# Local Government Energy Audit:
## Energy Audit Report


***High Mountain School***

515 High Mountain Rd.

North Haledon, NJ 07508

North Haledon Board of Education

August 28, 2018

Final Report by:

**TRC Energy Services**

# Disclaimer

The intent of this energy analysis report is to identify energy savings opportunities and recommend upgrades to the facility's energy using equipment and systems. Approximate saving are included in this report to help make decisions about reducing energy use at the facility. This report, however, is not intended to serve as a detailed engineering design document. Further design and analysis may be necessary in order to implement some of the measures recommended in this report.

The energy conservation measures and estimates of energy savings have been reviewed for technical accuracy. However, estimates of final energy savings are not guaranteed, because final savings may depend on behavioral factors and other uncontrollable variables. TRC Energy Services (TRC) and New Jersey Board of Public Utilities (NJBPU) shall in no event be liable should the actual energy savings vary.

Estimated installation costs are based on TRC's experience at similar facilities, pricing from local contractors and vendors, and/or cost estimates from *RS Means*. The owner of the facility is encouraged to independently confirm these cost estimates and to obtain multiple estimates when considering measure installations. Since actual installed costs can vary widely for certain measures and conditions, TRC and NJBPU do not guarantee installed cost estimates and shall in no event be held liable should actual installed costs vary from estimates.

New Jersey's Clean Energy Program (NJCEP) incentive values provided in this report are estimates based on program information available at the time of the report. Incentive levels are not guaranteed. The NJBPU reserves the right to extend, modify, or terminate programs without prior notice. The owner of the facility should review available program incentives and eligibility requirements prior to selecting and installing any energy conservation measures.

# Table of Contents

# Table of Figures

# 1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for the High Mountain School.

The goal of an LGEA report is to provide you with information on how your building uses energy, identify energy conservation measures (ECMs) that can reduce your energy use, and provide information and assistance to help facilities implement ECMs. The LGEA report also contains valuable information on financial incentives from New Jersey's Clean Energy Program (NJCEP) for implementing ECMs.

This study was conducted by TRC Energy Services (TRC), as part of a comprehensive effort to assist New Jersey public schools in controlling energy costs and protecting our environment by offering a wide range of energy management options and advice.

## 1.1 Building Summary

The High Mountain School is a 61,025 square-foot building comprised of various space types including classrooms, offices, a gymnasium, a media center, a small commercial kitchen, a cafeteria that doubles as an auditorium, a stage area, and various mechanical and storage spaces. There is a small basement which contains heating equipment including boilers, pumps, domestic hot water heater, and various electrical equipment.

Lighting at the High Mountain School consists of aging and inefficient fluorescent and incandescent lighting. Heating is supplied by hot water boilers. Cooling is supplied by various spilt-system, ductless mini-split, and packaged rooftop air conditioners. A thorough description of the building and our observations are in Section 2.

## 1.2 Your Cost Reduction Opportunities

### Energy Conservation Measures

TRC evaluated eight measures which together represent an opportunity for the High Mountain School to reduce annual energy costs by $23,845 and annual greenhouse gas emissions by 141,857 lbs. $CO_2e$. We estimate that if all measures were implemented as recommended, the project would pay for itself in 6.5 years. The breakdown of existing and potential utility costs after project implementation are illustrated in Figure 1 and Figure 2, respectively. Together these measures represent an opportunity to reduce the High Mountain School's annual energy use by 9%.

*Figure 1 – Previous 12 Month Utility Costs*

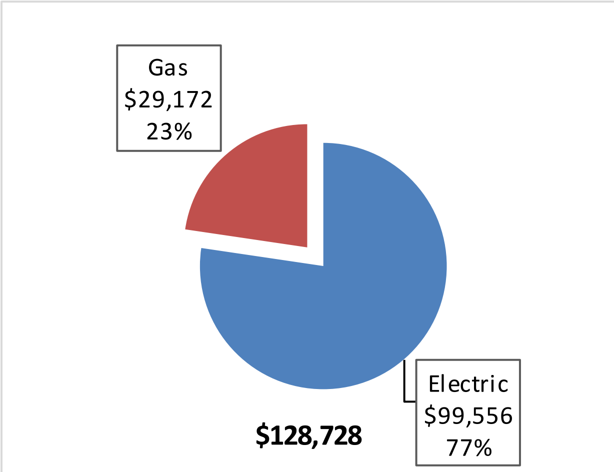
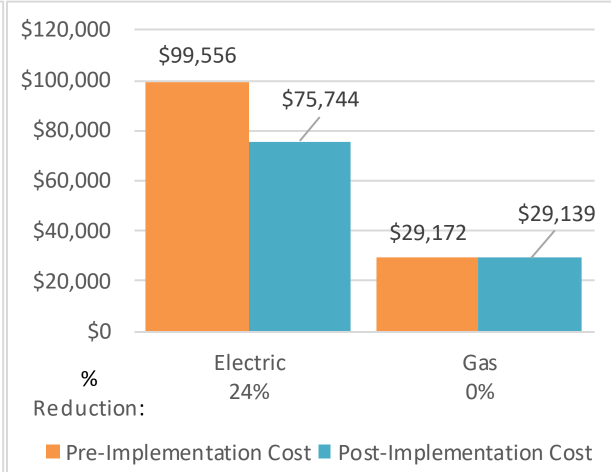



*Figure 2 – Potential Post-Implementation Costs*




A detailed description of the High Mountain School's existing energy use can be found in Section 3.

Estimates of the total cost, energy savings, and financial incentives for the proposed energy efficient upgrades are summarized below in Figure 3. A brief description of each category can be found below and a description of savings opportunities can be found in Section 4.

*Figure 3 – Summary of Energy Reduction Opportunities*

| Energy Conservation Measure | | Recommend? | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($)* | Estimated Net Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | | **106,185** | **28.2** | **0.0** | **$18,000.99** | **$131,726.15** | **$15,285.00** | **$116,441.15** | **6.5** | **106,928** |
| ECM 1 | Install LED Fixtures | Yes | 20,208 | 5.0 | 0.0 | $3,425.82 | $67,570.22 | $4,400.00 | $63,170.22 | 18.4 | 20,350 |
| ECM 2 | Retrofit Fixtures with LED Lamps | Yes | 85,977 | 23.2 | 0.0 | $14,575.17 | $64,155.93 | $10,885.00 | $53,270.93 | 3.7 | 86,578 |
| **Lighting Control Measures** | | | **10,754** | **2.3** | **0.0** | **$1,823.04** | **$18,880.00** | **$2,065.00** | **$16,815.00** | **9.2** | **10,829** |
| ECM 3 | Install Occupancy Sensor Lighting Controls | Yes | 7,849 | 1.7 | 0.0 | $1,330.61 | $16,080.00 | $2,065.00 | $14,015.00 | 10.5 | 7,904 |
| ECM 4 | Install High/Low Lighitng Controls | Yes | 2,905 | 0.5 | 0.0 | $492.43 | $2,800.00 | $0.00 | $2,800.00 | 5.7 | 2,925 |
| **Motor Upgrades** | | | **1,527** | **0.3** | **0.0** | **$258.93** | **$5,441.68** | **$0.00** | **$5,441.68** | **21.0** | **1,538** |
| ECM 5 | Premium Efficiency Motors | Yes | 1,527 | 0.3 | 0.0 | $258.93 | $5,441.68 | $0.00 | $5,441.68 | 21.0 | 1,538 |
| **Variable Frequency Drive (VFD) Measures** | | | **21,997** | **3.7** | **0.0** | **$3,729.08** | **$16,705.90** | **$1,200.00** | **$15,505.90** | **4.2** | **22,151** |
| ECM 6 | Install VFDs on Constant Volume (CV) HVAC | Yes | 7,072 | 2.0 | 0.0 | $1,198.85 | $7,083.80 | $1,200.00 | $5,883.80 | 4.9 | 7,121 |
| ECM 7 | Install VFDs on Hot Water Pumps | Yes | 14,925 | 1.7 | 0.0 | $2,530.23 | $9,622.10 | $0.00 | $9,622.10 | 3.8 | 15,030 |
| **Gas Heating (HVAC/Process) Replacement** | | | **0** | **0.0** | **311.7** | **$2,925.44** | **$81,723.99** | **$9,299.60** | **$72,424.39** | **24.8** | **36,492** |
| | Install High Efficiency Hot Water Boilers | No | 0 | 0.0 | 252.6 | $2,370.59 | $63,371.55 | $7,299.60 | $56,071.95 | 23.7 | 29,571 |
| | Install High Efficiency Furnaces | No | 0 | 0.0 | 59.1 | $554.85 | $18,352.44 | $2,000.00 | $16,352.44 | 29.5 | 6,921 |
| **TOTAL FOR RECOMMENDED MEASURES** | | | **140,464** | **34.5** | **3.5** | **$23,844.97** | **$172,775.24** | **$18,550.00** | **$154,225.24** | **6.5** | **141,857** |
| **TOTAL FOR ALL MEASURES** | | | **140,464** | **34.5** | **315.2** | **$26,770.41** | **$254,499.23** | **$27,849.60** | **$226,649.63** | **8.5** | **178,349** |

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

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

**Lighting Upgrades** generally involve the replacement of existing lighting components such as lamps and ballasts (or the entire fixture) with higher efficiency lighting components. These measures save energy by reducing the power used by the lighting components due to improved electrical efficiency.

**Lighting Controls** measures generally involve the installation of automated controls to turn off lights or reduce light output when not needed. Automated control reduces reliance on occupant behavior for adjusting lights. These measures save energy by reducing the amount of time lights are on.

**Motor Upgrades** generally involve replacing older standard efficiency motors with high efficiency standard (NEMA Premium). Motors replacements generally assume the same size motors, just higher efficiency. Although occasionally additional savings can be achieved by downsizing motors to better meet current load requirements. This measure saves energy by reducing the power used by the motors, due to improved electrical efficiency.

**Variable Frequency Drives (VFDs)** are motor control devices. These measures control the speed of a motor so that the motor spins at peak efficiency during partial load conditions. Sensors adapt the speed to flow, temperature, or pressure settings which is much more efficient that usage a valve or damper to control flow rates, or running the motor at full speed when only partial power is needed. These measures save energy by controlling motor usage more efficiently.

**Gas Heating** (HVAC/Process) measures generally involve replacing older inefficient hydronic heating systems with modern energy efficient systems. Gas heating systems can provide equivalent heating compared to older systems at a reduced energy cost. These measures save energy by reducing the fuel demands for heating, due to improved combustion and heat transfer efficiency.

**Domestic Hot Water** upgrade measures generally involve replacing older inefficient domestic water heating systems with modern energy efficient systems. New domestic hot water heating systems can provide equivalent, or greater, water heating capacity compared to older systems at a reduced energy cost. These measures save energy by reducing the fuel used for domestic hot water heating due to improved heating efficiency or reducing standby losses.

## Energy Efficient Practices

TRC also identified 13 low cost (or no cost) energy efficient practices. A building's energy performance can be significantly improved by employing certain behavioral or operational adjustments and by performing better routine maintenance on building systems. These practices can extend equipment lifetime, improve occupant comfort, provide better health and safety, as well as reduce annual energy and O&M costs. Potential opportunities identified at the High Mountain School include:

- Reduce Air Leakage
- Perform Proper Lighting Maintenance
- Develop a Lighting Maintenance Schedule
- Ensure Lighting Controls Are Operating Properly
- Perform Routine Motor Maintenance
- Use Fans to Reduce Cooling Load
- Clean Evaporator/Condenser Coils on AC Systems
- Clean and/or Replace HVAC Filters
- Perform Proper Boiler Maintenance
- Perform Proper Water Heater Maintenance
- Install Plug Load Controls
- Replace Computer Monitors
- Water Conservation

For details on these energy efficient practices, please refer to Section 5.

### On-Site Generation Measures

TRC evaluated the potential for installing on-site generation for the High Mountain School. Based on the configuration of the site and its loads there is a high potential for installing a photovoltaic (PV) array.

*Figure 4 – Photovoltaic Potential*

| | | |
|---|---|---|
| **Potential** | High | |
| **System Potential** | 154 | kW DC STC |
| **Electric Generation** | 115,876 | kWh/yr |
| **Displaced Cost** | $10,080 | /yr |
| **Installed Cost** | $400,400 | |

For details on our evaluation and on-site generation potential, please refer to Section 6.

## 1.3 Implementation Planning

To realize the energy savings from the ECMs listed in this report, a project implementation plan must be developed. Available capital must be considered and decisions need to be made whether it is best to pursue individual ECMs separately, groups of ECMs, or a comprehensive approach where all ECMs are implemented together, possibly in conjunction with other building upgrades or improvements.

Rebates, incentives, and financing are available from NJCEP, as well as other sources, to help reduce the costs associated with the implementation of energy efficiency projects. Prior to implementing any measure, please review the relevant incentive program guidelines before proceeding. This is important because in most cases you will need to submit applications for the incentives prior to purchasing materials or commencing with installation.

The ECMs outlined in this report may qualify under the following program(s):

- SmartStart
- Direct Install
- SREC (Solar Renewable Energy Certificate) Registration Program (SRP)
- Energy Savings Improvement Program (ESIP)

For facilities wanting to pursue only selected individual measures (or planning to phase implementation of selected measures over multiple years), incentives are available through the SmartStart program. To participate in this program, you may utilize internal resources, or an outside firm or contractor, to do the final design of the ECM(s) and do the installation. Program pre-approval is required for some SmartStart incentives, so only after receiving pre-approval should you proceed with ECM installation. The incentive estimates listed above in Figure 3 are based on the SmartStart program. More details on this program and others are available in Section 8.

This building may also qualify for the Direct Install program which can provide turnkey installation of multiple measures, through an authorized network of participating contractors. This program can provide substantially higher incentives than SmartStart, up to 70% of the cost of selected measures, although measure eligibility will have to be assessed and be verified by the designated Direct Install contractor and, in most cases, they will perform the installation work.

For larger facilities with limited capital availability to implement ECMs, project financing may be available through the Energy Savings Improvement Program (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. An LGEA report (or other approved energy audit) is required for participation in ESIP. Please refer to Section 8.4 for additional information on the ESIP Program.

The Demand Response Energy Aggregator is a (non-NJCEP) program designed to reduce 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. Demand Response (DR) service providers (a.k.a. Curtailment Service Providers) are registered with PJM, the independent system operator (ISO) for mid-Atlantic state region that is charged with maintaining electric grid reliability. By enabling grid operators to call upon commercial facilities to reduce their electric usage 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 DR programs. Program participation is voluntary and facilities receive payments whether or not they are called upon to curtail their load during times of peak demand. Refer to Section 7 for additional information on this program.

Additional information on relevant incentive programs is in Section 8. You may also check the following website for more details: www.njcleanenergy.com/ci.

