Local Government Energy Audit:
Energy Audit Report

Alice Costello School

301, Haakon Road

Brooklawn, NJ 08030

Brooklawn Board of Education

May 18, 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 Alice Costello 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 public schools in controlling energy costs and protecting our environment by offering a wide range of energy management options and advice.

1.1 Facility Summary

Alice Costello School is a three-story, 59,922 square foot facility comprised of various spaces such as classrooms, gymnasium, kitchen, offices and a mechanical space. The school operates on a 10 month schedule during the year, weekdays from 8:00 AM to 3:00 PM and remains closed during the weekends. During winter there are some sports activities during the weekends.

Heating in the building is provided by two non-condensing steam boilers. Space cooling is provided using rooftop packaged units for common areas, and split AC units and window AC units in the classrooms. The lighting predominantly consists of linear T8 fixtures. Some spaces also have compact fluorescent lamps (CFL) and incandescent bulbs. 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 nine measures which together represent an opportunity for Alice Costello School to reduce annual energy costs by $10,415 and annual greenhouse gas emissions by 60,866 lbs CO_2e. We estimate that if all measures were implemented as recommended, the project would pay for itself in 6.6 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 Alice Costello School's annual energy use by 10%.

Figure 1 – Previous 12 Month Utility Costs

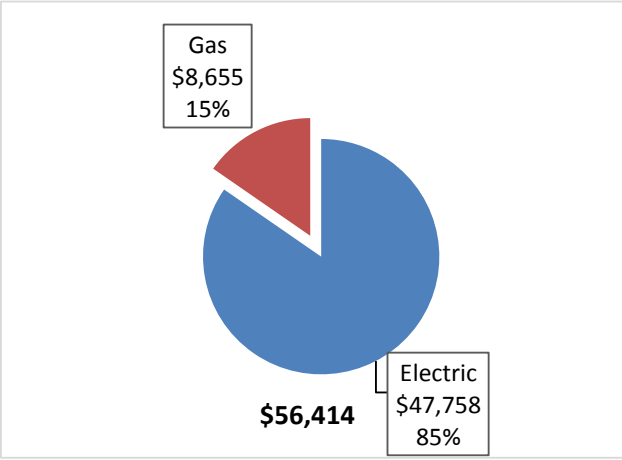
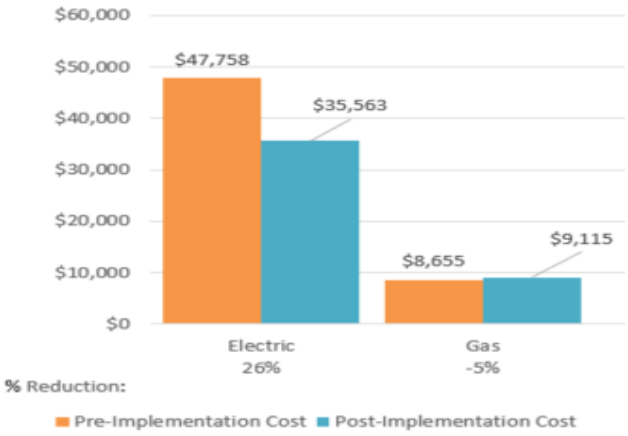


Figure 2 – Potential Post-Implementation Costs



A detailed description of Alice Costello 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		**40,328**	**15.3**	**0.0**	**$6,450.23**	**$44,039.53**	**$7,125.00**	**$36,914.53**	**5.7**	**40,610**
ECM 1	Install LED Fixtures	4,859	1.7	0.0	$777.16	$7,032.19	$1,800.00	$5,232.19	6.7	4,893
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	104	0.0	0.0	$16.71	$83.43	$0.00	$83.43	5.0	105
ECM 3	Retrofit Fixtures with LED Lamps	35,365	13.5	0.0	$5,656.36	$36,923.91	$5,325.00	$31,598.91	5.6	35,612
Lighting Control Measures		**4,612**	**1.8**	**0.0**	**$737.65**	**$7,292.00**	**$980.00**	**$6,312.00**	**8.6**	**4,644**
ECM 4	Install Occupancy Sensor Lighting Controls	4,612	1.8	0.0	$737.65	$7,292.00	$980.00	$6,312.00	8.6	4,644
Variable Frequency Drive (VFD) Measures		**2,471**	**0.8**	**0.0**	**$395.23**	**$6,015.30**	**$480.00**	**$5,535.30**	**14.0**	**2,488**
ECM 5	Install VFDs on Constant Volume (CV) HVAC	2,471	0.8	0.0	$395.23	$6,015.30	$480.00	$5,535.30	14.0	2,488
Electric Unitary HVAC Measures		**3,379**	**2.7**	**0.0**	**$540.43**	**$33,233.53**	**$1,623.00**	**$31,610.53**	**58.5**	**3,402**
	Install High Efficiency Electric AC	3,379	2.7	0.0	$540.43	$33,233.53	$1,623.00	$31,610.53	58.5	3,402
HVAC System Improvements		**5,360**	**1.2**	**0.0**	**$857.28**	**$1,650.00**	**$500.00**	**$1,150.00**	**1.3**	**5,397**
ECM 6	Install Dual Enthalpy Outside Economizer Control	5,360	1.2	0.0	$857.28	$1,650.00	$500.00	$1,150.00	1.3	5,397
Domestic Water Heating Upgrade		**8,136**	**0.5**	**-17.9**	**$1,176.72**	**$15,999.80**	**$550.00**	**$15,449.80**	**13.1**	**6,103**
ECM 7	Install High Efficiency Gas Water Heater	6,000	0.5	-20.3	$809.60	$15,892.25	$550.00	$15,342.25	19.0	3,662
ECM 8	Install Low-Flow Domestic Hot Water Devices	2,136	0.0	2.5	$367.12	$107.55	$0.00	$107.55	0.3	2,441
Plug Load Equipment Control - Vending Machine		**1,612**	**0.0**	**0.0**	**$257.80**	**$230.00**	**$0.00**	**$230.00**	**0.9**	**1,623**
ECM 9	Vending Machine Control	1,612	0.0	0.0	$257.80	$230.00	$0.00	$230.00	0.9	1,623
TOTAL OF ALL EVALUATED ECMS		**65,898**	**22.2**	**-17.9**	**$10,415.34**	**$108,460.15**	**$11,258.00**	**$97,202.15**	**9.3**	**64,268**
TOTAL OF ALL RECOMMENDED ECMS		**62,519**	**19**	**-18**	**$ 9,874.91**	**$ 75,226.63**	**$ 9,635.00**	**$ 65,591.63**	**6.6**	**60,866**

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.

HVAC System Improvements generally involve the installation of automated controls to reduce heating and cooling demand during periods of reduced demand. These measures could encompass changing temperature setpoints, using outside air for free cooling, or limiting excessive outside air during extreme outdoor air temperature conditions. These measures save energy by reducing the demand on HVAC systems and the amount of time systems operate.

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.

Plug Load Equipment control measures generally involve installing automated devices that limit the power usage or operation of equipment that is plugged into an electric outlets when not in use.

Energy Efficient Practices

TRC also identified eight 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 identified at Alice Costello School include:

- Close Doors and Windows
- Use Window Treatments/Coverings
- Practice Proper Use of Thermostat Schedules and Temperature Resets
- Clean and/or Replace HVAC Filters
- 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 for Alice Costello School. 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
- Direct Install

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

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

For larger facilities with limited capital availability to implement ECMs, project financing may be available through the Energy Savings Improvement Program (ESIP). Supported directly by the NJBPU, ESIP provides government agencies with project development, design, and implementation support services, as well as, attractive financing for implementing ECMs. An LGEA report (or other approved energy audit) is required for participation in ESIP. Please refer to Section 8.4 for additional information on the ESIP Program.

