evaluated for replacement. There are various split system ACs that serve various building spaces. These range in capacity between 1 ton and 3 tons. The units are in poor condition and have been evaluated for replacement.

There are five split system air source heat pumps with 3-ton cooling capacities and heating capacities of 34 MBh. They serve classrooms and offices and are in good condition. The split system units are controlled by programmable thermostats.



*Condensing Unit - Split System ACs*




*Split Air Source Heat Pump*

**Air Handling Units (AHUs)**

The second-floor storage room houses an AHU equipped with a supply fan motor and hot water heating coil. The supply fan motor is assumed to be 3 hp, constant speed, and standard efficiency. The heating coil is supplied by the hot water boiler, which is described in the section that follows. The AHU appears in fair condition and is controlled by a pneumatic control system.

The gym is served by a heating and ventilation unit (H&V unit). equipped with a supply fan motor, and hot water heating coil. It is physically located above the ceiling and was inaccessible during the energy audit. The supply fan motor is assumed to be 3 hp, constant speed, and standard efficiency. The heating coil is served by the hot water boiler.

*AHU and H&V Unit*

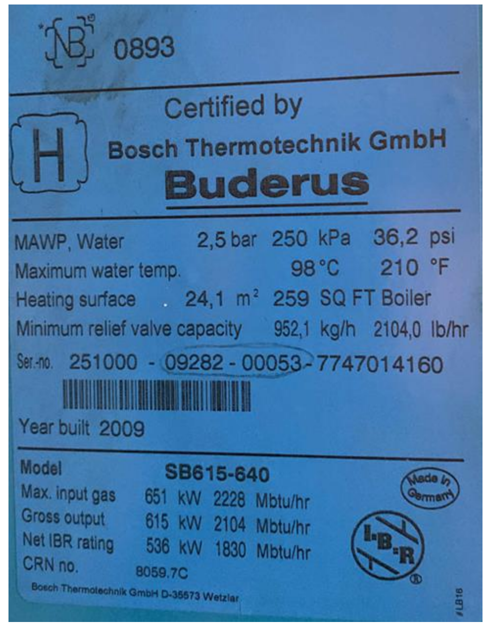
## 2.6 Building General Exhaust Fan System

The classrooms, restrooms, and other areas are exhausted by motor driven exhaust fans. The equipment is in good condition and controlled by manual switches.

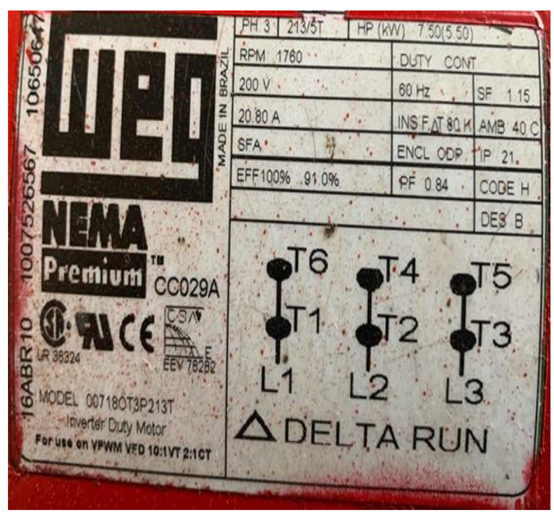
*Exhaust Fans*

## 2.7 Heating Hot Water Systems

Two Buderus 1830 MBh output non-condensing hot water boilers serve the building's heating load. The burners are non-modulating with a nominal efficiency of 82%. The boilers are controlled by a heat timer. Installed in 2010, the boilers are in good condition. The hydronic distribution system is a two-pipe heating only system. Two 7.5 hp constant speed pumps distribute heating hot water to AHUs, UVs, hydronic baseboards, and unit heaters. The boilers operate based on outside air temperature. The boilers hot water loop is controlled by a pneumatic system.




*Non-Condensing Hot Water Boilers*




*Heating Hot Water Pump*

## 2.8 Domestic Hot Water

Hot water is produced by an 82 gallon, 156 MBh gas-fired storage water heater rated at 80% efficiency. The water heater is in the boiler room and in good condition. A fractional horsepower circulating pump distributes water to end uses. The domestic hot water pipes are insulated, and the insulation is in good condition.


*Domestic Storage Tank Water Heater*

## 2.9 Food Service Equipment

The kitchen has two gas-fired cooking equipment and one electric insulated food holding cabinet that appear in good condition. The gas fired cooking equipment is used to prepare breakfast and lunch for students. The gas cooking equipment appears in good condition.

The dishwasher is an ENERGY STAR® high temperature, door type unit. The unit appears in good 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 and High Temperature Door Type Dishwasher*

## 2.10

## 2.11 Refrigeration

The kitchen has two stand-up refrigerators with solid doors and one refrigerated chest. All equipment is high efficiency and in good condition.

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


*Standup Refrigerator with Solid Doors*

## 2.12

## 2.13 Plug Load and Vending Machines

There are minimal 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 and projectors.

There are also typical office loads such as scanner/copiers, small printers, microwaves, and mini fridges; the site also has a server closet. There are two residential-style refrigerator that are in good condition. There is one refrigerated vending machine.


*Copier/Scanner and Vending Machine*

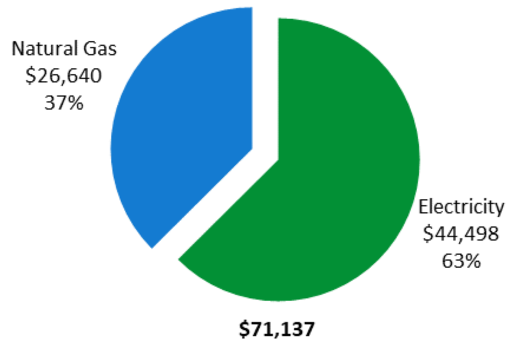
## 2.14 Water-Using Systems

There are several restrooms with toilets, urinals, and sinks. Faucet flow rates are at 2.2 gallons per minute (gpm) or higher. Toilets are rated at 2.5 gallons per flush (gpf) and urinals are rated at 2.5 gpf.

# 3 Energy Use and Costs

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

| Utility Summary | | |
|---|---|---|
| **Fuel** | **Usage** | **Cost** |
| Electricity | 308,321 kWh | $44,498 |
| Natural Gas | 27,284 Therms | $26,640 |
| **Total** | | **$71,137** |




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

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

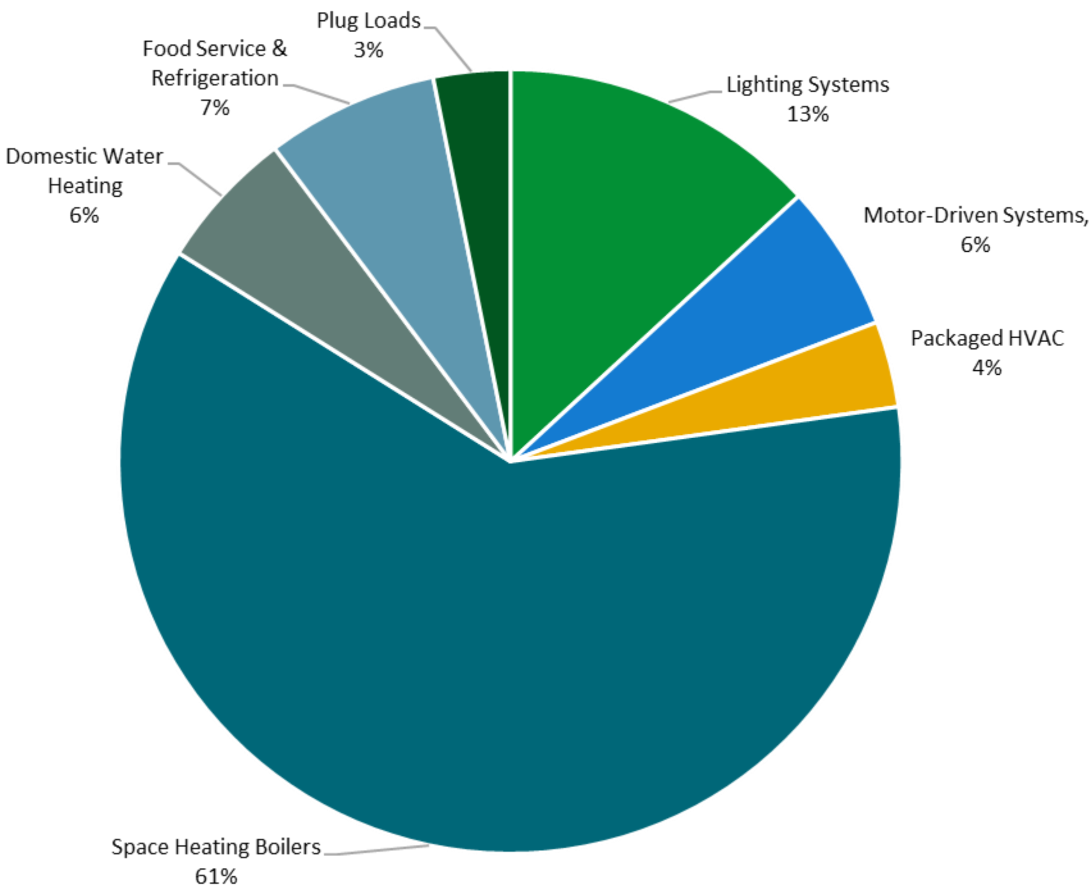
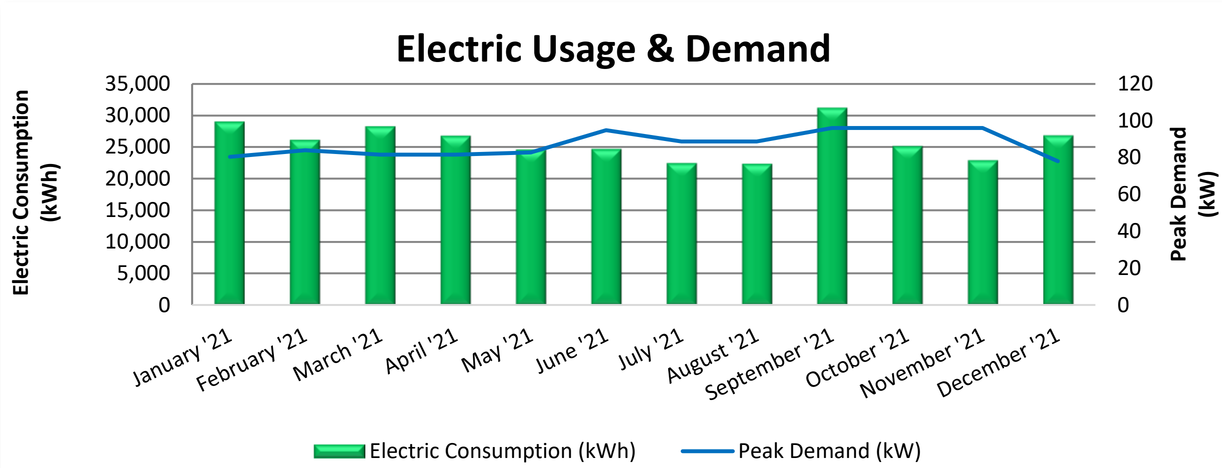



