



# Local Government Energy Audit: Energy Audit Report



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## ***Berkeley Elementary School***

35 Berkeley Ave

Westwood, New Jersey 07676

**Westwood Regional School District**

October 4, 2018

Final Report by:

**TRC Energy Services**

## Disclaimer

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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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# I EXECUTIVE SUMMARY

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The New Jersey Board of Public Utilities (NJBP) has sponsored this Local Government Energy Audit (LGEA) Report for Berkeley Elementary School.

The goal of an LGEA report is to provide public facilities and local governments with valuable information on their facilities' energy usage. Each LGEA report includes specific energy conservation measures (ECMs) and energy management options, which have been determined to be likely to benefit that facility. The LGEA report also contains valuable information on financial incentives from New Jersey's Clean Energy Program (NJCEP) and other sources which may be available to assist with ECM implementation.

This study was conducted by TRC Energy Services (TRC), as part of a comprehensive effort to assist New Jersey school districts in controlling energy costs and help protect our environment by promoting more efficient use of energy resources statewide.

## I.1 Facility Summary

Berkeley Elementary School is a 39,590 square foot, three story facility comprised of classroom space, gym, kitchen, cafeteria, auditorium and a library. The building is occupied between 6:00 AM and 6:00 PM Monday through Friday and the gymnasium stays open until 10:00 PM. The building has some use on Saturdays for school activities and the larger spaces are rented out to outside organizations between 8:00 AM and 3:00 PM. There is little to no occupancy on Sundays.

The main maintenance concern of the facility is the high bay lighting in the gymnasium. These are aging and inefficient light fixtures which are in need of replacement. A thorough description of the facility and our observations are located in Section 2.

## I.2 Your Cost Reduction Opportunities

### Energy Conservation Measures

TRC evaluated 12 energy conservation measures and recommended ten. The recommended measures represent an opportunity for Berkeley Elementary School to reduce its annual energy costs by \$17,698 and its annual greenhouse gas emissions by 130,958 lbs CO<sub>2</sub>e. We estimate that if all measures are implemented as recommended, the project would pay for itself in energy savings in 7.6 years. A breakdown of current utility costs is shown in Figure 1. The estimated reduction in utility costs for the proposed measures is shown in Figure 2. Together these measures represent an opportunity to reduce Berkeley Elementary School's annual energy use by 31% overall.

Figure 1 – Previous 12 Month Utility Costs

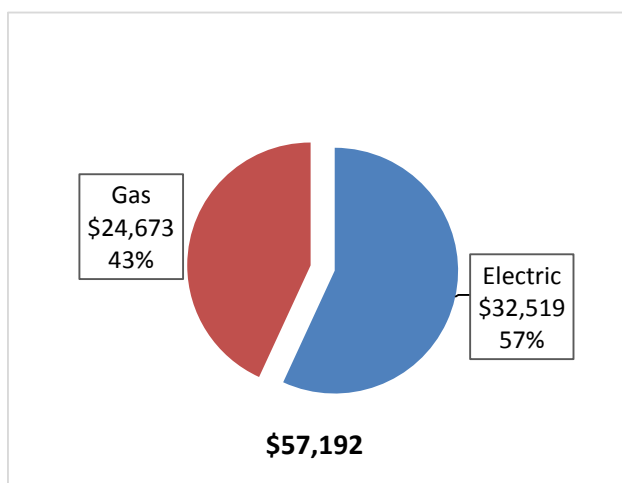
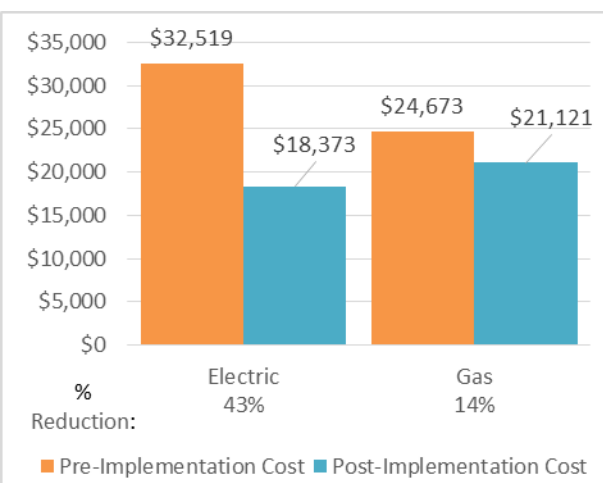