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			
Bud Rutter	Facility Manager	brutter@audubonschools.org	(609) 820-0917
TRC Energy Services			
Smruti Srinivasan	Auditor	ssrinivasan@trcsolutions.com	(732) 855-0033

2.2 General Site Information

On March 29, 2017, TRC performed an energy audit at Alice Costello School located in Brooklawn, New Jersey. TRC's team met with Bud Rutter to review the facility operations and help focus our investigation on specific energy-using systems.

Alice Costello School is a three-story 59,922 square foot facility comprised of various spaces such as classrooms, gymnasium, kitchen, offices and a mechanical space. The school operates on a 10 month schedule during the year, weekdays from 8:00 AM to 3:00 PM and remains closed during the weekends. During winter there are some sports activities during the weekends.

The building was constructed in 1925. Heating in the building is provided by two non-condensing steam boilers. Space cooling is provided using rooftop packaged units for common areas, and split AC units and window AC units in the classrooms. The lighting at the building predominantly consists of T8 linear fixtures. Some spaces also have compact fluorescent lamps (CFL) and incandescent bulbs.

2.3 Building Occupancy

The typical schedule is presented in the table below. This is a10 month school. On a typical day the school is occupied by approximately 325 students and 55 full time staff teachers, administration and maintenance staff.

Figure 5 - Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
Alice Costello School	Weekday	8AM - 3PM
Alice Costello School	Weekend	Gym basketball activities (in winter). Otherwise no operation

2.4 Building Envelope

The building is constructed using concrete blocks, brick and has a brick façade. The roofs are flat and covered with EPDM membrane and were found to be in good condition. The building has old single pane windows and aluminum doors that show signs of excessive infiltration.



2.5 On-Site Generation

Alice Costello School does not have any on-site electric generation systems currently installed.

2.6 Energy-Using Systems

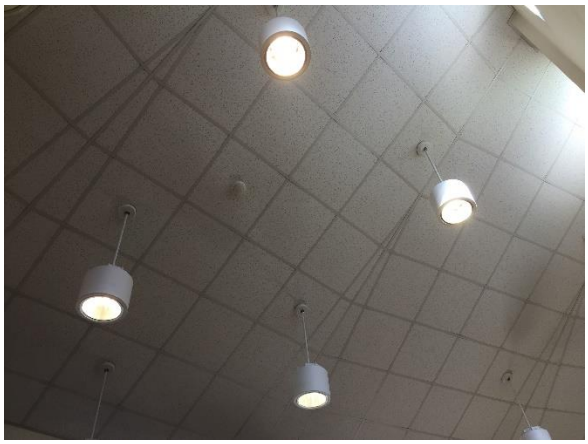
Please see Appendix A: Equipment Inventory & Recommendations for an inventory of the facility's equipment.

Lighting System

Lighting is provided mostly by 32-Watt linear fluorescent T8 lamps with electronic ballasts as well as some CFL and incandescent lamp fixtures. Most of the fixtures are 2-lamp or 4-lamp, 4-foot long troffers or 2-foot U-bent tube fixtures.

A few areas such as the hallways, gym and library are lit using 42-Watt CFL lamps. Areas such as the stairwell, storage spaces, and attic spaces are lit using 60-Watt incandescent lamps. Lighting control in most spaces is provided by manual wall switches.

Exterior lighting consists of 70-Watt, 175-Watt and 400-Watt metal halide fixtures. These are controlled by photocells. Exit signs throughout the school are 2-Watt LED fixtures.


Hot Water (or Steam) Heating System

The steam system consists of two gas-fired, non-condensing steam boilers from HB Smith with an output capacity 2232 kBtu/hr. The boilers have a nominal combustion efficiency of 77.6%. The steam travels through radiators (in the hallways and common areas) to provide space heating. The classrooms have unit vents with supply fans that provide space heating. Each of the boilers serves a different zone, so both boilers operate throughout the winter. The boilers were installed in 2004.

The boilers turn on when the outside air temperature is below 50°F and turn off when the outside temperature is above 70°F. The night/unoccupied heating setpoint is 60°F. The unoccupied heating setpoint is 68°F. The boilers are controlled from a building automation system provided by Delta Controls. This is an old system and the operation of the boilers need to be controlled manually through the system.

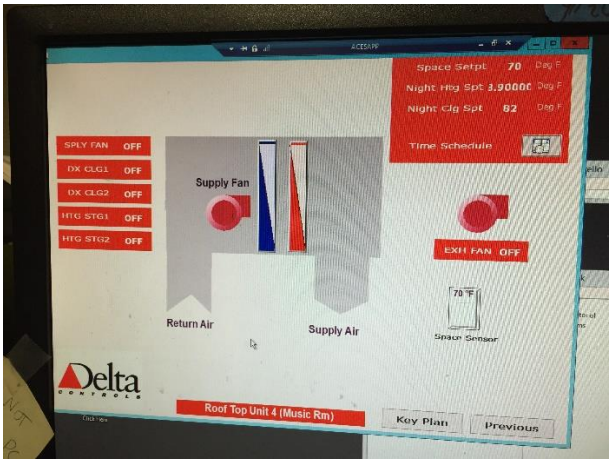
Areas such as the gym, library, a few classrooms, kitchen, and art and music room are heated using the furnaces contained within the rooftop packaged units. The output heating capacities range from 64 MBh to 324 MBh.

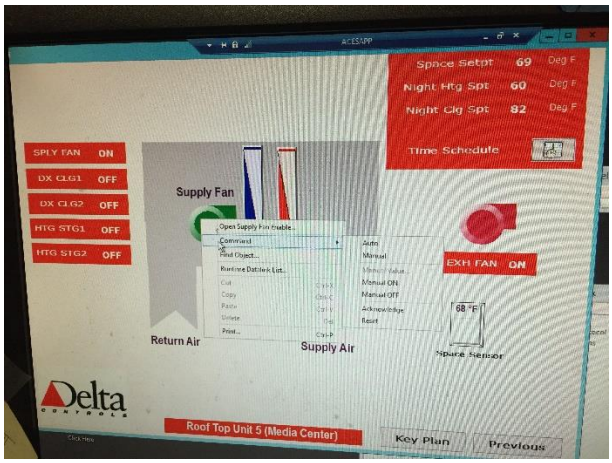

Direct Expansion Air Conditioning System (DX)

The building is cooled using packaged units, split AC units and window units in the various spaces. There are six packaged units in the facility ranging from 3 tons to 25 tons. There are 3-ton and 15-ton units serving the library, 6-ton units serving the classrooms and kitchen, two 25-ton units serving the gym, the art & music rooms and a 7.5-ton unit serving the gym. All packaged units are from Trane. The temperatures are controlled through the building automation system. The space temperature setpoint is 69°F and the night/unoccupied cooling setpoint is 82°F. The rooftop units are all single zone CAV (constant air volume) systems.

The 3.5 ton split system from Rudd serves the main offices. Another 1-ton split unit serves the elevator machine rooms and a 1.5-ton unit serves room B3. These units are controlled using thermostats in the respective zones. There are about 19 window AC units of 1.5 ton capacity serving the classrooms and some smaller capacity units (0.75 ton) serving the nurse's office.





Domestic Hot Water Heating System

Domestic hot water is provided by three hot water heaters. One of these is a gas-fired and other two are electric heaters. The gas-fired water heater (from Lochinvar) serves the lower level restrooms and sinks with an input capacity of 199 MBh and a tank capacity of 85 gallons. The system has an efficiency of 80%. One of the electric water heaters (from Bradford White) has an input capacity of 1.5 kW and a tank capacity of 52 gallons. This unit serves the third floor restrooms. The second electric hot water heater (from Bradford White) has an input capacity of 1.5 kW and a 2-gallon tank capacity. This unit serves the art room sink. The water heaters are 15, 20 and 2 years old respectively. The two older ones have been evaluated for replacement.


Food Service & Laundry Equipment

The school has an all-electric kitchen that is used to serve food for the kids in the school. There are two electric convection ovens and two insulating food holding cabinets. There is also one stand-up solid door refrigerator and one freezer of 19 cu.ft volume per unit.



