Local Government Energy Audit:
Energy Audit Report

Lester C. Noecker Elementary School

Roseland Board of Education
100 Passaic Avenue
Roseland, NJ 07068

February 21, 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 savings 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.

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1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for Lester C. Noecker Elementary School. The goal of an LGEA report is to provide you with information on how your facility 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 school districts in controlling energy costs and protecting our environment by offering a wide range of energy management options and advice.

1.1 Facility Summary

Lester C. Noecker Elementary School is a 98,000 square foot facility comprised of classrooms, offices, gymnasium, courtyards, storage spaces, and a mechanical space. This is a single story building serving students from Pre-K to sixth grade. The school functions for ten (10) months yearly, during weekdays it is open from 7:30 AM to 3:30 PM. During the weekends, there are other recreational activities scheduled from 8:30 AM to 6:00 PM. Summer activities are in the month of July from 8:00 AM to 12:00 PM.

Space heating in the school is provided by three gas fired condensing hot water boilers and multiple roof top packaged units with gas fired furnaces. Space cooling in the facility is primarily provided using rooftop packaged units and split AC units. Lighting at Lester C. Noecker Elementary School consists of T8 linear tube fixtures and compact fluorescent lamps (CFLs). Majority of the lighting is in need of replacement. A thorough description of the facility and our observations are located in Section 2.

1.2 Your Cost Reduction Opportunities

Energy Conservation Measures

TRC evaluated eight (8) energy conservation measures (ECMs) which together represent an opportunity to reduce annual energy costs by $43,528 and annual greenhouse gas emissions by 250,647 lbs CO_2e. We estimate that if all measures were implemented as recommended, the project would pay for itself in 4.4 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 annual energy use by 14%.

Figure 1 – Previous 12 Month Utility Costs

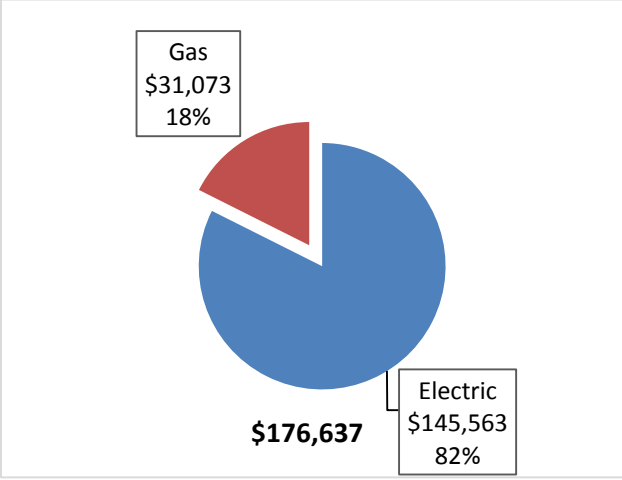
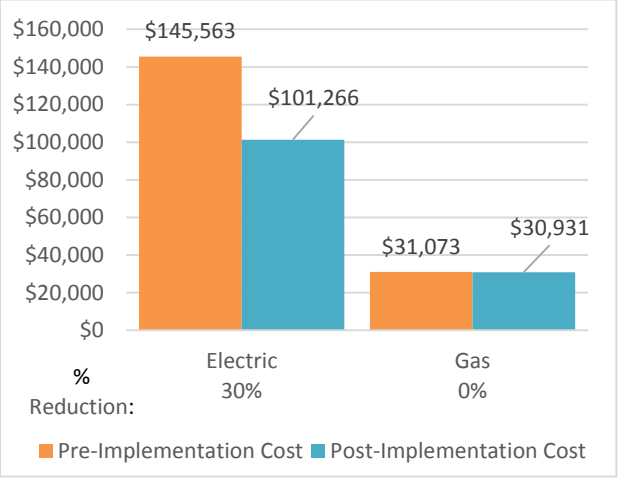


Figure 2 – Potential Post-Implementation Costs



A detailed description of Lester C. Noecker Elementary 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		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		**136,213**	**29.2**	**0.0**	**$23,916.87**	**$82,934.35**	**$15,500.00**	**$67,434.35**	**2.8**	**137,165**
ECM 1	Install LED Fixtures	35,386	8.5	0.0	$6,213.21	$28,910.10	$7,400.00	$21,510.10	3.5	35,633
ECM 2	Retrofit Fixtures with LED Lamps	100,827	20.7	0.0	$17,703.66	$54,024.25	$8,100.00	$45,924.25	2.6	101,532
Lighting Control Measures		**24,446**	**5.0**	**0.0**	**$4,292.34**	**$23,434.00**	**$6,110.00**	**$17,324.00**	**4.0**	**24,617**
ECM 3	Install Occupancy Sensor Lighting Controls	20,431	4.2	0.0	$3,587.43	$19,484.00	$2,730.00	$16,754.00	4.7	20,574
ECM 4	Install Daylight Dimming Controls	586	0.1	0.0	$102.93	$750.00	$180.00	$570.00	5.5	590
ECM 5	Install High/Low Lighitng Controls	3,428	0.7	0.0	$601.98	$3,200.00	$3,200.00	$0.00	0.0	3,452
Variable Frequency Drive (VFD) Measures		**6,675**	**2.2**	**0.0**	**$1,172.06**	**$12,567.00**	**$1,280.00**	**$11,287.00**	**9.6**	**6,722**
ECM 6	Install VFDs on Constant Volume (CV) HVAC	6,675	2.2	0.0	$1,172.06	$12,567.00	$1,280.00	$11,287.00	9.6	6,722
Electric Unitary HVAC Measures		**79,761**	**32.9**	**0.0**	**$14,004.81**	**$101,992.59**	**$6,280.00**	**$95,712.59**	**6.8**	**80,319**
ECM 7	Install High Efficiency Electric AC	79,761	32.9	0.0	$14,004.81	$101,992.59	$6,280.00	$95,712.59	6.8	80,319
Domestic Water Heating Upgrade		**0**	**0.0**	**15.6**	**$141.74**	**$100.38**	**$0.00**	**$100.38**	**0.7**	**1,825**
ECM 8	Install Low-Flow Domestic Hot Water Devices	0	0.0	15.6	$141.74	$100.38	$0.00	$100.38	0.7	1,825
TOTALS		**247,094**	**69.3**	**15.6**	**$43,527.83**	**$221,028.32**	**$29,170.00**	**$191,858.32**	**4.4**	**250,647**

* - 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 measure 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.

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.

Electric Unitary HVAC measures generally involve replacing older inefficient air conditioning systems with modern energy efficient systems. New air conditioning systems can provide equivalent cooling to older air condition systems at a reduced energy cost. These measures save energy by reducing the power used by the air conditioning systems, due to improved electrical 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 nine (9) low cost (or no-cost) energy efficient practices. A facility'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 include:

- Reduce Air Leakage
- Close Doors and Windows
- Use Window Treatments/Coverings
- Ensure Lighting Controls Are Operating Properly
- Practice Proper Use of Thermostat Schedules and Temperature Resets
- Perform Proper Boiler Maintenance
- Perform Proper Water Heater Maintenance
- Install Plug Load Controls
- 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. Based on the configuration of the site and its loads there is a high potential for installing a photovoltaic (PV) array. 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 facility 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
- Pay for Performance - Existing Building (P4P)
- 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.

Larger facilities with an interest in a more comprehensive whole building approach to energy conservation should consider participating in the Pay for Performance (P4P) program. Projects eligible for this project program must meet minimum savings requirements. Final incentives are calculated based on actual measured performance achieved at the end of the project. The application process is more involved, and it requires working with a qualified P4P contractor, but the process may result in greater energy savings overall and more lucrative incentives, up to 50% of project's total cost.

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.

Additional information on relevant incentive programs is located in Section 8 or: www.njcleanenergy.com/ci.

2 FACILITY INFORMATION AND EXISTING CONDITIONS

2.1 Project Contacts

Figure 4 – Project Contacts

Name	Role	E-Mail	Phone #
Customer			
Julie A. Kot	Business Administrator	jkot@roselandnjboe.org	973-226-1296 x 311
Thomas August	Supervisor of Buildings & Grounds	taugust@roselandnjboe.org	973-508-2150
TRC Energy Services			
Smruti Srinivasan	Auditor	ssrinivasan@trcsolutions.com	(732) 855-0033

2.2 General Site Information

On July 27, 2017, TRC performed an energy audit at Lester C. Noecker Elementary School located in Roseland, New Jersey. TRC's team met with Thomas August, Supervisor of Buildings and Grounds to review the facility operations and help focus our investigation on specific energy-using systems.

Lester C. Noecker Elementary School is a 98,000 square foot facility comprised of classrooms, offices, gymnasium, hallways, courtyards, storage spaces, restrooms and a mechanical space. This is a single story building serving students from Pre-k to sixth grade. The original building construction was built in 1964 with additions in 2004 and 2007.