*Figure 4 - Energy Balance*

## 3.1 Electricity

PSE&G delivers electricity under rate class PETGLPMD, with electric production provided by Direct Energy, a third-party supplier.



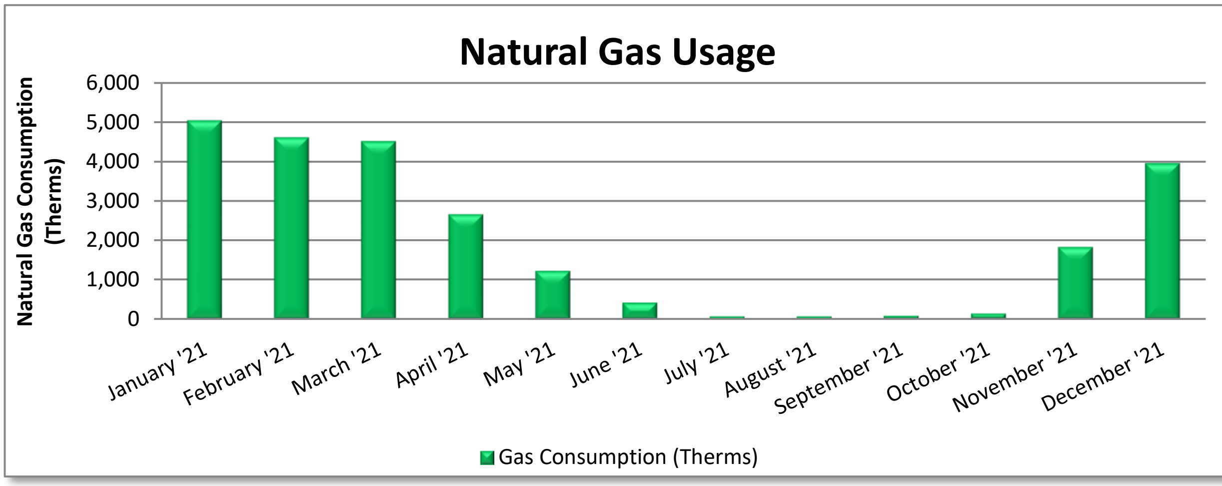

| Electric Billing Data | | | | | |
|---|---|---|---|---|---|
| **Period Ending** | **Days in Period** | **Electric Usage (kWh)** | **Demand (kW)** | **Demand Cost** | **Total Electric Cost** |
| 1/21/21 | 34 | 28,974 | 80 | $317 | $3,991 |
| 2/19/21 | 29 | 26,085 | 84 | $331 | $3,544 |
| 3/23/21 | 32 | 28,250 | 82 | $321 | $3,822 |
| 4/22/21 | 30 | 26,742 | 82 | $321 | $3,644 |
| 5/20/21 | 28 | 24,553 | 83 | $327 | $3,258 |
| 6/21/21 | 32 | 24,683 | 95 | $1,316 | $3,944 |
| 7/21/21 | 30 | 22,412 | 89 | $1,232 | $3,538 |
| 8/20/21 | 30 | 22,354 | 89 | $1,232 | $3,536 |
| 9/21/21 | 32 | 31,155 | 96 | $1,332 | $4,926 |
| 10/19/21 | 28 | 25,130 | 96 | $380 | $3,521 |
| 11/17/21 | 29 | 22,890 | 96 | $380 | $3,233 |
| 12/20/21 | 33 | 26,782 | 78 | $307 | $3,784 |
| **Totals** | **367** | **310,010** | **96** | **$7,796** | **$44,741** |
| **Annual** | **365** | **308,321** | **96** | **$7,754** | **$44,498** |

Notes:

- Peak demand of 96 kW occurred in September 2021.
- Average demand over the past 12 months was 87 kW.
- The average electric cost over the past 12 months was $0.144/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.

## 3.2 Natural Gas

Elizabethtown Gas delivers natural gas under rate class General Delivery Service-Transportation, with natural gas supply provided by Direct Energy, a third-party supplier.




| Gas Billing Data | | | |
|---|---|---|---|
| Period Ending | Days in Period | Natural Gas Usage (Therms) | Natural Gas Cost |
| 1/20/21 | | 5,048 | $4,339 |
| 2/17/21 | 28 | 4,619 | $4,004 |
| 3/22/21 | 33 | 4,523 | $3,945 |
| 4/21/21 | 30 | 2,667 | $2,453 |
| 5/20/21 | 29 | 1,229 | $1,335 |
| 6/21/21 | 32 | 419 | $716 |
| 7/21/21 | 30 | 68 | $453 |
| 8/20/21 | 30 | 66 | $452 |
| 9/21/21 | 32 | 82 | $463 |
| 10/20/21 | 29 | 145 | $513 |
| 11/17/21 | 28 | 1,836 | $1,862 |
| 12/16/21 | 29 | 3,966 | $3,550 |
| **Totals** | **330** | **24,668** | **$24,085** |
| **Annual** | **365** | **27,284** | **$26,640** |

Notes:

- The average gas cost for the past 12 months is $0.976/therm, which is the blended rate used throughout the analysis.

## 3.3 Benchmarking

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

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

| Benchmarking Score | 21 |
| --- | --- |

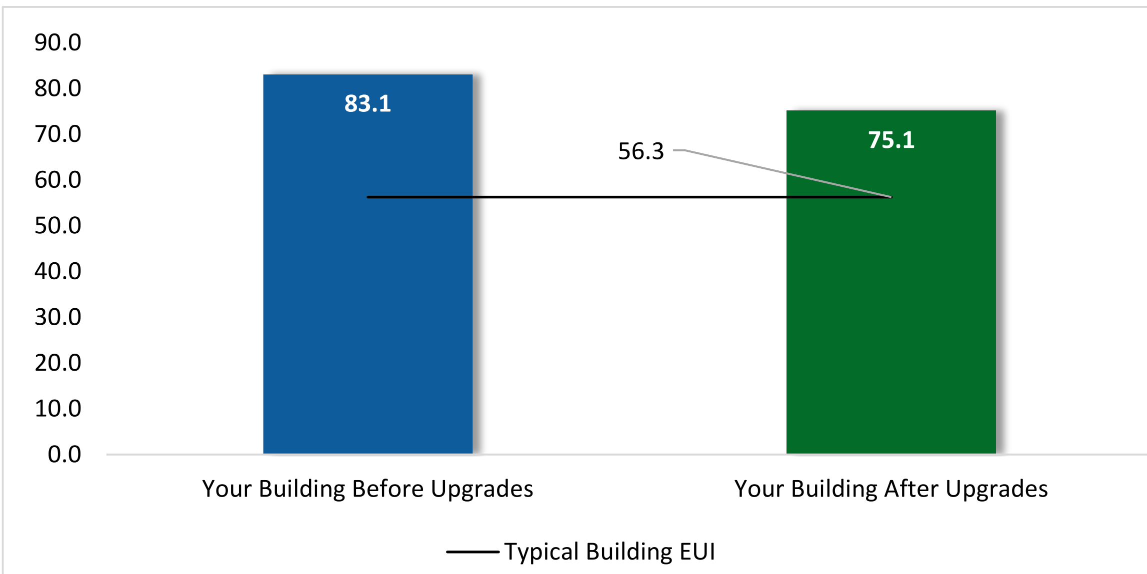



***Figure 5 - Energy Use Intensity Comparison[3]***

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

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

[3] Based on all evaluated ECMs

## Tracking Your Energy Performance

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

**We have created a Portfolio Manager® account for your facility, and 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 Energy Conservation Measures

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

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

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

Financial incentives are based on previously run state rebate programs. New utility programs are expected to start rolling out in the spring and summer of 2021. Keep up to date with developments by visiting the NJCEP website. Some measures and proposed upgrades may be eligible for higher incentives than those shown below.