Building Plug Load

There are 81 computer work stations throughout the facility. Other office plug loads include laptops printers of various sizes, paper shredders, projectors and smart boards in the classrooms and offices. The kitchenette equipment include microwave ovens, different sizes of refrigerators and coffee machines. There are also ceiling fans and CRT televisions. There is no centralized PC power management software installed. There is also one refrigerated vending machine in the teachers' lounge.

2.7 Water-Using Systems

A sampling of restrooms found that the faucets are rated for 2.5 gallons per minute (gpm) or lower, the toilets are rated at 2.5 gallons per flush (gpf) and the urinals are rated at 2 gpf.

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

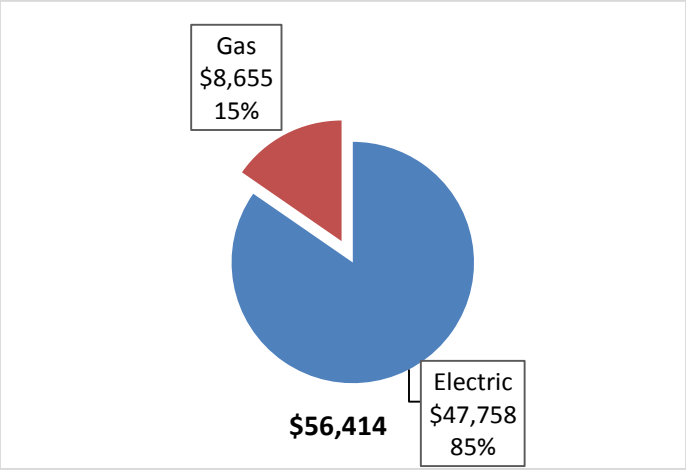
The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. A profile of the annual energy consumption and energy cost of the facility was developed from this information.

Figure 6 - Utility Summary

Utility Summary for Alice Costello School		
Fuel	**Usage**	**Cost**
Electricity	298,594 kWh	$47,758
Natural Gas	8,431 Therms	$8,655

The current annual energy cost for this facility is $56,414 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 $0.160/kWh, which is the blended rate that includes energy supply, distribution, and other charges. This rate is used throughout the analyses in this report to assess energy costs and savings. The electric third party supply is provided by Hudson Energy Services. The monthly electricity consumption and peak demand are shown in the chart below.

Figure 8 - Electric Usage & Demand

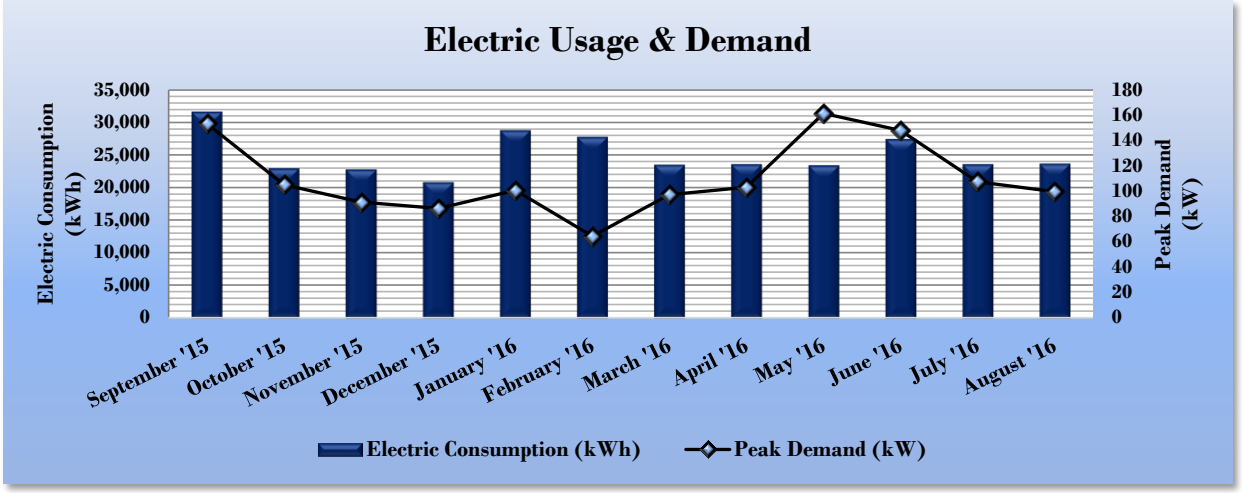


Figure 9 - Electric Usage & Demand

Electric Billing Data for Alice Costello School					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
9/29/15	30	31,582	153	$31,582	$6,052
10/28/15	29	22,902	105	$22,902	$3,531
11/30/15	33	22,750	91	$22,750	$3,607
12/31/15	31	20,810	86	$20,810	$2,917
2/1/16	32	28,713	101	$28,713	$3,767
3/2/16	30	27,723	65	$27,723	$4,066
4/1/16	30	23,448	97	$23,448	$3,297
5/2/16	31	23,558	103	$23,558	$3,294
6/1/16	30	23,387	161	$23,387	$3,637
6/30/16	29	27,371	148	$27,371	$5,033
8/1/16	32	23,530	107	$23,530	$4,643
8/30/16	29	23,638	100	$23,638	$4,047
Totals	**366**	**299,412**	**161.4**	**$299,412**	**$47,889**
Annual	**365**	**298,594**	**161.4**	**$298,594**	**$47,758**

3.3 Natural Gas Usage

Natural Gas is provided by PSE&G. The average gas cost for the past 12 months is $1.027/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

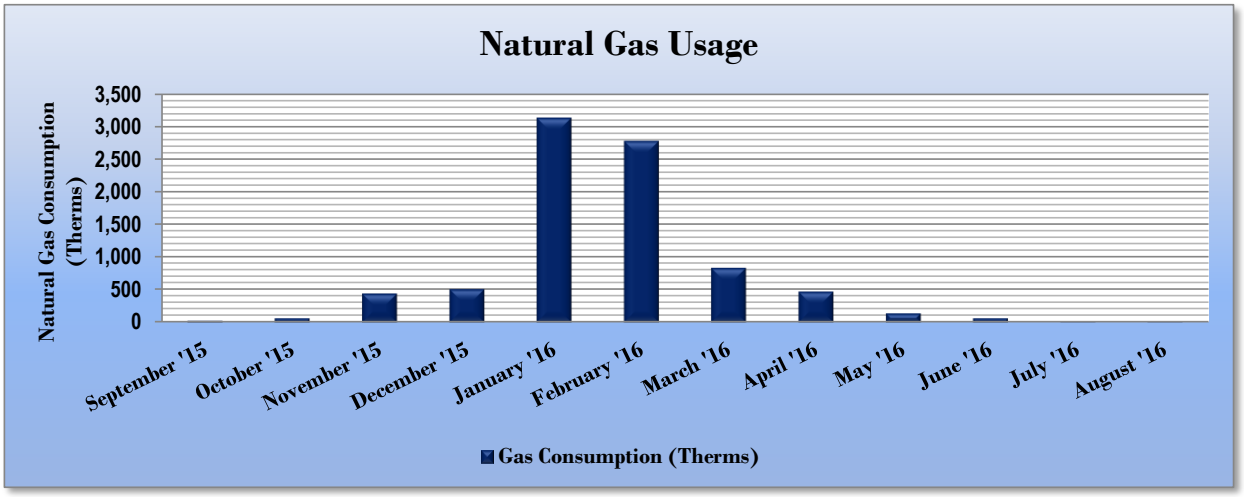


Figure 11 - Natural Gas Usage

Gas Billing Data for Alice Costello School			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
9/29/15	30	22	$119
10/28/15	29	63	$140
11/30/15	33	441	$924
12/31/15	31	511	$982
2/1/16	32	3,133	$2,491
3/2/16	30	2,777	$2,205
4/1/16	30	833	$942
5/2/16	31	473	$346
6/1/16	30	135	$177
6/30/16	29	63	$139
8/1/16	32	1	$107
8/30/16	29	1	$107
Totals	**366**	**8,454**	**$8,679**
Annual	**365**	**8,431**	**$8,655**

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		
	Alice Costello School	National Median Building Type: School (K-12)
Source Energy Use Intensity (kBtu/ft^2)	68.2	141.4
Site Energy Use Intensity (kBtu/ft^2)	31.1	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		
	Alice Costello School	National Median Building Type: School (K-12)
Source Energy Use Intensity (kBtu/ft^2)	57.5	141.4
Site Energy Use Intensity (kBtu/ft^2)	28.2	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. Although this facility has a current score of 97, this seems very high considering the age of the building and the usage. We suggest that the square footage and the gas use of the building be verified for accurate results.

