Local Government Energy Audit:
Energy Audit Report

Bradford Elementary School

Montclair Board of Education

87 Mount Hebron Road
Montclair, New Jersey 07403

January 3, 2019

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 Bradford Elementary School.

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

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

1.1 Facility Summary

Bradford Elementary School is a 58,129 square foot facility constructed in 1927. The building is a three-story educational facility including classrooms, library areas, offices, hallways and mechanical rooms.

Lighting at the facility consists mainly of 32-Watt T8 fluorescent fixtures with a few 28-Watt T5 fluorescent fixtures; all of which are inefficient in performance when compared to the latest lighting technology available in the market. In addition to linear fluorescent technology, the facility also has several compact fluorescent and incandescent lamps, as well as metal halide fixtures in the gym. Exterior lighting is provided primarily by 100-Watt and 250-Watt metal halide fixtures, with a few building mounted compact fluorescent and incandescent fixtures. Interior lighting control is provided by manual switches.

Cooling and ventilation is provided by a combination of rooftop packaged AC, window AC, split system AC, and package terminal AC systems. Heating hot water is distributed to the building's rooftop unit from natural draft steam boiler via a heat exchanger.

A thorough description of the facility and our observations are located in Section 2.

1.2 Your Cost Reduction Opportunities

Energy Conservation Measures

TRC evaluated eight and recommended seven measures which together represent an opportunity for Bradford Elementary School to reduce annual energy costs by roughly $18,773 and annual greenhouse gas emissions by 115,272 lbs CO_2e. We estimate that if all high priority measures are implemented as recommended, the project will pay for itself in roughly 6.3 years. TRC has defined high priority measures as the evaluated measures that have a simple payback less than the typical equipment life of the proposed equipment. 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 Bradford Elementary School's annual energy use by 12%.

Figure 1 – Previous 12 Month Utility Costs

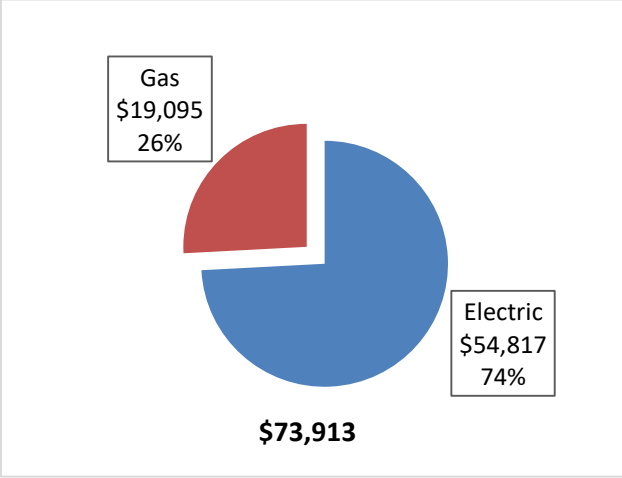
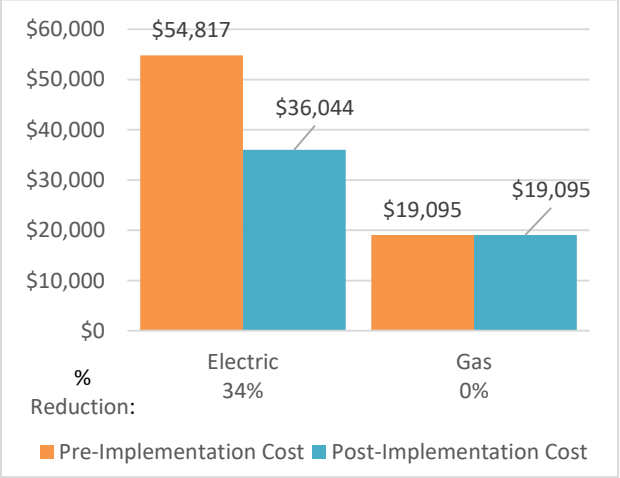


Figure 2 – Potential Post-Implementation Costs



A detailed description of Bradford Elementary School's existing energy use can be found in Section 3.

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

Figure 3 – Summary of Energy Reduction Opportunities

Energy Conservation Measure		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**96,779**	**29.4**	**$15,871.49**	**$104,403.19**	**$11,630.00**	**$92,773.19**	**5.8**	**97,455**
ECM 1	Install LED Fixtures	Yes	25,461	4.6	$4,175.59	$55,418.56	$3,690.00	$51,728.56	12.4	25,639
ECM 2	Retrofit Fixtures with LED Lamps	Yes	68,305	24.6	$11,201.92	$47,586.42	$7,940.00	$39,646.42	3.5	68,783
ECM 3	Install LED Exit Signs	Yes	3,012	0.2	$493.98	$1,398.22	$0.00	$1,398.22	2.8	3,033
Lighting Control Measures			**12,934**	**4.0**	**$2,121.22**	**$20,834.00**	**$2,575.00**	**$18,259.00**	**8.6**	**13,025**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	12,934	4.0	$2,121.22	$20,834.00	$2,575.00	$18,259.00	8.6	13,025
Motor Upgrades			**161**	**0.1**	**$26.35**	**$1,752.72**	**$0.00**	**$1,752.72**	**66.5**	**162**
ECM 5	Premium Efficiency Motors	Yes	161	0.1	$26.35	$1,752.72	$0.00	$1,752.72	66.5	162
Variable Frequency Drive (VFD) Measures			**2,986**	**0.8**	**$489.67**	**$6,015.30**	**$0.00**	**$6,015.30**	**12.3**	**3,007**
ECM 6	Install VFDs on Hot Water Pumps	Yes	2,986	0.8	$489.67	$6,015.30	$0.00	$6,015.30	12.3	3,007
Electric Unitary HVAC Measures			**3,502**	**2.3**	**$574.38**	**$15,067.21**	**$0.00**	**$15,067.21**	**26.2**	**3,527**
	Install High Efficiency Electric AC	No	3,502	2.3	$574.38	$15,067.21	$0.00	$15,067.21	26.2	3,527
Plug Load Equipment Control - Vending Machine			**1,612**	**0.0**	**$264.34**	**$230.00**	**$0.00**	**$230.00**	**0.9**	**1,623**
ECM 7	Vending Machine Control	Yes	1,612	0.0	$264.34	$230.00	$0.00	$230.00	0.9	1,623
TOTALS FOR RECOMMENDED MEASURES			**114,471**	**34.3**	**$18,773.07**	**$133,235.21**	**$14,205.00**	**$119,030.21**	**6.3**	**115,272**
TOTALS FOR ALL MEASURES			**117,974**	**36.6**	**$19,347.45**	**$148,302.43**	**$14,205.00**	**$134,097.43**	**6.9**	**118,799**

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

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

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

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

Motor Upgrades generally involve replacing older standard efficiency motors with high efficiency standard (IHP 2014). Motors replacements generally assume the same size motors, just higher efficiency. Although occasionally additional savings can be achieved by downsizing motors to better meet current load requirements. This measure saves energy by reducing the power used by the motors, due to improved electrical efficiency.

Variable Frequency Drives (VFDs) are motor control devices. These measures control the speed of a motor so that the motor spins at peak efficiency during partial load conditions. Sensors adapt the speed to flow, temperature, or pressure settings which is much more efficient than using 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.

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 outlet when not in use.

Energy Efficient Practices

TRC also identified seven 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 Bradford Elementary School include:

- Close Doors and Windows
- Ensure Economizers are Functioning Properly
- Clean Evaporator/Condenser Coils on AC Systems
- Clean and/or Replace HVAC Filters
- Perform Proper Boiler 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 Bradford Elementary School. Based on the configuration of the site and its loads there is a high potential for installing a photovoltaic (PV) array.