Figure 2 – Potential Post-Implementation Costs



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

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

Figure 3 – Summary of Energy Reduction Opportunities

Energy Conservation Measure	Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Natural Gas Savings (MMBtu)	Annual N/A Savings (MMBtu)	Annual N/A Savings (MMBtu)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO <sub>2</sub> e Reduction (lbs)
<b>Lighting Upgrades</b>		<b>69,069</b>	<b>16.5</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>\$11,101.01</b>	<b>\$109,334.95</b>	<b>\$10,165.00</b>	<b>\$99,169.95</b>	<b>8.9</b>	<b>69,552</b>
ECM 1 Install LED Fixtures	Yes	14,229	2.5	0.0	0.0	0.0	0.0	\$2,286.93	\$71,848.65	\$4,265.00	\$67,583.65	29.6	14,328
ECM 2 Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	697	0.2	0.0	0.0	0.0	0.0	\$111.99	\$647.33	\$0.00	\$647.33	5.8	702
ECM 3 Retrofit Fixtures with LED Lamps	Yes	54,143	13.8	0.0	0.0	0.0	0.0	\$8,702.09	\$36,838.97	\$5,900.00	\$30,938.97	3.6	54,522
<b>Lighting Control Measures</b>		<b>15,747</b>	<b>3.1</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>\$2,530.94</b>	<b>\$20,814.00</b>	<b>\$2,670.00</b>	<b>\$18,144.00</b>	<b>7.2</b>	<b>15,857</b>
ECM 4 Install Occupancy Sensor Lighting Controls	Yes	15,005	3.0	0.0	0.0	0.0	0.0	\$2,411.59	\$20,004.00	\$2,670.00	\$17,334.00	7.2	15,109
ECM 5 Install Photocell Controls	Yes	743	0.0	0.0	0.0	0.0	0.0	\$119.35	\$810.00	\$0.00	\$810.00	6.8	748
<b>Electric Unitary HVAC Measures</b>		<b>1,184</b>	<b>0.8</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>\$190.29</b>	<b>\$3,946.76</b>	<b>\$0.00</b>	<b>\$3,946.76</b>	<b>20.7</b>	<b>1,192</b>
Install High Efficiency Electric AC	No	1,184	0.8	0.0	0.0	0.0	0.0	\$190.29	\$3,946.76	\$0.00	\$3,946.76	20.7	1,192
<b>HVAC System Improvements</b>		<b>8,048</b>	<b>0.0</b>	<b>81.5</b>	<b>0.0</b>	<b>0.0</b>	<b>81.5</b>	<b>\$2,094.52</b>	<b>\$43,814.75</b>	<b>\$0.00</b>	<b>\$43,814.75</b>	<b>20.9</b>	<b>17,651</b>
Install Programmable Thermostats and EC Motors	No	8,048	0.0	81.5	0.0	0.0	81.5	\$2,094.52	\$43,814.75	\$0.00	\$43,814.75	20.9	17,651
<b>Domestic Water Heating Upgrade</b>		<b>0</b>	<b>0.0</b>	<b>1.8</b>	<b>0.0</b>	<b>0.0</b>	<b>1.8</b>	<b>\$18.00</b>	<b>\$64.53</b>	<b>\$0.00</b>	<b>\$64.53</b>	<b>3.6</b>	<b>215</b>
ECM 6 Install Low-Flow Domestic Hot Water Devices	Yes	0	0.0	1.8	0.0	0.0	1.8	\$18.00	\$64.53	\$0.00	\$64.53	3.6	215
<b>Food Service Equipment &amp; Refrigeration Measures</b>		<b>1,514</b>	<b>0.1</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>\$243.34</b>	<b>\$2,496.00</b>	<b>\$150.00</b>	<b>\$2,346.00</b>	<b>9.6</b>	<b>1,525</b>
ECM 7 Replace Refrigeration Equipment	Yes	1,514	0.1	0.0	0.0	0.0	0.0	\$243.34	\$2,496.00	\$150.00	\$2,346.00	9.6	1,525
<b>Custom Measures</b>		<b>1,681</b>	<b>0.0</b>	<b>359.7</b>	<b>0.0</b>	<b>0.0</b>	<b>359.7</b>	<b>\$3,804.27</b>	<b>\$14,650.00</b>	<b>\$0.00</b>	<b>\$14,650.00</b>	<b>3.9</b>	<b>43,810</b>
ECM 8 Computer Power Management Software	Yes	1,681	0.0	0.0	0.0	0.0	0.0	\$270.20	\$3,190.00	\$0.00	\$3,190.00	11.8	1,693
ECM 9 Building Envelope Weatherization	Yes	0	0.0	71.9	0.0	0.0	71.9	\$706.81	\$2,790.00	\$0.00	\$2,790.00	3.9	8,423
ECM 10 Steam Trap Survey and Replacements	Yes	0	0.0	287.8	0.0	0.0	287.8	\$2,827.26	\$8,670.00	\$0.00	\$8,670.00	3.1	33,694
<b>TOTALS FOR HIGH PRIORITY MEASURES</b>		<b>88,011</b>	<b>19.6</b>	<b>361.5</b>	<b>0.0</b>	<b>0.0</b>	<b>361.5</b>	<b>\$17,697.56</b>	<b>\$147,359.48</b>	<b>\$12,985.00</b>	<b>\$134,374.48</b>	<b>7.6</b>	<b>130,958</b>
<b>TOTALS FOR ALL EVALUATED MEASURES</b>		<b>97,243</b>	<b>20.4</b>	<b>443.1</b>	<b>0.0</b>	<b>0.0</b>	<b>443.1</b>	<b>\$19,982.37</b>	<b>\$195,120.98</b>	<b>\$12,985.00</b>	<b>\$182,135.98</b>	<b>9.1</b>	<b>149,801</b>