A Portfolio Manager Statement of Energy Performance (SEP) was generated for this facility, 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.

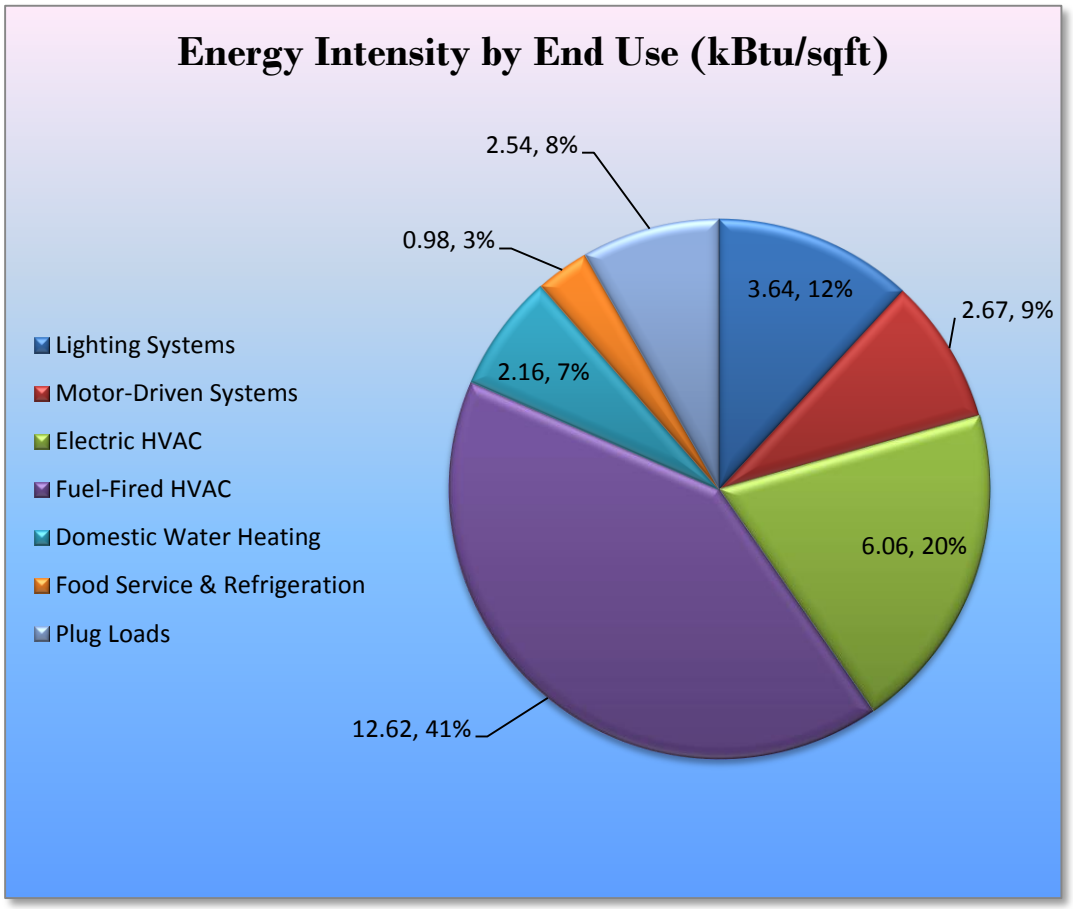
A Portfolio Manager account has been created online for your facility and you will be provided with the login information for the account. We encourage you to update your utility information in Portfolio Manager regularly, so that you can keep track of your building's performance. Free online training 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 utilizes standard practice engineering methods to evaluate all components of the various electric and fuel-fired systems found in a building to determine their proportional contribution to overall building energy usage. This chart of energy end uses highlights the relative contribution of each equipment category to total energy usage. This can help determine where the greatest benefits might be found from energy efficiency measures.

Figure 14 - Energy Balance (kBtu/SF, %)



4 ENERGY CONSERVATION MEASURES

Level of Analysis

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

The following sections describe the evaluated measures.

4.1 Recommended ECMs

The measures below have been evaluated by the auditor and are recommended for implementation at the 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		**40,328**	**15.3**	**0.0**	**$6,450.23**	**$44,039.53**	**$7,125.00**	**$36,914.53**	**5.7**	**40,610**
ECM 1	Install LED Fixtures	4,859	1.7	0.0	$777.16	$7,032.19	$1,800.00	$5,232.19	6.7	4,893
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	104	0.0	0.0	$16.71	$83.43	$0.00	$83.43	5.0	105
ECM 3	Retrofit Fixtures with LED Lamps	35,365	13.5	0.0	$5,656.36	$36,923.91	$5,325.00	$31,598.91	5.6	35,612
Lighting Control Measures		**4,612**	**1.8**	**0.0**	**$737.65**	**$7,292.00**	**$980.00**	**$6,312.00**	**8.6**	**4,644**
ECM 4	Install Occupancy Sensor Lighting Controls	4,612	1.8	0.0	$737.65	$7,292.00	$980.00	$6,312.00	8.6	4,644
Variable Frequency Drive (VFD) Measures		**2,471**	**0.8**	**0.0**	**$395.23**	**$6,015.30**	**$480.00**	**$5,535.30**	**14.0**	**2,488**
ECM 5	Install VFDs on Constant Volume (CV) HVAC	2,471	0.8	0.0	$395.23	$6,015.30	$480.00	$5,535.30	14.0	2,488
Electric Unitary HVAC Measures		**3,379**	**2.7**	**0.0**	**$540.43**	**$33,233.53**	**$1,623.00**	**$31,610.53**	**58.5**	**3,402**
	Install High Efficiency Electric AC	3,379	2.7	0.0	$540.43	$33,233.53	$1,623.00	$31,610.53	58.5	3,402
HVAC System Improvements		**5,360**	**1.2**	**0.0**	**$857.28**	**$1,650.00**	**$500.00**	**$1,150.00**	**1.3**	**5,397**
ECM 6	Install Dual Enthalpy Outside Economizer Control	5,360	1.2	0.0	$857.28	$1,650.00	$500.00	$1,150.00	1.3	5,397
Domestic Water Heating Upgrade		**8,136**	**0.5**	**-17.9**	**$1,176.72**	**$15,999.80**	**$550.00**	**$15,449.80**	**13.1**	**6,103**
ECM 7	Install High Efficiency Gas Water Heater	6,000	0.5	-20.3	$809.60	$15,892.25	$550.00	$15,342.25	19.0	3,662
ECM 8	Install Low-Flow Domestic Hot Water Devices	2,136	0.0	2.5	$367.12	$107.55	$0.00	$107.55	0.3	2,441
Plug Load Equipment Control - Vending Machine		**1,612**	**0.0**	**0.0**	**$257.80**	**$230.00**	**$0.00**	**$230.00**	**0.9**	**1,623**
ECM 9	Vending Machine Control	1,612	0.0	0.0	$257.80	$230.00	$0.00	$230.00	0.9	1,623
TOTAL OF ALL RECOMMENDED ECMS		**62,519**	**19**	**-18**	**$ 9,874.91**	**$ 75,226.63**	**$ 9,635.00**	**$ 65,591.63**	**6.6**	**60,866**

4.1.1 Lighting Upgrades

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

Figure 16 – Summary of Lighting Upgrade ECMs

Energy Conservation Measure		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**40,328**	**15.3**	**0.0**	**$6,450.23**	**$44,039.53**	**$7,125.00**	**$36,914.53**	**5.7**	**40,610**
ECM 1	Install LED Fixtures	Yes	4,859	1.7	0.0	$777.16	$7,032.19	$1,800.00	$5,232.19	6.7	4,893
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	104	0.0	0.0	$16.71	$83.43	$0.00	$83.43	5.0	105
ECM 3	Retrofit Fixtures with LED Lamps	Yes	35,365	13.5	0.0	$5,656.36	$36,923.91	$5,325.00	$31,598.91	5.6	35,612

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	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.0	0
Exterior	4,859	1.7	0.0	$777.16	$7,032.19	$1,800.00	$5,232.19	6.7	4,893

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 10 times longer than many incandescent lamps.

ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

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	104	0.0	0.0	$16.71	$83.43	$0.00	$83.43	5.0	105
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.0	0

Measure Description

We recommend retrofitting existing fluorescent T12 tube fixtures removing fluorescent tubes and ballasts and replacing them with LEDs and LED drivers (if necessary), which are designed to be used retrofitted fluorescent fixtures. The measure uses the existing fixture housing but replaces the rest of the components with more efficient lighting technology. 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 10 times longer than many incandescent lamps.

ECM 3: 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	35,273	13.5	0.0	$5,641.63	$36,826.06	$5,320.00	$31,506.06	5.6	35,519
Exterior	92	0.0	0.0	$14.73	$97.85	$5.00	$92.85	6.3	93

Measure Description

We recommend retrofitting existing linear T8 fluorescent tubes and incandescent bulbs 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 10 times longer than many incandescent lamps.

4.1.2 Lighting Control Measures

Figure 17 – Summary of Lighting Control ECMs

Energy Conservation Measure		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Control Measures			**4,612**	**1.8**	**0.0**	**$737.65**	**$7,292.00**	**$980.00**	**$6,312.00**	**8.6**	**4,644**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	4,612	1.8	0.0	$737.65	$7,292.00	$980.00	$6,312.00	8.6	4,644

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 4: 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)
4,612	1.8	0.0	$737.65	$7,292.00	$980.00	$6,312.00	8.6	4,644

Measure Description

We recommend installing occupancy sensors to control lighting fixtures that are currently controlled by manual switches in the relevant restrooms, storage rooms, 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.

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 (VFD) ECMs

Energy Conservation Measure		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures			**2,471**	**0.8**	**0.0**	**$395.23**	**$6,015.30**	**$480.00**	**$5,535.30**	**14.0**	**2,488**
ECM 5	Install VFDs on Constant Volume (CV) HVAC	Yes	2,471	0.8	0.0	$395.23	$6,015.30	$480.00	$5,535.30	14.0	2,488

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)
2,471	0.8	0.0	$395.23	$6,015.30	$480.00	$5,535.30	14.0	2,488

Measure Description

We recommend installing variable frequency drives (VFDs) to control supply fan motor speeds of the 3hp supply fans on the two air handlers 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.

4.1.4 HVAC System Upgrades

Our recommendations for HVAC system improvements are summarized in Figure 19 below.

Figure 19 - Summary of HVAC System Improvement ECMs

Energy Conservation Measure		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
HVAC System Improvements			**5,360**	**1.2**	**0.0**	**$857.28**	**$1,650.00**	**$500.00**	**$1,150.00**	**1.3**	**5,397**
ECM 6	Install Dual Enthalpy Outside Economizer Control	Yes	5,360	1.2	0.0	$857.28	$1,650.00	$500.00	$1,150.00	1.3	5,397

ECM 6: Install Dual-Enthalpy Economizers

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)
5,360	1.2	0.0	$857.28	$1,650.00	$500.00	$1,150.00	1.3	5,397

Measure Description

Dual enthalpy economizers are used to control a ventilation system's outside air intake in order to reduce a facility's total cooling load. A dual-enthalpy economizer monitors the air temperature and humidity of both the outside and return air. The control supplies the lowest energy (temperature and humidity) air to the air handling system. When outside air conditions allow, outside air can be used for cooling instead of running the air handling system's compressor. This reduces the demand on the cooling system, lowering its usage hours and saving energy.

We recommend installing dual enthalpy economizers on the 6-ton and the 15-ton packaged unit on the roof top that serves the kitchen & classrooms and the library. These units have also been evaluated for replacement in which case the new unit should be opted with dual enthalpy economizer options. Savings result from using outside air instead of mechanical cooling when outside air conditions permit.

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		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade			**8,136**	**0.5**	**-17.9**	**$1,176.72**	**$15,999.80**	**$550.00**	**$15,449.80**	**13.1**	**6,103**
ECM 7	Install High Efficiency Gas Water Heater	Yes	6,000	0.5	-20.3	$809.60	$15,892.25	$550.00	$15,342.25	19.0	3,662
ECM 8	Install Low-Flow Domestic Hot Water Devices	Yes	2,136	0.0	2.5	$367.12	$107.55	$0.00	$107.55	0.3	2,441

ECM 7: Install High Efficiency Gas-Fired Water Heater

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)
6,000	0.5	-20.3	$809.60	$15,892.25	$550.00	$15,342.25	19.0	3,662

Measure Description

We recommend replacing the existing gas-fired hot water heater and one of the electric water heater (both of which are more than 15 years old) with a high efficiency gas-fired tank water heater. Improvements in combustion efficiency and reductions in heat losses have improved the overall efficiency of storage water heaters. Energy savings results from using less gas to heat water, due to higher unit efficiency, and fewer run hours to maintain the tank water temperature.

ECM 8: Install Low-Flow DHW Devices

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
2,136	0.0	2.5	$367.12	$107.55	$0.00	$107.55	0.3	2,441

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.

4.1.6 Plug Load Equipment Control - Vending Machines

Our recommendations for plug load equipment controls are summarized in Figure 21 below.

Figure 21 - Summary of Plug Load Equipment Control ECMs

Energy Conservation Measure		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Plug Load Equipment Control - Vending Machine			**1,612**	**0.0**	**0.0**	**$257.80**	**$230.00**	**$0.00**	**$230.00**	**0.9**	**1,623**
ECM 9	Vending Machine Control	Yes	1,612	0.0	0.0	$257.80	$230.00	$0.00	$230.00	0.9	1,623

ECM 9: Vending Machine Control

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
1,612	0.0	0.0	$257.80	$230.00	$0.00	$230.00	0.9	1,623

Measure Description

Vending machines operate continuously, even during non-business hours. It is recommended to install occupancy sensor controls to reduce the energy use. These controls power down vending machines when the vending machine area has been vacant for some time, then power up at regular intervals, as needed, to turn machine lights on or keep the product cool. Energy savings are a dependent on vending machine and activity level in the area surrounding the machines.

4.2 ECMs Evaluated But Not Recommended

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

Figure 22 – Summary of Measures Evaluated, But Not Recommended

Energy Conservation Measure	Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Electric Unitary HVAC Measures		**3,379**	**2.7**	**0.0**	**$540.43**	**$33,233.53**	**$1,623.00**	**$31,610.53**	**58.5**	**3,402**
Install High Efficiency Electric AC	No	3,379	2.7	0.0	$540.43	$33,233.53	$1,623.00	$31,610.53	58.5	3,402
TOTAL OF NON_RECOMMENDED ECMS		**3,379**	**3**	**0**	**540**	**33,234**	**1,623**	**31,611**	**58.5**	**3,402**

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)
3,379	2.7	0.0	$540.43	$33,233.53	$1,623.00	$31,610.53	58.5	3,402

Measure Description

We evaluated replacing the packaged units serving the library (15 tons), the kitchen & classrooms (6 tons) and two window AC units (0.75) serving the nurse's office replacing standard efficiency air conditioning units with high efficiency 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.