Figure 4 – Photovoltaic Potential

Potential	High	
System Potential	90	kW DC STC
Electric Generation	107,224	kWh/yr
Displaced Cost	$9,330	/yr
Installed Cost	$257,400	

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

1.3 Implementation Planning

To realize the energy savings from the ECMs listed in this report, a project implementation plan must be developed. Available capital must be considered and decisions need to be made whether it is best to pursue individual ECMs separately, groups of ECMs, or a comprehensive approach where all ECMs are implemented together, possibly in conjunction with other 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
- SREC (Solar Renewable Energy Certificate) Registration Program (SRP)
- Energy Savings Improvement Program (ESIP)

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

This 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 than SmartStart, up to 70% of the cost of selected measures, although measure eligibility will have to be assessed and be verified by the designated Direct Install contractor and, in most cases, they will perform the installation work.

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

The Demand Response Energy Aggregator is a (non-NJCEP) program designed to reduce electric loads at commercial facilities, when wholesale electricity prices are high or when the reliability of the electric grid is threatened due to peak power demand. Demand Response (DR) service providers (a.k.a. Curtailment Service Providers) are registered with PJM, the independent system operator (ISO) for mid-Atlantic state region that is charged with maintaining electric grid reliability. By enabling grid operators to call upon commercial facilities to reduce their electric usage during times of peak demand, the grid is made more reliable and overall transmission costs are reduced for all ratepayers. Curtailment Service Providers provide regular payments to medium and large consumers of electric power for their participation in DR programs. Program participation is voluntary and facilities receive payments whether or not they are called upon to curtail their load during times of peak demand. Refer to Section 7 for additional information on this program.

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

2 FACILITY INFORMATION AND EXISTING CONDITIONS

2.1 Project Contacts

Figure 5 – Project Contacts

Name	Role	E-Mail	Phone #
Customer			
Emidio D'Andrea	Business Administrator	edandrea@montclair.k12.nj.us	(973) 509-4050
John Eschmann	Director of Facilities	jeschmann@montclair.k12.nj.us	(973) 509-4044
Designated Representative			
Matthew Wolchko	Project Architect	mwolchko@planetpsa.com	(973) 586-2400
TRC Energy Services			
Tom Page	Auditor	tpag@TRCsolutions.com	(732) 855-0033

2.2 General Site Information

On November 16, 2016, TRC performed an energy audit at Bradford Elementary School located in Montclair, New Jersey. TRC's team met with John Eschmann to review the facility operations and help focus our investigation on specific energy-using systems.

Bradford Elementary School is a 58,129 square foot facility constructed in 1927. The building is a three-story educational facility including classrooms, library areas, offices, hallways and mechanical rooms.

Lighting at the facility consists mainly of 32-Watt T8 fluorescent fixtures with a few 28-Watt T5 fluorescent fixtures; all of which are inefficient in performance when compared to the latest lighting technology available in the market. In addition to linear fluorescent technology, the facility also has several compact fluorescent and incandescent lamps, as well as metal halide fixtures in the gym. Exterior lighting is provided primarily by 100-Watt and 250-Watt metal halide fixtures, with a few building mounted compact fluorescent and incandescent fixtures. Interior lighting control is provided by manual switches.

Cooling and ventilation is provided by a combination of rooftop packaged AC, window AC, split system AC, and package terminal AC systems. Heating hot water is distributed to the building's rooftop unit from natural draft steam boiler via a heat exchanger.

2.3 Building Occupancy

The typical schedule is presented in the table below, with usage primarily in the non-summer months.

Figure 6 - Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
Bradford Elementary School	Weekday	7:00 am - 3:30 pm
Bradford Elementary School	Weekend	CLOSED

2.4 Building Envelope

Bradford Elementary School is a three-story building. The construction is of concrete masonry block with brick exterior and double pane clear windows with operable frames. The flat roof is constructed of built-up roofing material.

Figure 7 – Building Façade

2.5 On-Site Generation

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

Figure 8 – Photovoltaic Potential

Potential	High	
System Potential	90	kW DC STC
Electric Generation	107,224	kWh/yr
Displaced Cost	$9,330	/yr
Installed Cost	$257,400	

2.6 Energy-Using Systems

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

Lighting System

Lighting at Bradford Elementary School consists mainly of 32-Watt T8 fluorescent fixtures with a few 28-Watt T5 fluorescent fixtures in the library. These sources are inefficient in performance when compared to the latest lighting technology available in the market. Most linear fixtures are 2-foot or 4-foot long troffers with diffusers having 1, 2, 3, and 4-lamp configurations. In addition to the fluorescent fixtures, the facility is also served by 17-Watt compact fluorescent lamps and 60-Watt, 75-Watt, and 200-Watt incandescent lamps. Metal halide sources provide illumination for the gymnasium. All the exit signs are LED based fixtures.

Interior lighting control in the building is provided by manual switches.

Figure 9 - Building Lighting Systems

Fluorescent Fixture	*Exterior Metal Halide Fixture*
	

The building's exterior lighting consists primarily of 100-Watt and 250-Watt metal halide fixtures, although a few incandescent and compact fluorescent fixtures are mounted to the building. Exterior lamps are generally controlled by photocells.

Steam to Hot Water System

The hot water system consists of two Weil-McLain 2,274 kBtu/hr output, natural draft steam boilers. The boilers have a nominal combustion efficiency of 83%. The boilers are configured with a steam to water heat exchanger to convert steam to heating hot water. The hot water is circulated with two hot water pumps. Each boiler is supplied by a dedicated 3 hp pump operating at constant speed. The boilers are in good condition and well maintained.

Figure 10 – Hot Water System

Natural Gas Boiler	*Heating Hot Water Pumps*
	

Direct Expansion Air Conditioning System (DX)

The facility also has several window AC units with capacities ranging between 0.67 tons and 1.25 tons. There are two rooftop package units having capacities of 40-tons and 13-tons. In addition to the window AC units and package units, there are split systems serving the building.

Figure 11 – DX Air Conditioning System

Window AC	*Split Systems*
	

Domestic Hot Water Heating System

The domestic hot water heating system for the facility consists of two A.O. Smith gas fired hot water heaters with an input rating of 75 kBtu/hr and 150 kBtu/hr and nominal efficiencies of 80% and 88% respectively. Storage tank capacities are 75 gallons and 100 gallons.

Figure 12 – Domestic Hot Water System

DHW Heater	*DHW Heater Nameplate*
	

Food Service Equipment

The school has two electric convention ovens (half size) manufactured by Vulcan which has an electric demand of approximately 4.71 kW.

Refrigeration

The school has three stand-up refrigerators. Two refrigerators have 42 cu. ft, and one refrigerator has 22 cu. ft. capacities. Two of the larger units are in the kitchen and the smaller unit is in the break room.

Building Plug Load

There are roughly 80 computer work stations throughout the facility. All the computers are desktop units with LCD monitors. There is no centralized PC power management software installed.

The facility contains other systems which contribute to plug load including printers, microwaves, and televisions. In addition to the typical plug load equipment, the facility also has a refrigerated vending machine in the teacher's lounge.

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

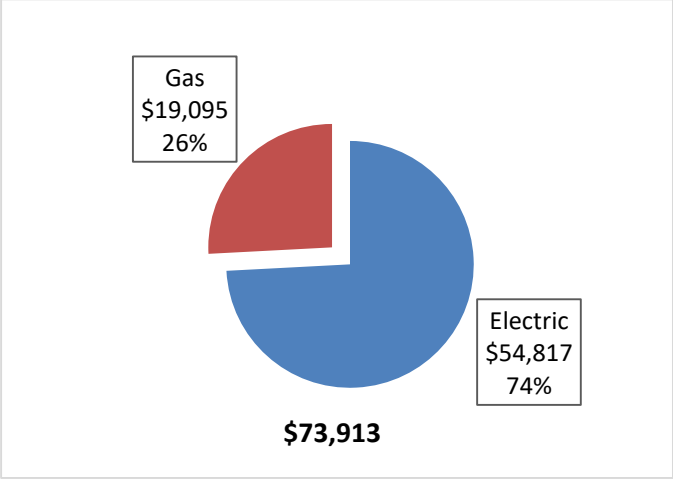
The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. A profile of the annual energy consumption and energy cost of the facility was developed from this information.