**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.

**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 conditioning systems at a reduced energy cost. These measures save energy by reducing the power used by the air conditioning systems, due to improved electrical efficiency.

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

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

**Food Service Equipment & Refrigeration** measures generally involve improvements in the efficiency of cooking, food service, dishwashing, and food storage equipment. These measures may include more efficient convection ovens, steamers, ice machines, or refrigeration. These measures save energy by reducing the energy usage with more energy efficient equipment.

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

### **Energy Efficient Practices**

TRC also identified 13 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 operation and maintenance costs (O&M). Potential opportunities identified at Berkeley Elementary School include:

- Reduce Air Leakage
- Close Doors and Windows
- Perform Proper Lighting Maintenance
- Develop a Lighting Maintenance Schedule
- Perform Routine Motor Maintenance
- Use Fans to Reduce Cooling Load
- Install De-stratification Fans
- Clean Evaporator/Condenser Coils on AC Systems
- Clean and/or Replace HVAC Filters
- Perform Proper Boiler Maintenance
- Perform Proper Water Heater Maintenance
- Install Plug Load Controls
- 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 Berkeley Elementary School. Based on the configuration of the site and its loads there is a low potential for installing any PV and combined heat and power self-generation measures.

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

### I.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
- 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 8.3 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. You may also check the following website for more details: [www.njcleanenergy.com/ci](http://www.njcleanenergy.com/ci).

## 2 FACILITY INFORMATION AND EXISTING CONDITIONS

### 2.1 Project Contacts

*Figure 4 – Project Contacts*

Name	Role	E-Mail	Phone #
<b>Customer</b>			
John Baumann	Director of Buildings and Grounds	john.baumann@wwrsd.org	201-664-0880 ext 2010
Keith Rosado	School Business Administrator / Board Secretary	keith.rosado@wwrsd.org	201-664-0880 ext 2004
<b>TRC Energy Services</b>			
Aimee Lalonde	Auditor	alalonde@trcsolutions.com	(732) 855-0033

### 2.2 General Site Information

On July 21, 2017, TRC performed an energy audit at Berkeley Elementary School located in Westwood, New Jersey. TRC’s team met with John Baumann, Director of Buildings and Grounds to review the facility operations and help focus our investigation on specific energy-using systems.

Berkeley Elementary School is a 39,590 square foot facility, three-story building comprised of classroom space, gym, kitchen, cafeteria, auditorium and library. The building was constructed in 1929. The major concern at this building are the old HID high bay fixtures in the gymnasium.

### 2.3 Building Occupancy

The building is occupied between 6:00 AM and 6:00 PM Monday through Friday and the gymnasium stays open until 10:00 PM. The building has some use on Saturdays for school activities and the larger spaces are rented out to outside organizations between 8:00 AM and 3:00 PM. There is little to no occupancy on Sundays. The typical schedule is presented in the table below. During a typical day, the facility is occupied by 293 students and 44 staff members.

*Figure 5 - Building Schedule*

Building Name	Weekday/Weekend	Operating Schedule
Berkeley Elementary School	Weekday	6AM to 6PM
Berkeley Elementary School	Weekend	8AM to 3PM
Gym	Weekday	6AM to 10PM
Gym	Weekend	8AM to 3PM

## 2.4 Building Envelope

The building is constructed of concrete block with a brick facade. The building has flat roof sections and a pitched roof section which all appear to be in fair condition. The building has double-pane windows, which are operable with metal or wooden frames. The perimeter of window frames are in poor condition and are showing signs of excessive infiltration. The exterior doors are constructed of metal with metal frames and are in fair condition. The door seals have worn or missing weather-stripping materials which increases the level of outside air infiltration. There is an opportunity for energy savings by caulking the perimeter of window frames and installing weather-stripping to exterior doors.