2.3 Building Occupancy

The typical schedule is presented in the table below. The regular school functions for ten (10) months annually with operation during weekdays from 7:00 AM to 6:00 PM including the after school activities. During the weekends, there are other recreational activities scheduled from 8:30 AM to 6:00 PM. The summer school is conducted during the month of July from 8:00 AM to 12:00 PM. The month of August is the slowest in terms of occupancy and the facility is occupied only by the administration staff from 7:30 AM to 3:30PM. During a typical day, the facility is occupied by approximately 79 full time staff (including teachers, admin and maintenance) and 460 students.

Figure 5 - Building Schedule

Building Occupancy Schedule		
Building Name	Weekday/Weekend	Operating Schedule
Lester C. Knoecker Elementary School	Weekday	7:00AM - 6:00PM
Lester C. Knoecker Elementary School	Weekend	8:00AM - 6:00PM
Summer School - July	Weekday	8:00AM - 12:00PM
Summer School - July	Weekend	No operation

2.4 Building Envelope

The building is constructed of concrete block and structural steel with a brick facade. The building has flat roof covered with rubber membrane. Most of the roof was done in 2008 and the remaining were completed in 2010. The roofs were observed to be in good condition. The windows in the original part of the building are all single pane and show signs of air infiltrations. The newer additions have double pane

windows that are in good condition. The exterior doors are constructed of aluminum or aluminum framed glass that are in good condition.



2.5 On-Site Generation

There are no on-site electric generation systems currently installed.

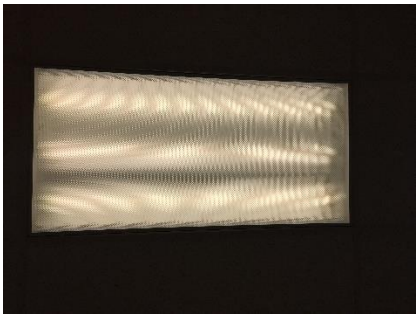
2.6 Energy-Using Systems

Please see Appendix A: Equipment Inventory & Recommendations for an inventory of systems and equipment.

Lighting System

Lighting is provided by linear 32-Watt fluorescent T8 lamps with electronic ballasts as well as some compact fluorescent lamps (CFLs). Most of the fixtures are 2-lamp or 3-lamp, 4-foot long troffers. Areas such as the closets, classrooms entrances, storage spaces, few offices are lit using 18-Watt or 42-Watt CFL lamps in recessed can ceiling fixtures.

Lighting control in most spaces is provided by manual wall switches. Lighting control in most of the restrooms and some storage spaces are provided by occupancy sensors. Exterior lighting consists primarily of 70-Watt or 175-Watt metal halide wall packs and 250-Watt or 400-Watt high pressure sodium (HPS) fixtures that are controlled by photocells. Exit signs are 2-Watt LED fixtures.



Hot Water (or Steam) Heating System

Space heating is provided by three (3) Aerco gas-fired condensing hydronic boilers (1720 Mbh each) as well as rooftop packaged units with gas-fired furnaces. The boilers are rated at combustion efficiency of 86%. Hot water is supplied to VAV boxes throughout the school and is used primarily for reheat. The hot water is circulated throughout the school using two (2) VFD driven 20 hp pumps. The kindergarten section is served by two (2)separate constant speed 1 hp pumps. Hot water is supplied at 180°F when the outside air temperature is below 55°F and the temperature is modulated upwards until outside air is 68°F. Above this temperature the boilers are shut off.

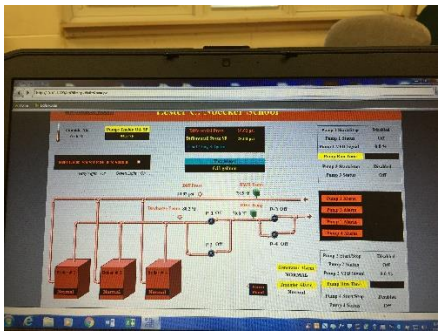
The rooftop packaged units serve bigger areas such as the gym, library, and multipurpose room (RTU 1 to 8), having output capacities ranging from 108 MBh – 384 MBh. Most of these rooftop units have an efficiency of 80%.

Heating control varies between spaces:

- Areas with VAV boxes are controlled by the Building Management System (BMS).
- Classrooms with occupancy sensors provide occupancy based heat supplied through the unit ventilators.
- Areas supplied by the rooftop packaged units (RTU1-RTU8) have their own programmable thermostats to control the space temperature.

The Building Management System is provided by AMA and said to be run by Sanders. The boilers are ten (10) years old and the roof top units are eight (8) years old. This equipment is in good condition and well maintained.



Direct Expansion Air Conditioning System (DX)

Space cooling in the bigger areas such as the gymnasium, multi-purpose room, library, and offices are provided by the rooftop packaged AC units. The cooling capacities range from 10 tons to 40 tons.

Some classrooms and offices have split AC units with cooling capacities ranging from 1 - 3.5 tons. Rooms 416, 418, 413 and 409 have DX coils in unit ventilators. These split AC units have thermostats located in the respective zones to control space temperature.

All of the packaged units are controlled using the building automation system, nine (9) years old and well maintained. The older section of the school has some split units that are as old as 30 years and have been evaluated for replacement.




Domestic Hot Water Heating System

The domestic hot water heating system for the facility consists of one (1) gas-fired water heater from Lochinvar with an input capacity of 180 MBh and a tank capacity of 119 gallons. The systems has an efficiency of 82% and serves the restrooms and the kitchen in the school. The equipment is ten (10) years old, in good condition and well maintained.

Food Service & Refrigeration

The school has an all-electric kitchen that is used to store and serve 300 lunches per day in the school. Most of the food is just re-heated and served. The kitchen equipment include convection ovens, food warmers, electric griddle and one single conveyor type commercial dishwasher. There is one (1) stand-up refrigerator and one (1) freezer chest in the kitchen to store food.

The kitchen operates for ten (10) months a year and all equipment except the food warmers and the griddles (original to the building) are about five (5) years old and in good condition.

Building Plug Load

There are roughly 17 computer work stations and about 52 laptops throughout the facility. Other plug loads include printers, projectors, smart boards, televisions and papers shredders. There are also kitchen equipment such as the coffee machines, different sizes of refrigerators, toaster ovens, microwave ovens, washer and dryer. There is no centralized PC power management software installed.

2.7 Water-Using Systems

A sampling of restrooms found that faucets are rated for 2.2 gallons per minute (gpm) or higher, the toilets are rated at 1.6 gallons per flush (gpf) and the urinals are rated at 1.6 (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 a number of 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

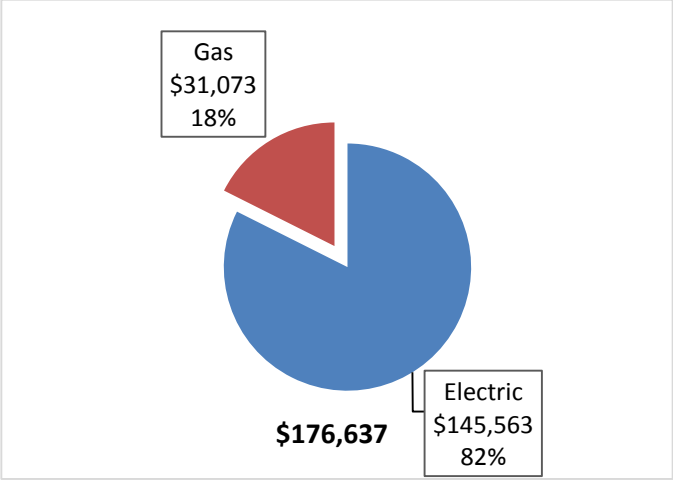
The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. A profile of the annual energy consumption and energy cost of the facility was developed from this information.

Figure 6 - Utility Summary

Utility Summary for LesterC. Knoecker Elementary School		
Fuel	**Usage**	**Cost**
Electricity	829,020 kWh	$145,563
Natural Gas	34,168 kWh	$31,073

The current annual energy cost for this facility is $176,637 as shown in the chart below.

Figure 7 - Energy Cost Breakdown



3.2 Electricity Usage

Electricity is provided by PSE&G. The average electric cost over the past 12 months was $0.176/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 third party electric supply is provided by South Jersey Energy Company. The monthly electricity consumption and peak demand are shown in the chart below.