Reasons for Not Recommending

The evaluation of replacing these units yield a higher pay back period that is more than the useful life of the equipment itself. When these equipment reach the end of their useful life we suggest replacing them with high efficiency units at the time.

Boilers and Unit Ventilators

Replacing the boilers and unit ventilators will require significant capital expenditure, reduce energy use, and probably improve comfort conditions. However, the project will probably not be justified solely on energy savings. If the district wants to replace the unit ventilators and convert to a hot water system there are at least two alternatives that could be considered. The first is using the existing steam boilers and a steam to hot water heat exchanger. The second is replacing the steam boilers with condensing hot water boilers. The life cycle cost of each option should be calculated in order to determine which system is the most cost effective.

Replacing the Unit Ventilators

This is a capital measure or infrastructure improvement measure that will not be justified solely on the basis of energy savings. The heat transfer from a unit ventilator coil is reduced if the coil is dirty, has damaged fins, or has internal scaling (all issues that can develop over 40+ years). Installing new unit ventilators will result in some savings over unit ventilators with any of those three issues since less heat will need to be provided to the unit ventilators to provide the same amount heat to the conditioned space. If the unit ventilators have circulation fans, the new unit ventilator fan motor efficiency will be better than the existing fan motors which will also provide some energy savings. New unit ventilators may be designed to use outside air more effectively than the existing unit ventilators.

Replacing the Boilers

Steam boiler efficiencies have not improved significantly in the past decade. Steam boilers have a maximum efficiency of 85%. Therefore, replacing the steam boilers with new steam boilers will not produce significant energy savings due to improved boiler efficiency.

Savings (therms/yr) = [Existing boiler fuel use therms/yr *[(1 - existing efficiency/proposed efficiency)]
= 6250 * [1-(77.64/84)]
= 473.75 therms/yr

Converting the steam system to a hot water system has the potential to provide reasonable fuel savings but will probably not be justified based on energy savings alone. To maximize the savings a hot water system with several small condensing boilers would be installed. The hot water system would also be designed to operate with a return water temperature lower than 130°F so that the boilers can operate in the condensing mode. Reducing the return water temperature below 130°F will increase the condensing boiler efficiency.

Converting to a hot water system will probably require replacing the steam and condensate return pipes with larger water pipes. The boiler feed and/or condensate return pumps will probably have to be replaced with a larger capacity hot water circulation pump. As a result, electricity use will likely be somewhat higher with a hot water system than a steam system.

Installing several smaller (modular) capacity boilers rather than one or two large boilers is beneficial for either a steam or hot water system. A system with several small boilers operates more efficiently at part load conditions than a system with one or two large boilers. The main savings comes from reducing the standby and surface losses from keeping one or two large boilers hot.

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.

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.

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.

Clean and/or Replace HVAC Filters

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

Perform Proper Boiler Maintenance

Many boiler problems develop slowly over time, so regular inspection and maintenance is essential to retain proper functionality and efficiency of the heating system. Fuel burning equipment should undergo yearly tune-ups to ensure they are operating as safely and efficiently as possible from a combustion standpoint. A tune-up should include a combustion analysis to analyze the exhaust from the boilers and to ensure the boiler is operating safely. Buildup of dirt, dust, or deposits on the internal surfaces of a boiler can greatly affect its heat transfer efficiency. These deposits can accumulate on the water side or fire side of the boiler. Boilers should be cleaned regularly according to the manufacturer's instructions to remove this build up 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 gpf and toilets that use as little as 1.28 gpf (this is lower than the current 1.6 gpf federal standard).

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

6 On-Site Generation Measures

On-site generation measure options include both renewable (e.g., solar, wind) and non-renewable (e.g., fuel cells) on-site technologies that generate power to meet all or a portion of the electric energy needs of a 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.

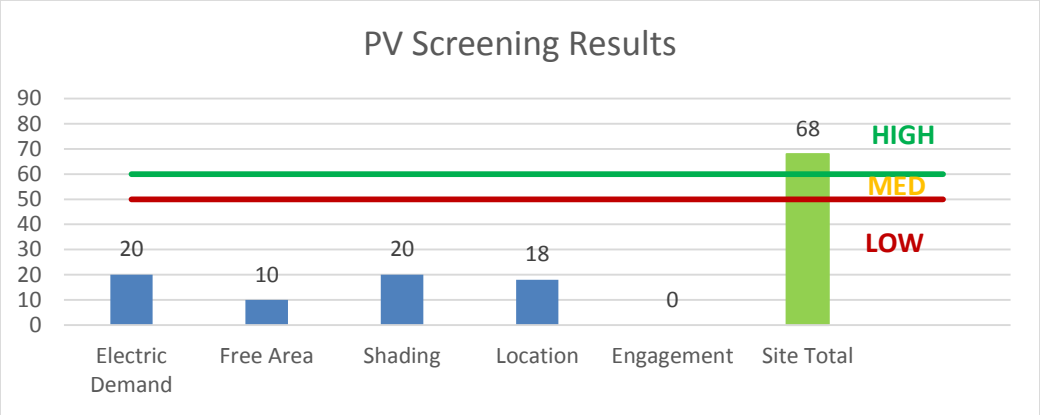
6.1 Photovoltaic

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 Alice Costello School is interested in pursuing the installation of PV, we recommended a full feasibility study be conducted.

Figure 23 - Photovoltaic Screening



Potential	High	
System Potential	64	kW DC
Electric Generation	76,248	kWh/yr
Displaced Cost	$6,630	/yr

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

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

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

6.2 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/.

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.

In our opinion this school is not a good candidate for the demand response program.

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 24 for a list of the eligible programs identified for each recommended ECM.

Figure 24 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive	SmartStart Custom	Direct Install
ECM 1	Install LED Fixtures	x		x
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	x		x
ECM 3	Retrofit Fixtures with LED Lamps	x		x
ECM 4	Install Occupancy Sensor Lighting Controls	x		x
ECM 5	Install VFDs on Constant Volume (CV) HVAC	x		x
ECM 6	Install Dual Enthalpy Outside Economizer Control	x		x
ECM 7	Install High Efficiency Gas Water Heater	x		x
ECM 8	Install Low-Flow Domestic Hot Water Devices			x
ECM 9	Vending Machine Control			x

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

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

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

8.1 SmartStart

Overview

The SmartStart program offers incentives for installing prescriptive and custom energy efficiency measures at your 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 Direct Install

Overview

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

Incentives

The program pays up to 70% of the total installed cost of eligible measures, up to $125,000 per project. Direct Install participants will also be held to a fiscal year cap of $250,000 per entity.

How to Participate

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

Since Direct Install offers a free assessment of eligible measures, Direct Install is also available to small businesses and other commercial facilities too that may not be eligible for the more detailed facility audits provided by LGEA.

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

8.3 SREC Registration Program

The SREC (Solar Registration Energy Certificate) Registration Program (SRP) is used to register the intent to install solar projects in New Jersey. Rebates are not available for solar projects, but owners of solar projects MUST register their projects in the SRP prior to the start of construction 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.