## 2.5 On-Site Generation

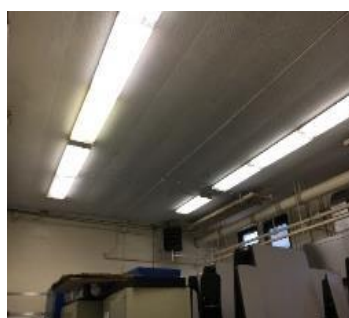
Berkeley Elementary School does not have any on-site electric generation capacity.

## 2.6 Energy-Using Systems

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

### Lighting System

Lighting at the facility is provided mostly by fixtures with 32-Watt linear fluorescent T8 lamps and electronic ballasts as well as some incandescent lamp fixtures. There are T12 lamp fixtures in the maintenance shop. The fixtures are generally in good condition, however, a few in poor condition should be replaced. The light fixtures throughout the building are controlled manually via wall switches. Majority of classrooms have bi-level switching. There is an opportunity for energy savings by upgrading to LED technology and installing occupancy based sensors in designated locations.





The gymnasium is illuminated by metal halide high bay fixtures which are in poor condition. There is an opportunity for energy savings by replacing these one for one with reduced wattage LED high bay fixtures equipped with occupancy based controls.

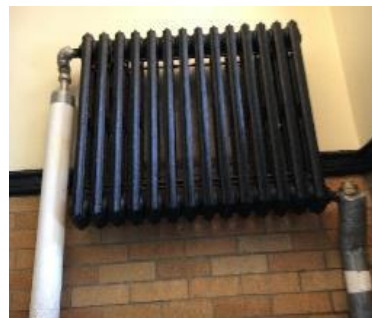
The exterior lighting includes metal halide, compact fluorescent lamp (CFL) and LED fixtures. A majority of these fixtures are controlled by a timeclock, however they were noted to be on during the day. The timeclock is not operating correctly.



### **Steam Heating System**

The steam system consists of two HB Smith cast iron boilers with a minimum output of 925 MBH and maximum output of 2,776 MBH. The boilers have a nominal combustion efficiency of approximately 83%. Each boiler has a 1 HP forced draft fan with discharge dampers to control the volume of combustion air. The boilers have industrial combustion controls which allow for modulating burner capabilities.

The boilers operate in a lead/lag configuration. Only a single boiler is required to meet the facility heating demand. Steam is supplied directly to radiators and unit ventilators throughout the building. The boilers are five years old and in fair condition.



The unit ventilators have fractional horsepower supply fan motors which are controlled by manual dial thermostats located in the zones. There is an opportunity for energy savings by replacing all of these with programmable thermostats.



### **Air Conditioning**

Some of the classrooms are cooled by window air-conditioning (AC) units, half of which are in good condition and higher efficiency. The remainder are older low efficiency units in fair condition. Window air conditioning units are manually turned on and off as needed throughout the summer months. There is an opportunity for energy savings by replacing these older units with new ENERGY STAR® high efficiency window AC Units. Also, there is a split system that conditions the IT room year round and is controlled by a programmable thermostat that is located in the server space.



## Domestic Hot Water Heating System

The domestic hot water heating system for the facility consists of a gas-fired non-condensing storage tank water heater with an input rating of 125 kBtu/hr and a nominal efficiency of 80%. The tank is 60 gallons in capacity and is in good condition. A fractional horsepower recirculation pump and motor distribute 140°F water to the sinks and restrooms throughout the building. Sink aerators throughout have higher low restrictors (2.0 gallons per minute [gpm] or higher).



## Food Service Equipment

The school has gas-fired oven and electric holding cabinets. The kitchen is used to warm up and serve lunch every school day. The equipment is in fair condition and there are no recommendations for improvement.

## Refrigeration

The kitchen has a number of refrigerators and freezers that are all in good condition. There are also refrigerators in the lounge, maintenance shop and a classroom. These were noted to be mostly empty, and there is an opportunity for energy savings by replacing these with ENERGY STAR® equipment.



## Building Plug Load

There are roughly 46 computers throughout the building. There is no centralized PC power management software installed. Plug loads in the building also include general office and café equipment. Additionally there are many circulating fans and smart boards in the classroom spaces. There is a non-refrigerated snack vending machine located in the lounge.