Figure 8 - Electric Usage & Demand

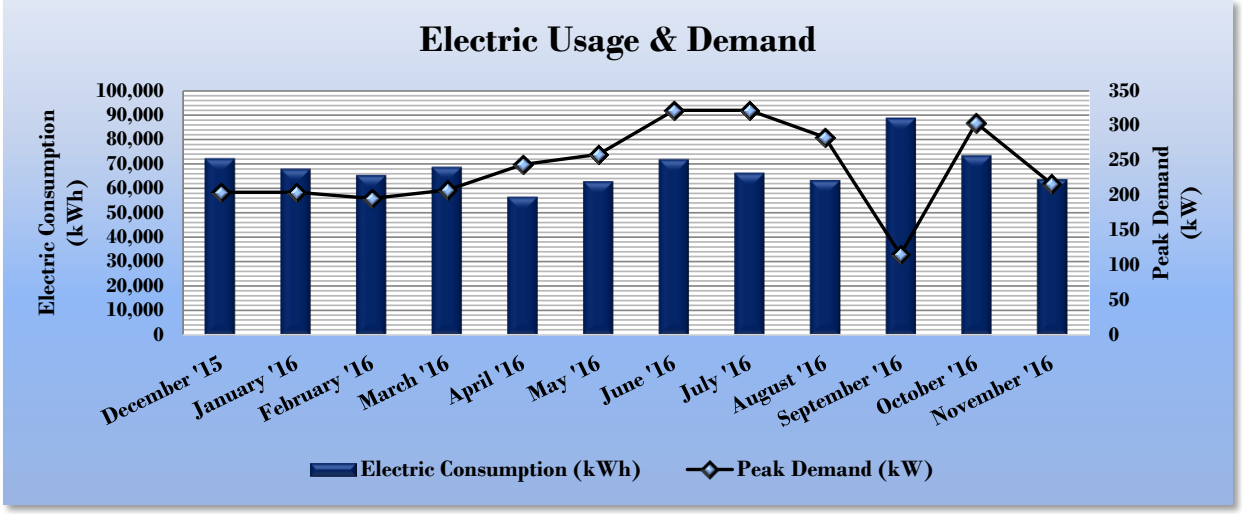


Figure 9 - Electric Usage & Demand

Electric Billing Data for Lester C. Knoeker Elementary School					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
12/28/15	30	72,126	205	$742	$11,946
1/28/16	31	67,820	204	$741	$11,122
2/26/16	29	65,309	196	$709	$10,623
3/29/16	32	68,595	208	$760	$11,132
4/27/16	29	56,471	244	$896	$9,561
5/26/16	29	62,825	259	$949	$10,549
6/27/16	32	71,796	322	$2,989	$14,868
7/27/16	30	66,224	322	$3,878	$13,972
8/25/16	29	63,213	283	$3,508	$13,151
9/26/16	32	88,695	115	$1,446	$14,703
10/26/16	30	73,316	304	$1,133	$12,045
11/23/16	28	63,545	217	$808	$10,296
Totals	**361**	**819,935**	**322.2**	**$18,559**	**$143,968**
Annual	**365**	**829,020**	**322.2**	**$18,765**	**$145,563**

3.3 Natural Gas Usage

Natural Gas is provided by PSE&G. The average gas cost for the past 12 months is $0.909/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is shown in the chart below.

Figure 10 - Natural Gas Usage

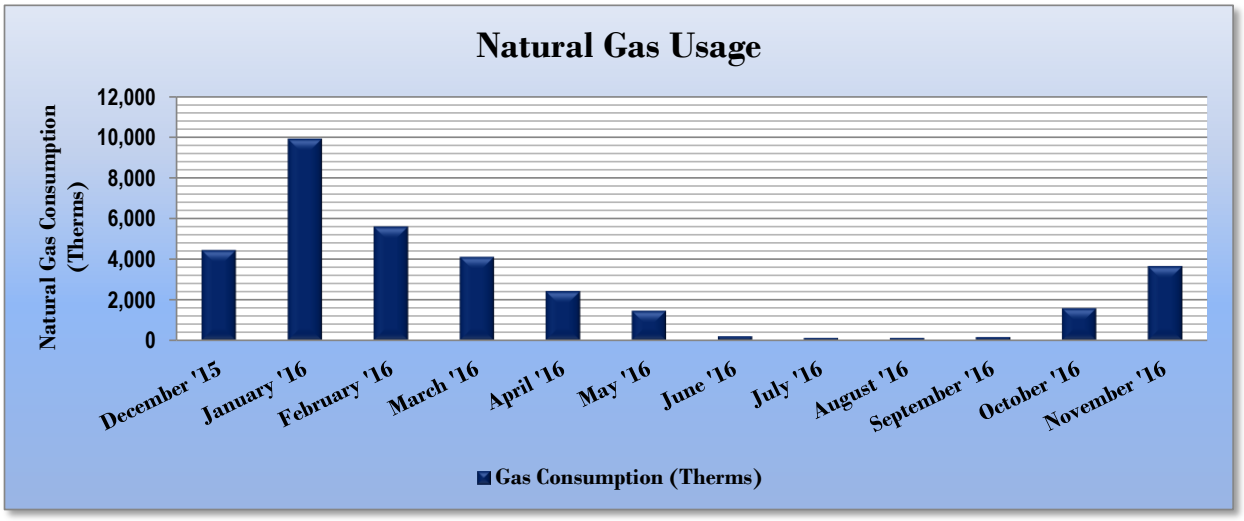


Figure 11 - Natural Gas Usage

Gas Billing Data for Lester C. Knoeker Elementary School			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
12/28/15	30	4,445	$4,755
1/28/16	31	9,922	$8,566
2/26/16	29	5,599	$5,021
3/29/16	32	4,115	$3,947
4/27/16	29	2,422	$1,629
5/26/16	29	1,453	$1,021
6/27/16	32	205	$236
7/27/16	30	115	$180
8/25/16	29	123	$185
9/26/16	32	164	$211
10/26/16	30	1,581	$1,112
11/23/16	28	3,651	$3,870
Totals	**361**	**33,794**	**$30,733**
Annual	**365**	**34,168**	**$31,073**

3.4 Benchmarking

This facility 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 facility'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 12 - Energy Use Intensity Comparison – Existing Conditions

Energy Use Intensity Comparison - Existing Conditions		
	Lester C. Knoeker Elementary School	National Median Building Type: School (K-12)
Source Energy Use Intensity (kBtu/ft^2)	127.2	141.4
Site Energy Use Intensity (kBtu/ft^2)	63.7	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 13 - Energy Use Intensity Comparison – Following Installation of Recommended Measures

Energy Use Intensity Comparison - Following Installation of Recommended Measures		
	Lester C. Knoeker Elementary School	National Median Building Type: School (K-12)
Source Energy Use Intensity (kBtu/ft^2)	100.1	141.4
Site Energy Use Intensity (kBtu/ft^2)	55.0	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 percent of all similar buildings nationwide and may be eligible for ENERGY STAR® certification. This facility has a current score of 79. See Appendix B: ENERGY STAR® Statement of Energy Performance.

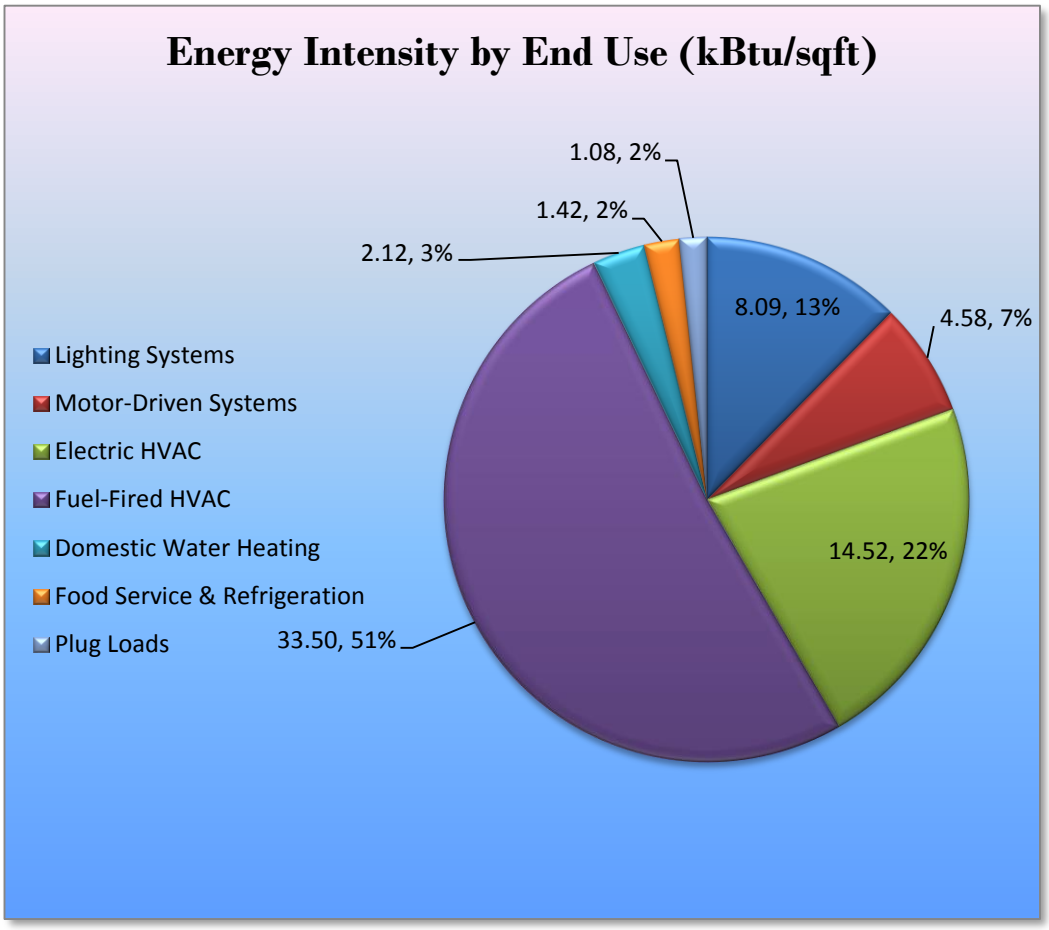
For more information on ENERGY STAR® certification go to: https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1.