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
Main office	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,078	0.14	369	0.0	$59.06	$408.50	$70.00	5.73
Hallway	8	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,540	Relamp	No	8	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,540	0.29	793	0.0	$126.90	$761.07	$160.00	4.74
Server room	3	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	52	Relamp	No	3	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	52	0.11	10	0.0	$1.61	$285.40	$60.00	140.27
Classroom A4	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,540	Relamp	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,078	0.58	1,560	0.0	$249.50	$1,411.60	$275.00	4.56
Boys' restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	880	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	880	0.04	67	0.0	$10.68	$117.00	$20.00	9.08
Girls' restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	880	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	880	0.04	67	0.0	$10.68	$117.00	$20.00	9.08
Hallway	5	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	No	5	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	1,540	0.10	257	0.0	$41.07	$316.00	$0.00	7.69
Library	27	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	No	27	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	1,540	0.51	1,387	0.0	$221.79	$1,706.40	$0.00	7.69
Library	25	Linear Fluorescent - T5: 4' T5 (28W) - 2L	Wall Switch	60	1,540	Relamp	No	25	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,540	0.51	1,373	0.0	$219.53	$1,462.50	$250.00	5.52
Library lav	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,540	0.04	117	0.0	$18.70	$117.00	$20.00	5.19
CR A5	8	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,540	Relamp	Yes	8	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,078	0.33	886	0.0	$141.74	$871.60	$155.00	5.06
Boiler Room	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	No	10	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,540	0.22	584	0.0	$93.48	$585.00	$100.00	5.19
Office A7	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,540	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,078	0.16	443	0.0	$70.87	$416.80	$80.00	4.75
Hallway	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,540	Relamp	No	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	1,540	0.06	175	0.0	$28.04	$150.40	$30.00	4.29
Hallway	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	No	4	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	1,540	0.08	205	0.0	$32.86	$252.80	$0.00	7.69
Gym Hall	11	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	No	11	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	1,540	0.21	565	0.0	$90.36	$695.20	$0.00	7.69
Elevator	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,540	0.02	58	0.0	$9.35	$58.50	$10.00	5.19
Gym	24	Linear Fluorescent - T5: 4' T5 (28W) - 3L	Wall Switch	90	1,540	Relamp	No	24	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	1,540	0.73	1,976	0.0	$316.12	$1,804.80	$360.00	4.57
Stage	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	No	10	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,540	0.22	584	0.0	$93.48	$585.00	$100.00	5.19
CR G1	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,540	Relamp	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,078	0.25	665	0.0	$106.31	$567.20	$110.00	4.30
Kitchen	9	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,540	Relamp	No	9	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	1,540	0.29	789	0.0	$126.19	$676.80	$135.00	4.29
Lavatory	1	Linear Fluorescent - T8: 2' T8 (17W) - 1L	Wall Switch	22	1,540	Relamp	No	1	LED - Linear Tubes: (1) 2' Lamp	Wall Switch	9	1,540	0.01	24	0.0	$3.82	$31.90	$5.00	7.03
Gym trainer	3	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	1,540	Relamp	No	3	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,540	0.03	93	0.0	$14.87	$107.70	$15.00	6.23
Boys' restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	880	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	880	0.02	33	0.0	$5.34	$58.50	$10.00	9.08
Girls' restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	880	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	880	0.04	67	0.0	$10.68	$117.00	$20.00	9.08

	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
Music A9	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,540	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,078	0.49	1,329	0.0	$212.62	$1,018.40	$200.00	3.85
Board room 11	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,540	0.09	234	0.0	$37.39	$234.00	$40.00	5.19
CR A8	11	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	Yes	11	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,078	0.30	812	0.0	$129.93	$759.50	$130.00	4.84
Stairwell	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,540	0.06	175	0.0	$28.04	$175.50	$30.00	5.19
CR B6,B7	14	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	Yes	14	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,078	0.38	1,034	0.0	$165.37	$1,051.00	$180.00	5.27
Hallway	13	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,540	Relamp	No	13	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	1,540	0.42	1,140	0.0	$182.28	$977.60	$195.00	4.29
Girls' restroom	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	880	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	616	0.12	190	0.0	$30.37	$495.60	$80.00	13.68
Boys' restroom	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	880	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	616	0.12	190	0.0	$30.37	$495.60	$80.00	13.68
Girls' restroom	2	Linear Fluorescent - T8: 2' T8 (17W) - 1L	Wall Switch	22	880	Relamp	No	2	LED - Linear Tubes: (1) 2' Lamp	Wall Switch	9	880	0.02	27	0.0	$4.37	$63.80	$10.00	12.31
Boys' restroom	3	Linear Fluorescent - T8: 2' T8 (17W) - 1L	Wall Switch	22	880	Relamp	No	3	LED - Linear Tubes: (1) 2' Lamp	Wall Switch	9	880	0.03	41	0.0	$6.56	$95.70	$15.00	12.31
CR B8, B9, B4, B1, B3	75	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	Yes	75	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,078	2.05	5,539	0.0	$885.90	$6,007.50	$960.00	5.70
CR B5	3	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	Yes	3	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,078	0.08	207	0.0	$33.06	$459.60	$35.00	12.84
CR B5	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,078	0.25	665	0.0	$106.31	$796.50	$125.00	6.32
Hallway	16	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,540	Relamp	No	16	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,540	0.59	1,587	0.0	$253.80	$1,522.13	$320.00	4.74
CR B2	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,078	0.14	369	0.0	$59.06	$562.50	$85.00	8.09
Stairwell	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	No	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,540	0.11	292	0.0	$46.74	$292.50	$50.00	5.19
C2	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,078	0.22	591	0.0	$94.50	$738.00	$115.00	6.59
C1	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,540	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,078	0.49	1,329	0.0	$212.62	$1,172.40	$215.00	4.50
C11	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,078	0.11	295	0.0	$47.25	$504.00	$75.00	9.08
C3	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,078	0.16	443	0.0	$70.87	$621.00	$95.00	7.42
C4,C10	28	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	Yes	28	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,078	0.77	2,068	0.0	$330.74	$2,178.00	$350.00	5.53
C9	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,078	0.41	1,108	0.0	$177.18	$1,147.50	$185.00	5.43
C5	3	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	Yes	3	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,078	0.08	207	0.0	$33.06	$459.60	$35.00	12.84
C5	9	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,540	Relamp	Yes	9	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,078	0.37	997	0.0	$159.46	$946.80	$170.00	4.87
Boys' restroom	3	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	880	Relamp	Yes	3	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	616	0.14	223	0.0	$35.64	$555.40	$95.00	12.92