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** | | | **80,327** | **24.1** | **-17** | **$11,429** | **$37,625** | **$10,039** | **$27,586** | **2.4** | **78,922** |
| ECM 1 | Install LED Fixtures | Yes | 187 | 0.2 | 0 | $27 | $417 | $50 | $367 | 13.8 | 184 |
| ECM 2 | Retrofit Fixtures with LED Lamps | Yes | 80,140 | 23.9 | -17 | $11,402 | $37,208 | $9,989 | $27,219 | 2.4 | 78,739 |
| **Lighting Control Measures** | | | **3,292** | **0.8** | **-1** | **$468** | **$5,800** | **$2,250** | **$3,550** | **7.6** | **3,235** |
| ECM 3 | Install Occupancy Sensor Lighting Controls | Yes | 1,825 | 0.5 | 0 | $260 | $3,550 | $395 | $3,155 | 12.2 | 1,793 |
| ECM 4 | Install High/Low Lighting Controls | Yes | 1,468 | 0.3 | 0 | $209 | $2,250 | $1,855 | $395 | 1.9 | 1,442 |
| **Variable Frequency Drive (VFD) Measures** | | | **18,155** | **3.9** | **0** | **$2,620** | **$17,245** | **$2,400** | **$14,845** | **5.7** | **18,282** |
| ECM 5 | Install VFDs on Constant Volume (CV) Fans | Yes | 9,163 | 2.4 | 0 | $1,322 | $7,768 | $400 | $7,368 | 5.6 | 9,228 |
| ECM 6 | Install VFDs on Heating Water Pumps | Yes | 8,992 | 1.4 | 0 | $1,298 | $9,476 | $2,000 | $7,476 | 5.8 | 9,055 |
| **Unitary HVAC Measures** | | | **5,395** | **6.8** | **0** | **$779** | **$69,499** | **$2,310** | **$67,189** | **86.3** | **5,432** |
| ECM 7 | Install High Efficiency Air Conditioning Units | No | 5,395 | 6.8 | 0 | $779 | $69,499 | $2,310 | $67,189 | 86.3 | 5,432 |
| **Domestic Water Heating Upgrade** | | | **0** | **0.0** | **8** | **$79** | **$122** | **$61** | **$61** | **0.8** | **944** |
| ECM 8 | Install Low-Flow DHW Devices | Yes | 0 | 0.0 | 8 | $79 | $122 | $61 | $61 | 0.8 | 944 |
| **Food Service & Refrigeration Measures** | | | **1,612** | **0.2** | **0** | **$233** | **$230** | **$50** | **$180** | **0.8** | **1,623** |
| ECM 9 | Vending Machine Control | Yes | 1,612 | 0.2 | 0 | $233 | $230 | $50 | $180 | 0.8 | 1,623 |
| **TOTALS** | | | **108,782** | **35.8** | **-9** | **$15,608** | **$130,521** | **$17,110** | **$113,411** | **7.3** | **108,439** |

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

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

*Figure 6 – All Evaluated ECMs*

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated M&L Cost ($) | Estimated Incentive ($)* | Estimated Net M&L Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | **80,327** | **24.1** | **-17** | **$11,429** | **$37,625** | **$10,039** | **$27,586** | **2.4** | **78,922** |
| ECM 1 | Install LED Fixtures | 187 | 0.2 | 0 | $27 | $417 | $50 | $367 | 13.8 | 184 |
| ECM 2 | Retrofit Fixtures with LED Lamps | 80,140 | 23.9 | -17 | $11,402 | $37,208 | $9,989 | $27,219 | 2.4 | 78,739 |
| **Lighting Control Measures** | | **3,292** | **0.8** | **-1** | **$468** | **$5,800** | **$2,250** | **$3,550** | **7.6** | **3,235** |
| ECM 3 | Install Occupancy Sensor Lighting Controls | 1,825 | 0.5 | 0 | $260 | $3,550 | $395 | $3,155 | 12.2 | 1,793 |
| ECM 4 | Install High/Low Lighting Controls | 1,468 | 0.3 | 0 | $209 | $2,250 | $1,855 | $395 | 1.9 | 1,442 |
| **Variable Frequency Drive (VFD) Measures** | | **18,155** | **3.9** | **0** | **$2,620** | **$17,245** | **$2,400** | **$14,845** | **5.7** | **18,282** |
| ECM 5 | Install VFDs on Constant Volume (CV) Fans | 9,163 | 2.4 | 0 | $1,322 | $7,768 | $400 | $7,368 | 5.6 | 9,228 |
| ECM 6 | Install VFDs on Heating Water Pumps | 8,992 | 1.4 | 0 | $1,298 | $9,476 | $2,000 | $7,476 | 5.8 | 9,055 |
| **Domestic Water Heating Upgrade** | | **0** | **0.0** | **8** | **$79** | **$122** | **$61** | **$61** | **0.8** | **944** |
| ECM 8 | Install Low-Flow DHW Devices | 0 | 0.0 | 8 | $79 | $122 | $61 | $61 | 0.8 | 944 |
| **Food Service & Refrigeration Measures** | | **1,612** | **0.2** | **0** | **$233** | **$230** | **$50** | **$180** | **0.8** | **1,623** |
| ECM 9 | Vending Machine Control | 1,612 | 0.2 | 0 | $233 | $230 | $50 | $180 | 0.8 | 1,623 |
| **TOTALS** | | **103,387** | **29.0** | **-9** | **$14,829** | **$61,022** | **$14,800** | **$46,222** | **3.1** | **103,007** |

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

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

*Figure 7 – Cost Effective ECMs*

## 4.1 Lighting

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated M&L Cost ($) | Estimated Incentive ($)* | Estimated Net M&L Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | **80,327** | **24.1** | **-17** | **$11,429** | **$37,625** | **$10,039** | **$27,586** | **2.4** | **78,922** |
| ECM 1 | Install LED Fixtures | 187 | 0.2 | 0 | $27 | $417 | $50 | $367 | 13.8 | 184 |
| ECM 2 | Retrofit Fixtures with LED Lamps | 80,140 | 23.9 | -17 | $11,402 | $37,208 | $9,989 | $27,219 | 2.4 | 78,739 |

When considering lighting upgrades, we suggest using a comprehensive design approach that simultaneously upgrades lighting fixtures and controls to maximize energy savings and improve occupant lighting. Comprehensive design will also consider appropriate lighting levels for different space types to make sure that the right amount of light is delivered where needed. If conversion to LED light sources is proposed, we suggest converting all 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 incandescent spot luminaire 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:** stage spot luminaires.

### ECM 2: Retrofit Fixtures with LED Lamps

Replace fluorescent T8 and T5 lamps with LED lamps. Many LED tubes are direct replacements for existing fluorescent tubes and can be installed while leaving the fluorescent fixture ballast in place. LED lamps can be used in existing fixtures as a direct replacement for most other lighting technologies. Be sure to specify replacement lamps that are compatible with existing dimming controls, where applicable. In some circumstances, you may need to upgrade your dimming system for optimum performance.

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

**Affected Building Areas:** all areas with fluorescent fixtures with T8 tubes, and T5 in the cafetorium.

## 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** | | **3,292** | **0.8** | **-1** | **$468** | **$5,800** | **$2,250** | **$3,550** | **7.6** | **3,235** |
| ECM 3 | Install Occupancy Sensor Lighting Controls | 1,825 | 0.5 | 0 | $260 | $3,550 | $395 | $3,155 | 12.2 | 1,793 |
| ECM 4 | Install High/Low Lighting Controls | 1,468 | 0.3 | 0 | $209 | $2,250 | $1,855 | $395 | 1.9 | 1,442 |

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

### ECM 3: Install Occupancy Sensor Lighting Controls

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

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

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

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

**Affected Building Areas:** restrooms, staff room, and storage rooms.

### ECM 4: Install High/Low Lighting Controls

Install occupancy sensors to provide dual level lighting control for lighting fixtures in spaces that are infrequently occupied but may require some level of continuous lighting for safety or security reasons.

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

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

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

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

**Affected Building Areas**: corridors and stairs.

## 4.3 Variable Frequency Drives (VFD)

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated M&L Cost ($) | Estimated Incentive ($)* | Estimated Net M&L Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Variable Frequency Drive (VFD) Measures** | | **18,155** | **3.9** | **0** | **$2,620** | **$17,245** | **$2,400** | **$14,845** | **5.7** | **18,282** |
| ECM 5 | Install VFDs on Constant Volume (CV) Fans | 9,163 | 2.4 | 0 | $1,322 | $7,768 | $400 | $7,368 | 5.6 | 9,228 |
| ECM 6 | Install VFDs on Heating Water Pumps | 8,992 | 1.4 | 0 | $1,298 | $9,476 | $2,000 | $7,476 | 5.8 | 9,055 |

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 5: Install VFDs on Constant Volume (CV) Fans

Install VFDs to control constant volume fan motor speeds. This converts a constant-volume, single-zone air handling system into a variable-air-volume (VAV) system. A separate VFD is usually required to control the return fan motor or dedicated exhaust fan motor if the air handler has one.

Zone thermostats signal the VFD to adjust fan speed to maintain the appropriate temperature in the zone, while maintaining a constant supply air temperature.

For air handlers with direct expansion (DX) cooling systems, the minimum air flow across the cooling coil required to prevent the coil from freezing must be determined during the final project design. The control system programming should maintain the minimum air flow whenever the compressor is operating. Prior to implementation, verify minimum fan speed in cooling mode with the manufacturer. Note that savings will vary depending on the operating characteristics of each AHU.

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

**Affected Air Handlers:** AHU.

### ECM 6: Install VFDs on Heating Water Pumps

Install variable frequency drives (VFD) to control heating water pumps. Two-way valves must serve the hot water coils, and the hot water loop must have a differential pressure sensor installed. If three-way valves or a bypass leg are used in the hot water distribution, they will need to be modified when this measure is implemented. As the hot water valves close, the differential pressure increases and the VFD modulates the pump speed to maintain a differential pressure setpoint.