A Portfolio Manager account has been created online for your facility 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 facility. An energy balance uses 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 14 - Energy Balance (% and 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 regarding financial incentives 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.

4.1 Recommended ECMs

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

Figure 15 – 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_2e Emissions Reduction (lbs)
Lighting Upgrades		**136,213**	**29.2**	**0.0**	**$23,916.87**	**$82,934.35**	**$15,500.00**	**$67,434.35**	**2.8**	**137,165**
ECM 1	Install LED Fixtures	35,386	8.5	0.0	$6,213.21	$28,910.10	$7,400.00	$21,510.10	3.5	35,633
ECM 2	Retrofit Fixtures with LED Lamps	100,827	20.7	0.0	$17,703.66	$54,024.25	$8,100.00	$45,924.25	2.6	101,532
Lighting Control Measures		**24,446**	**5.0**	**0.0**	**$4,292.34**	**$23,434.00**	**$6,110.00**	**$17,324.00**	**4.0**	**24,617**
ECM 3	Install Occupancy Sensor Lighting Controls	20,431	4.2	0.0	$3,587.43	$19,484.00	$2,730.00	$16,754.00	4.7	20,574
ECM 4	Install Daylight Dimming Controls	586	0.1	0.0	$102.93	$750.00	$180.00	$570.00	5.5	590
ECM 5	Install High/Low Lighitng Controls	3,428	0.7	0.0	$601.98	$3,200.00	$3,200.00	$0.00	0.0	3,452
Variable Frequency Drive (VFD) Measures		**6,675**	**2.2**	**0.0**	**$1,172.06**	**$12,567.00**	**$1,280.00**	**$11,287.00**	**9.6**	**6,722**
ECM 6	Install VFDs on Constant Volume (CV) HVAC	6,675	2.2	0.0	$1,172.06	$12,567.00	$1,280.00	$11,287.00	9.6	6,722
Electric Unitary HVAC Measures		**79,761**	**32.9**	**0.0**	**$14,004.81**	**$101,992.59**	**$6,280.00**	**$95,712.59**	**6.8**	**80,319**
ECM 7	Install High Efficiency Electric AC	79,761	32.9	0.0	$14,004.81	$101,992.59	$6,280.00	$95,712.59	6.8	80,319
Domestic Water Heating Upgrade		**0**	**0.0**	**15.6**	**$141.74**	**$100.38**	**$0.00**	**$100.38**	**0.7**	**1,825**
ECM 8	Install Low-Flow Domestic Hot Water Devices	0	0.0	15.6	$141.74	$100.38	$0.00	$100.38	0.7	1,825
TOTALS		**247,094**	**69.3**	**15.6**	**$43,527.83**	**$221,028.32**	**$29,170.00**	**$191,858.32**	**4.4**	**250,647**

* - 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

Recommended upgrades to existing lighting fixtures are summarized in Figure 16 below.

Figure 16 – 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_2e Emissions Reduction (lbs)
Lighting Upgrades		**138,709**	**29.2**	**0.0**	**$24,355.14**	**$82,934.35**	**$15,500.00**	**$67,434.35**	**2.8**	**139,678**
ECM 1	Install LED Fixtures	37,882	8.5	0.0	$6,651.47	$28,910.10	$7,400.00	$21,510.10	3.2	38,147
ECM 2	Retrofit Fixtures with LED Lamps	100,827	20.7	0.0	$17,703.66	$54,024.25	$8,100.00	$45,924.25	2.6	101,532

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_2e Emissions Reduction (lbs)
Interior	24,231	4.9	0.0	$4,254.53	$9,376.25	$2,400.00	$6,976.25	1.6	24,400
Exterior	11,155	3.6	0.0	$1,958.68	$19,533.85	$5,000.00	$14,533.85	7.4	11,233

Measure Description

We recommend replacing existing exterior fixtures containing HID 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 a fluorescent tubes and more than ten (10) times longer than many incandescent lamps.

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_2e Emissions Reduction (lbs)
Interior	99,647	20.4	0.0	$17,496.56	$51,659.11	$8,100.00	$43,559.11	2.5	100,344
Exterior	1,179	0.3	0.0	$207.10	$2,365.13	$0.00	$2,365.13	11.4	1,188

Measure Description

We recommend retrofitting existing incandescent and CFL 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 a fluorescent tubes and more than ten (10) times longer than many incandescent lamps.

4.1.2 Lighting Control Measures

Figure 17 – 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		**24,446**	**5.0**	**0.0**	**$4,292.34**	**$23,434.00**	**$6,110.00**	**$17,324.00**	**4.0**	**24,617**
ECM 3	Install Occupancy Sensor Lighting Controls	20,431	4.2	0.0	$3,587.43	$19,484.00	$2,730.00	$16,754.00	4.7	20,574
ECM 4	Install Daylight Dimming Controls	586	0.1	0.0	$102.93	$750.00	$180.00	$570.00	5.5	590
ECM 5	Install High/Low Lighitng Controls	3,428	0.7	0.0	$601.98	$3,200.00	$3,200.00	$0.00	0.0	3,452

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)
20,431	4.2	0.0	$3,587.43	$19,484.00	$2,730.00	$16,754.00	4.7	20,574

Measure Description

We recommend installing occupancy sensors to control lighting fixtures that are currently controlled by manual switches in all classrooms and offices areas. 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)
3,428	0.7	0.0	$601.98	$3,200.00	$3,200.00	$0.00	0.0	3,452

Measure Description

We recommend installing occupancy sensors in the hallways 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. In parking lots and parking garages with significant ambient lighting this control can sometimes be combined with photocell controls to turn the lights off when there is sufficient daylighting. 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 Variable Frequency Drive Measures

Our recommendations for variable frequency drive (VFD) measures are summarized in Figure 18 below.

Figure 18 – 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_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**6,675**	**2.2**	**0.0**	**$1,172.06**	**$12,567.00**	**$1,280.00**	**$11,287.00**	**9.6**	**6,722**
ECM 6	Install VFDs on Constant Volume (CV) HVAC	6,675	2.2	0.0	$1,172.06	$12,567.00	$1,280.00	$11,287.00	9.6	6,722

ECM 5: 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_2e Emissions Reduction (lbs)
6,675	2.2	0.0	$1,172.06	$12,567.00	$1,280.00	$11,287.00	9.6	6,722

Measure Description

We recommend installing variable frequency drives (VFDs) on the supply fans of RTU 3 & 8 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.

VAV systems should not be controlled such that the supply air temperature is raised at the expense of the fan power. A common mistake is to reset the supply air temperature to achieve compressor energy savings, which can lead to additional air flow requirements. Supply air temperature should be kept low, e.g. 55°F, until the minimum fan speed (typically about 50%) is met. At this point, it is efficient to raise the supply air temperature as the load decreases, but not such that additional air flow and thus fan energy is required.

For air handlers with direct expansion (DX) cooling systems, 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.

4.1.4 Electric Unitary HVAC Measures

Our recommendations for unitary HVAC measures are summarized in Figure 19 below.

Figure 19 - Summary of Unitary HVAC 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)
Electric Unitary HVAC Measures		**79,761**	**32.9**	**0.0**	**$14,004.81**	**$101,992.59**	**$6,280.00**	**$95,712.59**	**6.8**	**80,319**
ECM 7	Install High Efficiency Electric AC	79,761	32.9	0.0	$14,004.81	$101,992.59	$6,280.00	$95,712.59	6.8	80,319

ECM 6: Install High Efficiency Air Conditioning Units

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)
79,761	32.9	0.0	$14,004.81	$101,992.59	$6,280.00	$95,712.59	6.8	80,319

Measure Description

We recommend replacing eighteen standard efficiency split AC units (serving Rooms 372, 374, 375, 101, 105, 109, 113, 107, 111, 368, 369, 370, 371, 373, art, science, music) with high efficiency packaged air conditioning units. There have been significant improvements in both compressor and fan motor efficiencies over the past several years. Therefore, electricity savings can be achieved by replacing older units with new high efficiency units. A higher EER or SEER rating indicates a more efficient cooling system. The magnitude of energy savings for this measure depends on the relative efficiency of the older unit versus the new high efficiency unit, the average cooling load, and the estimated annual operating hours.