Figure 13 - Utility Summary

Utility Summary for Bradford Elementary School		
Fuel	**Usage**	**Cost**
Electricity	334,257 kWh	$54,817
Natural Gas	21,688 Therms	$19,095
Total		**$73,913**

The current annual energy cost for this facility is $73,913 as shown in the chart below.

Figure 14 - Energy Cost Breakdown



3.2 Electricity Usage

Electricity is provided by PSE&G. The average electric cost over the past 12 months was $0.164/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 monthly electricity consumption and peak demand are shown in the chart below.

Figure 15 - Electric Usage & Demand

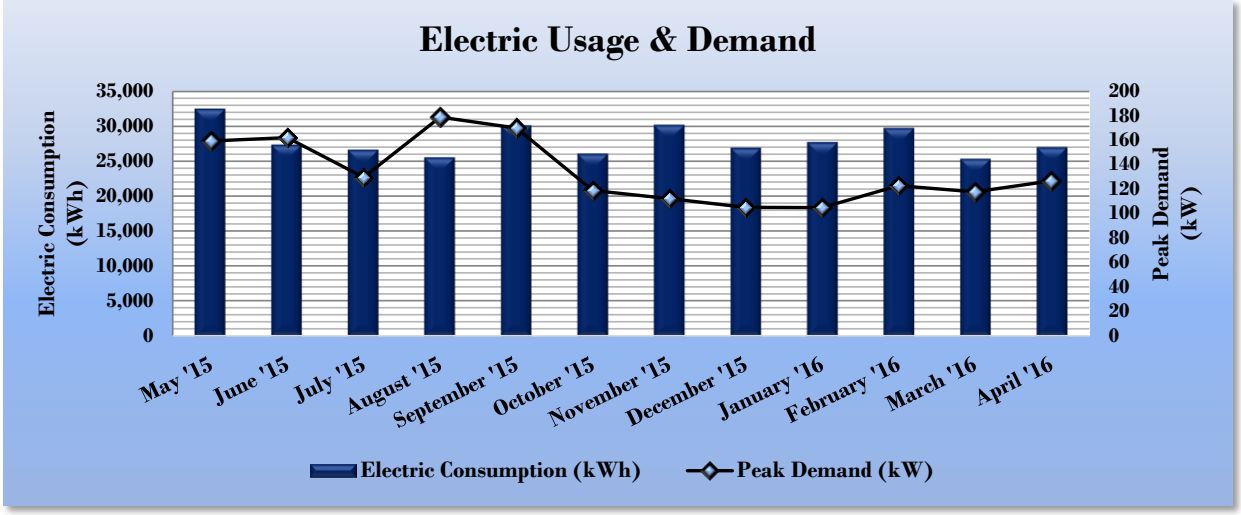


Figure 16 - Electric Usage & Demand

Electric Billing Data for Bradford Elementary School					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Total Electric Cost	TRC Estimated Usage?
6/15/15	32	32,388	159	$6,367	No
7/15/15	30	27,300	162	$5,749	No
8/13/15	29	26,550	130	$5,217	No
9/14/15	32	25,483	179	$5,636	No
10/13/15	29	30,032	170	$4,605	No
11/11/15	29	25,988	119	$3,915	No
12/14/15	33	30,113	112	$4,286	No
1/15/16	32	26,860	105	$3,752	No
2/12/16	28	27,645	105	$3,787	No
3/15/16	32	29,678	123	$4,097	No
4/14/16	30	25,278	118	$3,595	No
5/13/16	29	26,942	127	$3,812	No
Totals	**365**	**334,257**	**179**	**$54,817**	0
Annual	**365**	**334,257**	**179**	**$54,817**	

3.3 Natural Gas Usage

Natural gas is provided by PSE&G. The average gas cost for the past 12 months is $0.880/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is shown in the chart below.

Figure 17 - Natural Gas Usage

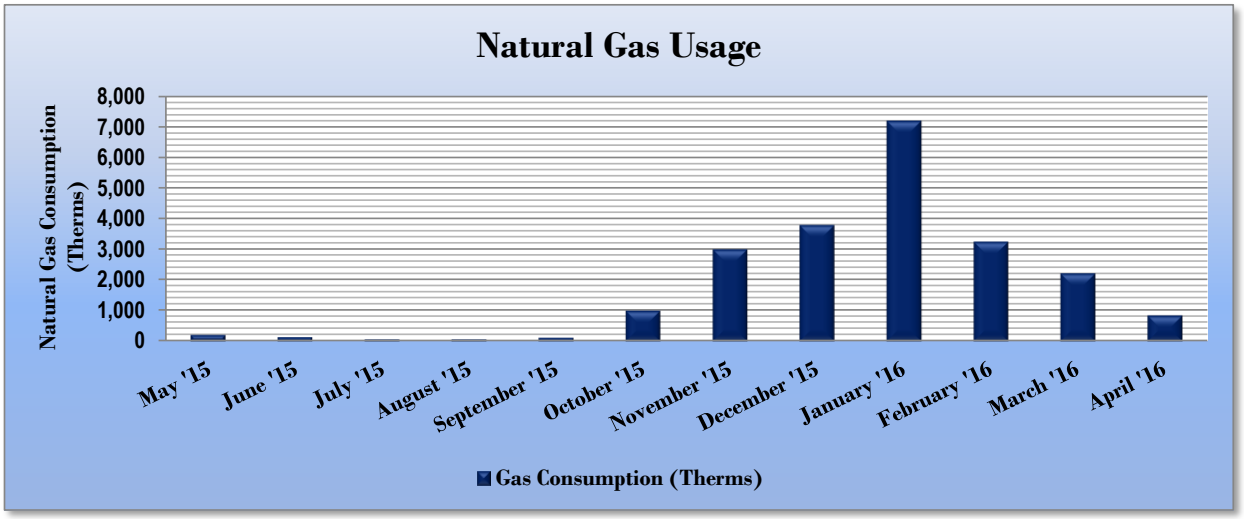


Figure 18 - Natural Gas Usage

Gas Billing Data for Bradford Elementary School			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
6/16/15	32	209	$220
7/20/15	34	133	$178
8/17/15	28	63	$139
9/15/15	29	61	$139
10/14/15	29	112	$168
11/12/15	29	1,003	$1,824
12/15/15	33	2,999	$3,036
1/15/16	31	3,789	$3,516
2/18/16	34	7,186	$5,284
3/16/16	27	3,248	$2,879
4/15/16	30	2,216	$1,304
5/17/16	32	845	$565
Totals	**368**	**21,866**	**$19,252**
Annual	**365**	**21,688**	**$19,095**

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 19 - Energy Use Intensity Comparison – Existing Conditions

Energy Use Intensity Comparison - Existing Conditions		
	Bradford Elementary School	National Median Building Type: School (K-12)
Source Energy Use Intensity (kBtu/ft^2)	100.8	141.4
Site Energy Use Intensity (kBtu/ft^2)	56.9	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 20 - Energy Use Intensity Comparison – Following Installation of Recommended Measures

Energy Use Intensity Comparison - Following Installation of Recommended Measures		
	Bradford Elementary School	National Median Building Type: School (K-12)
Source Energy Use Intensity (kBtu/ft^2)	79.7	141.4
Site Energy Use Intensity (kBtu/ft^2)	50.2	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. This facility has a current score of 65.