Energy savings result from reducing pump motor speed (and power) as hot water valves close. The magnitude of energy savings is based on the estimated amount of time that the system will operate at reduced load.

**Affected Pumps:** 7.5 hp HHW pumps.

## 4.4 Unitary HVAC

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated M&L Cost ($) | Estimated Incentive ($)* | Estimated Net M&L Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Unitary HVAC Measures** | | **5,395** | **6.8** | **0** | **$779** | **$69,499** | **$2,310** | **$67,189** | **86.3** | **5,432** |
| ECM 7 | Install High Efficiency Air Conditioning Units | 5,395 | 6.8 | 0 | $779 | $69,499 | $2,310 | $67,189 | 86.3 | 5,432 |

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

### ECM 7: Install High Efficiency Air Conditioning Units

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

**Affected Units:** Window and split ACs.

## 4.5 Domestic Water Heating

| # | Energy Conservation Measure | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated M&L Cost ($) | Estimated Incentive ($)* | Estimated Net M&L Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Domestic Water Heating Upgrade** | | **0** | **0.0** | **8** | **$79** | **$122** | **$61** | **$61** | **0.8** | **944** |
| ECM 8 | Install Low-Flow DHW Devices | 0 | 0.0 | 8 | $79 | $122 | $61 | $61 | 0.8 | 944 |

### ECM 8: Install Low-Flow DHW Devices

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

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

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

## 4.6 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** | | **1,612** | **0.2** | **0** | **$233** | **$230** | **$50** | **$180** | **0.8** | **1,623** |
| ECM 9 | Vending Machine Control | 1,612 | 0.2 | 0 | $233 | $230 | $50 | $180 | 0.8 | 1,623 |

### ECM 9: 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.

## 4.7 Measures for Future Consideration

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

Clark Public School District may wish to consider the Energy Savings Improvement Program (ESIP) or other whole building approach. With interest in implementing comprehensive, largescale and/or complex system wide projects, these measures may be pursued during development of a future energy savings plan. We recommend that you work with your energy service company (ESCO) and/or design team to:

- Evaluate these measures further.
- Develop firm costs.
- Determine measure savings.
- Prepare detailed implementation plans.

Other modernization or capital improvement funds may be leveraged for these types of refurbishments. As you plan for capital upgrades, be sure to consider the energy impact of the building systems and controls being specified.

## Retro-Commissioning Study

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

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

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

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

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

## Installation of an Energy Management System

Most larger facilities have some type of energy management system (EMS), which provides for centralization, remote control, and monitoring of HVAC equipment and sometimes lighting or other building systems. An EMS utilizes a system of temperature and pressure sensors that obtain feedback about field conditions and provide signals to control systems that adjust HVAC system operation for optimal functioning. Thirty years ago, most control systems were pneumatic systems driven by compressed air, with pneumatic thermostats and air driven actuators for valves and dampers. Pneumatics controls have largely been replaced by direct digital control (DDC) systems, but many pneumatic systems remain. Contemporary DDC systems afford tighter controls and enhanced monitoring and trending capabilities as compared to the older systems.

Often smaller facilities are not equipped with central controls. For many small sites, it has been less costly to install distributed local controls, such as programmable thermostats and timeclocks, rather than centralized DDC. Local controls do a reasonably good job of scheduling equipment and maintaining operating conditions by relying on controls integral to HVAC units, such as logic for compressor staging, to manage the equipment operating algorithms.

Even for smaller sites, inefficiencies arise when temperature sensors and thermostat schedules are not maintained, when there are separate systems for heating and cooling, and especially when equipment is added, or the facility is reconfigured or repurposed.

Based on our survey, it appears that the installation of an EMS at your site could increase the efficiency of your building HVAC system operation.

A controls upgrade would enable automated equipment start and stop times, temperature setpoints, and lockouts and deadbands to be programmed remotely using a graphic interface. Controls can be configured to optimize ventilation and outside air intake by adjusting economizer position, damper function, and fan speed. Existing chilled and hot water distribution system controls are typically tied in, including associated pumps and valves. Coordinated control of HVAC systems is dependent on a network of sensors and status points. A comprehensive building control system provides monitoring and control for all HVAC systems, so operators can adjust system programming for optimal comfort and energy savings.

It is recommended that an HVAC engineer or contractor who specializes in EMS be contacted for a detailed evaluation and implementation costs. For the purposes of this report, the potential energy savings and measure costs were estimated based on industry standards and previous project experience. Further analysis should be conducted for the feasibility of this measure. This is not an investment grade analysis nor should be used as a basis for design and construction.

## VRF Systems

Variable refrigerant flow (VRF) systems use direct expansion (DX) heat pumps to transport heat between an outdoor condensing unit and a network of indoor evaporators, located near or within the conditioned space, through refrigerant piping installed in the building. Attributes that distinguish VRF from other DX system types are:

- Multiple indoor units connected to a common outdoor unit
- Scalability
- Variable capacity
- Distributed control
- Simultaneous heating and cooling capability

VRF provides flexibility by allowing for many different indoor units (with different capacities and configurations), individual zone control, the unique ability to offer simultaneous heating and cooling in separate zones on a common refrigerant circuit, and heat recovery from one zone to another. VRF systems are equipped with at least one variable-speed and/or variable-capacity compressor.

To match the building's load profiles, energy is transferred from one indoor space to another through the refrigerant line, and only one energy source is necessary to provide both heating and cooling. VRF systems also operate efficiently at part load because of the compressor's variable capacity control. VRF systems are ideal for applications with varying loads or where zoning is required. Some other advantages of VRF systems include consistent comfort, quiet operation, energy efficiency, installation flexibility, zoned heating and cooling, state-of-the-art controls, and reliability.

VRF systems are more expensive than conventional heat pump systems; however, the higher initial cost can be offset by improved cooling efficiency during part load operation—a SEER (cooling) rating of 18.0 is not uncommon for small packaged VRF-equipped heat pumps.

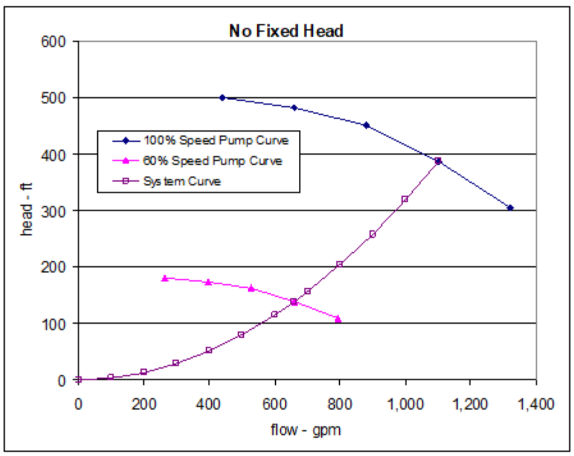
When you are replacing packaged HVAC equipment, we recommend a comprehensive approach. Work with your contractor or design engineer to make sure your systems are sized and zoned according to current space configurations and occupancy. Select high efficiency equipment and controls that match your heating and cooling needs. Commission the system and controls to ensure proper operation, comfort, ventilation, and energy use.

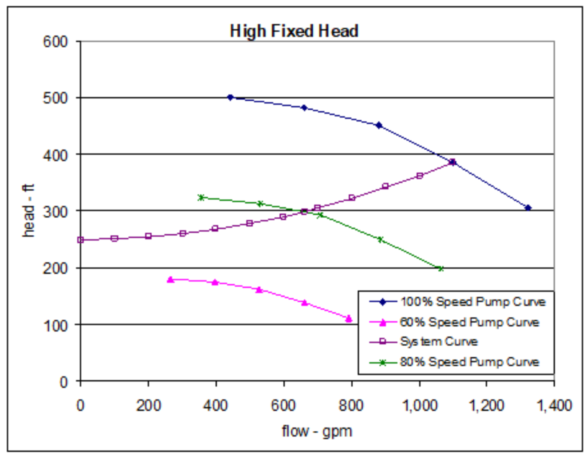
## Variable Frequency Drives to Control Fixed Head Pump Motors

The site has several pumps that operate with fixed head. Investigation of potential energy savings measures for these pumps is beyond the scope of this study. Site staff may want to conduct further investigation of potential savings for variable speed pumping controls.

Variable frequency drives (VFDs) regulate pump flow by regulating the speed of the drive motor. This is a more efficient way of regulating a pump than throttling the discharge of the pump. In systems with minimal fixed system head (for example a closed loop circulation system) pump power follows the affinity laws. This means that the required pump power varies approximately with the cube of the motor speed. As a result, a small change in pump speed will produce a significant reduction in motor power. In pumping systems with a fixed head that must be overcome regardless of the flow rate, the affinity laws no longer apply. Examples of fixed head systems are well and lift pumps. The lift required to move the water out of a well or sump to the surface is such a fixed head.

The figures below demonstrate the differences between a system with no fixed head and high fixed head. A pump will always operate at the intersection of the pump curve and the system curve. The pump curve is dictated by the pump design and operating speed, while the system curve is dictated by the physical system the pump is distributing water through such as the length of pipe, flow restrictions, and fixed head.




With no fixed head as the pump speed is reduced the pump operation follows the system curve. In the No fixed head example above, reducing the pump speed from 100% to 60% reduces the flow from 1,100 gpm to 660 gpm with an associated head of approximately 140 ft. In addition, the pump efficiency will remain the same at the two different flows. The reduced speed operation requires significantly less power than throttling the pump to 660 gpm, which would require 480 ft of head.