4.1.5 Domestic Hot Water Heating System Upgrades

Our recommendations for domestic water heating system improvements are summarized in Figure 20 below.

Figure 20 - Summary of Domestic Water Heating 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**	**15.6**	**$141.74**	**$100.38**	**$0.00**	**$100.38**	**0.7**	**1,825**
ECM 8	Install Low-Flow Domestic Hot Water Devices	0	0.0	15.6	$141.74	$100.38	$0.00	$100.38	0.7	1,825

ECM 7: 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	15.6	$141.74	$100.38	$0.00	$100.38	0.7	1,825

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 and low-flow showerheads can reduce hot water usage, relative to standard showerheads and aerators, which saves energy. Pre-rinse spray valves (PRSVs)—often used in commercial and institutional kitchens—are designed to remove food waste from dishes prior to dishwashing. Replacing standard pre-rinse spray valves with low flow PRSVs will reduce hot water usage and save energy.

Low-flow devices reduce the overall water flow from the fixture, while still adequate pressure for washing. This reduces the amount of water used per day resulting in energy and water savings.

5 ENERGY EFFICIENT PRACTICES

In addition to the quantifiable savings estimated in Section 4, a facility'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 facility. 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.

Close Doors and Windows

Ensure doors and windows are closed in conditioned spaces. Leaving doors and windows open leads to a significant increase in heat transfer between conditioned spaces and the outside air. Reducing a facility's air changes per hour (ACH) can lead to increased occupant comfort as well as significant heating and cooling savings, especially when combined with proper HVAC controls and adequate ventilation.

Use Window Treatments/Coverings

A substantial amount of heat gain can occur through uncovered or untreated windows, especially older single pane windows and east or west-facing windows. Treatments such as high-reflectivity films or covering windows with shades or shutters can reduce solar heat gain and, consequently, cooling load and can reduce internal heat loss and the associated heating load.

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.

Practice Proper Use of Thermostat Schedules and Temperature Resets

Ensure thermostats are correctly set back. By employing proper set back temperatures and schedules, facility heating and cooling costs can be reduced dramatically during periods of low or no occupancy. As such, thermostats should be programmed for a setback of 5-10°F during low occupancy hours (reduce heating setpoints and increase cooling setpoints). Cooling load can be reduced further by increasing the facility's occupied setpoint temperature. In general, during the cooling season, thermostats should be set as high as possible without sacrificing occupant comfort.

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 in order 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.

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 gpfand 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 facility, 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 facility. Before making a decision 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.

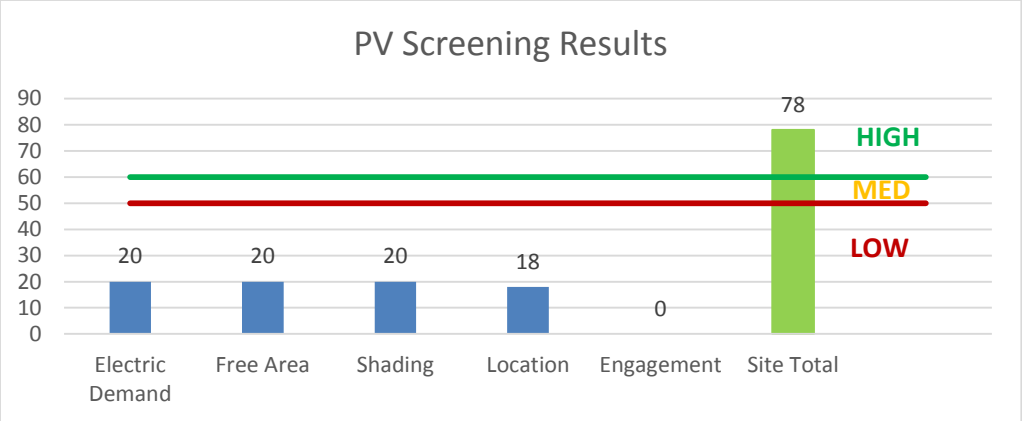
6.1 Photovoltaic

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 facility'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 facility's electric demand, size and location of free area, and shading elements shows that the facility 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 Lester C. Noecker Elementary School is interested in pursuing the installation of PV, we recommended a full feasibility study be conducted.

Figure 21 - Photovoltaic Screening



Potential	High	
System Potential	240	kW DC STC
Electric Generation	285,929	kWh/yr
Displaced Cost	$24,880	/yr
Installed Cost	$624,000	

Solar projects must register their projects in the SREC Registration Program 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 Combined Heat and Power

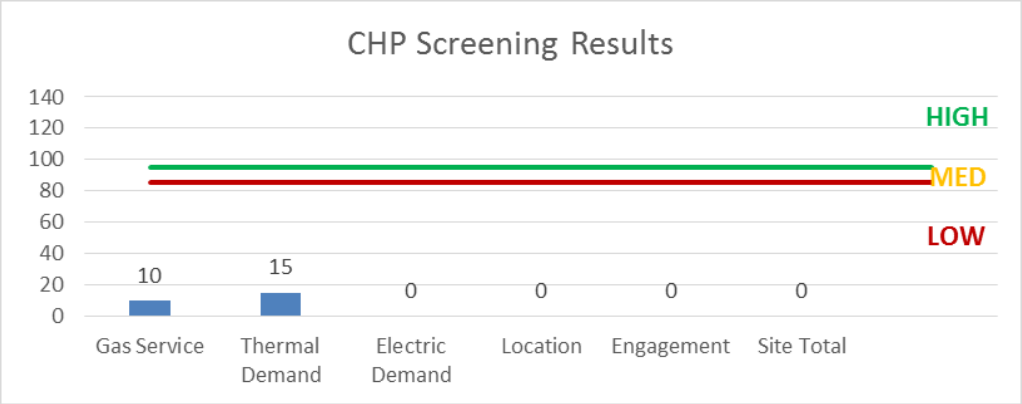
Combined heat and power (CHP) is the on-site generation of electricity along with the recovery of heat energy, which is put to beneficial use. Common technologies for CHP include reciprocating engines, microturbines, fuel cells, backpressure steam turbines, and (at large facilities) gas turbines. Electric 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 facility, with the balance of electric power needs supplied by grid purchases. The heat is used to supplement (or supplant) existing boilers for the purpose of space heating and/or domestic hot water heating. Waste heat can also be routed through absorption chillers for the purpose of space cooling. The key criteria used for screening, however, is the amount of time the system operates at full load and the facility'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 facility 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 potential for CHP at the site. In our opinion, the facility 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/.


CHP Screening Results
140
120
100
80
60
40
20
0
HIGH
MED
LOW
10
15
0
0
0
0
Gas Service
Thermal Demand
Electric Demand
Location
Engagement
Site Total

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 is able to 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 22 for a list of the eligible programs identified for each recommended ECM.

Figure 22 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive	Pay For Performance Existing Buildings
ECM 1	Install LED Fixtures	x	x
ECM 2	Retrofit Fixtures with LED Lamps	x	x
ECM 3	Install Occupancy Sensor Lighting Controls	x	x
ECM 4	Install Daylight Dimming Controls	x	x
ECM 5	Install High/Low Lighitng Controls	x	x
ECM 6	Install VFDs on Constant Volume (CV) HVAC	x	x
ECM 7	Install High Efficiency Electric AC	x	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. 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.

Generally, the incentive values provided throughout the report assume that the SmartStart program is used 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

SmartStart offers incentives for installing prescriptive and custom energy efficiency measures at your facility. 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 facility 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 submit an application 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 Pay for Performance - Existing Buildings

Overview

The Pay for Performance – Existing Buildings (P4P EB) program is designed for larger customers with a peak demand over 200 kW in any of the preceding 12 months. Under this program the minimum installed scope of work must include at least two unique measures resulting in at least 15% energy savings, where lighting cannot make up the majority of the savings. P4P is a generally a good option for medium to large sized facilities looking to implement as many measures as possible under a single project in order to achieve deep energy savings. This program has an added benefit of evaluating a broad spectrum of measures that may not otherwise qualify under other programs. Many facilities pursuing an Energy Savings Improvement Program (ESIP) loan also utilize the P4P program.

Incentives

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

How to Participate

To participate in the P4B EB program you will need to contact one of the pre-approved consultants and contractors ("Partners"). Under direct contract to you, the Partner will help further evaluate the measures identified in this report through development of the Energy Reduction Plan (ERP), assist you in implementing selected measures, and verify actual savings one year after the installation. At each of these three milestones your Partner will also facilitate securing program incentives.

Approval of the final scope of work is required by the program prior to installation completion. Although installation can be accomplished by a contractor of your choice (some P4P Partners are also contractors) or by internal personnel, the Partner must remain involved to ensure compliance with the program guidelines and requirements.

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

8.3 SREC Registration Program

The SREC 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 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 the pipeline of anticipated new solar capacity and insight into future SREC pricing.