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

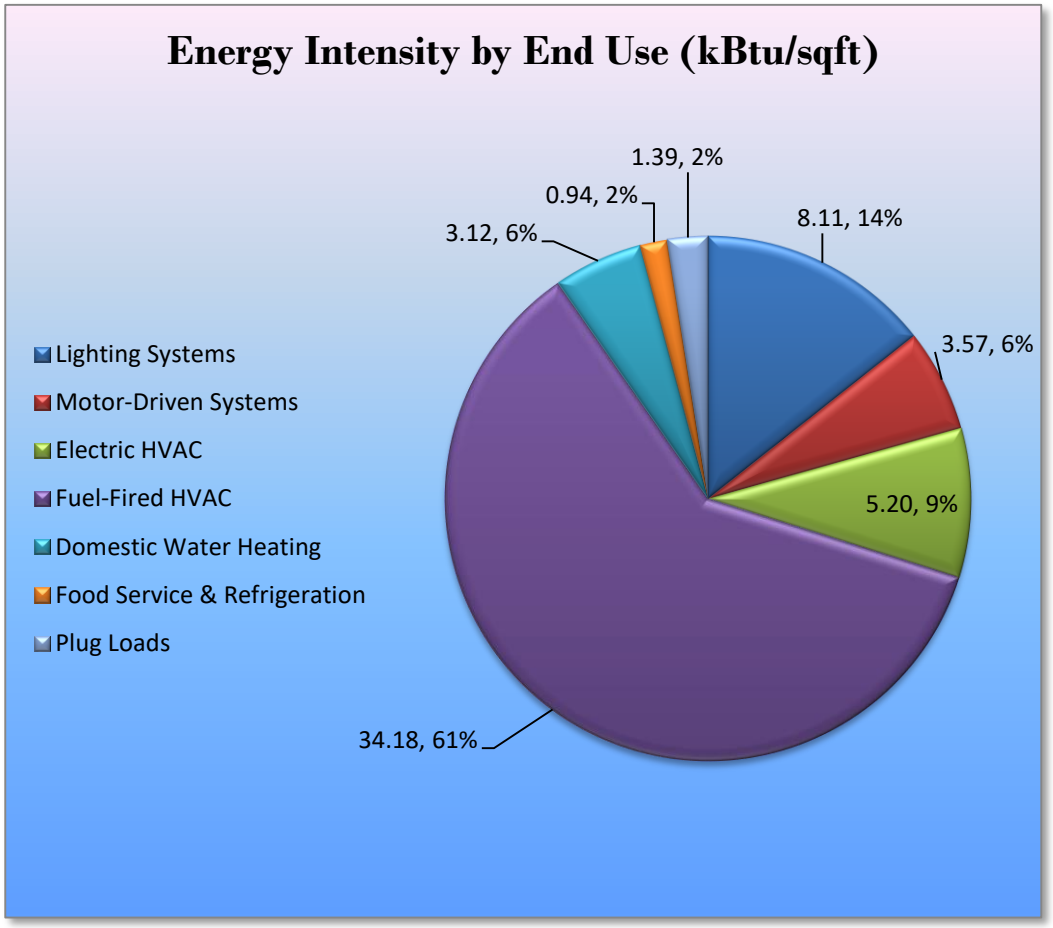
For more information on ENERGY STAR® certification go to: https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1.

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 21 - Energy Balance (% and kBtu/SF)



4 ENERGY CONSERVATION MEASURES

Level of Analysis

The goal of this audit report is to identify potential energy efficiency opportunities, help prioritize specific measures for implementation, and provide information to the Bradford Elementary 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 High Priority ECMs

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

Figure 22 – Summary of High Priority 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		**96,779**	**29.4**	**0.0**	**$15,871.49**	**$104,403.19**	**$11,630.00**	**$92,773.19**	**5.8**	**97,455**
ECM 1	Install LED Fixtures	25,461	4.6	0.0	$4,175.59	$55,418.56	$3,690.00	$51,728.56	12.4	25,639
ECM 2	Retrofit Fixtures with LED Lamps	68,305	24.6	0.0	$11,201.92	$47,586.42	$7,940.00	$39,646.42	3.5	68,783
ECM 3	Install LED Exit Signs	3,012	0.2	0.0	$493.98	$1,398.22	$0.00	$1,398.22	2.8	3,033
Lighting Control Measures		**12,934**	**4.0**	**0.0**	**$2,121.22**	**$20,834.00**	**$2,575.00**	**$18,259.00**	**8.6**	**13,025**
ECM 4	Install Occupancy Sensor Lighting Controls	12,934	4.0	0.0	$2,121.22	$20,834.00	$2,575.00	$18,259.00	8.6	13,025
Motor Upgrades		**161**	**0.1**	**0.0**	**$26.35**	**$1,752.72**	**$0.00**	**$1,752.72**	**66.5**	**162**
ECM 5	Premium Efficiency Motors	161	0.1	0.0	$26.35	$1,752.72	$0.00	$1,752.72	66.5	162
Variable Frequency Drive (VFD) Measures		**2,986**	**0.8**	**0.0**	**$489.67**	**$6,015.30**	**$0.00**	**$6,015.30**	**12.3**	**3,007**
ECM 6	Install VFDs on Hot Water Pumps	2,986	0.8	0.0	$489.67	$6,015.30	$0.00	$6,015.30	12.3	3,007
Plug Load Equipment Control - Vending Machine		**1,612**	**0.0**	**0.0**	**$264.34**	**$230.00**	**$0.00**	**$230.00**	**0.9**	**1,623**
ECM 7	Vending Machine Control	1,612	0.0	0.0	$264.34	$230.00	$0.00	$230.00	0.9	1,623
TOTALS		**114,471**	**34.3**	**0.0**	**$18,773.07**	**$133,235.21**	**$14,205.00**	**$119,030.21**	**6.3**	**115,272**

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

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

4.1.1 Lighting Upgrades

Our recommendations for upgrades to existing lighting fixtures are summarized in Figure 23 below.

Figure 23 – Summary of Lighting Upgrade ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**96,779**	**29.4**	**0.0**	**$15,871.49**	**$104,403.19**	**$11,630.00**	**$92,773.19**	**5.8**	**97,455**
ECM 1	Install LED Fixtures	25,461	4.6	0.0	$4,175.59	$55,418.56	$3,690.00	$51,728.56	12.4	25,639
ECM 2	Retrofit Fixtures with LED Lamps	68,305	24.6	0.0	$11,201.92	$47,586.42	$7,940.00	$39,646.42	3.5	68,783
ECM 3	Install LED Exit Signs	3,012	0.2	0.0	$493.98	$1,398.22	$0.00	$1,398.22	2.8	3,033

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	9,791	2.6	0.0	$1,605.72	$48,333.60	$2,700.00	$45,633.60	28.4	9,860
Exterior	15,670	2.0	0.0	$2,569.87	$7,084.96	$990.00	$6,094.96	2.4	15,780

Measure Description

We recommend replacing existing 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. Exterior fixtures are pole mounted or along the building exterior. Interior fixtures are located in the gymnasiums.

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

ECM 2: Retrofit Fixtures with LED Lamps

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	67,252	24.4	0.0	$11,029.27	$47,348.10	$7,920.00	$39,428.10	3.6	67,723
Exterior	1,053	0.1	0.0	$172.65	$238.32	$20.00	$218.32	1.3	1,060

Measure Description

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

Additional savings from lighting maintenance can be anticipated since LEDs have lifetimes which are more than twice that of fluorescent tubes and more than 10 times longer than many incandescent lamps.

ECM 3: Install LED Exit Signs

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	3,012	0.2	0.0	$493.98	$1,398.22	$0.00	$1,398.22	2.8	3,033
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.0	0

Measure Description

We recommend replacing all incandescent exit signs with LED exit signs. LED exit signs require virtually no maintenance and have a life expectancy of at least 20 years. This measure saves energy by installing LED fixtures, which use less power than other technologies with an equivalent lighting output.

4.1.2 Lighting Control Measures

Our recommendations for lighting control measures are summarized in Figure 24 below.