With the high fixed head condition, the system curve does not intersect the 60% speed curve. As a result, the pump cannot operate at 60% speed with this level of fixed head. Reducing the pump speed to 60% in this case would result in no flow and the pump would overheat. In order to achieve 660 gpm by reducing the pump speed the pump must operate at 80% speed now (see the intersection of the system curve and the 80% speed curve). In this case, the pump will produce 300 ft of head to achieve the 660-gpm flow. The pump will also most likely be operating at a different efficiency than when it was producing 1,100 gpm. The pump efficiency at the new operation at 80% speed will be a function of the pump design and may be higher or lower than at the full speed, 1,100 gpm operation. However, if the pump was sized for optimal performance at full speed and 1,100 gpm, it is likely that the pump efficiency will be lower when it is operating at 80% speed.

The following information is required to determine if installing a VFD to control a fixed head pump is feasible. The pump curves for the associated pump, the full speed flow and head, and the system fixed head. With that information the minimum feasible pump speed and associated power draw can be determined. To determine the potential energy savings the typical flow pattern of the system is required. With well or sump systems reducing the pump flow will increase the pump operating hours. Some system configurations will work with the pump operating at lower flow for longer hours. An example would be a well pump with excess flow capacity that is used to fill a large tank or reservoir. Other systems cannot function at significant reduced flows. An example would be a pump transferring fluid between two holding tanks if there are time constraints to the fluid transfer. If any of the pump systems at this site with motor capacities of 5 hp or more and a space to locate a VFD can operate for longer hours at reduced flow, then the feasibility of installing a VFD could be evaluated.

# 5 Energy Efficient Best Practices

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

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

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

## Energy Tracking with ENERGY STAR® Portfolio Manager®

You've heard it before—you cannot manage what you do not measure. ENERGY STAR® Portfolio Manager® is an online tool that you can use to measure and track energy and water consumption, as well as greenhouse gas emissions[4]. Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

## Weatherization

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

## Doors and Windows

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

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

## Lighting Maintenance

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

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

## 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°F-10°F during low occupancy hours (reduce heating setpoints and increase cooling setpoints). Cooling load can be reduced by increasing the facility's occupied setpoint temperature. In general, during the cooling season, thermostats should be set as high as possible without sacrificing occupant comfort.

## Economizer Maintenance

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

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

## AC System Evaporator/Condenser Coil Cleaning

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

## HVAC Filter Cleaning and Replacement

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

## Boiler Maintenance

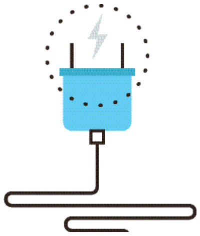
Many boiler problems develop slowly over time, so regular inspection and maintenance is essential to keeping the heating system running efficiently and preventing expensive repairs. Annual tune-ups should include a combustion analysis to analyze the exhaust from the boilers and to ensure the boiler is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

## Optimize HVAC Equipment Schedules

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

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

## Plug Load Controls



Reducing plug loads is a common way to decrease your electrical use. Limiting the energy use of plug loads can include increasing occupant awareness, removing under-used equipment, installing hardware controls, and using software controls. Consider enabling the most aggressive power settings on existing devices or install load sensing or occupancy sensing (advanced) power strips[5]. Your local utility may offer incentives or rebates for this equipment.

## 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.

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

# 6 On-site Generation

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

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

## 6.1 Solar Photovoltaic

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

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

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

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

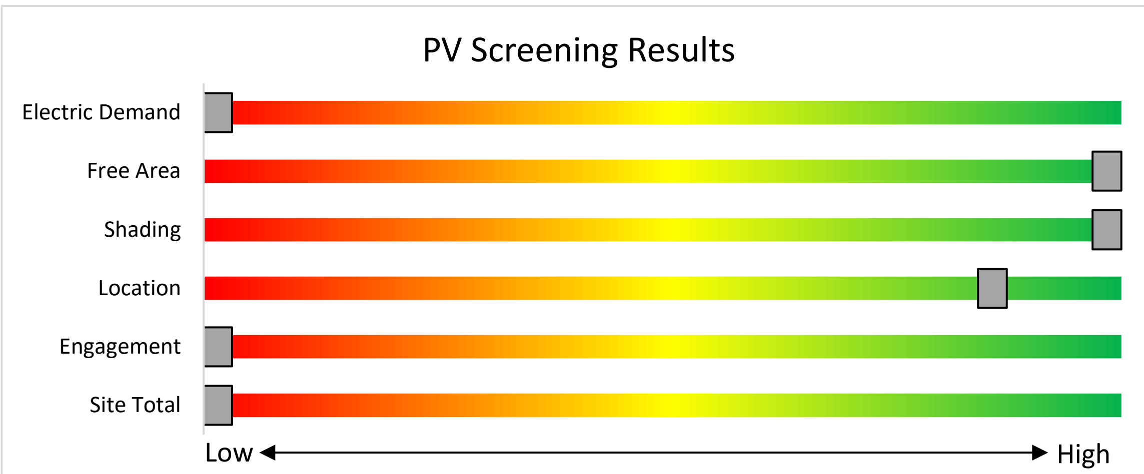



***Figure 8 - Photovoltaic Screening***

**Successor Solar Incentive Program (SuSI)**

The SuSI program replaces the SREC Registration Program (SRP) and the Transition Incentive (TI) program. The SuSI program is used to register and certify solar projects in New Jersey. Rebates are not available for solar projects. Solar projects may qualify to earn SREC- IIs (Solar Renewable Energy Certificates-II), however, the project owners *must* register their solar projects prior to the start of construction to establish the project's eligibility.

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

**Successor Solar Incentive Program (SuSI):** https://www.njcleanenergy.com/renewable-energy/programs/susi-program

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

## 6.2 Combined Heat and Power

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

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

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

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

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

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

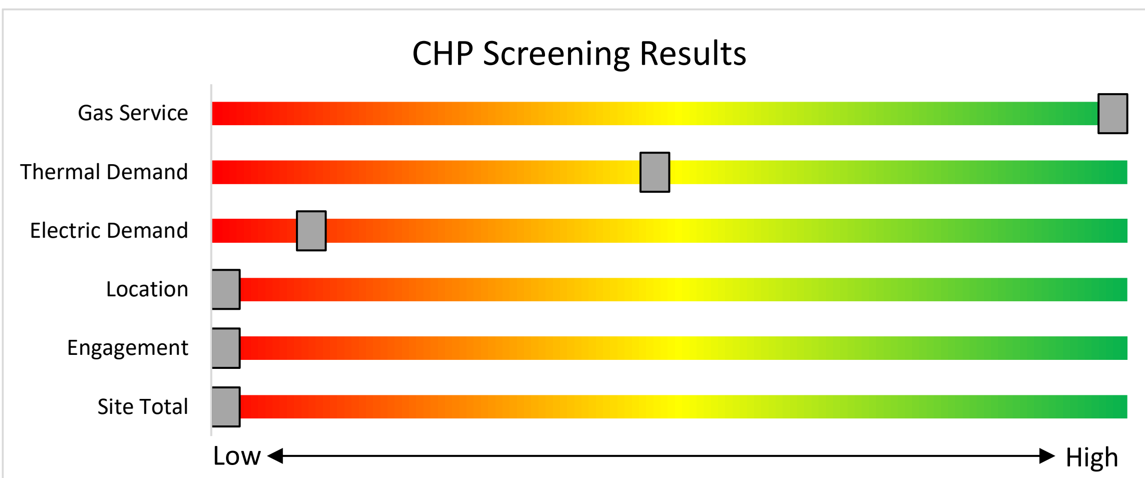



*Figure 9 - Combined Heat and Power Screening*

Find a qualified firm that specializes in commercial CHP cost assessment and installation: [http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/](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? Your utility provider may be able to help.

## 7.1 Utility Energy Efficiency Programs

The Clean Energy Act, signed into law by Governor Murphy in 2018, requires New Jersey's investor-owned gas and electric utilities to reduce their customers' use by set percentages over time. To help reach these targets the New Jersey Board of Public Utilities approved a comprehensive suite of energy efficiency programs to be run by the utility companies.


These new utility programs are rolling out in the spring and summer of 2021. Keep up to date with developments by visiting:

https://www.njcleanenergy.com/transition

# 8 New Jersey's Clean Energy Programs

New Jersey's Clean Energy Program will continue to offer some energy efficiency programs.


## 8.1 Large Energy Users

The Large Energy Users Program (LEUP) is designed to foster self-directed investment in energy projects. This program is offered to New Jersey's largest energy customers that annually contribute at least $200,000 to the NJCEP aggregate of all buildings/sites. This equates to roughly $5 million in energy costs in the prior fiscal year.

**Incentives**

Incentives are based on the specifications below. The maximum incentive per entity is the lesser of:

- $4 million
- 75% of the total project(s) cost
- 90% of total NJCEP fund contribution in previous year
- $0.33 per projected kWh saved; $3.75 per projected Therm saved annually

**How to Participate**

To participate in LEUP, you will first need submit an enrollment application. This program requires all qualified and approved applicants to submit an energy plan that outlines the proposed energy efficiency work for review and approval. Applicants may submit a Draft Energy Efficiency Plan (DEEP), or a Final Energy Efficiency Plan (FEEP). Once the FEEP is approved, the proposed work can begin.

Detailed program descriptions, instructions for applying, and applications can be found at www.njcleanenergy.com/LEUP.

## 8.2 Combined Heat and Power

The Combined Heat & Power (CHP) program provides incentives for eligible CHP or waste heat to power (WHP) projects. Eligible CHP or WHP projects must achieve an annual system efficiency of at least 65% (lower heating value, or LHV), based on total energy input and total utilized energy output. Mechanical energy may be included in the efficiency evaluation.