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

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

Electricity suppliers, the primary purchasers of SRECs, are required to pay a Solar Alternative Compliance Payment (SACP) if they do not meet the requirements of New Jersey's Solar 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 descriptions 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.

8.5 Demand Response Energy Aggregator

The first step toward participation in a Demand Response (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).

Curtailment Service Providers typically offer free assessments to determine a facility's eligibility to participate in a DR program. They will provide details regarding the program rules and requirements for metering and controls, a facility's ability to temporarily reduce electric load, as well as the payments involved in participating in the program. Also, these providers usually offer multiple options for DR to larger facilities and may also install controls or remote monitoring equipment to help ensure compliance of all terms and conditions of a DR contract.

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 facility's interconnection to the grid and repair to local power distribution will still reside with the traditional utility company serving your region.

If your facility is not purchasing electricity from a third party supplier, consider shopping for a reduced rate from third party electric suppliers. If your facility is purchasing electricity from a third party supplier, review and compare prices at the end of the current contract or every couple 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 on a monthly basis. 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 facility is not purchasing natural gas from a third party supplier, consider shopping for a reduced rate from third party natural gas suppliers. If your facility is purchasing natural gas from a third party supplier, review and compare prices at the end of the current contract or every couple 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
Maintenance	5	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	No	5	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,832	0.16	806	0.0	$141.53	$376.00	$75.00	2.13
Restroom - maintenance	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	780	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	780	0.03	44	0.0	$7.80	$75.20	$15.00	7.72
Garage - maintenance	11	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	No	11	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,832	0.24	1,182	0.0	$207.58	$643.50	$110.00	2.57
Boiler room	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	No	7	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,832	0.15	752	0.0	$132.10	$409.50	$70.00	2.57
204 Hallway	14	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	14	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,982	0.38	1,901	0.0	$333.84	$1,219.00	$490.00	2.18
Faculty Men's restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	1,982	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,388	0.03	95	0.0	$16.69	$174.50	$10.00	9.85
Boys' restroom - 214 hallway	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.12	611	0.0	$107.31	$495.60	$80.00	3.87
214 - Storage	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.08	407	0.0	$71.54	$266.40	$50.00	3.02
Receiving	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,982	0.14	679	0.0	$119.23	$562.50	$85.00	4.00
CR-207	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.25	1,222	0.0	$214.61	$721.20	$125.00	2.78
Girls' restroom - 214 hallway	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,982	0.08	407	0.0	$71.54	$445.50	$65.00	5.32
CR 374,375,372,368,369,373, 370,371	96	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	96	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	3.94	19,556	0.0	$3,433.82	$9,379.20	$1,720.00	2.23
Hallway 371-374	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	16	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,982	0.44	2,173	0.0	$381.54	$1,336.00	$560.00	2.03
Boys' restroom - 371-374	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,982	0.08	407	0.0	$71.54	$445.50	$65.00	5.32
Rear play ground entrance	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.08	407	0.0	$71.54	$266.40	$50.00	3.02
Hallway	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,982	0.25	1,222	0.0	$214.61	$726.50	$315.00	1.92
CR 401	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.62	3,056	0.0	$536.53	$1,398.00	$260.00	2.12
CR 403 Music	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	14	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.57	2,852	0.0	$500.76	$1,322.80	$245.00	2.15
406 office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,982	0.05	272	0.0	$47.69	$233.00	$40.00	4.05
CR 409,413,418,416	60	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	60	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	2.46	12,223	0.0	$2,146.13	$5,592.00	$1,040.00	2.12
Hallway 409-502	20	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	20	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,982	0.55	2,716	0.0	$476.92	$1,770.00	$700.00	2.24
Office 505, 502 conference	8	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	8	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.33	1,630	0.0	$286.15	$833.60	$160.00	2.35
office 506	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.16	815	0.0	$143.08	$416.80	$80.00	2.35
Kitchenette 508	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,982	0.11	543	0.0	$95.38	$350.00	$60.00	3.04
Front of BA office	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	No	4	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,832	0.13	645	0.0	$113.23	$300.80	$60.00	2.13

	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
BA office exit	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,832	0.03	161	0.0	$28.31	$75.20	$15.00	2.13
Hallway BA office	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,832	0.13	645	0.0	$113.23	$351.00	$60.00	2.57
Faculty restroom - BA office	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	1,982	Relamp	Yes	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,388	0.04	143	0.0	$25.04	$191.20	$15.00	7.04
Office 501	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.16	815	0.0	$143.08	$416.80	$80.00	2.35
509 - electrical room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,982	0.05	272	0.0	$47.69	$233.00	$40.00	4.05
CR 429, 423	24	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	24	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.98	4,889	0.0	$858.45	$2,344.80	$430.00	2.23
CR 427,426	16	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	16	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.66	3,259	0.0	$572.30	$1,743.20	$310.00	2.50
CR 428,425,424,419,417	30	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	30	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,982	0.82	4,074	0.0	$715.38	$3,105.00	$475.00	3.68
Custodial closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	208	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	146	0.03	10	0.0	$1.75	$174.50	$30.00	82.51
Canopy	5	Metal Halide: (1) 100W Lamp	Wall Switch	128	2,832	Fixture Replacement	No	5	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	48	2,832	0.26	1,303	0.0	$228.74	$1,953.39	$500.00	6.35
Wallpack	2	Metal Halide: (1) 175W Lamp	Wall Switch	215	2,832	Fixture Replacement	Yes	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	89	1,416	0.22	1,111	0.0	$195.00	$1,031.35	$290.00	3.80
Wallpack	1	Metal Halide: (1) 175W Lamp	Wall Switch	215	2,832	Fixture Replacement	Yes	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	89	1,416	0.11	555	0.0	$97.50	$640.68	$145.00	5.08
Wallpack	1	High-Pressure Sodium: (1) 250W Lamp	Wall Switch	295	2,832	Fixture Replacement	Yes	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	93	1,416	0.16	809	0.0	$142.10	$640.68	$145.00	3.49
208 - custodial closet	1	Compact Fluorescent: 1 lamp	Wall Switch	42	2,832	Relamp	Yes	1	LED Screw-In Lamps: 1 Lamp	Occupancy Sensor	29	1,982	0.01	70	0.0	$12.25	$169.75	$20.00	12.23
402-storage	2	Compact Fluorescent: 1 lamp	Wall Switch	42	2,832	Relamp	Yes	2	LED Screw-In Lamps: 1 Lamp	Occupancy Sensor	29	1,982	0.03	140	0.0	$24.50	$223.51	$20.00	8.31
408-storage	2	Compact Fluorescent: 1 lamp	Wall Switch	42	2,832	Relamp	Yes	2	LED Screw-In Lamps: 1 Lamp	Occupancy Sensor	29	1,982	0.03	140	0.0	$24.50	$223.51	$20.00	8.31
CR 409,413,418,416	8	Compact Fluorescent: 2 lamps	Wall Switch	36	2,832	Relamp	No	8	LED Screw-In Lamps: 2 Lamps	Wall Switch	25	2,832	0.06	281	0.0	$49.41	$860.05	$0.00	17.41
405-storage	1	Compact Fluorescent: 1 lamp	Occupancy Sensor	42	1,982	Relamp	No	1	LED Screw-In Lamps: 1 Lamp	Occupancy Sensor	29	1,982	0.01	29	0.0	$5.04	$53.75	$0.00	10.66
Boys' restroom	5	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	1,982	Relamp	Yes	5	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,388	0.21	713	0.0	$125.19	$646.00	$110.00	4.28
Girls' restroom	5	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	1,982	Relamp	Yes	5	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,388	0.21	713	0.0	$125.19	$646.00	$110.00	4.28
Hallway between 429 and 428	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,982	0.25	1,222	0.0	$214.61	$726.50	$315.00	1.92
510 Gym office	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.16	815	0.0	$143.08	$416.80	$80.00	2.35
512 Gym storage	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,982	0.11	543	0.0	$95.38	$350.00	$60.00	3.04
Gym entrance	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,832	0.03	161	0.0	$28.31	$75.20	$15.00	2.13
520 - outdoor storage	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,832	0.09	430	0.0	$75.48	$234.00	$40.00	2.57