Figure 24 – Summary of Lighting Control ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**12,934**	**4.0**	**0.0**	**$2,121.22**	**$20,834.00**	**$2,575.00**	**$18,259.00**	**8.6**	**13,025**
ECM 4	Install Occupancy Sensor Lighting Controls	12,934	4.0	0.0	$2,121.22	$20,834.00	$2,575.00	$18,259.00	8.6	13,025

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)
12,934	4.0	0.0	$2,121.22	$20,834.00	$2,575.00	$18,259.00	8.6	13,025

Measure Description

We recommend installing occupancy sensors to control lighting fixtures that are currently controlled by manual switches in many classrooms, restrooms, teacher's lounge, etc. 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 Motor Upgrades

Our recommendations for motor upgrades are summarized in Figure 25 below.

Figure 25 - Summary of Motor Upgrade ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Motor Upgrades		**161**	**0.1**	**0.0**	**$26.35**	**$1,752.72**	**$0.00**	**$1,752.72**	**66.5**	**162**
ECM 5	Premium Efficiency Motors	161	0.1	0.0	$26.35	$1,752.72	$0.00	$1,752.72	66.5	162

ECM 5: Premium Efficiency Motors

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
161	0.1	0.0	$26.35	$1,752.72	$0.00	$1,752.72	66.5	162

Measure Description

We recommend replacing standard efficiency motors with IHP 2014 efficiency motors. Our evaluation assumes that existing motors will be replaced with motors of equivalent size and type. Although occasionally additional savings can be achieved by downsizing motors to better meet the motor's current load requirements. The base case motor efficiencies are estimated from nameplate information and our best estimates of motor run hours. Efficiencies of proposed motor upgrades are obtained from the *New Jersey's Clean Energy Program Protocols to Measure Resource Savings (2016)*. Savings are based on the difference between baseline and proposed efficiencies and the assumed annual operating hours.

This long payback measure is recommended in conjunction with the variable frequency drive measure, ECM 6 in order to assure that an inverter rated motor is in place so that the VFD can function properly.

4.1.4 Variable Frequency Drive Measures

Our recommendations for variable frequency drive (VFD) measures are summarized in Figure 26 below.

Figure 26 – Summary of Variable Frequency Drive ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**2,986**	**0.8**	**0.0**	**$489.67**	**$6,015.30**	**$0.00**	**$6,015.30**	**12.3**	**3,007**
ECM 6	Install VFDs on Hot Water Pumps	2,986	0.8	0.0	$489.67	$6,015.30	$0.00	$6,015.30	12.3	3,007

ECM 6: Install VFDs on Hot Water Pumps

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
2,986	0.8	0.0	$489.67	$6,015.30	$0.00	$6,015.30	12.3	3,007

Measure Description

We recommend installing a variable frequency drives (VFD) to control the hot water pumps. This measure requires that a majority of the hot water coils be served by 2-way valves and that a differential pressure sensor is installed in the hot water loop. As the hot water valves close, the differential pressure increases. The VFD modulates pump speed to maintain a differential pressure setpoint. Energy savings results from reducing pump motor speed (and power) as hot water valves close. The magnitude of energy savings is based on the estimated amount of time that the system will operate at reduced load.

4.1.5 Plug Load Equipment Control - Vending Machines

Our recommendations for plug load equipment measures are summarized in Figure 27 below.

Figure 27-Summary of Plug Load Equipment Control ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Plug Load Equipment Control - Vending Machine		**1,612**	**0.0**	**0.0**	**$264.34**	**$230.00**	**$0.00**	**$230.00**	**0.9**	**1,623**
ECM 7	Vending Machine Control	1,612	0.0	0.0	$264.34	$230.00	$0.00	$230.00	0.9	1,623

ECM 7: 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	$264.34	$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 ECM Evaluated but not Recommended

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

Figure 28 – Summary of Measure Evaluated, But Not Recommended

Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Electric Unitary HVAC Measures	**3,502**	**2.3**	**0.0**	**$574.38**	**$15,067.21**	**$0.00**	**$15,067.21**	**26.2**	**3,527**
Install High Efficiency Electric AC	3,502	2.3	0.0	$574.38	$15,067.21	$0.00	$15,067.21	26.2	3,527
TOTALS	**3,502**	**2.3**	**0.0**	**$574.38**	**$15,067.21**	**$0.00**	**$15,067.21**	**26.2**	**3,527**

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

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

Install High Efficiency 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)
3,502	2.3	0.0	$574.38	$15,067.21	$0.00	$15,067.21	26.2	3,527

Measure Description

We considered and evaluated replacing standard efficiency packaged air conditioning units with high efficiency packaged air conditioning units. There have been significant improvements in both compressor and fan motor efficiencies over the past several years. Therefore, electricity savings can be achieved by replacing older units with new high efficiency units. A higher EER or SEER rating indicates a more efficient cooling system. The magnitude of energy savings for this measure depends on the relative efficiency of the older unit versus the new high efficiency unit, the average cooling load, and the estimated annual operating hours.

Reasons for not Recommending

This measure was evaluated but not recommended due to long payback, which exceeds the useful life of the proposed equipment.

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.

Ensure Economizers are Functioning Properly

Economizers, when properly configured, can be used to significantly reduce mechanical cooling. However, if the outdoor thermostat or enthalpy control is malfunctioning or the damper is stuck or improperly adjusted, benefits from the economizer may not be fully realized. As such, periodic inspection and maintenance is required to ensure proper operation. This maintenance should be scheduled with maintenance of the facility's air conditioning system and should include proper setting of the outdoor thermostat/enthalpy control, inspection of control and damper operation, lubrication of damper connections, and adjustment of minimum damper position. A malfunctioning economizer can significantly increase the amount of heating and mechanical cooling required by introducing excess amounts of cold or hot outside air.

Clean Evaporator/Condenser Coils on AC Systems

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

Clean and/or Replace HVAC Filters

Air filters work to reduce the amount of indoor air pollution and increase occupant comfort. Over time, filters become less and less effective as particulate buildup increases. In addition to health concerns related to clogged filters, filters that have reached saturation also restrict air flow through the 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.

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 gallons per minute (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 gallons per flush (gpf) and toilets that use as little as 1.28 gpf (this is lower than the current 1.6 gpf federal standard).

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.

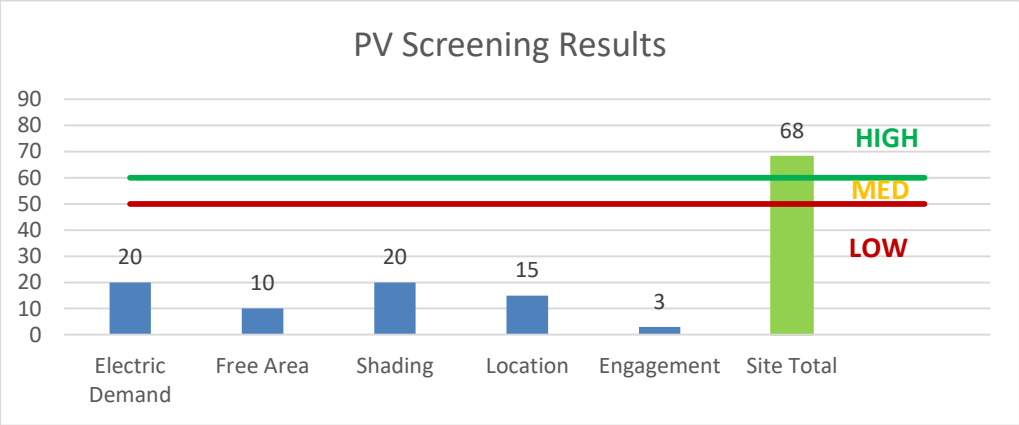
6.1 Photovoltaic

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 building may be feasible. If Bradford Elementary School is interested in pursuing the installation of PV, we recommended a full feasibility study be conducted.

Figure 29 - Photovoltaic Screening



Potential	High	
System Potential	90	kW DC STC
Electric Generation	107,224	kWh/yr
Displaced Cost	$9,330	/yr
Installed Cost	$257,400	

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

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

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

6.2 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.