# 2 Building Information and Existing Conditions

## 2.1 Project Contacts

*Figure 5 – Project Contacts*

| Name | Role | E-Mail | Phone # |
|---|---|---|---|
| **Customer** | | | |
| John Maquire | Supervisor of Buildings & Grounds | jmaguire@nhschools.net | 973-427-1220 |
| **Designated Representative** | | | |
| John Maquire | Supervisor of Buildings & Grounds | jmaguire@nhschools.net | 973-427-1220 |
| **TRC Energy Services** | | | |
| Alexander Klieverik | Auditor | aklieverik@trcsolutions.com | (732) 855-0033 |

## 2.2 General Site Information

On January 23 and 24, 2018, TRC an energy audit at the High Mountain School located in North Haledon, New Jersey. TRC's team met with John Maguire, Supervisor of Buildings & Grounds to review the building operations and help focus our investigation on specific energy-using systems.

The High Mountain School is a 61,025 square-foot building comprised of various space types including classrooms, offices, a gymnasium, a media center, a small commercial kitchen, a cafeteria that doubles as an auditorium, a stage area, and various mechanical and storage spaces. There is a small basement which contains most of heating equipment including boilers, pumps, domestic hot water heater, and various electrical equipment.

The building was originally constructed in 1960. The last year of major renovation was in 2007 when fluorescent lighting was updated, and other non-energy related upgrades were made. The site is interested in solar and wind generation on site, but has been unable to fund the project.

## 2.3 Building Occupancy

The school building is open Monday through Friday and occasionally on Saturday. The typical schedule is presented in the table below. The entire building is used year-round, though only the main office and a few areas are occupied throughout the summer. During a typical day, the building is occupied by 50 staff and 300 students.

*Figure 6 - Building Schedule*

| Building Name | Weekday/Weekend | Operating Schedule |
|---|---|---|
| High Mountain School | Weekday | 6:00 AM to 4:00 PM |
| High Mountain School | Weekend | As Needed |

## 2.4 Building Envelope

The building is constructed of concrete block, and structural steel with a brick facade. The building has a flat roof covered with a membrane and gravel ballast that is in good condition. The building has double pane windows which are in good condition and show little sign of excessive infiltration. The exterior doors are constructed of aluminum and in good condition except that the door seals have worn out which increases the level of outside air infiltration.



## 2.5 On-Site Generation

The High Mountain School does not have any on-site electric generation capacity.

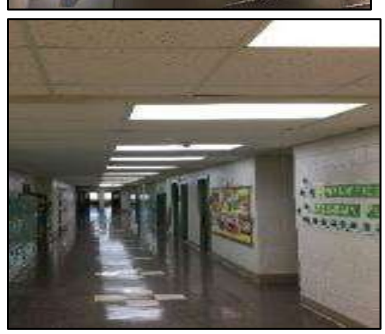
## 2.6 Energy-Using Systems

Please see Appendix A: Equipment Inventory & Recommendations for an inventory of the building's equipment.

### Lighting System

Lighting at the building is provided mostly by 32-Watt linear fluorescent T8 lamps with electronic ballasts as well as some compact fluorescent lamps (CFL). Most of the fixtures are 2-lamp or 3-lamp, 4-foot long indirect hanging fixtures. Some areas contain troffers or ceiling-mounted fixtures with diffusers.



Lighting control is provided by a mixture of occupancy sensors and wall switches. The media center, classrooms, and locker rooms all have occupancy sensors installed. Lighting in most offices, restrooms, mechanical rooms, and storage rooms is controlled by wall switches. Occupancy sensors are either wall or ceiling mounted depending on the space layout. Stairwells, elevator lobbies and main lobby areas do not contain any occupancy sensors and are on continuously when the building is occupied.

The building's exterior lighting consists primarily of efficient LED fixtures, though there are a small number of compact fluorescent, metal halide, and incandescent fixtures. All exterior lighting is controlled by schedule timers and run from 5:30 PM to 11:00 PM every day.



## Hot Water & Furnace Heating System

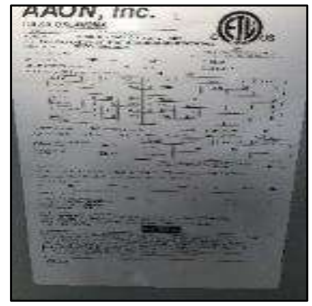
The hot water system at this building consists of two banks of HydroTherm MR-2100B atmospheric modular boilers. Each bank has seven modules with an output capacity of 237 MBH each, for a total output capacity 3,318 MBH and a nominal combustion efficiency of 79%. The hot water heating is divided into a primary-secondary loop with two secondary loop distribution branches serving the East and West side of the building. The primary loop is served by a 1.5 HP pump. The East and West branch each have a 3 HP supply pump, and there is one 7.5 HP return pump serving each branch. Hot water is supplied at 180°F to the primary loop, then the secondary loop water temperature is reduced by three-way valves. The secondary loop water temperature is automatically adjusted based on outdoor temperature. Hot water is provided to air handlers, packaged terminal air conditioners (PTACs), and the perimeter convection heaters throughout the building.

The boiler operation and secondary loop temperature is controlled by a Tekmar 268 control panel. The lead boiler is rotated weekly. The boilers are in fair condition but well maintained.




There are five AAON packaged rooftop units (RTU1 through RTU5) serving the media center (RTU1), computer room (RTU2), gymnasium (RTU4), locker rooms (RTU5), and the music room, art room, and the associated hallway (RTU3). RTU1, RTU3, and RTU5 all have a heating output capacity of 146 MBH. The computer room unit (RTU2) has a heating output capacity of 56 MBH, and the gymnasium (RTU4) is served by a 316 MBH capacity unit. All RTUs were installed in 2008 and have a combustion efficiency of 81%.



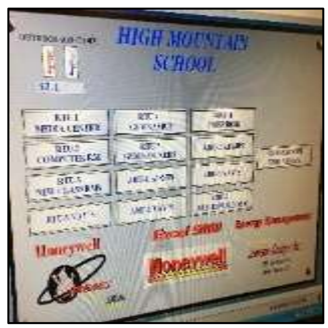

The packaged units are in good condition and well maintained.

## Direct Expansion (DX) Air Conditioning Systems

The building is primarily cooled by 28 Airedale packaged terminal air conditioners (PTACs) with direct expansion coils (DX) and hot water coils, located in classroom HVAC closets. Each unit has a cooling capacity of 36,000 Btu/hr. Other areas are conditioned by a mixture of split-system air conditioners serving the air handler units, ductless mini-split air conditioners for small spaces, and packaged rooftop units for larger areas.

There are three air handler units (AHU1, AHU2, & AHU3) with hot water coils and DX components that condition various spaces on the north side of the building. The main office (AHU1) is served by a 6-ton capacity AAON unit with a 3 HP supply fan and a 2 HP exhaust fan. The nurse's office, teachers' room, and rooms 152, 153, 154, 155, and 156 (AHU2) are also served by a 6-ton capacity AAON unit with a 3 HP supply fan and a 2 HP exhaust fan. The cafeteria (AHU3) is served by a 25-ton capacity AAON unit with a 10 HP supply fan and a 5 HP exhaust fan.


The packaged rooftop units serving the media center (RTU1), locker rooms (RTU5), as well as the music room, art room, and hallway (RTU3) have a cooling capacity of 8 tons each. RTU1 and RTU3 have 5 HP supply fans and 2 HP exhaust fans with variable frequency drives installed. RTU5 has a 3 HP supply fan and a 2 HP exhaust fan. The computer room (RTU2) is served by a 3-ton unit with a 1 HP supply fan and 1 HP exhaust fan with variable frequency drives installed. The gymnasium (RTU4) is served by a 20-ton unit with a 10 HP supply fan and 7.5 HP exhaust fan with variable frequency drives installed.


All AHUs, RTUs, and PTACs are controlled by a central Honeywell Building Energy Management System (BEMS).

Room 117 and the server room are cooled by two Mitsubishi mini-split units, each with a capacity of 9,000Btu/hr. In addition to the above-mentioned AHUs, the main office and nurse's office are served by two 2-ton Mitsubishi mini-split units.

The four mini-split units are controlled by individual thermostats located in the room; adjustable by staff.

## Building Energy Management System (BEMS)

The building's internal temperature is controlled by a central Honeywell EMS. The system operates on a schedule which controls the AHUs, RTUs, and PTACs throughout the building, and can be adjusted by the building supervisor. The design occupied heating setpoint is 70°F, though many areas have temperature setpoints that have been adjusted since its installation. The average temperature throughout the building is approximately 74°F.

## Domestic Hot Water Heating System

The domestic hot water heating system for the building consists of one Rheem SPIDERfire model GHE100ES gas fired condensing water heater with an input rating of 199 MBH and a nominal efficiency of 95%. The water heater has a 100-gallon storage tank. One 1/4 HP recirculation pump distributes 110°F water to the entire site. The pump operates based on an aquastat.


## Food Service & Refrigeration

The building has a small commercial kitchen that is used to prepare lunch for the students. Meals are brought in from the food service company, and stored at the kitchen.

There are two reach-in refrigerators, a refrigerated beverage cabinet, and a chest refrigerator for storing milk cartons. The kitchen also has a walk-in freezer storage area which is maintained at a constant temperature of 15°F.

The ovens and range tops are all gas fired.

## Building Plug Load

There are 105 computer work stations throughout the building. Approximately 90% of the computers are desktop units with LCD monitors. There is no centralized PC power management software installed.

Other equipment contributing to the building plug load includes 24 projectors and smartboards, ten desk printers, one photocopier, six televisions, and four refrigerators/freezers of various sizes. There is also a tech room which contains various power tools and stationary equipment.




## 2.7 Water-Using Systems

There are ten restrooms at this building. A sampling of restrooms found that the faucets are rated for 2.2 gallons per minute (gpm) or lower, the toilets are rated at 2.5 gallons per flush (gpf) and the urinals are rated at 2 gpf. There are no showers at this building.

The school has a girl's and boy's locker room. The locker rooms each have 2 sinks rated at 0.5 gpm, and 2 toilets rated at 2.5 gpf. The boy's locker room also has 2 urinals rated at 1.0 gpf.

# 3 SITE ENERGY USE AND COSTS

Utility data for electricity and natural gas was analyzed to identify opportunities for savings. In addition, data for electricity and natural gas was evaluated to determine the annual energy performance metrics for the building in energy cost per square foot and energy usage per square foot. These metrics are an estimate of the relative energy efficiency of this building. There are several factors that could cause the energy use of this building to vary from the "typical" energy usage profile for facilities with similar characteristics. Local weather conditions, building age and insulation levels, equipment efficiency, daily occupancy hours, changes in occupancy throughout the year, equipment operating hours, and energy efficient behavior of occupants all contribute to benchmarking scores. Please refer to the Benchmarking section within Section 3.4 for additional information.

## 3.1 Total Cost of Energy

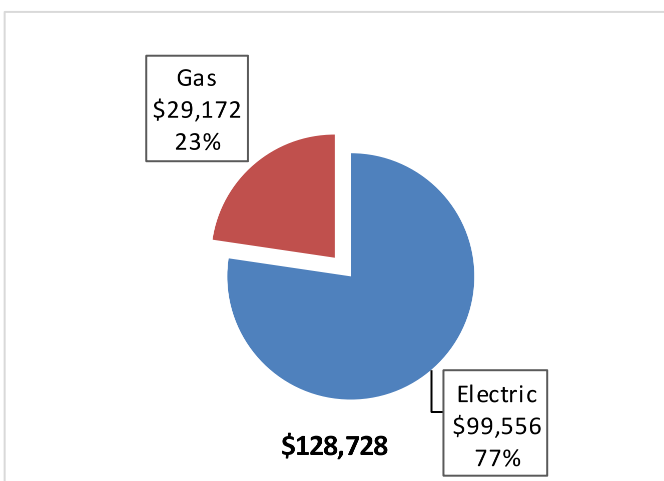
The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. A profile of the annual energy consumption and energy cost of the building was developed from this information.

*Figure 7 - Utility Summary*

| Utility Summary for High Mountain School | | |
|---|---|---|
| **Fuel** | **Usage** | **Cost** |
| Electricity | 587,267 kWh | $99,556 |
| Natural Gas | 31,079 Therms | $29,172 |
| **Total** | | **$128,728** |

The current annual energy cost for this building is $128,728 as shown in the chart below.

*Figure 8 - Energy Cost Breakdown*



## 3.2 Electricity Usage

Electricity is provided by PSE&G. The average electric cost over the past 12 months was $0.170/kWh, which is the blended rate that includes energy supply, distribution, and other charges. This rate is used throughout the analyses in this report to assess energy costs and savings. The electric energy profile (pattern of consumption) indicates a spike in consumption during June due to increased cooling load, and drops off again in July and August due lack of summer programs. The increase in consumption in September is most likely due increased activity at the beginning of the school year. The monthly electricity consumption and peak demand are shown in the chart below. The monthly electricity consumption and peak demand are shown in the chart below. The annual energy use profile (pattern of usage over time) indicates an interrupted air conditioning load "hump" in the summer months as the building occupancy declines. The usage spikes in September when the occupancy increases coincidently with warm summer temperatures.