**Incentives**

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

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

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

**How to Participate**

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

## 8.3 Successor Solar Incentive Program (SuSI)

The SuSI program replaces the SREC Registration Program (SRP) and the Transition Incentive (TI) program. The program is used to register and certify solar projects in New Jersey. Rebates are not available for solar projects, but owners of solar projects *must* register their projects prior to the start of construction to establish the project's eligibility to earn SREC-IIs (Solar Renewable Energy Certificates-II). SuSI consists of two sub-programs. The Administratively Determined Incentive (ADI) Program and the Competitive Solar Incentive (CSI) Program.

**Administratively Determined Incentive (ADI) Program**

The ADI Program provides administratively set incentives for net metered residential projects, net metered non-residential projects 5 MW or less, and all community solar projects.

After the registration is accepted, construction is complete, and a complete final as-built packet has been submitted, the project is issued a New Jersey certification number, which enables it to generate New Jersey SREC- IIs.

| Market Segments | Size MW dc | Incentive Value ($/SREC II) | Public Entities Incentive Value - $20 Adder ($/SRECII) |
|---|---|---|---|
| Net Metered Residential | All types and sizes | $90 | N/A |
| Small Net Metered Non-Residential located on Rooftop, Carport, Canopy and Floating Solar | Projects smaller than 1 MW | $100 | $120 |
| Large Net Metered Non-Residential located on Rooftop, Carport, Canopy and Floating Solar | Projects 1 MW to 5 MW | $90 | $110 |
| Small Net Metered Non-Residential Ground Mount | Projects smaller than 1 MW | $85 | $105 |
| Large Net Metered Non-Residential Ground Mount | Projects 1 MW to 5 MW | $80 | $100 |
| LMI Community Solar | Up to 5 MW | $90 | N/A |
| Non-LMI Community Solar | Up to 5 MW | $70 | N/A |
| Interim Subsection (t) | All types and sizes | $100 | N/A |

Eligible projects may generate SREC-IIs for 15 years following the commencement of commercial operations which is defined as permission to operate (PTO) from the Electric Distribution Company. After 15 years, projects may be eligible for a NJ Class I REC.

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

The ADI Program online portal is now open to new registrations effective August 28, 2021.

**Competitive Solar Incentive Program**

The Competitive Solar Incentive (CSI) Program will provide competitively set incentives for grid supply projects and net metered non-residential projects greater than 5MW. The program is currently under development with the goal of holding the first solicitation by early-to-mid 2022. For updates, please continue to check the Solar Proceedings page on the New Jersey's Clean Energy Program website.

Solar projects help the State of New Jersey reach renewable energy goals outlined in the state's Energy Master Plan. If you are considering installing solar photovoltaics on your building, visit the following link for more information: https://njcleanenergy.com/renewable-energy/programs/susi-program.

## 8.4 Energy Savings Improvement Program

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

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

**How to Participate**

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

(1) Use an energy services company or "ESCO."

(2) Use independent engineers and other specialists, or your own qualified staff, to provide and manage the requirements of the program through bonds or lease obligations.

(3) Use a hybrid approach of the two options described above where the ESCO is used for some services and independent engineers, or other specialists or qualified staff, are used to deliver other requirements of the program.

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

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

*ESIP is a program delivered directly by the NJBPU and is not an NJCEP incentive program. As mentioned above, you can use NJCEP incentive programs to help further reduce costs when developing the energy savings plan. Refer to the ESIP guidelines at the link above for further information and guidance on next steps.*

# 9 Project Development

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

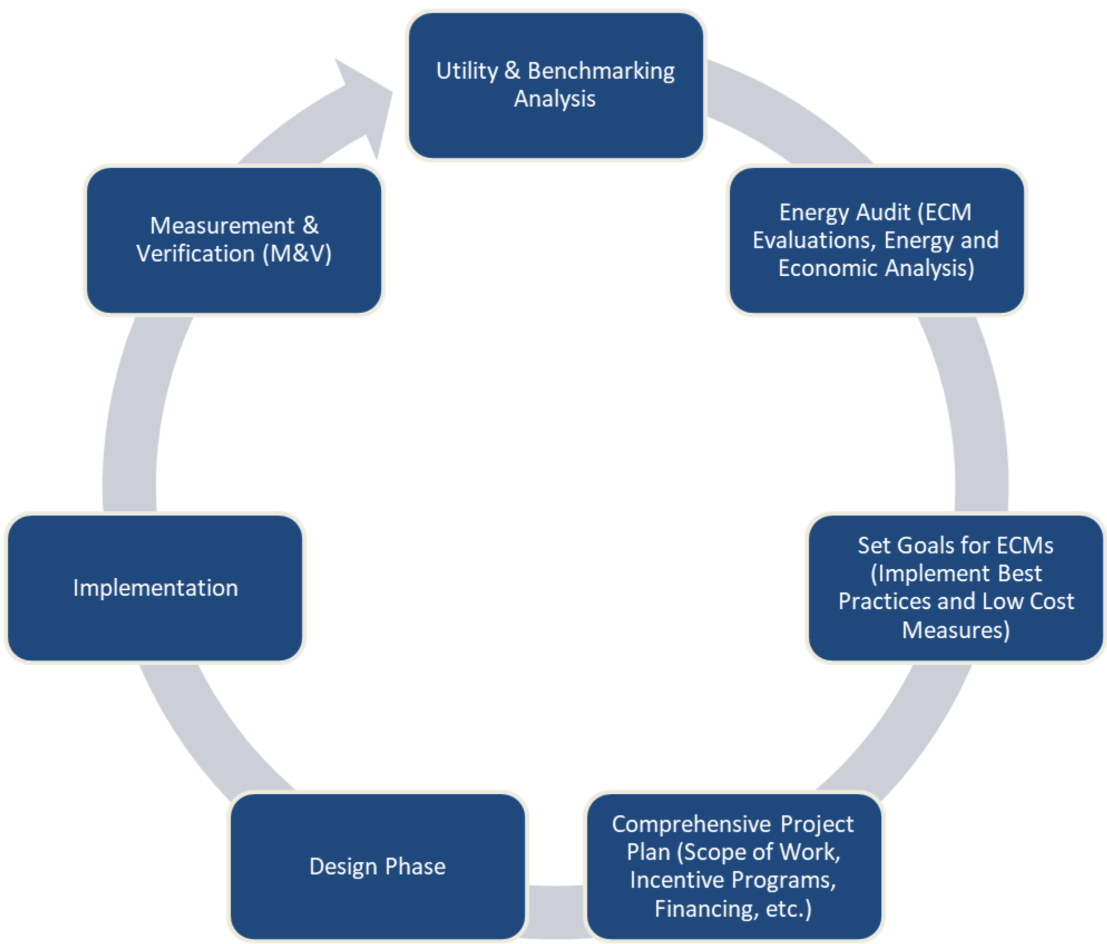



***Figure 10 – Project Development Cycle***

# 10 Energy Purchasing and Procurement Strategies

## 10.1 Retail Electric Supply Options

Energy deregulation in New Jersey has increased energy buyers' options by separating the function of electricity distribution from that of electricity supply. Though you may choose a different company from which to buy your electric power, responsibility for your facility's interconnection to the grid and repair to local power distribution will still reside with the traditional utility company serving your region.

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

A list of licensed third-party electric suppliers is available at the NJBPU website[6].

## 10.2 Retail Natural Gas Supply Options

The natural gas market in New Jersey is also deregulated. Most customers that remain with the utility for natural gas service pay rates that are market based and fluctuate monthly. The utility provides basic gas supply service to customers who choose not to buy from a third-party supplier for natural gas commodity.

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

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

A list of licensed third-party natural gas suppliers is available at the NJBPU website[7].

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

[7] 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 |
| Boiler room | 1 | Exit Signs: LED - 2 W Lamp | None | S | 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 room | 7 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,800 | 2 | Relamp | No | 7 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 2,800 | 0.2 | 711 | 0 | $101 | $256 | $70 | 1.8 |
| Cafeterium | 3 | Exit Signs: LED - 2 W Lamp | None | S | 6 | 8,760 | | None | No | 3 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Cafeterium | 12 | Linear Fluorescent - T5HO: 4' T5HO (54W) - 4L | Occupancy Sensor | S | 234 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 1.5 | 5,343 | -1 | $760 | $876 | $240 | 0.8 |
| Classroom 10 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 11 | 16 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 16 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.6 | 2,267 | 0 | $323 | $1,168 | $320 | 2.6 |
| Classroom 12 | 16 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 16 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.6 | 2,267 | 0 | $323 | $1,168 | $320 | 2.6 |
| Classroom 13 | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 2,300 | 2 | Relamp | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,300 | 0.0 | 167 | 0 | $24 | $73 | $20 | 2.2 |
| Classroom 13 | 16 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 16 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.6 | 2,267 | 0 | $323 | $1,168 | $320 | 2.6 |
| Classroom 14 | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 2,300 | 2 | Relamp | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,300 | 0.0 | 167 | 0 | $24 | $73 | $20 | 2.2 |
| Classroom 14 | 16 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 16 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.6 | 2,267 | 0 | $323 | $1,168 | $320 | 2.6 |
| Classroom 2 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 25 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 27 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 26 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 3 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 4 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 6 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 5 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 7 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 8 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 9 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Corridor 1 | 1 | Exit Signs: LED - 2 W Lamp | None | S | 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 1 | 11 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,800 | 2, 4 | Relamp | Yes | 11 | LED - Linear Tubes: (2) 4' Lamps | High/Low Control | 29 | 1,932 | 0.3 | 1,423 | 0 | $202 | $852 | $495 | 1.8 |
| Corridor 2 | 6 | Exit Signs: LED - 2 W Lamp | None | S | 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 |