A low or infrequent thermal load is the most significant factor 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.

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 building is not is a good candidate for DR curtailment.

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

Figure 30 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive	SmartStart Custom	Direct Install	Pay For Performance Existing Buildings
ECM 1	Install LED Fixtures	X		X	
ECM 2	Retrofit Fixtures with LED Lamps	X		X	
ECM 3	Install LED Exit Signs			X	
ECM 4	Install Occupancy Sensor Lighting Controls	X		X	
ECM 5	Premium Efficiency Motors			X	
ECM 6	Install VFDs on Hot Water Pumps			X	
ECM 7	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. This facility does not meet all of the criteria for participating in the P4P program based on the measures identified in this study. 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 any 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 Renewable Energy Certificate) Registration Program (SRP) is used to register the intent to install solar projects in New Jersey. Rebates are not available for solar projects, but owners of solar projects MUST register their projects in the SRP prior to the start of construction 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 com are 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	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,150	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,505	0.16	619	0.0	$101.45	$621.00	$95.00	5.18
Boiler Rm Area	23	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	1,075	Relamp	No	23	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,075	0.26	498	0.0	$81.60	$825.70	$115.00	8.71
Boiler Rm Area	3	Incandescent: Standard 60W Bulbs	Wall Switch	60	1,075	Relamp	No	3	LED Screw-In Lamps: 9W LED Bulbs	Wall Switch	9	1,075	0.10	189	0.0	$31.02	$161.26	$15.00	4.72
Teacher Work Rm	3	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	1,800	Relamp	Yes	3	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,260	0.04	136	0.0	$22.25	$223.70	$15.00	9.38
1st Flr Corridor	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,150	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,150	0.13	490	0.0	$80.29	$351.00	$60.00	3.62
1st Flr Corridor	4	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	2,150	Relamp	No	4	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,150	0.05	173	0.0	$28.38	$143.60	$20.00	4.35
Stairwell	3	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	2,150	Relamp	No	3	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,150	0.03	130	0.0	$21.29	$107.70	$15.00	4.35
Stairwell	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,150	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,150	0.02	82	0.0	$13.38	$58.50	$10.00	3.62
Classroom 1	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.27	863	0.0	$141.56	$855.00	$135.00	5.09
Teachers' Lounge	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.05	173	0.0	$28.31	$387.00	$55.00	11.73
Teachers' Lounge	1	Incandescent: Standard 60W Bulbs	Wall Switch	60	1,800	Relamp	Yes	1	LED Screw-In Lamps: 9W LED Bulbs	Occupancy Sensor	9	1,260	0.04	111	0.0	$18.23	$53.75	$40.00	0.75
Teachers' Lounge	1	Linear Fluorescent - T9: 32W Circline Lamps	Wall Switch	32	1,800	Relamp	Yes	1	LED - Linear Tubes: 17W LED replacement for T9 Circline	Occupancy Sensor	17	1,260	0.01	42	0.0	$6.82	$82.16	$35.00	6.91
Music Rm	21	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,800	Relamp	Yes	21	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,260	0.86	2,719	0.0	$445.92	$2,389.20	$420.00	4.42
Music Rm Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,600	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,600	0.02	61	0.0	$9.96	$58.50	$10.00	4.87
Child Study	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,800	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,260	0.16	518	0.0	$84.94	$416.80	$80.00	3.97
2nd Flr Fan Rm	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	500	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	500	0.01	10	0.0	$1.65	$35.90	$5.00	18.72
2nd Flr Electrical Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	500	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	500	0.02	19	0.0	$3.11	$58.50	$10.00	15.59
Tech Lab Rm 22	14	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,800	Relamp	Yes	14	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,260	0.67	2,127	0.0	$348.85	$1,871.87	$350.00	4.36
2nd Flr Back Corridor	11	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,150	Relamp	No	11	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,150	0.36	1,346	0.0	$220.79	$827.20	$165.00	3.00
Stair 6, 2nd Flr	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	8,760	Relamp	No	3	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	8,760	0.10	1,496	0.0	$245.34	$225.60	$45.00	0.74
Art Rm 23	18	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,800	Relamp	Yes	18	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,260	0.87	2,735	0.0	$448.52	$2,252.40	$430.00	4.06
Rm 23 Supply Rm	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,800	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,260	0.16	518	0.0	$84.94	$416.80	$80.00	3.97
Office	3	Incandescent: Standard 60W Bulbs	Wall Switch	60	1,800	Relamp	Yes	3	LED Screw-In Lamps: 9W LED Bulbs	Occupancy Sensor	9	1,260	0.11	333	0.0	$54.69	$277.26	$35.00	4.43
Rm 21	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,800	Relamp	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,260	0.58	1,823	0.0	$299.01	$1,411.60	$275.00	3.80
SGI-A	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,800	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,260	0.29	912	0.0	$149.51	$686.80	$140.00	3.66

	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
SGI-B	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,800	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,260	0.29	912	0.0	$149.51	$686.80	$140.00	3.66
Boys' Rm	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	7	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.19	604	0.0	$99.09	$679.50	$105.00	5.80
Girls' Rm	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	7	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.19	604	0.0	$99.09	$679.50	$105.00	5.80
Rm 17	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.57	1,813	0.0	$297.28	$2,038.50	$315.00	5.80
Rm 18	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.57	1,813	0.0	$297.28	$2,038.50	$315.00	5.80
2nd Flr Corridor	5	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,150	Relamp	No	5	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,150	0.18	692	0.0	$113.54	$475.67	$100.00	3.31
2nd Flr Corridor	7	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	2,150	Relamp	No	7	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,150	0.08	303	0.0	$49.67	$251.30	$35.00	4.35
2nd Flr Corridor	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,150	Relamp	No	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,150	0.06	245	0.0	$40.14	$150.40	$30.00	3.00
2nd Flr Front Corridor	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	8,760	Relamp	No	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.11	1,662	0.0	$272.60	$292.50	$50.00	0.89
Stairwell Exit 8	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	8,760	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.04	665	0.0	$109.04	$117.00	$20.00	0.89
Stairwell 2nd Flr	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	8,760	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	8,760	0.01	176	0.0	$28.91	$35.90	$5.00	1.07
Stairwell 2nd Flr	1	Linear Fluorescent - T9: 32W Circline Lamps	Wall Switch	32	8,760	Relamp	No	1	LED - Linear Tubes: 17W LED replacement for T9 Circline	Wall Switch	17	8,760	0.01	151	0.0	$24.78	$82.16	$0.00	3.32
Girls' Rm	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.05	173	0.0	$28.31	$233.00	$20.00	7.52
Rm 16	10	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,800	Relamp	Yes	10	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,260	0.48	1,519	0.0	$249.18	$1,221.33	$235.00	3.96
Rm 15	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.49	1,554	0.0	$254.81	$1,593.00	$250.00	5.27
Rm 14	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.57	1,813	0.0	$297.28	$2,038.50	$315.00	5.80
Rm 13	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.49	1,554	0.0	$254.81	$1,593.00	$250.00	5.27
Rm 13	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	1,800	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,800	0.01	36	0.0	$5.94	$35.90	$5.00	5.20
Rm 12	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.57	1,813	0.0	$297.28	$2,038.50	$315.00	5.80
Rm 14A	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,800	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,260	0.10	304	0.0	$49.84	$306.27	$60.00	4.94
Boys' Rm	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.05	173	0.0	$28.31	$233.00	$20.00	7.52
Stairwell 2nd Flr	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	8,760	Relamp	No	2	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	8,760	0.02	353	0.0	$57.82	$71.80	$10.00	1.07
Attic	2	Incandescent: Standard 60W Bulbs	Wall Switch	60	600	Relamp	No	2	LED Screw-In Lamps: 9W LED Bulbs	Wall Switch	9	600	0.07	70	0.0	$11.54	$107.51	$10.00	8.45
Rm 20	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.57	1,813	0.0	$297.28	$2,038.50	$315.00	5.80
Sm. Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	1,075	Relamp	Yes	1	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	753	0.01	27	0.0	$4.43	$151.90	$5.00	33.16