*Figure 9 - Electric Usage & Demand*

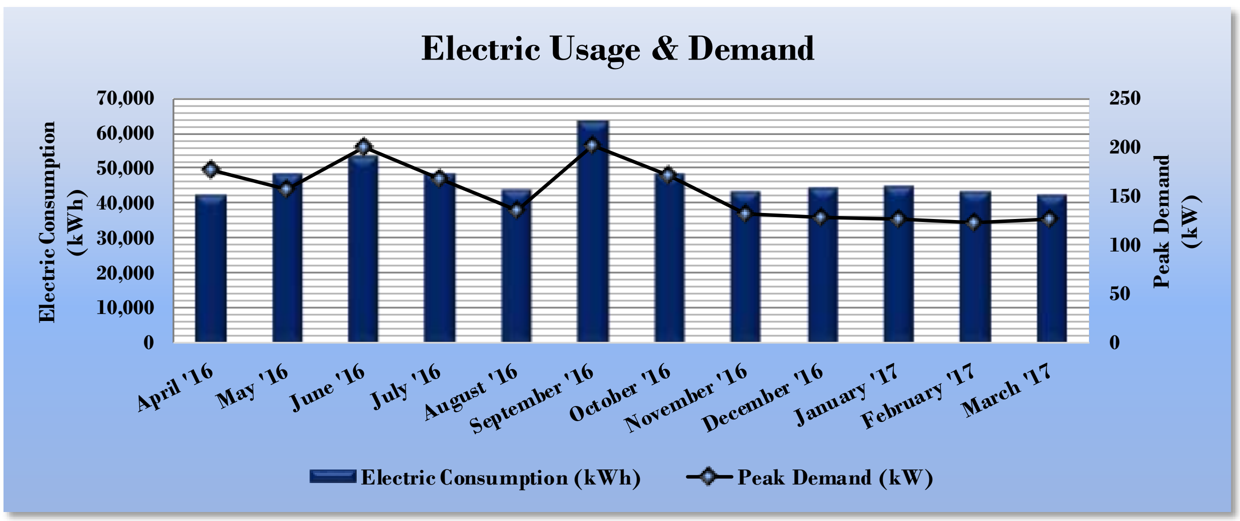


*Figure 10 - Electric Usage & Demand*

| Electric Billing Data for High Mountain School | | | | | | |
|---|---|---|---|---|---|---|
| Period Ending | Days in Period | Electric Usage (kWh) | Demand (kW) | Demand Cost | Total Electric Cost | TRC Estimated Usage? |
| 4/25/16 | 31 | 42,643 | 177 | $649 | $6,756 | No |
| 5/24/16 | 28 | 48,306 | 157 | $575 | $7,445 | No |
| 6/23/16 | 29 | 53,665 | 200 | $734 | $10,071 | No |
| 7/25/16 | 31 | 48,693 | 167 | N/A | $9,252 | Yes |
| 8/23/16 | 28 | 43,721 | 135 | $495 | $8,223 | No |
| 9/22/16 | 29 | 63,765 | 203 | $752 | $11,921 | No |
| 10/21/16 | 28 | 48,694 | 171 | $637 | $7,808 | No |
| 11/21/16 | 30 | 43,317 | 132 | $491 | $6,812 | No |
| 12/22/16 | 30 | 44,211 | 129 | N/A | $7,074 | Yes |
| 1/24/17 | 32 | 45,105 | 126 | $468 | $7,110 | No |
| 2/23/17 | 29 | 43,518 | 122 | $455 | $6,876 | No |
| 3/24/17 | 28 | 42,322 | 126 | $472 | $6,936 | No |
| **Totals** | **353** | **567,960** | **202.7** | **$5,728** | **$96,283** | 2 |
| **Annual** | **365** | **587,267** | **202.7** | **$5,922** | **$99,556** | |

## 3.3 Natural Gas Usage

Natural gas is provided by PSE&G. The average gas cost for the past 12 months is $0.939/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is shown in the chart below. The usage profile is typical of a school with little in the way of domestic hot water demand in a temperate climate zone. The energy use profile for natural gas is typical for a gas heated building with a small service water load in a temperate climate.

*Figure 11 - Natural Gas Usage*

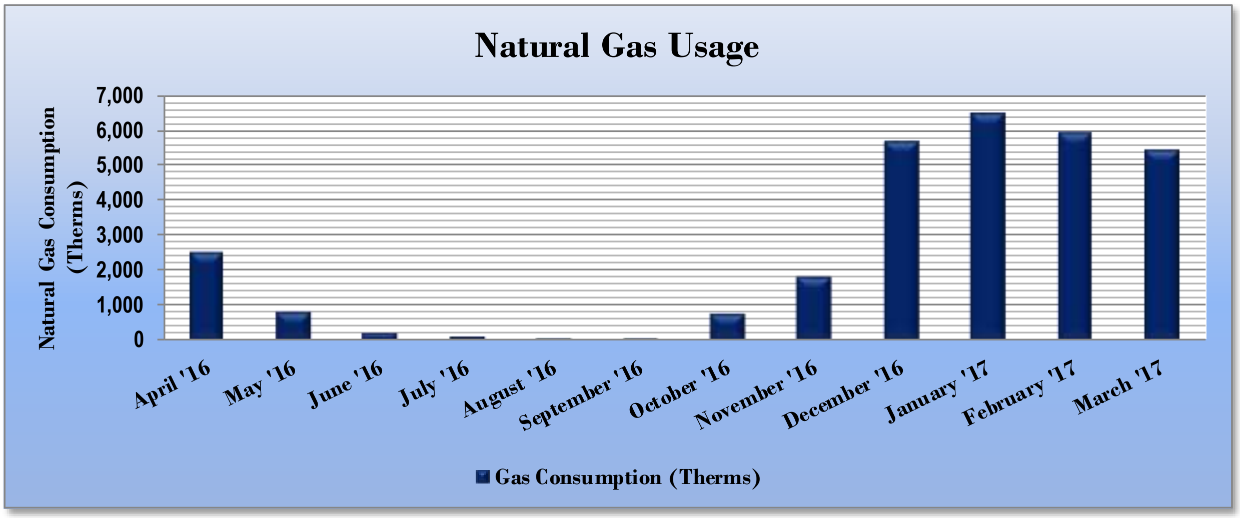



*Figure 12 - Natural Gas Usage*

| Gas Billing Data for High Mountain School | | | | |
|---|---|---|---|---|
| **Period Ending** | **Days in Period** | **Natural Gas Usage (Therms)** | **Natural Gas Cost** | **TRC Estimated Usage?** |
| 4/26/16 | 28 | 2,521 | $1,468 | No |
| 5/25/16 | 28 | 803 | $542 | No |
| 6/24/16 | 29 | 218 | $226 | No |
| 7/27/16 | 32 | 133 | $179 | No |
| 8/24/16 | 27 | 49 | $134 | No |
| 9/23/16 | 29 | 71 | $146 | No |
| 10/25/16 | 31 | 748 | $517 | No |
| 11/22/16 | 27 | 1,838 | $2,166 | No |
| 12/22/16 | 29 | 5,694 | $5,949 | Yes |
| 1/25/17 | 33 | 6,514 | $6,331 | No |
| 2/24/17 | 29 | 5,938 | $5,659 | No |
| 3/27/17 | 30 | 5,443 | $4,815 | No |
| **Totals** | **352** | **29,972** | **$28,133** | |
| **Annual** | **365** | **31,079** | **$29,172** | |

## 3.4 Benchmarking

This building was benchmarked using Portfolio Manager®, an online tool created and managed by the United States Environmental Protection Agency (EPA) through the ENERGY STAR® program. Portfolio Manager® analyzes your building's consumption data, cost information, and operational use details and then compares its performance against a national median for similar buildings of its type. Metrics provided by this analysis are Energy Use Intensity (EUI) and an ENERGY STAR® score for select building types.

The EUI is a measure of a building's energy consumption per square foot, and it is the standard metric for comparing buildings' energy performance. Comparing the EUI of a building with the national median EUI for that building type illustrates whether that building uses more or less energy than similar buildings of its type on a square foot basis. 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.

*Figure 13 - Energy Use Intensity Comparison – Existing Conditions*

| Energy Use Intensity Comparison - Existing Conditions | | |
|---|---|---|
| | High Mountain School | National Median<br>Building Type: School (K-12) |
| Source Energy Use Intensity (kBtu/ft$^2$) | 156.6 | 141.4 |
| Site Energy Use Intensity (kBtu/ft$^2$) | 83.8 | 58.2 |

Implementation of all recommended measures in this report would improve the building's estimated EUI significantly, as shown in the table below:

*Figure 14 - Energy Use Intensity Comparison – Following Installation of Recommended Measures*

| Energy Use Intensity Comparison - Following Installation of Recommended Measures | | |
|---|---|---|
| | High Mountain School | National Median<br>Building Type: School (K-12) |
| Source Energy Use Intensity (kBtu/ft$^2$) | 131.9 | 141.4 |
| Site Energy Use Intensity (kBtu/ft$^2$) | 75.9 | 58.2 |

Many types of commercial buildings are also eligible to receive an ENERGY STAR® score. This score is a percentile ranking from 1 to 100. It compares your building's energy performance to similar buildings nationwide. A score of 50 represents median energy performance, while a score of 75 means your building performs better than 75% of all similar buildings nationwide and may be eligible for ENERGY STAR® certification. This building has a current score of 63.

A Portfolio Manager® Statement of Energy Performance (SEP) was generated for this building, see Appendix B: ENERGY STAR® Statement of Energy Performance.

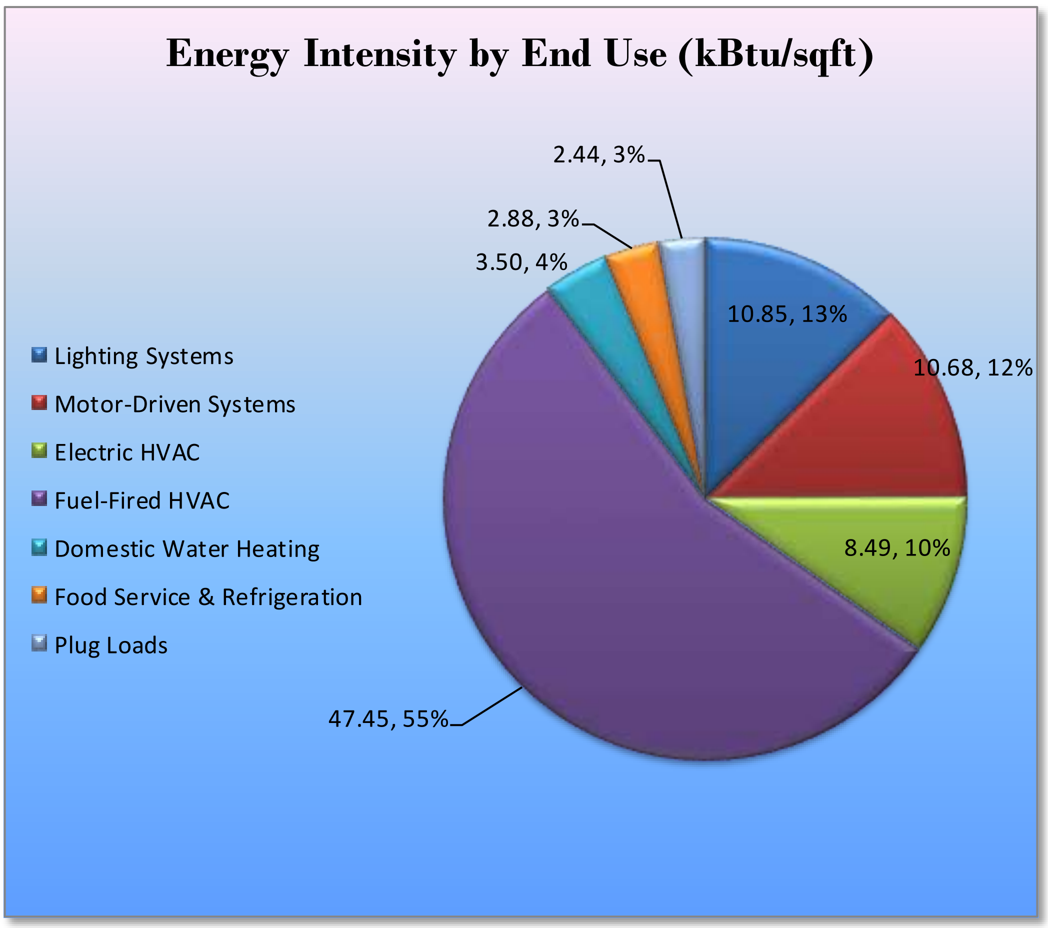
For more information on ENERGY STAR® certification go to: https://www.energystar.gov/buildings/building-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1.

A Portfolio Manager® account has been created online for your building and you will be provided with the login information for the account. We encourage you to update your utility information in Portfolio Manager regularly, so that you can keep track of your building's performance. 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.

## 3.5 Energy End-Use Breakdown

In order to provide a complete overview of energy consumption across building systems, an energy balance was performed at this building. An energy balance utilizes standard practice engineering methods to evaluate all components of the various electric and fuel-fired systems found in a building to determine their proportional contribution to overall building energy usage. This chart of energy end uses highlights the relative contribution of each equipment category to total energy usage. This can help determine where the greatest benefits might be found from energy efficiency measures.

***Figure 15 - Energy Balance (kBtu/SF)***



# 4 Energy Conservation Measures

*Level of Analysis*

The goal of this audit report is to identify potential energy efficiency opportunities, help prioritize specific measures for implementation, and provide information to the High Mountain School regarding financial incentives for which they may qualify to implement the recommended measures. For this audit report, most measures have received only a preliminary analysis of feasibility which identifies expected ranges of savings and costs. This level of analysis is usually considered sufficient to demonstrate project cost-effectiveness and help prioritize energy measures. Savings are based on the New Jersey Clean Energy Program Protocols to Measure Resource Savings dated June 29, 2016, approved by the New Jersey Board of Public Utilities. Further analysis or investigation may be required to calculate more precise savings based on specific circumstances. A higher level of investigation may be necessary to support any custom SmartStart or Pay for Performance, or Direct Install incentive applications. Financial incentives for the ECMs identified in this report have been calculated based the NJCEP prescriptive SmartStart program. Some measures and proposed upgrade projects may be eligible for higher incentives than those shown below through other NJCEP programs as described in Section 8.

The following sections describe the evaluated measures.

## 4.1 Recommended ECMs

The measures below have been evaluated by the auditor and are recommended for implementation at the building.

*Figure 16 – Summary of Recommended ECMs*

| Energy Conservation Measure | | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($)* | Estimated Net Cost ($) | Simple Payback Period (yrs)** | $CO_2$e Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Lighting Upgrades** | | **106,185** | **28.2** | **0.0** | **$18,000.99** | **$131,726.15** | **$15,285.00** | **$116,441.15** | **6.5** | **106,928** |
| ECM 1 | Install LED Fixtures | 20,208 | 5.0 | 0.0 | $3,425.82 | $67,570.22 | $4,400.00 | $63,170.22 | 18.4 | 20,350 |
| ECM 2 | Retrofit Fixtures with LED Lamps | 85,977 | 23.2 | 0.0 | $14,575.17 | $64,155.93 | $10,885.00 | $53,270.93 | 3.7 | 86,578 |
| **Lighting Control Measures** | | **10,754** | **2.3** | **0.0** | **$1,823.04** | **$18,880.00** | **$2,065.00** | **$16,815.00** | **9.2** | **10,829** |
| ECM 3 | Install Occupancy Sensor Lighting Controls | 7,849 | 1.7 | 0.0 | $1,330.61 | $16,080.00 | $2,065.00 | $14,015.00 | 10.5 | 7,904 |
| ECM 4 | Install High/Low Lighitng Controls | 2,905 | 0.5 | 0.0 | $492.43 | $2,800.00 | $0.00 | $2,800.00 | 5.7 | 2,925 |
| **Motor Upgrades** | | **1,527** | **0.3** | **0.0** | **$258.93** | **$5,441.68** | **$0.00** | **$5,441.68** | **21.0** | **1,538** |
| ECM 5 | Premium Efficiency Motors | 1,527 | 0.3 | 0.0 | $258.93 | $5,441.68 | $0.00 | $5,441.68 | 21.0 | 1,538 |
| **Variable Frequency Drive (VFD) Measures** | | **21,997** | **3.7** | **0.0** | **$3,729.08** | **$16,705.90** | **$1,200.00** | **$15,505.90** | **4.2** | **22,151** |
| ECM 6 | Install VFDs on Constant Volume (CV) HVAC | 7,072 | 2.0 | 0.0 | $1,198.85 | $7,083.80 | $1,200.00 | $5,883.80 | 4.9 | 7,121 |
| ECM 7 | Install VFDs on Hot Water Pumps | 14,925 | 1.7 | 0.0 | $2,530.23 | $9,622.10 | $0.00 | $9,622.10 | 3.8 | 15,030 |
| **Domestic Water Heating Upgrade** | | **0** | **0.0** | **3.5** | **$32.93** | **$21.51** | **$0.00** | **$21.51** | **0.7** | **411** |
| ECM 8 | Install Low-Flow Domestic Hot Water Devices | 0 | 0.0 | 3.5 | $32.93 | $21.51 | $0.00 | $21.51 | 0.7 | 411 |
| **TOTALS** | | **140,464** | **34.5** | **3.5** | **$23,844.97** | **$172,775.24** | **$18,550.00** | **$154,225.24** | **6.5** | **141,857** |

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

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

### 4.1.1 Lighting Upgrades

Our recommendations for upgrades to existing lighting fixtures are summarized in Figure 17 below.