| | 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 |
| Corridor 2 | 17 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,800 | 2, 4 | Relamp | Yes | 17 | LED - Linear Tubes: (2) 4' Lamps | High/Low Control | 29 | 1,932 | 0.5 | 2,199 | 0 | $313 | $1,296 | $765 | 1.7 |
| Corridor 3 | 2 | Exit Signs: LED - 2 W Lamp | None | S | 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 |
| Corridor 3 | 25 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,800 | 2, 4 | Relamp | Yes | 25 | LED - Linear Tubes: (2) 4' Lamps | High/Low Control | 29 | 1,932 | 0.8 | 3,233 | -1 | $460 | $2,038 | $1,125 | 2.0 |
| Exit 10 Foyer | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | S | 93 | 2,800 | 2 | Relamp | No | 1 | LED - Linear Tubes: (3) 4' Lamps | Wall Switch | 44 | 2,800 | 0.0 | 152 | 0 | $22 | $55 | $15 | 1.8 |
| Exterior - Envelop lighting | 1 | LED - Fixtures: Outdoor Wall-Mounted Area Fixture | Photocell | S | 26 | 4,380 | | None | No | 1 | LED - Fixtures: Outdoor Wall-Mounted Area Fixture | Photocell | 26 | 4,380 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Exterior - Envelop lighting | 4 | LED - Fixtures: Outdoor Wall-Mounted Area Fixture | Photocell | S | 37 | 4,380 | | None | No | 4 | LED - Fixtures: Outdoor Wall-Mounted Area Fixture | Photocell | 37 | 4,380 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Gymnasium | 3 | Exit Signs: LED - 2 W Lamp | None | S | 6 | 8,760 | | None | No | 3 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Gymnasium | 28 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 28 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 1.1 | 3,967 | -1 | $564 | $2,045 | $560 | 2.6 |
| Health Office | 6 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 6 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.2 | 850 | 0 | $121 | $438 | $120 | 2.6 |
| Janitorial Corridor 2 | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 2,300 | 2 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,300 | 0.0 | 83 | 0 | $12 | $37 | $10 | 2.2 |
| Kitchen | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,300 | 0.1 | 215 | 0 | $31 | $37 | $10 | 0.9 |
| Kitchen | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,300 | 0.1 | 215 | 0 | $31 | $37 | $10 | 0.9 |
| Kitchen | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,300 | 0.1 | 215 | 0 | $31 | $37 | $10 | 0.9 |
| Learning Center | 15 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 15 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.6 | 2,125 | 0 | $302 | $1,095 | $300 | 2.6 |
| Main Entrance Foyer | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 2,300 | 2 | Relamp | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,300 | 0.0 | 167 | 0 | $24 | $73 | $20 | 2.2 |
| Main Office | 7 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 7 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.3 | 992 | 0 | $141 | $511 | $140 | 2.6 |
| Office - Applebaum | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 2 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.1 | 283 | 0 | $40 | $146 | $40 | 2.6 |
| Office - Applebaum | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 2 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.1 | 283 | 0 | $40 | $146 | $40 | 2.6 |
| Office - Guidance | 5 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 5 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.2 | 708 | 0 | $101 | $365 | $100 | 2.6 |
| Office - Principal | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 4 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.2 | 567 | 0 | $81 | $292 | $80 | 2.6 |
| Principal office break room | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 2 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.1 | 283 | 0 | $40 | $146 | $40 | 2.6 |
| Resource Room A | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | None | S | 62 | 3,740 | 2 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | None | 29 | 3,740 | 0.0 | 136 | 0 | $19 | $37 | $10 | 1.4 |
| Restroom - Boys Corridor 1 | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | None | S | 62 | 3,740 | 2, 3 | Relamp | Yes | 1 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,581 | 0.0 | 173 | 0 | $25 | $37 | $10 | 1.1 |
| Restroom - Boys Corridor 1 | 3 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | S | 93 | 2,800 | 2, 3 | Relamp | Yes | 3 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,932 | 0.1 | 582 | 0 | $83 | $434 | $80 | 4.3 |
| Restroom - Boys Corridor 2 | 3 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | S | 93 | 2,800 | 2, 3 | Relamp | Yes | 3 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,932 | 0.1 | 582 | 0 | $83 | $434 | $80 | 4.3 |

| | 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 |
| Restroom - Boys Corridor 2 | 5 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,800 | 2, 3 | Relamp | Yes | 5 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,932 | 0.2 | 647 | 0 | $92 | $453 | $85 | 4.0 |
| Restroom - Faculty | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,800 | 2, 3 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,932 | 0.1 | 259 | 0 | $37 | $189 | $40 | 4.0 |
| Restroom - Faculty | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,800 | 2, 3 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,932 | 0.1 | 259 | 0 | $37 | $189 | $40 | 4.0 |
| Restroom - Unisex room 11 | 1 | LED - Fixtures: Ambient 2x4 Fixture | Wall Switch | S | 40 | 2,800 | | None | No | 1 | LED - Fixtures: Ambient 2x4 Fixture | Wall Switch | 40 | 2,800 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Restroom - Unisex room 12 | 1 | LED - Fixtures: Ambient 2x4 Fixture | Wall Switch | S | 40 | 2,800 | | None | No | 1 | LED - Fixtures: Ambient 2x4 Fixture | Wall Switch | 40 | 2,800 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Restroom - Unisex room 13 | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Wall Switch | S | 114 | 2,800 | 2 | Relamp | No | 1 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | 58 | 2,800 | 0.0 | 172 | 0 | $25 | $73 | $20 | 2.2 |
| Restroom - Unisex room 14 | 1 | LED - Fixtures: Ambient 2x4 Fixture | Wall Switch | S | 40 | 2,800 | | None | No | 1 | LED - Fixtures: Ambient 2x4 Fixture | Wall Switch | 40 | 2,800 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Staff Room | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Wall Switch | S | 114 | 2,800 | 2, 3 | Relamp | Yes | 4 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 1,932 | 0.2 | 911 | 0 | $130 | $562 | $115 | 3.4 |
| Stairs Exit 3 | 1 | Exit Signs: LED - 2 W Lamp | None | S | 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 Exit 3 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,800 | 2, 3 | Relamp | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,932 | 0.1 | 517 | 0 | $74 | $416 | $75 | 4.6 |
| Stairs Exit 6 | 1 | Exit Signs: LED - 2 W Lamp | None | S | 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 Exit 6 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,800 | 2, 3 | Relamp | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,932 | 0.1 | 517 | 0 | $74 | $416 | $75 | 4.6 |
| Storage - Next to Boiler Room | 7 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,800 | 2, 3 | Relamp | Yes | 7 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,932 | 0.2 | 905 | 0 | $129 | $526 | $70 | 3.5 |
| Storage 1 | 1 | LED - Fixtures: Ambient 2x4 Fixture | Wall Switch | S | 50 | 2,800 | | None | No | 1 | LED - Fixtures: Ambient 2x4 Fixture | Wall Switch | 50 | 2,800 | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Storage 1 | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,800 | 2, 3 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,932 | 0.1 | 259 | 0 | $37 | $189 | $20 | 4.6 |
| Storage 4 | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 2,300 | 2 | Relamp | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,300 | 0.0 | 167 | 0 | $24 | $73 | $20 | 2.2 |
| Storage 5 Corridor 2 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,300 | 0.3 | 1,002 | 0 | $143 | $438 | $120 | 2.2 |
| Theater Stage | 1 | Exit Signs: LED - 2 W Lamp | None | S | 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 |
| Theater Stage | 1 | Halogen Incandescent: Stage Spot Luminaire | Wall Switch | S | 400 | 500 | 1 | Fixture Replacement | No | 1 | LED - Fixtures: Architectural Flood/Spot Luminaire | Wall Switch | 60 | 500 | 0.2 | 187 | 0 | $27 | $417 | $50 | 13.8 |
| Theater Stage | 54 | Incandescent: 65W A Lamp | Wall Switch | S | 65 | 500 | 2 | Relamp | No | 54 | LED Lamps: LED Lamps | Wall Switch | 10 | 500 | 2.1 | 1,634 | 0 | $232 | $930 | $54 | 3.8 |
| Theater Stage | 10 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 1,000 | 2, 3 | Relamp | Yes | 10 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 690 | 0.3 | 462 | 0 | $66 | $635 | $135 | 7.6 |
| Classroom 15 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 16 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 17 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 18 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |

| | 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 19 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 20 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 21 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 22 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 23 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Classroom 24 | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Occupancy Sensor | S | 114 | 2,300 | 2 | Relamp | No | 12 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,300 | 0.5 | 1,700 | 0 | $242 | $876 | $240 | 2.6 |
| Corridor 4 | 2 | Exit Signs: LED - 2 W Lamp | None | S | 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 |
| Corridor 4 | 9 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,800 | 2 | Relamp | No | 9 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 2,800 | 0.2 | 915 | 0 | $130 | $329 | $90 | 1.8 |
| Restroom - Boys Corridor 4 | 5 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,800 | 2, 3 | Relamp | Yes | 5 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,932 | 0.2 | 647 | 0 | $92 | $453 | $85 | 4.0 |
| Restroom - Girls Corridor 4 | 5 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,800 | 2, 3 | Relamp | Yes | 5 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,932 | 0.2 | 647 | 0 | $92 | $453 | $85 | 4.0 |
| Restroom - Unisex Faculty | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,800 | 2 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 2,800 | 0.0 | 102 | 0 | $14 | $37 | $10 | 1.8 |
| Restroom - Unisex Faculty | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | S | 62 | 2,300 | 2 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,300 | 0.0 | 83 | 0 | $12 | $37 | $10 | 2.2 |
| Stairs Exit 3 | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,800 | 2, 3 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,932 | 0.1 | 259 | 0 | $37 | $189 | $40 | 4.0 |
| Stairs Exit 6 | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,800 | 2, 3 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,932 | 0.1 | 259 | 0 | $37 | $189 | $40 | 4.0 |
| Storage Room | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | S | 62 | 2,800 | 2, 3 | Relamp | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,932 | 0.1 | 517 | 0 | $74 | $416 | $40 | 5.1 |