	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
Rm 19A	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.05	173	0.0	$28.31	$387.00	$55.00	11.73
Back Stairwell	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	8,760	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.02	332	0.0	$54.52	$58.50	$10.00	0.89
Rm 19	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.66	2,072	0.0	$339.75	$2,214.00	$345.00	5.50
Sm. Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	1,075	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,075	0.01	22	0.0	$3.55	$35.90	$5.00	8.71
Back Entrance, 1st Flr	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	2,150	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,150	0.01	43	0.0	$7.10	$35.90	$5.00	4.35
Rm 2	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.44	1,381	0.0	$226.50	$1,476.00	$230.00	5.50
Sm. Restroom & Closet	2	Incandescent: Standard 60W Bulbs	Wall Switch	60	600	Relamp	No	2	LED Screw-In Lamps: 9W LED Bulbs	Wall Switch	9	600	0.07	70	0.0	$11.54	$107.51	$10.00	8.45
Boys' Rm	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,600	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,120	0.05	153	0.0	$25.17	$233.00	$20.00	8.46
Custodian Closet	1	Linear Fluorescent - T8: 2' T8 (17W) - 1L	Wall Switch	22	500	Relamp	No	1	LED - Linear Tubes: (1) 2' Lamp	Wall Switch	9	500	0.01	8	0.0	$1.27	$31.90	$5.00	21.13
2nd Main Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.05	173	0.0	$28.31	$233.00	$20.00	7.52
Sm. Restroom	2	Incandescent: Standard 60W Bulbs	Wall Switch	60	1,075	Relamp	Yes	2	LED Screw-In Lamps: 9W LED Bulbs	Occupancy Sensor	9	753	0.07	133	0.0	$21.77	$223.51	$10.00	9.81
Rm 3	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.49	1,554	0.0	$254.81	$1,593.00	$250.00	5.27
Rm 4	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.49	1,554	0.0	$254.81	$1,593.00	$250.00	5.27
Rm 4	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	1,800	Relamp	No	2	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,800	0.02	72	0.0	$11.88	$71.80	$10.00	5.20
Rm 5	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.49	1,554	0.0	$254.81	$1,593.00	$250.00	5.27
Rm 6	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.66	2,072	0.0	$339.75	$2,214.00	$345.00	5.50
Rm 7	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.57	1,813	0.0	$297.28	$2,038.50	$315.00	5.80
Kitchen	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,075	Relamp	No	6	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,075	0.22	415	0.0	$68.12	$570.80	$120.00	6.62
Nurse's Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.05	173	0.0	$28.31	$233.00	$20.00	7.52
Girls' Rm	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.05	173	0.0	$28.31	$233.00	$20.00	7.52
Exit 6 Stairwell, 1st Flr	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,150	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,150	0.02	82	0.0	$13.38	$58.50	$10.00	3.62
1st Flr Corridor (front to back)	6	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	2,150	Relamp	No	6	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,150	0.07	260	0.0	$42.58	$215.40	$30.00	4.35
1st Flr Corridor (front to back)	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,150	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,150	0.04	163	0.0	$26.76	$117.00	$20.00	3.62
Gym 1	9	Metal Halide: (1) 250W Lamp	Wall Switch	295	2,150	Fixture Replacement	Yes	9	LED - Fixtures: High-Bay	Occupancy Sensor	75	1,505	1.43	5,396	0.0	$884.97	$24,436.80	$1,385.00	26.05
Gym 2	9	Metal Halide: (1) 250W Lamp	Wall Switch	295	2,150	Fixture Replacement	Yes	9	LED - Fixtures: High-Bay	Occupancy Sensor	75	1,505	1.43	5,396	0.0	$884.97	$24,436.80	$1,385.00	26.05

	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
Stage	6	Compact Fluorescent: 17W CFL Bulbs	Wall Switch	17	500	Relamp	No	6	LED Screw-In Lamps: 9W LED Bulbs	Wall Switch	9	500	0.03	28	0.0	$4.53	$93.00	$0.00	20.55
Stage	1	Incandescent: Standard 60W Bulbs	Wall Switch	60	500	Relamp	No	1	LED Screw-In Lamps: 9W LED Bulbs	Wall Switch	9	500	0.03	29	0.0	$4.81	$53.75	$5.00	10.14
Stage	60	Incandescent: 200W Bulbs	Wall Switch	200	500	Relamp	No	60	LED Screw-In Lamps: 9W LED Bulbs	Wall Switch	30	500	6.69	5,865	0.0	$961.85	$2,236.80	$0.00	2.33
Back Corridor	6	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	2,150	Relamp	No	6	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,150	0.07	260	0.0	$42.58	$215.40	$30.00	4.35
1st Flr Back Hall (New Sec.)	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,150	Relamp	No	14	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,150	0.45	1,713	0.0	$281.00	$1,052.80	$210.00	3.00
1st Flr Back Hall (New Sec.)	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,150	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,150	0.02	82	0.0	$13.38	$58.50	$10.00	3.62
Boys' Rm	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,600	Relamp	Yes	7	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,120	0.19	537	0.0	$88.08	$679.50	$105.00	6.52
Water Heater Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	500	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	500	0.03	28	0.0	$4.67	$75.20	$15.00	12.90
Guidance Office	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,800	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,260	0.19	608	0.0	$99.67	$496.53	$100.00	3.98
Girls' Rm	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,600	Relamp	Yes	7	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,120	0.19	537	0.0	$88.08	$679.50	$105.00	6.52
Rm 8	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.33	1,036	0.0	$169.87	$972.00	$155.00	4.81
Rm 9	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.33	1,036	0.0	$169.87	$972.00	$155.00	4.81
Sm. Restroom	10	Incandescent: Standard 60W Bulbs	Wall Switch	60	1,600	Relamp	Yes	10	LED Screw-In Lamps: 9W LED Bulbs	Occupancy Sensor	9	1,120	0.35	988	0.0	$162.04	$807.53	$85.00	4.46
Sm. Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,600	Relamp	Yes	1	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,120	0.04	115	0.0	$18.87	$191.20	$15.00	9.34
Rm 10	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,800	Relamp	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,260	0.58	1,823	0.0	$299.01	$1,411.60	$275.00	3.80
Rm 11	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,800	Relamp	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,260	0.58	1,823	0.0	$299.01	$1,411.60	$275.00	3.80
Faculty Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,075	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	753	0.03	52	0.0	$8.45	$174.50	$10.00	19.46
Library	32	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	2,150	Relamp	Yes	32	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,505	0.46	1,729	0.0	$283.52	$2,228.80	$300.00	6.80
Library	22	Incandescent: 75W Spotlight Bulbs	Wall Switch	75	2,150	Relamp	Yes	22	LED Screw-In Lamps: 12W LED Spotlight Bulbs	Occupancy Sensor	12	1,505	0.96	3,623	0.0	$594.12	$1,884.77	$215.00	2.81
Library	18	Linear Fluorescent - T5: 4' T5 (28W) - 2L	Wall Switch	60	2,150	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,505	0.47	1,767	0.0	$289.76	$1,593.00	$250.00	4.63
Library Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,600	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,120	0.10	270	0.0	$44.30	$306.27	$60.00	5.56
Stairwell 6	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	8,760	Relamp	No	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	8,760	0.06	997	0.0	$163.56	$150.40	$30.00	0.74
Stairwell 5	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	8,760	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	8,760	0.04	665	0.0	$109.04	$117.00	$20.00	0.89
Elevator	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,150	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,150	0.02	82	0.0	$13.38	$58.50	$10.00	3.62
Elevator Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	500	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	500	0.02	19	0.0	$3.11	$58.50	$10.00	15.59