*Figure 17 – Summary of Lighting Upgrade ECMs*

| Energy Conservation Measure | | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2$e Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| Lighting Upgrades | | 106,185 | 28.2 | 0.0 | $18,000.99 | $131,726.15 | $15,285.00 | $116,441.15 | 6.5 | 106,928 |
| ECM 1 | Install LED Fixtures | 20,208 | 5.0 | 0.0 | $3,425.82 | $67,570.22 | $4,400.00 | $63,170.22 | 18.4 | 20,350 |
| ECM 2 | Retrofit Fixtures with LED Lamps | 85,977 | 23.2 | 0.0 | $14,575.17 | $64,155.93 | $10,885.00 | $53,270.93 | 3.7 | 86,578 |

During lighting upgrade planning and design, we recommend a comprehensive approach that considers both the efficiency of the lighting fixtures and how they are controlled.

## ECM 1: Install LED Fixtures

*Summary of Measure Economics*

| Interior/ Exterior | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2$e Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| Interior | 18,690 | 4.6 | 0.0 | $3,168.41 | $64,444.80 | $3,600.00 | $60,844.80 | 19.2 | 18,821 |
| Exterior | 1,518 | 0.4 | 0.0 | $257.41 | $3,125.42 | $800.00 | $2,325.42 | 9.0 | 1,529 |

*Measure Description*

We recommend replacing existing fixtures containing metal halide lamps with new high-performance LED light fixtures. This measure saves energy by installing LEDs which use less power than other technologies with a comparable light output.

Additional savings from lighting maintenance can be anticipated since LEDs have lifetimes which are more than twice that of other lighting technologies.

## ECM 2: Retrofit Fixtures with LED Lamps

*Summary of Measure Economics*

| Interior/ Exterior | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2$e Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| Interior | 85,176 | 23.0 | 0.0 | $14,439.43 | $63,564.65 | $10,850.00 | $52,714.65 | 3.7 | 85,772 |
| Exterior | 801 | 0.2 | 0.0 | $135.74 | $591.28 | $35.00 | $556.28 | 4.1 | 806 |

*Measure Description*

We recommend retrofitting existing incandescent, halogen, fluorescent, or other lighting technologies with LED lamps. Many LED tube lamps are direct replacements for existing fluorescent lamps and can be installed while leaving the fluorescent fixture ballast in place. LED bulbs can be used in existing fixtures as a direct replacement for most other lighting technologies. This measure saves energy by installing LEDs which use less power than other lighting technologies yet provide equivalent lighting output for the space.

Additional savings from lighting maintenance can be anticipated since LEDs have lifetimes which are more than twice that of fluorescent tubes and more than ten times longer than many incandescent lamps.

## 4.1.2 Lighting Control Measures

Our recommendations for lighting control measures are summarized in Figure 18 below.

*Figure 18 – Summary of Lighting Control ECMs*

| Energy Conservation Measure | | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| Lighting Control Measures | | 10,754 | 2.3 | 0.0 | $1,823.04 | $18,880.00 | $2,065.00 | $16,815.00 | 9.2 | 10,829 |
| ECM 3 | Install Occupancy Sensor Lighting Controls | 7,849 | 1.7 | 0.0 | $1,330.61 | $16,080.00 | $2,065.00 | $14,015.00 | 10.5 | 7,904 |
| ECM 4 | Install High/Low Lighitng Controls | 2,905 | 0.5 | 0.0 | $492.43 | $2,800.00 | $0.00 | $2,800.00 | 5.7 | 2,925 |

During lighting upgrade planning and design, we recommend a comprehensive approach that considers both the efficiency of the lighting fixtures and how they are controlled.

### ECM 3: Install Occupancy Sensor Lighting Controls

*Summary of Measure Economics*

| Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|
| 7,849 | 1.7 | 0.0 | $1,330.61 | $16,080.00 | $2,065.00 | $14,015.00 | 10.5 | 7,904 |

*Measure Description*

We recommend installing occupancy sensors to control lighting fixtures that are currently controlled by manual switches in most restrooms, storage rooms, classrooms, and offices areas. For this building, we also recommend installing occupancy sensors in the gymnasium, kitchen, and cafeteria. Lighting sensors detect occupancy using ultrasonic and/or infrared sensors. For most spaces, we recommend lighting controls use dual technology sensors, which can eliminate the possibility of any lights turning off unexpectedly. Lighting systems are enabled when an occupant is detected. Fixtures are automatically turned off after an area has been vacant for a preset period. Some controls also provide dimming options and all modern occupancy controls can be easily over-ridden by room occupants to allow them to manually turn fixtures on or off, as desired. Energy savings results from only operating lighting systems when they are required.

Occupancy sensors may be mounted on the wall at existing switch locations, mounted on the ceiling, or in remote locations. In general, wall switch replacement sensors are recommended for single occupant offices and other small rooms. Ceiling-mounted or remote mounted sensors are used in locations without local switching or where wall switches are not in the line-of-sight of the main work area and in large spaces. We recommend a comprehensive approach to lighting design that upgrades both the lighting fixtures and the controls together for maximum energy savings and improved lighting for occupants.

## ECM 4: Install High/Low Lighting Controls

*Summary of Measure Economics*

| Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|
| 2,905 | 0.5 | 0.0 | $492.43 | $2,800.00 | $0.00 | $2,800.00 | 5.7 | 2,925 |

*Measure Description*

We recommend installing 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. Typical areas for such lighting control are stairwells, interior corridors, parking lots, and parking garages.

Lighting fixtures with these controls operate at default low levels when the area is not occupied to provide minimal lighting to meet security or safety requirements. Sensors detect occupancy using ultrasonic and/or infrared sensors. The lighting systems are switched to full lighting levels whenever an occupant is detected. Fixtures are automatically switched back to low level after an area has been vacant for a preset period of time. Energy savings results from only providing full lighting levels when it is required.

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

Additional savings from reduced lighting maintenance may also result from this measure, due to reduced lamp operation.

### 4.1.3 Motor Upgrades

Our recommendations for motor upgrades are summarized in Figure 19 below.

*Figure 19 – Summary of Motor Upgrade ECMs*

| Energy Conservation Measure | | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($)* | Estimated Net Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Motor Upgrades** | | **1,527** | **0.3** | **0.0** | **$258.93** | **$5,441.68** | **$0.00** | **$5,441.68** | **21.0** | **1,538** |
| ECM 5 | Premium Efficiency Motors | 1,527 | 0.3 | 0.0 | $258.93 | $5,441.68 | $0.00 | $5,441.68 | 21.0 | 1,538 |

## ECM 5: Premium Efficiency Motors

*Summary of Measure Economics*

| Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|
| 1,527 | 0.3 | 0.0 | $258.93 | $5,441.68 | $0.00 | $5,441.68 | 21.0 | 1,538 |

*Measure Description*

We recommend replacing standard efficiency motors with *NEMA Premium™* efficiency motors. Our evaluation assumes that existing motors will be replaced with motors of equivalent size and type. Although occasionally additional savings can be achieved by downsizing motors to better meet the motor's current load requirements. The base case motor efficiencies are estimated from nameplate information and our best estimates of motor run hours. Efficiencies of proposed motor upgrades are obtained from the *New Jersey's Clean Energy Program Protocols to Measure Resource Savings (2016)*. Savings are based on the difference between baseline and proposed efficiencies and the assumed annual operating hours.

### 4.1.4 Variable Frequency Drive Measures

Our recommendations for variable frequency drive (VFD) measures are summarized in Figure 20 below.

*Figure 20 – Summary of Variable Frequency Drive ECMs*

| Energy Conservation Measure | | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2$e Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Variable Frequency Drive (VFD) Measures** | | **21,997** | **3.7** | **0.0** | **$3,729.08** | **$16,705.90** | **$1,200.00** | **$15,505.90** | **4.2** | **22,151** |
| ECM 6 | Install VFDs on Constant Volume (CV) HVAC | 7,072 | 2.0 | 0.0 | $1,198.85 | $7,083.80 | $1,200.00 | $5,883.80 | 4.9 | 7,121 |
| ECM 7 | Install VFDs on Hot Water Pumps | 14,925 | 1.7 | 0.0 | $2,530.23 | $9,622.10 | $0.00 | $9,622.10 | 3.8 | 15,030 |

## ECM 6: Install VFDs on Constant Volume (CV) HVAC

*Summary of Measure Economics*

| Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2$e Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|
| 7,072 | 2.0 | 0.0 | $1,198.85 | $7,083.80 | $1,200.00 | $5,883.80 | 4.9 | 7,121 |

*Measure Description*

We recommend installing variable frequency drives (VFDs) to control supply fan motor speeds to convert 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 will cause the VFD to modulate fan speed to maintain the appropriate temperature in the zone, while maintaining a constant supply air temperature. Energy savings results from reducing fan speed (and power) when there is a reduced load required for the zone. The magnitude of energy savings is based on the estimated amount of time that fan motors operate at partial load.

For air handlers with direct expansion (DX) cooling systems (AHU3), the minimum air flow across the cooling coil required to prevent the coil from freezing will have to be determined during the final project design. The control system should be programmed to maintain the minimum air flow whenever the compressor is operating.

## ECM 7: Install VFDs on Hot Water Pumps

*Summary of Measure Economics*

| Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|
| 14,925 | 1.7 | 0.0 | $2,530.23 | $9,622.10 | $0.00 | $9,622.10 | 3.8 | 15,030 |

*Measure Description*

We recommend installing a variable frequency drives (VFD) to control a hot water pumps. This measure requires that most of the hot water coils be served by 2-way valves and that a differential pressure sensor is installed in the hot water loop. As the hot water valves close, the differential pressure increases. The VFD modulates pump speed to maintain a differential pressure setpoint. Energy savings results 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.

### 4.1.5 Domestic Hot Water System Upgrades

Our recommendations for domestic hot water system improvements are summarized in Figure 21 below.

***Figure 21 - Summary of Domestic Hot Water ECMs***

| Energy Conservation Measure | | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Domestic Water Heating Upgrade** | | **0** | **0.0** | **3.5** | **$32.93** | **$21.51** | **$0.00** | **$21.51** | **0.7** | **411** |
| ECM 8 | Install Low-Flow Domestic Hot Water Devices | 0 | 0.0 | 3.5 | $32.93 | $21.51 | $0.00 | $21.51 | 0.7 | 411 |

## ECM 8: Install Low-Flow DHW Devices

*Summary of Measure Economics*

| Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.0 | 3.5 | $32.93 | $21.51 | $0.00 | $21.51 | 0.7 | 411 |

*Measure Description*

We recommend installing low-flow domestic hot water devices to reduce overall hot water demand. Energy demand from domestic hot water heating systems can be reduced by reducing water usage in general. Faucet aerators can reduce hot water usage, relative to standard aerators, which saves energy without compromising water pressure.

## 4.2 ECMs Evaluated But Not Recommended

The measures below have been evaluated by the auditor but are not recommended for implementation at the building. Reasons for exclusion can be found in each measure description section.

***Figure 22 – Summary of Measures Evaluated, But Not Recommended***

| Energy Conservation Measure | | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($)* | Estimated Net Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Gas Heating (HVAC/Process) Replacement** | | **0** | **0.0** | **311.7** | **$2,925.44** | **$81,723.99** | **$9,299.60** | **$72,424.39** | **24.8** | **36,492** |
| | Install High Efficiency Hot Water Boilers | 0 | 0.0 | 252.6 | $2,370.59 | $63,371.55 | $7,299.60 | $56,071.95 | 23.7 | 29,571 |
| | Install High Efficiency Furnaces | 0 | 0.0 | 59.1 | $554.85 | $18,352.44 | $2,000.00 | $16,352.44 | 29.5 | 6,921 |
| **TOTALS** | | **0** | **0.0** | **311.7** | **$2,925.44** | **$81,723.99** | **$9,299.60** | **$72,424.39** | **24.8** | **36,492** |

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

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

### Install High Efficiency Hot Water Heating Boilers

*Summary of Measure Economics*

| Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.0 | 252.6 | $2,370.59 | $63,371.55 | $7,299.60 | $56,071.95 | 23.7 | 29,571 |

*Measure Description*

We typically recommend replacing older inefficient hot water heating boilers with high efficiency hot water boilers. Significant improvements have been made in combustion technology resulting in increased overall boiler efficiency. Energy savings results from improved combustion efficiency and reduced standby losses at low loads.

The most notable efficiency improvement is condensing hydronic boilers that can achieve over 90% efficiency under the proper conditions. Condensing hydronic boilers typically operate at efficiencies between 85% and 87% (comparable to other high efficiency boilers) when the return water temperature is above 130°F. The boiler efficiency increases as the return water temperature drops below 130°F. Therefore, condensing hydronic boilers were only evaluated when the return water temperature is less than 130°F during most of the operating hours. As a result, condensing hydronic boilers are not recommended for this site.

*Reasons for not Recommending*

Due to the long payback period for this measure.  We are not currently recommending replacing the existing boilers with high efficiency ones.

## Install High Efficiency Furnaces

*Summary of Measure Economics*

| Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.0 | 59.1 | $554.85 | $18,352.44 | $2,000.00 | $16,352.44 | 29.5 | 6,921 |

*Measure Description*

We evaluated replacing existing standard efficiency furnaces with condensing furnaces. Improved combustion technology and heat exchanger design optimize heat recovery from the combustion gases which can significantly improve furnace efficiency. Savings result from improved system efficiency.

*Reasons for not Recommending*

Due to the long payback period for this measure. We are not currently recommending replacing the existing furnaces with high efficiency ones.

# 5 Energy Efficient Practices

In addition to the quantifiable savings estimated in Section 4, a building's energy performance can also be improved through application of many low cost or no-cost energy efficiency strategies. By employing certain behavioral and operational changes and performing routine maintenance on building systems, equipment lifetime can be extended; occupant comfort, health and safety can be improved; and energy and O&M costs can be reduced. The recommendations below are provided as a framework for developing a whole building maintenance plan that is customized to your building. Consult with qualified equipment specialists for details on proper maintenance and system operation.