	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
Hallway - 519	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,982	0.22	1,086	0.0	$190.77	$668.00	$280.00	2.03
Girls' restroom 519	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	1,982	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,388	0.16	570	0.0	$100.15	$570.80	$95.00	4.75
Room 519	5	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	1,982	Relamp	Yes	5	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,388	0.21	713	0.0	$125.19	$492.00	$95.00	3.17
Gym entrance	8	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	No	8	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,832	0.26	1,290	0.0	$226.45	$601.60	$120.00	2.13
Boys' restroom	5	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	1,982	Relamp	Yes	5	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,388	0.21	713	0.0	$125.19	$646.00	$110.00	4.28
Gym exit	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,832	0.03	161	0.0	$28.31	$75.20	$15.00	2.13
Room 516 - CR	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Occupancy Sensor	93	1,982	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,388	0.16	570	0.0	$100.15	$570.80	$95.00	4.75
Custodial closet 522	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Occupancy Sensor	32	1,982	Relamp	Yes	1	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,388	0.01	50	0.0	$8.75	$151.90	$25.00	14.51
Hallway opposite 407	13	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	13	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,982	0.36	1,766	0.0	$310.00	$1,160.50	$455.00	2.28
137-child study	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	No	6	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,832	0.19	967	0.0	$169.84	$451.20	$90.00	2.13
Child study conference 133	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.25	1,222	0.0	$214.61	$567.20	$110.00	2.13
131 - office	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.16	815	0.0	$143.08	$416.80	$80.00	2.35
Principals office 129	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.16	815	0.0	$143.08	$416.80	$80.00	2.35
Faculty Men's restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.04	204	0.0	$35.77	$191.20	$15.00	4.93
Faculty Women's restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.08	407	0.0	$71.54	$266.40	$30.00	3.30
Mail room	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.08	407	0.0	$71.54	$266.40	$50.00	3.02
Main office suite	8	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	No	8	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,832	0.26	1,290	0.0	$226.45	$601.60	$120.00	2.13
122-Nurse's office	7	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	No	7	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,832	0.23	1,128	0.0	$198.14	$526.40	$105.00	2.13
Nurse's restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,832	0.03	161	0.0	$28.31	$75.20	$15.00	2.13
Media center	71	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	No	71	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,832	2.30	11,446	0.0	$2,009.75	$5,339.20	$1,065.00	2.13
Main entrance	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	No	4	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,832	0.13	645	0.0	$113.23	$300.80	$60.00	2.13
Hallway MPR	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,982	0.27	1,358	0.0	$238.46	$785.00	$350.00	1.82
Kitchen	15	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	72	2,832	None	No	15	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	72	2,832	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
205-storage	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.04	204	0.0	$35.77	$191.20	$35.00	4.37
Kitchen office	6	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	72	2,832	None	No	6	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	72	2,832	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
KG Hallway	13	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	13	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,982	0.36	1,766	0.0	$310.00	$1,160.50	$455.00	2.28
Courtyard	6	Metal Halide: (1) 175W Lamp	High/Low Control	215	1,982	Fixture Replacement	No	6	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	High/Low Control	89	1,982	0.50	1,723	0.0	$302.62	$2,344.06	$600.00	5.76
513 Gymnasium	24	High-Pressure Sodium: (1) 400W Lamp	Wall Switch	465	2,832	Fixture Replacement	Yes	24	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Occupancy Sensor	155	1,982	5.61	27,865	0.0	$4,892.71	$14,656.25	$3,240.00	2.33
Courtyard entrance	6	Compact Fluorescent: Recessed fixture - 2 lamps	Wall Switch	36	2,832	Relamp	No	6	LED Screw-In Lamps: 2 Lamps - Recessed fixture	Wall Switch	25	2,832	0.04	211	0.0	$37.06	$645.04	$0.00	17.41
Main office suite	6	Compact Fluorescent: Recessed fixture - 2 lamps	Wall Switch	36	2,832	Relamp	No	6	LED Screw-In Lamps: 2 Lamps - Recessed fixture	Wall Switch	25	2,832	0.04	211	0.0	$37.06	$645.04	$0.00	17.41
Main entrance	6	Compact Fluorescent: 2 lamps	High/Low Control	36	1,982	Relamp	No	6	LED Screw-In Lamps: 2 Lamps	High/Low Control	25	1,982	0.04	148	0.0	$25.94	$645.04	$0.00	24.87
Back stage	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,832	0.06	322	0.0	$56.61	$175.50	$30.00	2.57
CR 222	14	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	2,832	Relamp	Yes	14	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,982	0.20	996	0.0	$174.93	$772.60	$105.00	3.82
Faculty Women's restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,982	0.03	136	0.0	$23.85	$174.50	$10.00	6.90
Faculty Men's restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,982	0.03	136	0.0	$23.85	$174.50	$10.00	6.90
CR 222 - restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,832	0.04	215	0.0	$37.74	$117.00	$20.00	2.57
CR 223 - storage	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	2,832	Relamp	Yes	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,982	0.03	142	0.0	$24.99	$187.80	$30.00	6.31
CR 217 - Custodial Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,982	0.03	136	0.0	$23.85	$174.50	$30.00	6.06
CR 220	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.49	2,445	0.0	$429.23	$1,172.40	$215.00	2.23
CR 220	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,832	0.04	215	0.0	$37.74	$117.00	$20.00	2.57
CR 220 restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	1,982	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,982	0.02	75	0.0	$13.21	$58.50	$10.00	3.67
CR 227	4	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	2,832	Relamp	No	4	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,832	0.05	228	0.0	$40.03	$143.60	$20.00	3.09
CR 227	10	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	10	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.41	2,037	0.0	$357.69	$1,022.00	$185.00	2.34
CR 227 restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,832	0.04	215	0.0	$37.74	$117.00	$20.00	2.57
CR 221 - Faculty lounge	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.25	1,222	0.0	$214.61	$567.20	$110.00	2.13
228 - hallway	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	6	LED - Linear Tubes: (3) 4' Lamps	High/Low Control	44	1,982	0.25	1,222	0.0	$214.61	$651.20	$210.00	2.06
KG entrance	4	Linear Fluorescent - T8: 2' T8 (17W) - 1L	Wall Switch	22	2,832	Relamp	No	4	LED - Linear Tubes: (1) 2' Lamp	Wall Switch	9	2,832	0.04	176	0.0	$30.88	$127.60	$20.00	3.48
Room 228	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,982	0.08	407	0.0	$71.54	$291.50	$50.00	3.38
CR 231	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,832	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,982	0.49	2,445	0.0	$429.23	$1,172.40	$215.00	2.23
CR 231 restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,832	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,832	0.02	107	0.0	$18.87	$58.50	$10.00	2.57

	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
Multi Purpose Room	44	LED Screw-In Lamps: 2 lamps	Wall Switch	72	2,832	None	No	44	LED Screw-In Lamps: 2 lamps	Wall Switch	72	2,832	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Stage	1	Compact Fluorescent: 1 lamp	Wall Switch	42	2,832	Relamp	No	1	LED Screw-In Lamps: 1 Lamp	Wall Switch	29	2,832	0.01	41	0.0	$7.21	$53.75	$0.00	7.46
CR 222 - Storage	4	Compact Fluorescent: 1 lamp	Wall Switch	42	2,832	Relamp	Yes	4	LED Screw-In Lamps: 1 Lamp	Occupancy Sensor	29	1,982	0.06	279	0.0	$49.00	$331.01	$20.00	6.35
CR 223 - storage	2	Compact Fluorescent: 1 lamp	Wall Switch	42	2,832	Relamp	Yes	2	LED Screw-In Lamps: 1 Lamp	Occupancy Sensor	29	1,982	0.03	140	0.0	$24.50	$223.51	$20.00	8.31
CR 231	7	Compact Fluorescent: 2 lamps	Wall Switch	36	2,832	Relamp	Yes	7	LED Screw-In Lamps: 2 Lamps	Occupancy Sensor	25	1,982	0.08	419	0.0	$73.49	$1,022.54	$35.00	13.44
Canopy lights	20	Compact Fluorescent: 1 lamp	Wall Switch	42	2,832	Relamp	No	20	LED Screw-In Lamps: 1 Lamp	Wall Switch	29	2,832	0.17	821	0.0	$144.10	$1,075.06	$0.00	7.46
Wallpack	13	Metal Halide: (1) 175W Lamp	Daylight Dimming	215	1,416	Fixture Replacement	No	13	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	89	1,416	1.07	2,667	0.0	$468.34	$5,078.80	$1,300.00	8.07
Wallpack	1	High-Pressure Sodium: (1) 250W Lamp	Daylight Dimming	295	1,416	Fixture Replacement	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	93	1,416	0.13	329	0.0	$57.76	$390.68	$100.00	5.03
Wallpack	3	High-Pressure Sodium: (1) 400W Lamp	Daylight Dimming	465	1,416	Fixture Replacement	No	3	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	155	1,416	0.61	1,514	0.0	$265.91	$1,172.03	$300.00	3.28
Garden poles	18	Metal Halide: (1) 70W Lamp	Daylight Dimming	95	1,416	Fixture Replacement	No	18	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	36	1,416	0.70	1,729	0.0	$303.65	$7,032.19	$1,800.00	17.23
214 storage	2	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	72	2,832	None	No	2	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	72	2,832	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Exit signs	31	Exit Signs: LED - 2 W Lamp	None	6	8,760	None	No	31	Exit Signs: LED - 2 W Lamp	None	6	8,760	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
Maintenance area	Maintenance area	4	Supply Fan	0.2	60.0%	No	2,745	No	60.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler room	All school	2	Heating Hot Water Pump	20.0	93.0%	Yes	1,696	No	93.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler room	DHW	1	Water Supply Pump	0.2	60.0%	No	2,745	No	60.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler room	KG section	2	Heating Hot Water Pump	1.0	85.5%	No	1,373	No	85.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Above ceiling	Fan coil units	20	Supply Fan	0.5	60.0%	No	2,745	No	60.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Outdoor storage	Ceiling	1	Supply Fan	5.0	89.5%	No	2,745	No	89.5%	Yes	1	0.68	2,059	0.0	$361.57	$3,275.85	$400.00	7.95
Outdoor storage	AC2 - Hallway	1	Return Fan	3.0	86.5%	No	2,745	No	86.5%	Yes	1	0.42	1,278	0.0	$224.46	$3,007.65	$240.00	12.33
Storage	AC1 AHU	1	Supply Fan	5.0	89.5%	No	2,745	No	89.5%	Yes	1	0.68	2,059	0.0	$361.57	$3,275.85	$400.00	7.95
Storage	AC1 AHU	1	Return Fan	3.0	86.5%	No	2,745	No	86.5%	Yes	1	0.42	1,278	0.0	$224.46	$3,007.65	$240.00	12.33
Roof	RTU 8	1	Supply Fan	5.0	89.5%	No	1,131	No	89.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	RTU 3	1	Supply Fan	15.0	92.5%	No	1,131	No	92.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	RTU 3	1	Exhaust Fan	5.0	89.5%	No	2,745	No	89.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Exhausts	13	Exhaust Fan	0.3	60.0%	No	2,745	No	60.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00