TRC

New Jersey's cleanenergy program

## 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 Room | Fuel Combustion System | 2 | Combustion Air Fan | 1.0 | 77.0% | No | Marathon | 5K38PN47 | W | 2,745 | | No | 77.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Gym | H&V Unit Gym | 1 | Supply Fan | 3.0 | 86.5% | No | NA | NA | B | 2,745 | 5 | No | 89.5% | Yes | 1 | 0.9 | 2,824 | 0 | $408 | $3,884 | $200 | 9.0 |
| Various | Classrooms | 26 | Fan Coil Unit | 0.3 | 65.0% | No | | | W | 2,745 | | No | 65.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Boiler Room | Compressed Air System | 2 | Air Compressor | 0.5 | 78.2% | No | Marathon | 056T17D11044 | W | 1,000 | | No | 78.2% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Roof | Exhaust Fan | 2 | Exhaust Fan | 0.2 | 65.0% | No | | | B | 2,745 | | No | 65.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Roof | Exhaust Fan | 2 | Exhaust Fan | 0.3 | 65.0% | No | | | W | 2,745 | | No | 65.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Roof | Exhaust Fan | 4 | Exhaust Fan | 0.5 | 70.0% | No | | | W | 2,745 | | No | 70.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Roof | Exhaust Fan | 1 | Exhaust Fan | 0.8 | 70.0% | No | | | W | 2,745 | | No | 70.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Roof | Exhaust Fan | 2 | Exhaust Fan | 0.3 | 65.0% | No | | | W | 2,745 | | No | 65.0% | No | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Boiler Room | Heating Hot Water Loop | 2 | Heating Hot Water Pump | 7.5 | 91.0% | No | WEG | CC029A | W | 1,950 | 6 | No | 91.0% | Yes | 2 | 1.4 | 8,992 | 0 | $1,298 | $9,476 | $2,000 | 5.8 |
| Storage Room 2nd Floor | AHUs - School | 2 | Supply Fan | 3.0 | 70.0% | No | | | B | 2,745 | 5 | No | 89.5% | Yes | 2 | 2.4 | 9,163 | 0 | $1,322 | $7,768 | $400 | 5.6 |

## 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 |
| Roof | Classroom and Offices | 1 | Split-System | 1.50 | | 11.00 | | RUUD | UAKB-018JAZ | B | 7 | Yes | 1 | Split-System | 1.50 | | 18.00 | | 0.3 | 251 | 0 | $36 | $5,678 | $158 | 152.6 |
| Roof | Classrooms and Offices | 1 | Split-System | 1.00 | | 9.50 | | Freidrich | MR12C1E | B | 7 | Yes | 1 | Split-System | 1.00 | | 18.00 | | 0.3 | 235 | 0 | $34 | $5,392 | $105 | 155.9 |
| Roof | Teacher's Lounge | 1 | Split-System | 2.00 | | 10.00 | | York | BRCS024 | B | 7 | Yes | 1 | Split-System | 2.00 | | 16.00 | | 0.5 | 355 | 0 | $51 | $5,922 | $210 | 111.6 |
| Roof | Classrooms and Offices | 1 | Split-System | 2.00 | | 10.00 | | Fujitsu | AOU24CL1 | B | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Roof | Classrooms and Offices | 2 | Split-System | 2.00 | | 10.00 | | Sanyo | C2422 | W | 7 | Yes | 2 | Split-System | 2.00 | | 16.00 | | 0.9 | 709 | 0 | $102 | $11,843 | $420 | 111.6 |
| Roof | Classrooms and Offices | 5 | Split-System Air-Source HP | 3.00 | 34.00 | 15.50 | 9 HSPF | Fujitsu | AOU36RLXB | W | | No | | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Roof & Ground | Classrooms and Offices | 4 | Split-System | 3.00 | | 10.00 | | RUUD | UAKB-036JAZ | B | 7 | Yes | 4 | Split-System | 3.00 | | 16.00 | | 2.7 | 2,128 | 0 | $307 | $25,144 | $1,260 | 77.8 |
| Exterior | Classroom | 1 | Split-System | 1.50 | | 10.00 | | RUUD | UAKB-018JAZ | B | 7 | Yes | 1 | Split-System | 1.50 | | 16.00 | | 0.3 | 266 | 0 | $38 | $5,678 | $158 | 143.8 |
| Various | Classrooms and Offices | 14 | Window AC | 1.00 | | 9.50 | | Various | Various | W | 7 | Yes | 14 | Window AC | 1.00 | | 12.00 | | 1.8 | 1,452 | 0 | $209 | $9,842 | $0 | 47.0 |
| Gym | Heating & Ventilation Unit - Gym | 1 | Built Up System | | 480.00 | | | NA | NA | B | | 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 Hot Water Loop | 2 | Non-Condensing Hot Water Boiler | 1,830 | Boderus | SB615-640 | W | | No | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

### 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 |
| Boiler Room | DHW Loop | 1 | Storage Tank Water Heater (> 50 Gal) | Rheem | G82-156 | W | | No | | | | | | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Kitchen | Booster Pump | 1 | Booster Water Heater | | | 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 |
| Restrooms | 8 | 17 | Faucet Aerator (Lavatory) | 2.20 | 0.50 | 0.0 | 0 | 8 | $79 | $122 | $61 | 0.8 |

### 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 |
| Kitchen | 1 | Freezer Chest | NA | GLFC2027FW3 | No | | No | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Kitchen | 1 | Stand-Up Refrigerator, Solid Door (>50 cu. ft.) | Migali | C-3R | Yes | | No | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Kitchen | 1 | Stand-Up Freezer, Solid Door (31 - 50 cu. ft.) | Migali | C-2R | No | | 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 |
| Kitchen | 1 | Gas Combination Oven/Steam Cooker (<15 Pans) | US Range | NA | No | | No | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Kitchen | 1 | Insulated Food Holding Cabinet (Full Size) | NA | NA | No | | No | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |
| Kitchen | 1 | Gas Rack Oven (Double) | US Range | NA | No | | No | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

## Dishwasher Inventory & Recommendations

| | Existing Conditions | | | | | | | Proposed Conditions | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Quantity | Dishwasher Type | Manufacturer | Model | Water Heater Fuel Type | Booster Heater Fuel Type | 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 | Payback w/ Incentives in Years |
| Kitchen | 1 | Door Type (High Temp) | CMA | CMA-180 | Natural Gas | None | Yes | | No | 0.0 | 0 | 0 | $0 | $0 | $0 | 0.0 |

## Plug Load Inventory

| | Existing Conditions | | | | | |
|---|---|---|---|---|---|---|
| Location | Quantity | Equipment Description | Energy Rate (W) | ENERGY STAR Qualified? | Manufacturer | Model |
| Various | 47 | Fan | 100 | No | NA | NA |
| Various | 1 | Dehumidifier | 480 | No | Dayton | NA |
| Various | 2 | Desktop Computer | 270 | Yes | Various | Various |
| Classrooms | 30 | Projector | 200 | No | Various | Various |
| Various | 3 | Microwave | 800 | No | Various | Various |
| Various | 1 | Printer (Medium) | 192 | No | Various | Various |
| Offices | 3 | Printer (Large) | 494 | No | Xerox | Various |
| Various | 2 | Refrigerator (Large) | 572 | No | Various | Various |
| Various | 4 | Refrigerator (Mini) | 126 | No | Various | Various |
| Various | 16 | Television | 240 | No | Various | Various |
| Various | 1 | Toaster | 1,500 | No | Various | Various |
| Kitchen | 1 | Food warmer | 1,440 | No | NA | NA |

## 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 |
| Various | 1 | Refrigerated | 9 | Yes | 0.2 | 1,612 | 0 | $233 | $230 | $50 | 0.8 |

# APPENDIX B: ENERGY STAR® STATEMENT OF ENERGY PERFORMANCE

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

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## ENERGY STAR® Statement of Energy Performance

**21**

ENERGY STAR® Score[1]

### Frank K. Hehnly Elementary School

**Primary Property Type:** K-12 School
**Gross Floor Area (ft²):** 45,497
**Built:** 1970

**For Year Ending:** November 30, 2021
**Date Generated:** November 01, 2022

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 |
|---|---|---|
| Frank K. Hehnly Elementary School<br>590 Raritan Road<br>Clark, New Jersey 07066 | Clark Public School District<br>365 Westfield Ave<br>Clark, NJ 07066<br>(732) 574-9600 | Paul Vizzuso<br>365 Westfield Ave<br>Clark, NJ 07066<br>(732) 574-9600 ext 3354<br>pvizzuso@clarkschools.org |

**Property ID:** 21589154

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

**Site EUI**
75.8 kBtu/ft²

**Source EUI**
117.4 kBtu/ft²

| Annual Energy by Fuel | |
|---|---|
| Electric - Grid (kBtu) | 982,784 (28%) |
| Natural Gas (kBtu) | 2,465,037 (72%) |

| National Median Comparison | |
|---|---|
| National Median Site EUI (kBtu/ft²) | 56.3 |
| National Median Source EUI (kBtu/ft²) | 87.2 |
| % Diff from National Median Source EUI | 35% |
| **Annual Emissions** | |
| Greenhouse Gas Emissions (Metric Tons CO2e/year) | 217 |

**Signature & Stamp of Verifying Professional**

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

LP Signature: ________________________Date: ___________

**Licensed Professional**

____ ________

,

(____)____-______

___________________

Professional Engineer or Registered Architect Stamp
(if applicable)

# Appendix C: Glossary

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

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

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