### Reduce Air Leakage

Air leakage, or infiltration, occurs when outside air enters a building uncontrollably through cracks and openings. Properly sealing such cracks and openings can significantly reduce heating and cooling costs, improve building durability, and create a healthier indoor environment. This includes caulking or installing weather stripping around leaky doors and windows allowing for better control of indoor air quality through controlled ventilation.

### Perform Proper Lighting Maintenance

In order to sustain optimal lighting levels, lighting fixtures should undergo routine maintenance. Light levels decrease over time due to lamp aging, lamp and ballast failure, and buildup of dirt and dust on lamps, fixtures and reflective surfaces. Together, these factors can reduce total illumination by 20%-60% or more, while operating fixtures continue drawing full power. To limit this reduction, lamps, reflectors and diffusers should be thoroughly cleaned of dirt, dust, oil, and smoke film buildup approximately every 6–12 months.

### Develop a Lighting Maintenance Schedule

In addition to routine fixture cleaning, development of a maintenance schedule can both ensure maintenance is performed regularly and can reduce the overall cost of fixture re-lamping and re-ballasting. By re-lamping and re-ballasting fixtures in groups, lighting levels are better maintained and the number of site visits by a lighting technician or contractor can be minimized, decreasing the overall cost of maintenance.

### Ensure Lighting Controls Are Operating Properly

Lighting controls are very cost-effective energy efficient devices, when installed and operating correctly. As part of a lighting maintenance schedule, lighting controls should be tested annually to ensure proper functioning. For occupancy sensors, this requires triggering the sensor and verifying that the sensor's timer settings are correct. For daylight sensors, maintenance involves cleaning of sensor lenses and confirming setpoints and sensitivity are appropriately configured.

### Perform Routine Motor Maintenance

Motors consist of many moving parts whose collective degradation can contribute to a significant loss of motor efficiency. To prevent damage to motor components, routine maintenance should be performed. This maintenance consists of 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.

## Use Fans to Reduce Cooling Load

Utilizing ceiling fans to supplement cooling is a low-cost strategy to reduce cooling load considerably. Thermostat settings can be increased by 4°F with no change in overall occupant comfort when the wind chill effect of moving air is employed for cooling.

## Clean Evaporator/Condenser Coils on AC Systems

Dirty evaporators and condensers coils cause a restriction to air flow and restrict heat transfer. This results in increased evaporator and condenser fan load and a decrease in cooling system performance. Keeping the coils clean allows the fans and cooling system to operate more efficiently.

## Clean and/or Replace HVAC Filters

Air filters work to reduce the amount of indoor air pollution and increase occupant comfort. Over time, filters become less and less effective as particulate buildup increases. In addition to health concerns related to clogged filters, filters that have reached saturation also restrict air flow through the building's air conditioning or heat pump system, increasing the load on the distribution fans and decreasing occupant comfort levels. Filters should be checked monthly and cleaned or replaced when appropriate.

## Perform Proper Boiler Maintenance

Many boiler problems develop slowly over time, so regular inspection and maintenance is essential to retain proper functionality and efficiency of the heating system. Fuel burning equipment should undergo yearly tune-ups to ensure they are operating as safely and efficiently as possible from a combustion standpoint. A tune-up should include a combustion analysis to analyze the exhaust from the boilers and to ensure the boiler is operating safely. Buildup of dirt, dust, or deposits on the internal surfaces of a boiler can greatly affect its heat transfer efficiency. These deposits can accumulate on the water side or fire side of the boiler. Boilers should be cleaned regularly according to the manufacturer's instructions to remove this build up to sustain efficiency and equipment life.

## Perform Proper Water Heater Maintenance

At least once a year, drain a few gallons out of the water heater using the drain valve. If there is a lot of sediment or debris, then a full flush is recommended. Turn the temperature down and then completely drain the tank. Once a year check for any leaks or heavy corrosion on the pipes and valves. For gas water heaters, check the draft hood and make sure it is placed properly, with a few inches of air space between the tank and where it connects to the vent. Look for any corrosion or wear on the gas line and on the piping. If you noticed any black residue, soot or charred metal, this is a sign you may be having combustion issues and you should have the unit serviced by a professional. For electric water heaters, look for any signs of leaking such as rust streaks or residue around the upper and lower panels covering the electrical components on the tank. For water heaters over three to four years old have a technician inspect the sacrificial anode annually.

## Plug Load Controls

There are a variety of ways to limit the energy use of plug loads including increasing occupant awareness, removing under-utilized equipment, installing hardware controls, and using software controls. Some control steps to take are to enable the most aggressive power settings on existing devices or install load sensing or occupancy sensing (advanced) power strips. For additional information refer to "Plug Load Best Practices Guide" http://www.advancedbuildings.net/plug-load-best-practices-guide-offices.

## Replace Computer Monitors

Replacing old computer monitors or displays with efficient monitors will reduce energy use. ENERGY STAR® rated monitors have specific requirements for on mode power consumption as well as idle and sleep mode power. According to the ENERGY STAR® website monitors that have earned the ENERGY STAR® label are 25% more efficient than standard monitors.

## Water Conservation

Installing low-flow faucets or faucet aerators, low-flow showerheads, and kitchen sink pre-rinse spray valves saves both energy and water. These devices save energy by reducing the overall amount of hot water used hence reducing the energy used to heat the water. The flow ratings for EPA WaterSense™ (http://www3.epa.gov/watersense/products) labeled devices are 1.5 gpm for bathroom faucets, 2.0 gpm for showerheads, and 1.28 gpm for pre-rinse spray valves.

Installing dual flush or low-flow toilets and low-flow or waterless urinals are additional ways to reduce the sites water use, however, these devices do not provide energy savings at the site level. Any reduction in water use does however ultimately reduce grid level electricity use since a significant amount of electricity is used to deliver water from reservoirs to end users. The EPA WaterSense™ ratings for urinals is 0.5 gpf and toilets that use as little as 1.28 gpf (this is lower than the current 1.6 gpf federal standard).

Refer to Section 4.1.5 for any low-flow ECM recommendations.

# 6 On-Site Generation Measures

On-site generation measure options include both renewable (e.g., solar, wind) and non-renewable (e.g., fuel cells) on-site technologies that generate power to meet all or a portion of the electric energy needs of a building, often repurposing any waste heat where applicable. Also referred to as distributed generation, these systems contribute to Greenhouse Gas (GHG) emission reductions, demand reductions and reduced customer electricity purchases, resulting in the electric system reliability through improved transmission and distribution system utilization.

The State of New Jersey's Energy Master Plan (EMP) encourages new distributed generation of all forms and specifically focuses on expanding use of combined heat and power (CHP) by reducing financial, regulatory and technical barriers and identifying opportunities for new entries. The EMP also outlines a goal of 70% of the State's electrical needs to be met by renewable sources by 2050.

Preliminary screenings were performed to determine the potential that a generation project could provide a cost-effective solution for your building. Before deciding to implement, a feasibility study should be conducted that would take a detailed look at 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.

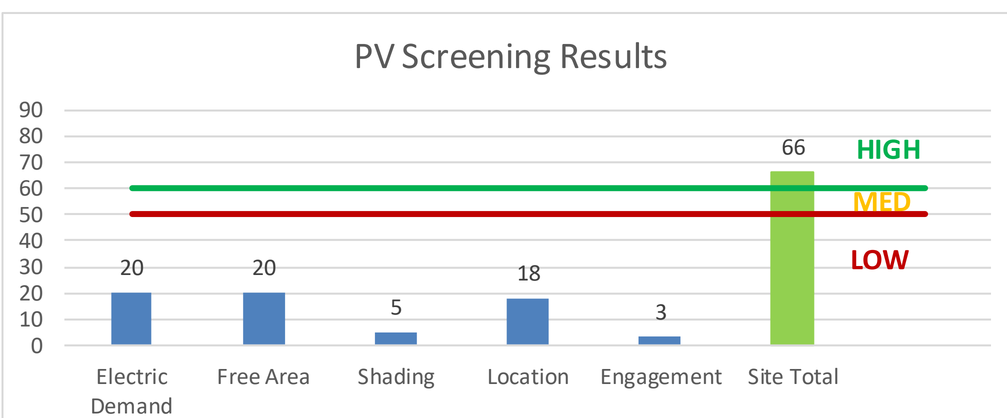
## 6.1 Photovoltaic

Sunlight can be converted into electricity using photovoltaics (PV) modules. Modules are racked together into an array that produces direct current (DC) electricity. The DC current is converted to alternating current (AC) through an inverter. The inverter is interconnected to the building's electrical distribution system. The amount of unobstructed area available determines how large of a solar array can be installed. The size of the array combined with the orientation, tilt, and shading elements determines the energy produced.

A preliminary screening based on the building's electric demand, size and location of free area, and shading elements shows that the building has a High potential for installing a PV array.

The amount of free area, ease of installation (location), and the lack of shading elements contribute to the high potential for PV at the site. A PV array located on the roof of the main building/ground next to the building/over the main parking lot may be feasible. If the High Mountain School is interested in pursuing the installation of PV, we recommended a full feasibility study be conducted.

*Figure 23 - Photovoltaic Screening*



| | | |
|---|---|---|
| **Potential** | High | |
| **System Potential** | 154 | kW DC STC |
| **Electric Generation** | 115,876 | kWh/yr |
| **Displaced Cost** | $10,080 | /yr |
| **Installed Cost** | $400,400 | |

Solar projects must register their projects in the SREC (Solar Renewable Energy Certificate) Registration Program (SRP) prior to the start of construction in order to establish the project's eligibility to earn SRECs. Registration of the intent to participate in New Jersey's solar marketplace provides market participants with information about developed new solar projects and insight into future SREC pricing. Refer to Section 8.3 for additional information.

For more information on solar PV technology and commercial solar markets in New Jersey, or to find a qualified solar installer, who can provide a more detailed assessment of the specific costs and benefits of solar develop of the site, please visit the following links below:

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

## 6.2 Wind Generation

Wind turbines convert the kinetic energy from wind into electricity. Conventional and building integrated wind turbines can be divided into three main components: rotor, generator with gear box, and support structure. Wind turbines produce direct current (DC) electricity. The DC current is converted to alternating current (AC) through an inverter.

According to information published by NREL, most on-shore areas of NJ are generally not good candidates for economic development small wind power projects. For further information on wind power, go to: http://www.njcleanenergy.com/renewable-energy/home/home.

## 6.3 Combined Heat and Power

Combined heat and power (CHP) is the on-site generation of electricity along with the recovery of heat energy, which is put to beneficial use. Common technologies for CHP include reciprocating engines, microturbines, fuel cells, backpressure steam turbines, and (at large facilities) gas turbines. Electric generation from a CHP system is typically interconnected to local power distribution systems. Heat is recovered from exhaust and ancillary cooling systems and interconnected to the existing hot water (or steam) distribution systems.

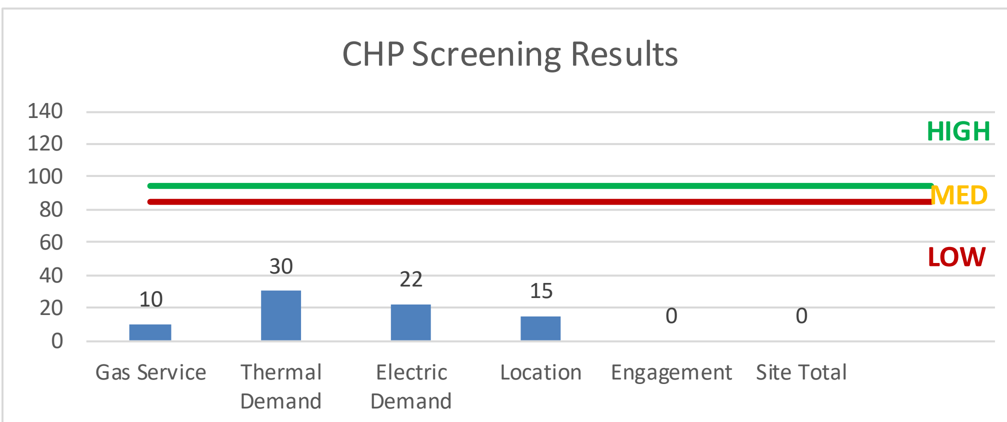
CHP systems are typically used to produce a portion of the electric power used onsite by a building, with the balance of electric power needs supplied by grid purchases. The heat is used to supplement (or supplant) existing boilers for space heating and/or domestic hot water heating. Waste heat can also be routed through absorption chillers for space cooling. The key criteria used for screening, however, is the amount of time the system operates at full load and the building's ability to use the recovered heat. Facilities with continuous use 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 building has a Low potential for installing a cost-effective CHP system.

Lack of gas service, low or infrequent thermal load, and lack of space near the existing boilers are the most significant factors contributing to the low potential for CHP at the site. In our opinion, the building does not appear to meet the minimum requirements for a cost-effective CHP installation.

For a list of qualified firms in New Jersey specializing in commercial CHP cost assessment and installation, go to: [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/)

***Figure 24 - Combined Heat and Power Screening***



# 7 Demand Response

Demand Response (DR) is a program designed to reduce the electric load of commercial facilities when electric wholesale prices are high or when the reliability of the electric grid is threatened due to peak demand. Demand Response service providers (a.k.a. Curtailment Service Providers) are registered with PJM, the independent system operator (ISO) for mid-Atlantic state region that is charged with maintaining electric grid reliability.

By enabling grid operators to call upon Curtailment Service Providers and commercial facilities to reduce electric usage 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 DR programs. Program participation is voluntary and participants receive payments whether or not their facility is called upon to curtail their electric usage.

Typically an electric customer needs to be capable of reducing their electric demand, within minutes, by at least 100 kW or more in order to participate in a DR program. Customers with a greater capability to quickly curtail their demand during peak hours will receive higher payments. Customers with back-up generators onsite may also receive additional DR payments for their generating capacity if they agree to run the generators for grid support when called upon. Eligible customers who have chosen to participate in a DR programs often find it to be a valuable source of revenue for their facility because the payments can significantly offset annual electric costs.

Participating customers can often quickly reduce their peak load through simple measures, such as temporarily raising temperature set points on thermostats, so that air conditioning units run less frequently, or agreeing to dim or shut off less critical lighting. This usually requires some level of building automation and controls capability to ensure rapid load reduction during a DR curtailment event. DR program participants may need to install smart meters or may need to also sub-meter larger energy-using equipment, such as chillers, in order to demonstrate compliance with DR program requirements.

DR does not include the reduction of electricity consumption based on normal operating practice or behavior. For example, if a company's normal schedule is to close for a holiday, the reduction of electricity due to this closure or scaled-back operation is not considered a demand response activity in most situations.

The first step toward participation in a DR program is to contact a Curtailment Service Provider. A list of these providers is available on PJM's website and it includes contact information for each company, as well as the states where they have active business (http://www.pjm.com/markets-and-operations/demand-response/csps.aspx). PJM also posts training materials that are developed for program members interested in specific rules and requirements regarding DR activity (http://www.pjm.com/training/training%20material.aspx), along with a variety of other DR program information.