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Girls' restroom	3	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	880	Relamp	Yes	3	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	616	0.14	223	0.0	$35.64	$555.40	$95.00	12.92
C8-Nurse's office	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,540	0.06	175	0.0	$28.04	$175.50	$30.00	5.19
Storage	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	52	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	52	0.02	2	0.0	$0.32	$58.50	$10.00	153.66
CR 7, CR 6	20	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,540	Relamp	No	20	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,540	0.43	1,169	0.0	$186.95	$1,170.00	$200.00	5.19
Attic room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	520	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	520	0.02	20	0.0	$3.16	$58.50	$10.00	15.37
Storage	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	1,540	Fixture Replacement	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,540	0.04	104	0.0	$16.71	$83.43	$0.00	4.99
Exterior	10	Metal Halide: (1) 175W Lamp	Wall Switch	215	1,540	Fixture Replacement	No	10	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	89	1,540	0.83	2,231	0.0	$356.91	$3,906.77	$1,000.00	8.14
Exterior	1	Incandescent: 1 lamp	Wall Switch	60	1,540	Relamp	No	1	LED Screw-In Lamps: 1 lamp	Wall Switch	8	1,540	0.03	92	0.0	$14.73	$97.85	$5.00	6.30
Exterior	4	Metal Halide: (1) 70W Lamp	Wall Switch	95	4,380	Fixture Replacement	No	4	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	11	4,380	0.22	1,692	0.0	$270.69	$1,562.71	$400.00	4.30
Exterior	4	Metal Halide: (1) 400W Lamp	Daylight Dimming	458	770	Fixture Replacement	No	4	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	194	770	0.69	935	0.0	$149.56	$1,562.71	$400.00	7.77
Attic room	2	Incandescent: 1 lamp	Wall Switch	84	1,540	Relamp	No	2	LED Screw-In Lamps: 1 lamp	Wall Switch	11	1,540	0.10	259	0.0	$41.36	$195.71	$10.00	4.49
Hallway	1	Compact Fluorescent: 2 lamps	Wall Switch	42	1,540	Relamp	No	1	LED Screw-In Lamps: 2 lamps	Wall Switch	8	1,540	0.02	60	0.0	$9.63	$195.71	$0.00	20.32
Stairwell	2	Incandescent: 1 lamp	Wall Switch	60	1,540	Relamp	No	2	LED Screw-In Lamps: 1 lamp	Wall Switch	8	1,540	0.07	184	0.0	$29.46	$195.71	$10.00	6.30
Gym	3	Compact Fluorescent: 2 lamps	Wall Switch	84	1,540	Relamp	No	3	LED Screw-In Lamps: 2 lamps	Wall Switch	8	1,540	0.15	404	0.0	$64.58	$587.12	$0.00	9.09
Storage	1	Incandescent: 1 lamp	Wall Switch	60	1,540	Relamp	No	1	LED Screw-In Lamps: 1 lamp	Wall Switch	8	1,540	0.03	92	0.0	$14.73	$97.85	$5.00	6.30
Office A6	5	Incandescent: 1 lamp	Wall Switch	60	1,540	Relamp	No	5	LED Screw-In Lamps: 1 lamp	Wall Switch	8	1,540	0.17	460	0.0	$73.65	$489.27	$25.00	6.30
Library	14	Compact Fluorescent: 2 lamps	Wall Switch	84	1,540	Relamp	No	14	LED Screw-In Lamps: 2 lamps	Wall Switch	8	1,540	0.70	1,884	0.0	$301.39	$2,739.88	$0.00	9.09
Main office	6	Incandescent: 1 lamp	Wall Switch	75	1,540	Relamp	No	6	LED Screw-In Lamps: 1 lamp	Wall Switch	8	1,540	0.26	712	0.0	$113.87	$587.12	$30.00	4.89
All school	21	Exit Signs: LED - 2 W Lamp	Wall Switch	6	8,760	None	No	21	Exit Signs: LED - 2 W Lamp	Wall Switch	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
Boiler room	Boiler	2	Other	2.0	86.5%	No	2,745	No	86.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler room	Hot water storage tank	2	Water Supply Pump	0.5	60.0%	No	2,745	No	60.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Rooftop	restrooms and kitchen	5	Exhaust Fan	0.3	58.0%	No	2,745	No	58.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Classrooms	Unit Ventilators	18	Supply Fan	0.3	58.0%	No	2,745	No	58.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler room	Burner	2	Other	2.0	86.5%	No	2,745	No	86.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Elevator machine room	Elevator	1	Other	20.0	86.5%	No	1,560	No	86.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Library attic	AHU	2	Supply Fan	3.0	89.5%	No	2,745	No	89.5%	Yes	2	0.81	2,471	0.0	$395.23	$6,015.30	$480.00	14.01

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
Outside	Main Offices	1	Split-System AC	3.50		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Rooftop	Library	2	Packaged AC	3.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Rooftop	Unknown	1	Packaged AC	15.00		Yes	1	Packaged AC	15.00		13.00		Yes	2.55	5,855	0.0	$936.48	$21,807.75	$1,435.00	21.75
Office A7 and B2	Office A7 and B2	2	Window AC	1.50		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Elevator machine room	Elevator machine room	1	Split-System AC	1.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Rooftop	Kitchen and classrooms	1	Packaged AC	6.00		Yes	1	Packaged AC	6.00		13.00		Yes	1.00	2,318	0.0	$370.78	$11,442.63	$688.00	29.01
Rooftop	Gym	1	Packaged AC	25.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Rooftop	Art room and Music room	1	Packaged AC	25.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Rooftop	Gym	1	Packaged AC	7.50		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
A7,B8,B4,B5,B2,B3,C11, C3,C4,C10,C9,C2,C1,B 6, C5,C6,C7, B9, B1	A7,B8,B4,B5,B2,B3,C11, C3,C4,C10,C9,C2,C1,B 6, C5,C6,C7, B9, B1	19	Window AC	1.50		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Nurse's office	Nurse's office	2	Window AC	0.75		Yes	2	Window AC	0.75		12.00		No	0.34	566	0.0	$90.45	$1,633.14	$0.00	18.06
School	Unknown	1	Window AC	1.10		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
B3	B3	1	Split-System AC	1.50		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
B6	B6	1	Window AC	2.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Fuel Heating Inventory & Recommendations

		Existing Conditions			Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	All school	2	Forced Draft Steam Boiler	1,733.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Gym	1	Furnace	324.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Art and Music room	1	Furnace	243.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Gym	1	Furnace	96.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Library	1	Furnace	284.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Library	1	Furnace	64.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Kitchen and classrooms	1	Furnace	96.00	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
Storage room	restrooms	1	Storage Tank Water Heater (> 50 Gal)	Yes	1	Storage Tank Water Heater (> 50 Gal)	Natural Gas	88.00%	Et	0.00	0	5.7	$58.24	$11,500.21	$398.00	190.63
Storage room	Art room	1	Storage Tank Water Heater (≤ 50 Gal)	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Storage room	3rd floor restrooms	1	Storage Tank Water Heater (> 50 Gal)	Yes	1	Storage Tank Water Heater (> 50 Gal)	Natural Gas	88.00%	Et	0.45	6,000	-26.0	$751.36	$4,392.04	$152.00	5.64

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
B8, B9, B4, B5, B1, B3, A4, A7	8	Faucet Aerator (Kitchen)	2.50	2.20	0.00	0	2.5	$25.40	$57.36	$0.00	2.26
Boys' restroom, Girls' restroom, Attic room	7	Faucet Aerator (Lavatory)	2.20	1.00	0.00	2,136	0.0	$341.72	$50.19	$0.00	0.15

Commercial Refrigerator/Freezer Inventory & Recommendations

	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	1	Stand-Up Refrigerator, Solid Door (16 - 30 cu. ft.)	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Kitchen	1	Stand-Up Freezer, Solid Door (16 - 30 cu. ft.)	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Cooking Equipment Inventory & Recommendations

	Existing Conditions			Proposed Conditions	Energy Impact & Financial Analysis						
Location	Quantity	Equipment Type	High Efficiency Equipement?	Install High Efficiency Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	2	Electric Convection Oven (Full Size)	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Kitchen	2	Insulated Food Holding Cabinet (3/4 Size)	No	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?
Alice costello school	81	Computer	150.0	Yes
Alice costello school	6	Laptop	45.0	Yes
Alice costello school	2	Printer - small	20.0	Yes
Alice costello school	6	Printer - medium	60.0	Yes
Alice costello school	4	Printer - large	200.0	Yes
Alice costello school	2	Paper shredder	120.0	Yes
Alice costello school	23	Projector	200.0	Yes
Alice costello school	4	Microwave	1,000.0	No
Alice costello school	1	Refrigerator - small	153.0	No
Alice costello school	1	Refrigerator - medium	172.0	No
Alice costello school	3	Refrigerator - large	218.0	Yes
Alice costello school	16	Ceiling fan	60.0	No
Alice costello school	9	CRT/DLP - television	120.0	Yes
Alice costello school	22	Smart board	5.0	Yes

Vending Machine Inventory & Recommendations

	Existing Conditions		Proposed Conditions	Energy Impact & Financial Analysis						
Location	Quantity	Vending Machine Type	Install Controls?	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
Teacher's lounge	1	Refrigerated	Yes	0.00	1,612	0.0	$257.80	$230.00	$0.00	0.89

Appendix B: ENERGY STAR® Statement of Energy Performance

ENERGY STAR® Statement of Energy Performance

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ENERGY STAR® Score[1]

Alice Costello School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 59,922
Built: 1925

For Year Ending: September 30, 2016
Date Generated: December 21, 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
Alice Costello School 301 Haakon Road Brooklawn, New Jersey 07933	_____ , (___)___-_____	___ _____ , (___)___-_____ _____

Property ID: 6131865

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
31.6 kBtu/ft²

Source EUI
69.6 kBtu/ft²

Annual Energy by Fuel

Electric - Grid (kBtu)	1,045,401 (55%)
Natural Gas (kBtu)	846,359 (45%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	66.3
National Median Source EUI (kBtu/ft²)	146.1
% Diff from National Median Source EUI	-52%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	161

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)