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
Maintenance	Maintenance	1	Split-System AC	1.50		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Outside ground - tech lounge and Pre-K	Outside ground	1	Split-System AC	7.50		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Outside ground	Outside ground	1	Split-System AC	6.00		Yes	1	Split-System AC	6.00		16.00		No	2.84	4,793	0.0	$841.58	$6,982.62	$438.00	7.78
Unit 6 - ground	372	1	Split-System AC	3.50		Yes	1	Split-System AC	3.50		16.00		No	1.66	4,746	0.0	$833.40	$5,236.77	$322.00	5.90
Unit 7 - ground	374	1	Split-System AC	3.50		Yes	1	Split-System AC	3.50		16.00		No	1.66	4,746	0.0	$833.40	$5,236.77	$322.00	5.90
Unit 8 - ground	375	1	Split-System AC	3.50		Yes	1	Split-System AC	3.50		16.00		No	1.66	4,746	0.0	$833.40	$5,236.77	$322.00	5.90
Grounds	1.01105E+11	4	Split-System AC	3.50		Yes	4	Split-System AC	3.50		16.00		No	6.63	18,986	0.0	$3,333.59	$20,947.08	$1,288.00	5.90
Roof	227	1	Packaged AC	5.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	228	1	Packaged AC	5.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	RTU 4 - One half of the MPR	1	Packaged AC	20.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
11A, 10A, 9A - Roof	Art, Science, Music (401,403,407)	3	Split-System AC	4.00		Yes	3	Split-System AC	4.00		16.00		No	5.68	9,586	0.0	$1,683.17	$17,954.64	$1,104.00	10.01
Roof	RTU 7 - Office	1	Packaged AC	13.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	RTU3	1	Packaged AC	40.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	RTU 8	1	Packaged AC	10.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	RTU 2 - one half of new gym - play ground side	1	Packaged AC	10.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	RTU 1 - New Gym - front half	1	Packaged AC	20.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	RTU 5 - 2nd half of MPR	1	Packaged AC	20.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	RTU - 6 - Library	1	Packaged AC	20.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Grounds	18A - Room 111	1	Split-System AC	4.00		Yes	1	Split-System AC	4.00		16.00		No	1.89	3,195	0.0	$561.06	$5,984.88	$368.00	10.01
Grounds	Room 107 - Grounds	1	Split-System AC	4.00		Yes	1	Split-System AC	4.00		16.00		No	1.89	3,195	0.0	$561.06	$5,984.88	$368.00	10.01

		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
Grounds	Room 103, Room 115	2	Split-System AC	4.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Rooms 418,416,413,409	Rooms 418,416,413,409	4	Split-System AC	3.50		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Office	Office	1	Split-System AC	1.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Office	Office	1	Split-System AC	2.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Grounds	369, 371	2	Split-System AC	3.50		Yes	2	Split-System AC	3.50		16.00		No	3.31	9,493	0.0	$1,666.80	$10,473.54	$644.00	5.90
Grounds	368, 373, 370	3	Split-System AC	4.00		Yes	3	Split-System AC	4.00		16.00		No	5.68	16,273	0.0	$2,857.36	$17,954.64	$1,104.00	5.90

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	All classrooms with unit vents and VAV boxes	3	Condensing Hot Water Boiler	1,720.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	227 and 228	2	Furnace	108.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	RTU 7 - Office	1	Furnace	208.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Heating for RTU 2 and RTU 3 zones	1	Furnace	800.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	RTU 8	1	Furnace	192.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	RTU 1 - New Gym - front half	1	Furnace	384.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	RTU 5 - 2nd half of MPR	1	Furnace	384.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	RTU - 6 - Library	1	Furnace	384.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	RTU 4 - One half of the MPR	1	Furnace	384.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00

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	All school	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

	Recommedation 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
Boys restroom - 204 hall	2	Faucet Aerator (Lavatory)	2.50	1.00	0.00	0	4.7	$42.95	$14.34	$0.00	0.33
CR 369 - 375	8	Faucet Aerator (Kitchen)	2.50	2.20	0.00	0	3.8	$34.36	$57.36	$0.00	1.67
BRR 371 hall	3	Faucet Aerator (Lavatory)	2.50	1.00	0.00	0	7.1	$64.43	$21.51	$0.00	0.33
Nurse's office	1	Faucet Aerator (Kitchen)	2.20	2.20	0.00	0	0.0	$0.00	$7.17	$0.00	0.00

Cooking Equipment Inventory, Commercial Refrigerator/Freezer 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	2	Electric Convection Oven (Half Size)	Yes	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Kitchen	1	Electric Griddle (4 Feet Width)	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Kitchen	5	Insulated Food Holding Cabinet (1/2 Size)	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

	Existing Conditions			Proposed Condi	Energy Impact & Financial Analysis						
Location	Quantity	Refrigerator/ Freezer Type	ENERGY STAR Qualified?	Install ENERGY STAR 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	2	Stand-Up Refrigerator, Solid Door (>50 cu. ft.)	Yes	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Kitchen	1	Freezer Chest	Yes	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Dishwasher Inventory & Recommendations

	Existing Conditions					Proposed Conditions	Energy Impact & Financial Analysis						
Location	Quantity	Dishwasher Type	Water Heater Fuel Type	Booster Heater Fuel Type	ENERGY STAR Qualified?	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Payback w/ Incentives in Years
Kitchen	1	Single Tank Conveyor (High Temp)	Electric	N/A	Yes	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Plug Load Inventory

	Existing Conditions			
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
All school	17	Computer	145.0	Yes
All school	52	Laptop	75.0	Yes
All school	2	Printer - Small	20.0	Yes
All school	39	Printer - Medium	40.0	Yes
All school	4	Printer - Big	220.0	Yes
All school	4	Paper shredder	150.0	Yes
All school	28	Projector	200.0	Yes
All school	5	Microwave	1,000.0	No
All school	5	Refrigerator - Medium	40.0	No
All school	1	Refrigerator - Large	220.0	No
All school	4	Coffee machine	400.0	Yes
All school	4	Toaster oven	1,200.0	No
All school	1	Clothes washer	900.0	Yes
All school	1	Clothes dryer	1,500.0	Yes
All school	2	Television LCD	120.0	No
All school	1	Television LED	100.0	No
All school	1	Space heater	1,500.0	No
All school	1	Kettle	1,500.0	No
All school	27	Smart board	5.0	Yes
All school	1	Kiln	13,000.0	No
All school	2	Ceiling fan	60.0	No

Appendix B: ENERGY STAR® Statement of Energy Performance

ENERGY STAR® Statement of Energy Performance

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ENERGY STAR® Score[1]

Lester C. Noecker Elementary School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 98,000
Built: 1967

For Year Ending: November 30, 2016
Date Generated: October 25, 2017

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
Lester C. Noecker Elementary School 100 Passaic Avenue Roseland, New Jersey 07068	Roseland Board of Education 100 Passaic Avenue Roseland, NJ 07068 (973) 226-1296	Julie Kot 100 Passaic Avenue Roseland, NJ 07068 (973) 226-1296 Ext 311 jkot@roselandnjboe.org

Property ID: 6088972

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
63.9 kBtu/ft²

Source EUI
127 kBtu/ft²

Annual Energy by Fuel	
Electric - Grid (kBtu)	2,808,509 (45%)
Natural Gas (kBtu)	3,455,863 (55%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	85.3
National Median Source EUI (kBtu/ft²)	169.4
% Diff from National Median Source EUI	-25%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	495

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)