Curtailment Service Providers typically offer free assessments to determine a facility's eligibility to participate in a DR program. They will provide details regarding program rules and requirements for metering and controls, assess a facility's ability to temporarily reduce electric load, and provide details on payments to be expected for participation in the program. Providers usually offer multiple options for DR to larger facilities and may also install controls or remote monitoring equipment of their own to help ensure compliance with all terms and conditions of a DR contract.

# 8 Project Funding / Incentives

The NJCEP can provide the incentive programs described below, and other benefits to ratepayers, because of the Societal Benefits Charge (SBC) Fund. The SBC was created by the State of New Jersey's Electricity Restructuring Law (1999), which requires all customers of investor-owned electric and gas utilities to pay a surcharge on their monthly energy bills. As a customer of a state-regulated electric or gas utility, and therefore a contributor to the fund, your organization is eligible to participate in the LGEA program and also eligible to receive incentive payment for qualifying energy efficiency measures. Also available through the NJBPU are some alternative financing programs described later in this section. Please refer to Figure 25 for a list of the eligible programs identified for each recommended ECM.

*Figure 25 - ECM Incentive Program Eligibility*

| Energy Conservation Measure | | SmartStart Prescriptive | SmartStart Custom | Direct Install | Pay For Performance Existing Buildings | Large Energy Users Program | Combined Heat & Power and Fuel Cell |
|---|---|---|---|---|---|---|---|
| ECM 1 | Install LED Fixtures | X | | | | | |
| ECM 2 | Retrofit Fixtures with LED Lamps | X | | | | | |
| ECM 3 | Install Occupancy Sensor Lighting Controls | X | | | | | |
| ECM 4 | Install High/Low Lighitng Controls | | | X | | | |
| ECM 5 | Premium Efficiency Motors | | | X | | | |
| ECM 6 | Install VFDs on Constant Volume (CV) HVAC | X | | | | | |
| ECM 7 | Install VFDs on Hot Water Pumps | | | X | | | |
| ECM 8 | Install Low-Flow Domestic Hot Water Devices | | | X | | | |

SmartStart is generally well-suited for implementation of individual measures or small group of measures. It provides flexibility to install measures at your own pace using in-house staff or a preferred contractor. Direct Install caters to small to mid-size facilities that can bundle multiple ECMs together. This can greatly simplify participation and may lead to higher incentive amounts, but requires the use of pre-approved contractors. The Pay for Performance (P4P) program is a "whole-building" energy improvement program designed for larger facilities. It requires implementation of multiple measures meeting minimum savings thresholds, as well as use of pre-approved consultants. The Large Energy Users Program (LEUP) is available to New Jersey's largest energy users giving them flexibility to install as little or as many measures, in a single building or several facilities, with incentives capped based on the entity's annual energy consumption. LEUP applicants can use in-house staff or a preferred contractor.

Generally, the incentive values provided throughout the report assume the SmartStart program is utilized because it provides a consistent basis for comparison of available incentives for various measures, though in many cases incentive amounts may be higher through participation in other programs.

Brief descriptions of all relevant financing and incentive programs are located in the sections below. Further information, including most current program availability, requirements, and incentive levels can be found at: www.njcleanenergy.com/ci.

## 8.1 SmartStart

**Overview**

The SmartStart program offers incentives for installing prescriptive and custom energy efficiency measures at your building. Routinely the program adds, removes or modifies incentives from year to year for various energy efficiency equipment based on market trends and new technologies.

**Equipment with Prescriptive Incentives Currently Available:**

*Electric Chillers*
*Electric Unitary HVAC*
*Gas Cooling*
*Gas Heating*
*Gas Water Heating*
*Ground Source Heat Pumps*
*Lighting*
*Lighting Controls*
*Refrigeration Doors*
*Refrigeration Controls*
*Refrigerator/Freezer Motors*
*Food Service Equipment*
*Variable Frequency Drives*

Most equipment sizes and types are served by this program. This program provides an effective mechanism for securing incentives for energy efficiency measures installed individually or as part of a package of energy upgrades.

**Incentives**

The SmartStart prescriptive incentive program provides fixed incentives for specific energy efficiency measures, whereas the custom SmartStart program provides incentives for more unique or specialized technologies or systems that are not addressed through prescriptive incentive offerings for specific devices.

Since your building is an existing building, only the retrofit incentives have been applied in this report. Custom measure incentives are calculated at $0.16/kWh and $1.60/therm based on estimated annual savings, capped at 50% of the total installed incremental project cost, or a project cost buy down to a one-year payback (whichever is less). Program incentives are capped at $500,000 per electric account and $500,000 per natural gas account, per fiscal year.

**How to Participate**

To participate in the SmartStart program you will need to apply for the specific equipment to be installed. Many applications are designed as rebates, although others require application approval prior to installation. Applicants may work with a contractor of their choosing and can also utilize internal personnel, which provides added flexibility to the program. Using internal personnel also helps improve the economics of the ECM by reducing the labor cost that is included in the tables in this report.

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

## 8.2 Direct Install

Direct Install is a turnkey program available to existing small to medium-sized facilities with an average peak electric demand that does not exceed 200 kW over the recent 12-month period. You work directly with a pre-approved contractor who will perform a free energy assessment at your facility, identify specific eligible measures, and provide a clear scope of work for installation of selected measures. Energy efficiency measures may include lighting and lighting controls, refrigeration, HVAC, motors, variable speed drives and controls.

**Incentives**

The program pays up to 70% of the total installed cost of eligible measures, up to $125,000 per project. Each entity is limited to incentives up to $250,000 per fiscal year.

**How to Participate**

To participate in Direct Install, you will need to contact the participating contractor assigned to the region of the state where your facility is located. A complete list of Direct Install program partners is provided on the DI website linked below. The contractor will be paid the measure incentives directly by the program which will pass on to you in the form of reduced material and implementation costs. This means up to 70% of eligible costs are covered by the program, subject to program caps and eligibility, while the remaining 30% of the cost is paid to the contractor by the customer.

Detailed program descriptions and applications can be found at: www.njcleanenergy.com/DI.

## 8.3 SREC Registration Program

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

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

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

Electricity suppliers, the primary purchasers of SRECs, are required to pay a Solar Alternative Compliance Payment (SACP) if they do not meet the requirements of New Jersey's Solar RPS. One way they can meet the RPS requirements is by purchasing SRECs. As SRECs are traded in a competitive market, the price may vary significantly. The actual price of an SREC during a trading period can and will fluctuate depending on supply and demand.

Information about the SRP can be found at: www.njcleanenergy.com/srec.

## 8.4 Energy Savings Improvement Program

The Energy Savings Improvement Program (ESIP) is an alternate method for New Jersey's government agencies to finance the implementation of energy conservation measures. An ESIP is a type of "performance contract," whereby school districts, counties, municipalities, housing authorities and other public and state entities enter in to contracts to help finance building energy upgrades. This is done in a manner that ensures that annual payments are lower than the savings projected from the ECMs, ensuring that ESIP projects are cash flow positive in year one, and every year thereafter. 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 can be leveraged to help further reduce the total project cost of eligible measures.

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 utilized for some services and independent engineers, or other specialists or qualified staff, are used to deliver other requirements of the program.

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

The ESIP approach may not be appropriate for all energy conservation and energy efficiency improvements. Entities should carefully consider all alternatives to develop an approach that best meets their needs. A detailed program description and application can be found at: www.njcleanenergy.com/ESIP.

Please note that ESIP is a program delivered directly by the NJBPU and is not an NJCEP incentive program. As mentioned above, you may utilize NJCEP incentive programs to help further reduce costs when developing the ESP. You should refer to the ESIP guidelines at the link above for further information and guidance on next steps.

# 9 Energy Purchasing and Procurement Strategies

## 9.1 Retail Electric Supply Options

In 1999, New Jersey State Legislature passed the Electric Discount & Energy Competition Act (EDECA) to restructure the electric power industry in New Jersey. This law deregulated the retail electric markets, allowing all consumers to shop for service from competitive electric suppliers. The intent was to create a more competitive market for electric power supply in New Jersey. As a result, utilities were allowed to charge Cost of Service and customers were given the ability to choose a third party (i.e., non-utility) energy supplier.

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

If your building is not purchasing electricity from a third-party supplier, consider shopping for a reduced rate from third party electric suppliers. If your building is purchasing electricity from a third-party supplier, review and compare prices at the end of the current contract or every couple of years.

A list of third party electric suppliers, who are licensed by the state to provide service in New Jersey, can be found online at: www.state.nj.us/bpu/commercial/shopping.html.

## 9.2 Retail Natural Gas Supply Options

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

A customer's decision about whether to buy natural gas from a retail supplier is typically dependent upon whether a customer seeks 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 building is not purchasing natural gas from a third-party supplier, consider shopping for a reduced rate from third party natural gas suppliers. If your building is purchasing natural gas from a third-party supplier, review and compare prices at the end of the current contract or every couple of years.

A list of third party natural gas suppliers, who are licensed by the state to provide service in New Jersey, can be found online at: 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 | Watts per Fixture | Annual Operating Hours | Fixture Recommendation | Add Controls? | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Boiler Room | 2 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | None | No | 2 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Boiler Room | 12 | Compact Fluorescent: Screw-In: (23W) 1L | Wall Switch | 23 | 780 | Relamp | Yes | 12 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Occupancy Sensor | 10 | 546 | 0.13 | 176 | 0.0 | $29.83 | $1,185.04 | $70.00 | 37.37 |
| Boiler Room | 3 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 780 | None | No | 3 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 780 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Electrical Room | 1 | Compact Fluorescent: Screw-In: (23W) 1L | Wall Switch | 23 | 780 | Relamp | No | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 780 | 0.01 | 12 | 0.0 | $2.05 | $53.75 | $0.00 | 26.18 |
| Electrical Room | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 780 | None | No | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 780 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Air Handler Room | 5 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 780 | None | No | 5 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 780 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Air Handler Room | 1 | Incandescent: Screw-In: (60W) 1L | Wall Switch | 60 | 780 | Relamp | Yes | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Occupancy Sensor | 10 | 546 | 0.03 | 48 | 0.0 | $8.11 | $323.75 | $40.00 | 34.98 |
| Air Handler Room Closet | 1 | Incandescent: Screw-In: (60W) 1L | Wall Switch | 60 | 780 | Relamp | No | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 780 | 0.03 | 45 | 0.0 | $7.68 | $53.75 | $5.00 | 6.35 |
| Room 143 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Wall Switch | 114 | 2,148 | Relamp | Yes | 4 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 1,504 | 0.19 | 725 | 0.0 | $122.95 | $650.53 | $115.00 | 4.36 |
| Room 143 | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 2,148 | None | No | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 2,148 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| CR 150 | 18 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | 62 | 1,760 | Relamp | No | 18 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,760 | 0.39 | 1,202 | 0.0 | $203.81 | $1,053.00 | $180.00 | 4.28 |
| CR 150 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| 100H HVAC Room | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 780 | None | No | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 780 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| 100H HVAC Room | 1 | Incandescent: Screw-In: (60W) 1L | Wall Switch | 60 | 780 | Relamp | Yes | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Occupancy Sensor | 10 | 546 | 0.03 | 48 | 0.0 | $8.11 | $323.75 | $40.00 | 34.98 |
| Nurse's Office | 8 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 2,148 | Relamp | Yes | 8 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,504 | 0.33 | 1,236 | 0.0 | $209.55 | $871.60 | $155.00 | 3.42 |
| Nurse's Office Side Room | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 2,148 | Relamp | Yes | 1 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,504 | 0.04 | 155 | 0.0 | $26.19 | $345.20 | $50.00 | 11.27 |
| Nurse's Office RR | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 2,148 | Relamp | No | 1 | LED - Linear Tubes: (3) 4' Lamps | Wall Switch | 44 | 2,148 | 0.03 | 122 | 0.0 | $20.73 | $75.20 | $15.00 | 2.90 |
| Main Office | 9 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 3,068 | Relamp | Yes | 9 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,148 | 0.37 | 1,986 | 0.0 | $336.71 | $946.80 | $170.00 | 2.31 |
| Main Office Storage | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 780 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 780 | 0.02 | 30 | 0.0 | $5.02 | $58.50 | $10.00 | 9.67 |
| Main Office Hallway | 7 | U-Bend Fluorescent - T8: U T8 (32W) - 2L | Wall Switch | 62 | 3,068 | Relamp | Yes | 7 | LED - Linear Tubes: (2) U-Lamp | Occupancy Sensor | 33 | 2,148 | 0.18 | 961 | 0.0 | $162.87 | $712.40 | $35.00 | 4.16 |
| Main Office 100D | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 3,068 | Relamp | Yes | 2 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,148 | 0.08 | 441 | 0.0 | $74.82 | $420.40 | $65.00 | 4.75 |
| Main Office 100A | 6 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 3,068 | Relamp | Yes | 6 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,148 | 0.25 | 1,324 | 0.0 | $224.47 | $721.20 | $125.00 | 2.66 |
| Main Office 100B | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 3,068 | Relamp | Yes | 2 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,148 | 0.08 | 441 | 0.0 | $74.82 | $420.40 | $65.00 | 4.75 |
| Main Office 100F | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 3,068 | Relamp | Yes | 2 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,148 | 0.08 | 441 | 0.0 | $74.82 | $420.40 | $65.00 | 4.75 |
| Main Office 100G | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 3,068 | Relamp | Yes | 2 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,148 | 0.08 | 441 | 0.0 | $74.82 | $420.40 | $65.00 | 4.75 |