	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
2nd Basement	2	Incandescent: Standard 60W Bulbs	Wall Switch	60	600	Relamp	No	2	LED Screw-In Lamps: 9W LED Bulbs	Wall Switch	9	600	0.07	70	0.0	$11.54	$107.51	$10.00	8.45
Whole School	24	Exit Signs: LED - 2 W Lamp	None	6	8,760	None	No	24	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Whole School	13	Exit Signs: Incandescent	None	25	8,760	Fixture Replacement	No	13	LED Exit Signs: 2 W Lamp	None	2	8,760	0.20	3,012	0.0	$493.98	$1,398.22	$0.00	2.83
Exterior Front	4	Incandescent: Standard 60W Bulbs	None	60	4,380	Relamp	No	4	LED Screw-In Lamps: 9W LED Bulbs	None	9	4,380	0.13	1,028	0.0	$168.52	$215.01	$20.00	1.16
Exterior Front	1	Compact Fluorescent: 17W CFL Bulbs	None	17	4,380	Relamp	No	1	LED Screw-In Lamps: 9W LED Bulbs	None	12	4,380	0.00	25	0.0	$4.13	$23.31	$0.00	5.64
Exterior Front	4	Metal Halide: (1) 100W Lamp	None	128	4,380	Fixture Replacement	No	4	LED - Fixtures: Wall-Wash Lights	None	20	4,380	0.28	2,176	0.0	$356.86	$952.76	$120.00	2.33
Exterior Side	1	Metal Halide: (1) 100W Lamp	None	128	4,380	Fixture Replacement	No	1	LED - Fixtures: Wall-Wash Lights	None	20	4,380	0.07	544	0.0	$89.21	$238.19	$30.00	2.33
Exterior Back	9	Metal Halide: (1) 100W Lamp	None	128	4,380	Fixture Replacement	No	9	LED - Fixtures: Wall-Wash Lights	None	20	4,380	0.64	4,896	0.0	$802.93	$2,143.71	$270.00	2.33
Exterior Side	9	Metal Halide: (1) 100W Lamp	None	128	4,380	Fixture Replacement	No	9	LED - Fixtures: Wall-Wash Lights	None	20	4,380	0.64	4,896	0.0	$802.93	$2,143.71	$270.00	2.33
Parking Lot	3	Metal Halide: (1) 250W Lamp	None	295	4,380	Fixture Replacement	No	3	LED - Fixtures: Parking Garage Fixture	None	86	4,380	0.41	3,158	0.0	$517.94	$1,606.59	$300.00	2.52

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	Heating System / Newer Section	2	Heating Hot Water Pump	3.0	86.5%	No	1,373	Yes	89.5%	Yes	2	0.84	3,147	0.0	$516.03	$7,768.02	$0.00	15.05
Boiler Room	Steam System	2	Condenser Water Pump	0.3	77.0%	No	2,745	No	77.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Pneumatic Controls	2	Air Compressor	2.0	84.0%	No	4,957	No	84.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Gym	1	Exhaust Fan	1.0	82.5%	No	2,745	No	82.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Various Locations	5	Exhaust Fan	0.1	74.0%	No	2,745	No	74.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Various Locations	1	Exhaust Fan	2.5	82.0%	No	2,745	No	82.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Various Locations	3	Exhaust Fan	0.3	77.0%	No	2,745	No	77.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Various Locations	2	Supply Fan	7.5	89.5%	No	2,745	No	89.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Various Locations	1	Supply Fan	3.0	86.5%	No	2,745	No	86.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00

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
Bradford ES	Copy Rm & Wire Rm	2	Ductless Mini-Split AC	0.75		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Bradford ES	Rm 1	1	Window AC	0.83		Yes	1	Ductless Mini-Split AC	0.75		18.00		No	0.35	520	0.0	$85.35	$2,054.62	$0.00	24.07
Bradford ES	Rm 1	1	Window AC	0.83		Yes	1	Ductless Mini-Split AC	0.75		18.00		No	0.29	426	0.0	$69.85	$2,054.62	$0.00	29.41
Bradford ES	Rm 2	2	Window AC	0.83		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Bradford ES	Rm 3	1	Window AC	1.25		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Bradford ES	Rm 4	1	Window AC	1.00		Yes	1	Ductless Mini-Split AC	1.00		18.00		No	0.37	558	0.0	$91.48	$2,739.49	$0.00	29.95
Bradford ES	Rm 5	1	Window AC	1.25		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Bradford ES	Rm 6	1	Window AC	1.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Bradford ES	Rm 7	1	Window AC	0.83		Yes	1	Ductless Mini-Split AC	0.75		18.00		No	0.35	520	0.0	$85.35	$2,054.62	$0.00	24.07
Bradford ES	Rm 5A	1	Packaged Terminal AC	1.22		Yes	1	Ductless Mini-Split AC	1.00		18.00		No	0.51	765	0.0	$125.41	$2,739.49	$0.00	21.84
Bradford ES	Rm 17	1	Window AC	0.83		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Bradford ES	Rm18	1	Window AC	1.25		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Bradford ES	Rm 19	1	Window AC	1.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Bradford ES	Rm 20	1	Window AC	1.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Bradford ES	Main Office	1	Window AC	1.25		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Bradford ES	Nurse's Office	1	Window AC	0.67		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Bradford ES	Principal's Office	1	Window AC	1.25		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Bradford ES	Teacher's Lounge	1	Window AC	1.25		Yes	1	Ductless Mini-Split AC	1.25		18.00		No	0.48	713	0.0	$116.94	$3,424.37	$0.00	29.28
Bradford ES	Roof - RTU#1	1	Packaged AC	40.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Bradford ES	Roof - RTU#2	1	Packaged AC	13.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

		Existing Conditions				Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	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
Bradford ES	Roof - RTU#3	1	Split-System 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
Bradford ES	Whole School	2	Natural Draft Steam Boiler	2,274.45	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
1st Flr Water Heater Closet	1st Floor	1	Storage Tank Water Heater (> 50 Gal)	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
2nd Floor	2nd Floor	1	Storage Tank Water Heater (> 50 Gal)	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00

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	2	Stand-Up Refrigerator, Solid Door (31 - 50 cu. ft.)	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Break Room	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

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 (Half Size)	Yes	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Plug Load Inventory

	Existing Conditions			
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
Bradford ES	80	Desktop Computer + Monitor	150.0	Yes
Bradford ES	6	TVs (med. CRT)	150.0	No
Bradford ES	7	Printers (sm.)	80.0	Yes
Bradford ES	3	Copy Machine (Lg.)	240.0	Yes
Bradford ES	1	Server Rack	360.0	No
Bradford ES	3	Microwave Ovens (med.)	1,000.0	No
Bradford ES	22	Smart Boards	316.0	No

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
Teachers' Lounge	1	Refrigerated	Yes	0.00	1,612	0.0	$264.34	$230.00	$0.00	0.87

Appendix B: ENERGY STAR® Statement of Energy Performance

ENERGY STAR® Statement of Energy Performance

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ENERGY STAR® Score[1]

Bradford Elementary School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 58,129
Built: 1927

For Year Ending: April 30, 2016
Date Generated: December 25, 2017

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
Bradford Elementary School 87 Mt. Hebron Road Montclair, New Jersey 07042	Montclair Board of Education 22 Valley Road Montclair, NJ 07042 (973) 509-4050	Steve DiGeronimo 22 Valley Road Montclair, NJ 07042 (973) 509-4050 bfleischer@montclair.k12.nj.us

Property ID: 5724465

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
56.8 kBtu/ft²

Source EUI
100.7 kBtu/ft²

Annual Energy by Fuel	
Electric - Grid (kBtu)	1,141,148 (34%)
Natural Gas (kBtu)	2,163,240 (66%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	65.6
National Median Source EUI (kBtu/ft²)	116.2
% Diff from National Median Source EUI	-13%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	242

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)