| | Existing Conditions | | | | | Proposed Conditions | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Fixture Recommendation | Add Controls? | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Main Office 100E | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 3,068 | Relamp | Yes | 2 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,148 | 0.08 | 441 | 0.0 | $74.82 | $420.40 | $65.00 | 4.75 |
| CR 102 | 18 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | 62 | 1,760 | Relamp | No | 18 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,760 | 0.39 | 1,202 | 0.0 | $203.81 | $1,053.00 | $180.00 | 4.28 |
| CR 102 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| 101 Faculty Room | 9 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 3,068 | Relamp | Yes | 9 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,148 | 0.25 | 1,324 | 0.0 | $224.47 | $796.50 | $125.00 | 2.99 |
| Men's RR | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 2,148 | Relamp | Yes | 2 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,504 | 0.08 | 309 | 0.0 | $52.39 | $420.40 | $65.00 | 6.78 |
| Women's RR | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 2,148 | Relamp | Yes | 2 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,504 | 0.08 | 309 | 0.0 | $52.39 | $420.40 | $65.00 | 6.78 |
| Boys 5th Grade RR | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 2,148 | Relamp | Yes | 4 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,504 | 0.16 | 618 | 0.0 | $104.77 | $570.80 | $95.00 | 4.54 |
| CR 103 | 18 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | 62 | 1,760 | Relamp | No | 18 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,760 | 0.39 | 1,202 | 0.0 | $203.81 | $1,053.00 | $180.00 | 4.28 |
| CR 103 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| CR 104 | 18 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | 62 | 1,760 | Relamp | No | 18 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,760 | 0.39 | 1,202 | 0.0 | $203.81 | $1,053.00 | $180.00 | 4.28 |
| CR 104 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| CR 105 | 18 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | 62 | 1,760 | Relamp | No | 18 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,760 | 0.39 | 1,202 | 0.0 | $203.81 | $1,053.00 | $180.00 | 4.28 |
| CR 105 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| CR 106 | 18 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | 62 | 1,760 | Relamp | No | 18 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,760 | 0.39 | 1,202 | 0.0 | $203.81 | $1,053.00 | $180.00 | 4.28 |
| CR 106 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| CR 108 | 18 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | 62 | 1,760 | Relamp | No | 18 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,760 | 0.39 | 1,202 | 0.0 | $203.81 | $1,053.00 | $180.00 | 4.28 |
| CR 108 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| Boys Locker Room (110) | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 2,148 | Relamp | No | 12 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,148 | 0.39 | 1,467 | 0.0 | $248.70 | $902.40 | $180.00 | 2.90 |
| Boys Locker Room (110) | 3 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | None | No | 3 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| 114B Janitor Closet | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 780 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 780 | 0.02 | 30 | 0.0 | $5.02 | $58.50 | $10.00 | 9.67 |
| Boys RR (Gym) | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 2,148 | Relamp | No | 4 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,148 | 0.13 | 489 | 0.0 | $82.90 | $300.80 | $60.00 | 2.90 |
| Gym | 24 | Metal Halide: (1) 400W Lamp | Wall Switch | 458 | 2,304 | Fixture Replacement | Yes | 24 | LED - Fixtures: High-Bay | Occupancy Sensor | 120 | 1,613 | 5.88 | 23,783 | 0.0 | $4,031.76 | $69,724.80 | $4,440.00 | 16.19 |
| Gym | 3 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | None | No | 3 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Gym Storage | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 780 | None | No | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 780 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Gym Office 114 | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 2,304 | Relamp | No | 1 | LED - Linear Tubes: (3) 4' Lamps | Wall Switch | 44 | 2,304 | 0.03 | 131 | 0.0 | $22.23 | $75.20 | $15.00 | 2.71 |

| | Existing Conditions | | | | | Proposed Conditions | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Fixture Recommendation | Add Controls? | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Girls Locker Room (116) | 9 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 2,148 | Relamp | No | 9 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,148 | 0.29 | 1,100 | 0.0 | $186.52 | $676.80 | $135.00 | 2.90 |
| Girls Locker Room (116) | 2 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | None | No | 2 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Girls RR (Gym) | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 2,148 | Relamp | No | 4 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,148 | 0.13 | 489 | 0.0 | $82.90 | $300.80 | $60.00 | 2.90 |
| 117 Storage/Office | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 780 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 546 | 0.05 | 75 | 0.0 | $12.68 | $387.00 | $55.00 | 26.18 |
| CR 119 Art Room | 16 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 16 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.52 | 1,603 | 0.0 | $271.75 | $1,203.20 | $240.00 | 3.54 |
| CR 119 Art Room | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| CR 119 Art Room Storage Closet | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 780 | Relamp | No | 2 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 780 | 0.06 | 89 | 0.0 | $15.05 | $150.40 | $30.00 | 8.00 |
| CR 121 | 15 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | 62 | 1,760 | Relamp | No | 15 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,760 | 0.32 | 1,002 | 0.0 | $169.84 | $877.50 | $150.00 | 4.28 |
| 118 Storage | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 780 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 546 | 0.05 | 75 | 0.0 | $12.68 | $387.00 | $20.00 | 28.94 |
| 123 Storage | 3 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 780 | Relamp | Yes | 3 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 546 | 0.12 | 168 | 0.0 | $28.53 | $495.60 | $45.00 | 15.79 |
| 120 Storage | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 780 | Relamp | Yes | 2 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 546 | 0.08 | 112 | 0.0 | $19.02 | $420.40 | $30.00 | 20.52 |
| CR 125 | 21 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 21 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.68 | 2,104 | 0.0 | $356.67 | $1,579.20 | $315.00 | 3.54 |
| CR 127 | 14 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 14 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.45 | 1,403 | 0.0 | $237.78 | $1,052.80 | $210.00 | 3.54 |
| CR 127 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| CR 127 | 1 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | None | No | 1 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Media Center | 30 | Compact Fluorescent: Pin-Style: (23W) 2L | Occupancy Sensor | 46 | 2,148 | Relamp | No | 30 | LED Screw-In Lamps: Pin-Style: (9.5W) 2L | Occupancy Sensor | 19 | 2,148 | 0.53 | 2,000 | 0.0 | $339.13 | $2,643.06 | $0.00 | 7.79 |
| Media Center | 1 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | None | No | 1 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Media Center | 9 | Compact Fluorescent: Dome Fixture Pin-Style: (23W) 2L | Occupancy Sensor | 336 | 2,148 | Relamp | No | 9 | LED Screw-In Lamps: Pin-Style: (9.5W) 2L | Occupancy Sensor | 19 | 2,148 | 1.87 | 7,046 | 0.0 | $1,194.50 | $792.92 | $0.00 | 0.66 |
| Media Center Office | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 2,148 | Relamp | No | 4 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,148 | 0.13 | 489 | 0.0 | $82.90 | $300.80 | $60.00 | 2.90 |
| Media Center | 18 | Halogen Incandescent: Recessed: (50W) 1L | Occupancy Sensor | 50 | 2,148 | Relamp | No | 18 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Occupancy Sensor | 10 | 2,148 | 0.48 | 1,800 | 0.0 | $305.22 | $967.55 | $90.00 | 2.88 |
| Media Center Storage | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 780 | Relamp | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 546 | 0.11 | 150 | 0.0 | $25.36 | $504.00 | $40.00 | 18.29 |
| CR 128 | 17 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 17 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.55 | 1,703 | 0.0 | $288.73 | $1,278.40 | $255.00 | 3.54 |
| CR 128 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| CR 130 | 18 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 18 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.58 | 1,803 | 0.0 | $305.72 | $1,353.60 | $270.00 | 3.54 |
| CR 130 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |

| | Existing Conditions | | | | | Proposed Conditions | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Fixture Recommendation | Add Controls? | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| CR 131 | 15 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 15 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.49 | 1,503 | 0.0 | $254.76 | $1,128.00 | $225.00 | 3.54 |
| CR 131 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| CR 133 | 15 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 15 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.49 | 1,503 | 0.0 | $254.76 | $1,128.00 | $225.00 | 3.54 |
| CR 133 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| CR 135 | 15 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 15 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.49 | 1,503 | 0.0 | $254.76 | $1,128.00 | $225.00 | 3.54 |
| CR 135 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| CR 137 | 15 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 15 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.49 | 1,503 | 0.0 | $254.76 | $1,128.00 | $225.00 | 3.54 |
| CR 137 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| CR 139 | 15 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 15 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.49 | 1,503 | 0.0 | $254.76 | $1,128.00 | $225.00 | 3.54 |
| CR 139 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| Girls 7th Grade RR | 1 | U-Bend Fluorescent - T8: U T8 (32W) - 2L | Occupancy Sensor | 62 | 2,148 | Relamp | No | 1 | LED - Linear Tubes: (2) U-Lamp | Occupancy Sensor | 33 | 2,148 | 0.02 | 72 | 0.0 | $12.14 | $63.20 | $0.00 | 5.21 |
| Girls 7th Grade RR | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 2,148 | Relamp | No | 4 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,148 | 0.13 | 489 | 0.0 | $82.90 | $300.80 | $60.00 | 2.90 |
| Boys 7th Grade RR | 5 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 2,148 | Relamp | No | 5 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,148 | 0.16 | 611 | 0.0 | $103.62 | $376.00 | $75.00 | 2.90 |
| CR 138 | 15 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 15 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.49 | 1,503 | 0.0 | $254.76 | $1,128.00 | $225.00 | 3.54 |
| CR 138 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| CR 140 | 15 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 15 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.49 | 1,503 | 0.0 | $254.76 | $1,128.00 | $225.00 | 3.54 |
| CR 140 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| 141 Storage | 1 | Incandescent: Flood Light - Screw-In: (75W) 2L | Wall Switch | 150 | 780 | Relamp | No | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 2L | Wall Switch | 19 | 780 | 0.09 | 118 | 0.0 | $19.92 | $107.51 | $10.00 | 4.89 |
| CR 142 (Home Ec) | 24 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 24 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.78 | 2,405 | 0.0 | $407.62 | $1,804.80 | $360.00 | 3.54 |
| CR 147 | 18 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 18 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.58 | 1,803 | 0.0 | $305.72 | $1,353.60 | $270.00 | 3.54 |
| CR 147 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| CR 149 | 18 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 18 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.58 | 1,803 | 0.0 | $305.72 | $1,353.60 | $270.00 | 3.54 |
| CR 149 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| CR 148 Tech Room | 25 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 25 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.81 | 2,505 | 0.0 | $424.61 | $1,880.00 | $375.00 | 3.54 |
| CR 148 Tech Room Storage | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 780 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 546 | 0.05 | 75 | 0.0 | $12.68 | $387.00 | $20.00 | 28.94 |

| | Existing Conditions | | | | | Proposed Conditions | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Fixture Recommendation | Add Controls? | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Girls 5th Grade RR | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 2,148 | Relamp | Yes | 4 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,504 | 0.16 | 618 | 0.0 | $104.77 | $570.80 | $95.00 | 4.54 |
| 151 Storage | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 780 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 780 | 0.02 | 30 | 0.0 | $5.02 | $58.50 | $10.00 | 9.67 |
| CR 153 | 1 | U-Bend Fluorescent - T8: U T8 (32W) - 2L | Occupancy Sensor | 62 | 1,760 | Relamp | No | 1 | LED - Linear Tubes: (2) U-Lamp | Occupancy Sensor | 33 | 1,760 | 0.02 | 59 | 0.0 | $9.95 | $63.20 | $0.00 | 6.35 |
| CR 153 | 8 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 8 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.26 | 802 | 0.0 | $135.87 | $601.60 | $120.00 | 3.54 |
| CR 153 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 1,760 | 0.05 | 142 | 0.0 | $24.02 | $143.60 | $20.00 | 5.15 |
| 152 Conference Room | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 3,068 | Relamp | Yes | 4 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,148 | 0.16 | 883 | 0.0 | $149.65 | $570.80 | $95.00 | 3.18 |
| CR 155 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 4 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.13 | 401 | 0.0 | $67.94 | $300.80 | $60.00 | 3.54 |
| CR 154 | 9 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 9 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.29 | 902 | 0.0 | $152.86 | $676.80 | $135.00 | 3.54 |
| 157 (Extra Room) | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 3,068 | Relamp | Yes | 4 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 2,148 | 0.16 | 883 | 0.0 | $149.65 | $570.80 | $95.00 | 3.18 |
| CR 132 | 19 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 1,760 | Relamp | No | 19 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 1,760 | 0.62 | 1,904 | 0.0 | $322.70 | $1,428.80 | $285.00 | 3.54 |
| Kitchen Area RR | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 2,148 | Relamp | Yes | 1 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 1,504 | 0.03 | 103 | 0.0 | $17.46 | $328.50 | $45.00 | 16.24 |
| Kitchen Area RR | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 2L | Wall Switch | 19 | 2,148 | None | Yes | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 2L | Occupancy Sensor | 19 | 1,504 | 0.00 | 14 | 0.0 | $2.39 | $0.00 | $0.00 | 0.00 |
| Kitchen / Mechanical Hallway | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Wall Switch | 114 | 3,068 | Relamp | No | 1 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | 58 | 3,068 | 0.04 | 198 | 0.0 | $33.49 | $95.13 | $20.00 | 2.24 |
| Kitchen / Mechanical Hallway | 2 | U-Bend Fluorescent - T8: U T8 (32W) - 2L | Wall Switch | 62 | 3,068 | Relamp | Yes | 2 | LED - Linear Tubes: (2) U-Lamp | High/Low Control | 33 | 2,148 | 0.05 | 274 | 0.0 | $46.53 | $326.40 | $0.00 | 7.01 |
| Back Kitchen Area | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 3,068 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,148 | 0.05 | 294 | 0.0 | $49.88 | $387.00 | $55.00 | 6.66 |
| Main Kitchen Area | 22 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 3,068 | Relamp | Yes | 22 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,148 | 0.60 | 3,237 | 0.0 | $548.71 | $2,367.00 | $360.00 | 3.66 |
| Kitchen Walk-In Area | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Wall Switch | 114 | 3,068 | Relamp | No | 1 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | 58 | 3,068 | 0.04 | 198 | 0.0 | $33.49 | $95.13 | $20.00 | 2.24 |
| Kitchen Office | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 3,068 | Relamp | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 2,148 | 0.11 | 589 | 0.0 | $99.77 | $504.00 | $75.00 | 4.30 |
| Cafeteria | 45 | Linear Fluorescent - T8: 4' T8 (32W) - 4L | Wall Switch | 114 | 3,068 | Relamp | Yes | 45 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 2,148 | 2.17 | 11,654 | 0.0 | $1,975.57 | $5,361.00 | $1,040.00 | 2.19 |
| Cafeteria | 3 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | None | No | 3 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Stage Area | 8 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 3,068 | None | No | 8 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 3,068 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Stage Area | 1 | Incandescent: Flood Light - Screw-In: (60W) 1L | Wall Switch | 60 | 3,068 | Relamp | No | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 3,068 | 0.03 | 178 | 0.0 | $30.20 | $53.75 | $5.00 | 1.61 |
| Stage Area | 13 | Incandescent: Screw-In: (60W) 1L (White) | Wall Switch | 60 | 3,068 | None | No | 13 | Incandescent: Screw-In: (60W) 1L (White) | Wall Switch | 60 | 3,068 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Stage Area | 12 | Incandescent: Screw-In: (60W) 1L (Blue) | Wall Switch | 60 | 3,068 | None | No | 12 | Incandescent: Screw-In: (60W) 1L (Blue) | Wall Switch | 60 | 3,068 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Stage Area | 9 | Incandescent: Screw-In: (60W) 1L (Red) | Wall Switch | 60 | 3,068 | None | No | 9 | Incandescent: Screw-In: (60W) 1L (Red) | Wall Switch | 60 | 3,068 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |

| | Existing Conditions | | | | | Proposed Conditions | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Fixture Recommendation | Add Controls? | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Cafeteria Storage 1 | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 780 | None | No | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 780 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Cafeteria Storage 2 | 1 | Compact Fluorescent: Screw-In: (23W) 1L | Wall Switch | 23 | 780 | Relamp | Yes | 1 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Occupancy Sensor | 10 | 546 | 0.01 | 15 | 0.0 | $2.49 | $53.75 | $0.00 | 21.62 |
| Cafeteria Storage 2 | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 780 | Relamp | Yes | 2 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 546 | 0.05 | 75 | 0.0 | $12.68 | $387.00 | $55.00 | 26.18 |
| Hallways | 102 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 3,068 | Relamp | Yes | 102 | LED - Linear Tubes: (2) 4' Lamps | High/Low Control | 29 | 2,148 | 2.79 | 15,007 | 0.0 | $2,544.02 | $8,367.00 | $1,020.00 | 2.89 |
| Hallways | 15 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | None | No | 15 | Exit Signs: LED - 2 W Lamp | None | 6 | 8,760 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Hallways | 5 | Compact Fluorescent: Pin-Style: (23W) 1L | Wall Switch | 23 | 3,068 | Relamp | No | 5 | LED Screw-In Lamps: Pin-Style: (9.5W) 1L | Wall Switch | 10 | 3,068 | 0.04 | 238 | 0.0 | $40.37 | $220.26 | $0.00 | 5.46 |
| Entry Area | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 3,068 | Relamp | No | 1 | LED - Linear Tubes: (3) 4' Lamps | Wall Switch | 44 | 3,068 | 0.03 | 175 | 0.0 | $29.61 | $75.20 | $15.00 | 2.03 |
| Hallways | 4 | U-Bend Fluorescent - T8: U T8 (32W) - 2L | Wall Switch | 62 | 3,068 | Relamp | Yes | 4 | LED - Linear Tubes: (2) U-Lamp | High/Low Control | 33 | 2,148 | 0.10 | 549 | 0.0 | $93.07 | $452.80 | $0.00 | 4.87 |
| Building Lights | 4 | Compact Fluorescent: Screw-In: (23W) 1L | Wall Switch | 23 | 2,373 | Relamp | No | 4 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 2,373 | 0.04 | 147 | 0.0 | $24.98 | $215.01 | $0.00 | 8.61 |
| Building Lights | 8 | Metal Halide: (1) 70W Lamp | Wall Switch | 95 | 2,373 | Fixture Replacement | No | 8 | LED - Fixtures: Outdoor Wall-Mounted Area Fixture | Wall Switch | 15 | 2,373 | 0.42 | 1,746 | 0.0 | $296.02 | $3,125.42 | $800.00 | 7.86 |
| Building Lights | 7 | Halogen Incandescent: Flood Light - Screw-In: (50W) 1L | Wall Switch | 50 | 2,373 | Relamp | No | 7 | LED Screw-In Lamps: Screw-In: (9.5W) 1L | Wall Switch | 10 | 2,373 | 0.19 | 773 | 0.0 | $131.13 | $376.27 | $35.00 | 2.60 |
| Parking Lot | 28 | LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture | Wall Switch | 40 | 2,373 | None | No | 28 | LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture | Wall Switch | 40 | 2,373 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |

## 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? | Annual Operating Hours | Install High Efficiency Motors? | Full Load Efficiency | Install VFDs? | Number of VFDs | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Boiler Room | Hot Water Heating System | 2 | Heating Hot Water Pump | 3.0 | 90.2% | No | 2,745 | No | 90.2% | Yes | 2 | 0.75 | 5,925 | 0.0 | $1,004.49 | $6,015.30 | $0.00 | 5.99 |
| Boiler Room | Hot Water Heating System | 1 | Heating Hot Water Pump | 7.5 | 91.7% | No | 3,391 | Yes | 91.7% | Yes | 1 | 0.92 | 9,000 | 0.0 | $1,525.74 | $4,760.59 | $0.00 | 3.12 |
| Boiler Room | DHW Distribution | 2 | Water Supply Pump | 1.5 | 84.0% | No | 2,745 | No | 84.0% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Boiler Room | DHW Recircluation | 1 | Water Supply Pump | 0.3 | 75.0% | No | 2,745 | No | 75.0% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Room Above Girls&Boys Club | Cafeteria/Multi Purppose Room | 1 | Supply Fan | 10.0 | 89.5% | No | 3,391 | Yes | 91.7% | Yes | 1 | 1.42 | 5,423 | 0.0 | $919.38 | $5,375.00 | $800.00 | 4.98 |
| Room Above Girls&Boys Club | Cafeteria/Multi Purppose Room | 1 | Exhaust Fan | 5.0 | 87.5% | No | 2,745 | No | 87.5% | Yes | 1 | 0.69 | 2,106 | 0.0 | $357.06 | $3,275.85 | $400.00 | 8.05 |
| 100H (HVAC Room) | Teachers Room, Conf. Room (152), Nurse's Office, 154, 157, 155, 153 | 1 | Supply Fan | 3.0 | 86.5% | No | 2,745 | No | 86.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| 100H (HVAC Room) | Teachers Room, Conf. Room (152), Nurse's Office, 154, 157, 155, 153 | 1 | Exhaust Fan | 2.0 | 84.0% | No | 2,745 | No | 84.0% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| 100H (HVAC Room) | Main Office Area | 1 | Supply Fan | 3.0 | 86.5% | No | 2,745 | No | 86.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| 100H (HVAC Room) | Main Office Area | 1 | Exhaust Fan | 2.0 | 84.0% | No | 2,745 | No | 84.0% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Classroom HVAC closets | Classrooms | 28 | Supply Fan | 0.3 | 75.0% | No | 2,745 | No | 75.0% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Classroom HVAC closets | Classrooms | 28 | Exhaust Fan | 0.3 | 75.0% | No | 2,745 | No | 75.0% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof | Media Center | 1 | Supply Fan | 5.0 | 87.5% | Yes | 2,745 | No | 87.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof | Media Center | 1 | Exhaust Fan | 2.0 | 84.0% | Yes | 2,745 | No | 84.0% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof | Computer Room | 1 | Supply Fan | 1.0 | 82.5% | Yes | 2,745 | No | 82.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof | Computer Room | 1 | Exhaust Fan | 1.0 | 82.5% | Yes | 2,745 | No | 82.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof | Music Room / Art Room / Hallway | 1 | Supply Fan | 5.0 | 87.5% | Yes | 2,745 | No | 87.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof | Music Room / Art Room / Hallway | 1 | Exhaust Fan | 2.0 | 84.0% | Yes | 2,745 | No | 84.0% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof | Gym Locker Rooms | 1 | Supply Fan | 3.0 | 86.5% | No | 2,745 | No | 86.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof | Gym Locker Rooms | 1 | Exhaust Fan | 2.0 | 84.0% | No | 2,745 | No | 84.0% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |

| | | 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? | Annual Operating Hours | Install High Efficiency Motors? | Full Load Efficiency | Install VFDs? | Number of VFDs | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Roof | Gym | 1 | Supply Fan | 10.0 | 89.5% | Yes | 3,391 | Yes | 91.7% | No | | 0.11 | 509 | 0.0 | $86.22 | $1,567.05 | $0.00 | 18.18 |
| Roof | Gym | 1 | Exhaust Fan | 7.5 | 88.5% | Yes | 3,391 | Yes | 91.7% | No | | 0.12 | 561 | 0.0 | $95.12 | $1,153.79 | $0.00 | 12.13 |

## Electric 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 (kBtu/hr) | Install High Efficiency System? | System Quantity | System Type | Cooling Capacity per Unit (Tons) | Heating Capacity per Unit (kBtu/hr) | Cooling Mode Efficiency (SEER/EER) | Heating Mode Efficiency (COP) | Install Dual Enthalpy Economizer? | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Roof / Nurse's Office | Nurse's Office | 1 | Ductless Mini-Split AC | 2.00 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof / Main Office | Main Office | 1 | Ductless Mini-Split AC | 2.00 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof / 117 Storage/Office | 117 Storage/Office | 1 | Ductless Mini-Split AC | 0.75 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof | Main Office Area | 1 | Split-System AC | 6.00 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof | Teachers Room, Conf. Room (152), Nurse's Office, 154, 157, 155, 153 | 1 | Split-System AC | 6.00 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof | Cafetria / Multipurpose Room | 1 | Split-System AC | 25.00 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof | Server Room | 1 | Ductless Mini-Split AC | 0.75 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof | Media Center | 1 | Packaged AC | 8.00 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof | Computer Room | 1 | Packaged AC | 3.00 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof | Music Room / Art Room / Hallway | 1 | Packaged AC | 8.00 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof | Gym Hallway | 1 | Split-System AC | 4.00 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof | Locker Rooms | 1 | Packaged AC | 8.00 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Roof | Gym Hallway | 1 | Packaged AC | 20.00 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Classroom HVAC closets | Individual classrooms | 28 | Packaged Terminal AC | 3.00 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |

## Fuel Heating 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) | Install High Efficiency System? | System Quantity | System Type | Output Capacity per Unit (MBh) | Heating Efficiency | Heating Efficiency Units | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Boiler Room | Whole Building | 1 | Non-Condensing Hot Water Boiler | 1,659.00 | Yes | 1 | Condensing Hot Water Boiler | 1,659.00 | 91.00% | Et | 0.00 | 0 | 126.3 | $1,185.29 | $31,685.78 | $3,649.80 | 23.65 |
| Boiler Room | Whole Building | 1 | Non-Condensing Hot Water Boiler | 1,659.00 | Yes | 1 | Condensing Hot Water Boiler | 1,659.00 | 91.00% | Et | 0.00 | 0 | 126.3 | $1,185.29 | $31,685.78 | $3,649.80 | 23.65 |
| Roof | Media Center | 1 | Furnace | 146.00 | Yes | 1 | Furnace | 146.00 | 95.00% | AFUE | 0.00 | 0 | 10.5 | $98.73 | $3,307.97 | $400.00 | 29.45 |
| Roof | Computer Room | 1 | Furnace | 56.00 | Yes | 1 | Furnace | 56.00 | 95.00% | AFUE | 0.00 | 0 | 4.1 | $38.64 | $1,268.81 | $400.00 | 22.49 |
| Roof | Music Room / Art Room / Hallway | 1 | Furnace | 146.00 | Yes | 1 | Furnace | 146.00 | 95.00% | AFUE | 0.00 | 0 | 10.5 | $98.73 | $3,307.97 | $400.00 | 29.45 |
| Roof | Gym Locker Rooms | 1 | Furnace | 146.00 | Yes | 1 | Furnace | 146.00 | 95.00% | AFUE | 0.00 | 0 | 10.7 | $100.73 | $3,307.97 | $400.00 | 28.87 |
| Roof | Gym | 1 | Furnace | 316.00 | Yes | 1 | Furnace | 316.00 | 95.00% | AFUE | 0.00 | 0 | 23.2 | $218.02 | $7,159.72 | $400.00 | 31.01 |

## DHW Inventory & Recommendations

| | | Existing Conditions | | Proposed Conditions | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | System Quantity | System Type | Replace? | System Quantity | System Type | Fuel Type | System Efficiency | Efficiency Units | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Boiler Room | Whole Building | 1 | Storage Tank Water Heater (> 50 Gal) | No | | | | | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |

## Low-Flow Device Recommendations

| | Recommendation Inputs | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Device Quantity | Device Type | Existing Flow Rate (gpm) | Proposed Flow Rate (gpm) | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| CR 140 | 3 | Faucet Aerator (Kitchen) | 3.00 | 2.20 | 0.00 | 0 | 3.5 | $32.93 | $21.51 | $0.00 | 0.65 |

## Walk-In Cooler/Freezer Inventory & Recommendations

| | Existing Conditions | | Proposed Conditions | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Cooler/ Freezer Quantity | Case Type/Temperature | Install EC Evaporator Fan Motors? | Install Electric Defrost Control? | Install Evaporator Fan Control? | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Kitchen | 1 | Medium Temp Freezer (0F to 30F) | No | No | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |

## Cooking Equipment Inventory & Recommendations

| | Existing Conditions | | | Proposed Conditions | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Quantity | Equipment Type | High Efficiency Equipement? | Install High Efficiency Equipment? | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Kitchen Area | 1 | Gas Convection Oven (Full Size) | Yes | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Kitchen Area | 1 | Gas Griddle (≤2 Feet Width) | Yes | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |

## Plug Load Inventory

| Location | Existing Conditions: Quantity | Equipment Description | Energy Rate (W) | ENERGY STAR Qualified? |
|---|---|---|---|---|
| Whole Building | 105 | Desktop Computers | 150.0 | Yes |
| Whole Building | 24 | Projector | 200.0 | Yes |
| Whole Building | 24 | Smartboard | 60.0 | Yes |
| Whole Building | 3 | LCD TV | 71.0 | Yes |
| Whole Building | 3 | Tube TV | 120.0 | No |
| Whole Building | 10 | Desk Printer | 60.0 | Yes |
| Whole Building | 1 | Minifridge | 153.0 | No |
| Main Office | 1 | Photocopier | 600.0 | Yes |
| Whole Building | 4 | Laptops | 45.0 | Yes |
| Whole Building | 3 | Refrigerators | 172.0 | Yes |
| Teacher's Room | 1 | Microwave | 800.0 | No |
| Stage Area | 1 | Wheelchair Lift | 1,000.0 | No |
| Tech Room | 1 | Misc. Tech Equipment | 5,000.0 | No |
| Kitchen Area | 2 | Double door Refrigerators | 200.0 | Yes |
| Kitchen Area | 1 | Refrigerator chest | 175.0 | Yes |
| Kitchen Area | 2 | Refrigerated Beverage Chest | 146.0 | Yes |

# *Appendix B: ENERGY STAR® Statement of Energy Performance*

## ENERGY STAR® Statement of Energy Performance

LEARN MORE AT energystar.gov

**63**

ENERGY STAR® Score[1]

### High Mountain School

**Primary Property Type:** K-12 School
**Gross Floor Area (ft²):** 61,025
**Built:** 1960

**For Year Ending:** February 28, 2017
**Date Generated:** March 28, 2018

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 |
|---|---|---|
| High Mountain School<br>515 High Mountain Rd<br>North Haledon, New Jersey 07508 | North Haledon Board of Education<br>201 Squaw Brook Road<br>North Haledon, NJ 07508<br>(____)____-______ | John Maguire<br>201 Squaw Brook Road<br>North Haledon, NJ 07508<br>973-427-1220<br>jmaguire@nhschools.net |

Property ID: 6258403

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

**Site EUI**
78.9 kBtu/ft²

**Source EUI**
149.5 kBtu/ft²

**Annual Energy by Fuel**

| | | |
|---|---|---|
| Electric - Grid (kBtu) | 1,946,216 (40%) |
| Natural Gas (kBtu) | 2,867,680 (60%) |

**National Median Comparison**

| | |
|---|---|
| National Median Site EUI (kBtu/ft²) | 88.3 |
| National Median Source EUI (kBtu/ft²) | 167.3 |
| % Diff from National Median Source EUI | -11% |

**Annual Emissions**

| | |
|---|---|
| Greenhouse Gas Emissions (Metric Tons CO2e/year) | 368 |

### Signature & Stamp of Verifying Professional

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

Signature: ________________________Date: ___________

**Licensed Professional**

____ _________
,
(____)____-______
___________________

Professional Engineer Stamp
(if applicable)