## 2.7 Water-Using Systems

The restrooms throughout the building have sinks with higher flow restrictors. A sampling of restrooms found that the faucets are rated for 2.0 gpm or higher. There is an opportunity for energy savings by replacing these with low flow aerators.

### 3 SITE ENERGY USE AND COSTS

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

#### 3.1 Total Cost of Energy

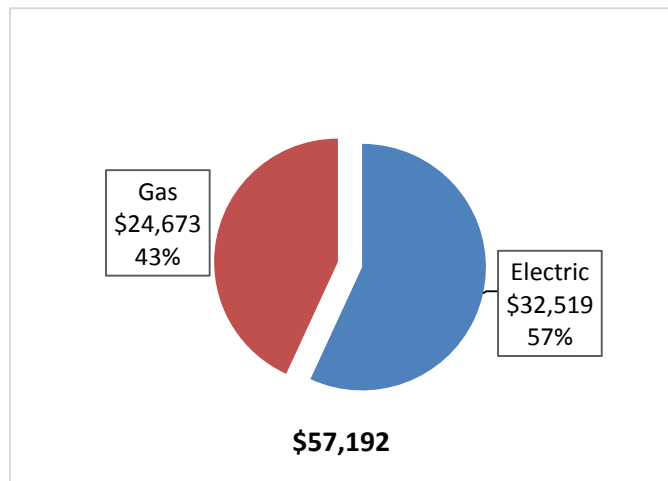
The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. A profile of the annual energy consumption and energy cost of the facility was developed from this information.

*Figure 6 - Utility Summary*

Utility Summary for Berkeley Elementary School		
Fuel	Usage	Cost
Electricity	202,326 kWh	\$32,519
Natural Gas	25,113 Therms	\$24,673
<b>Total</b>		<b>\$57,192</b>

The current annual energy cost for this facility is \$57,192 as shown in the chart below.

*Figure 7 - Energy Cost Breakdown*





### 3.2 Electricity Usage

Electricity is provided by PSE&G. The average electric rate over a recent 12-month period was \$0.161/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 facility pays electric demand charges. The monthly electricity consumption and peak demand are shown in the chart below. The relatively high summer power demand is typical for year round operation for buildings with a significant cooling load.

Figure 8 - Electric Usage & Demand

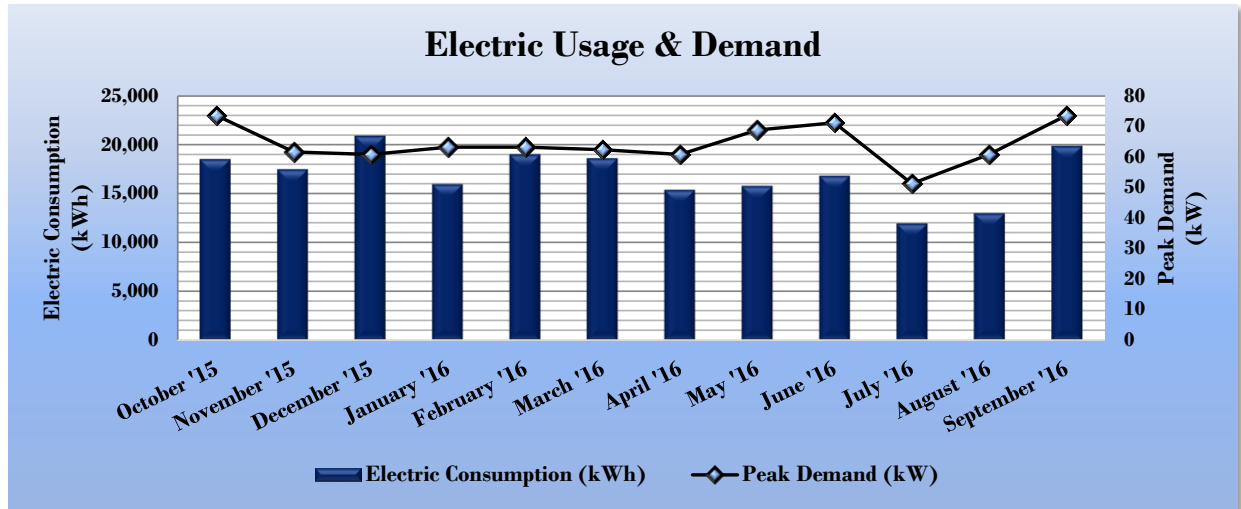


Figure 9 - Electric Usage & Demand

Electric Billing Data for Berkeley Elementary School					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
10/27/15	29	18,480	74	\$1,076	\$2,696
11/25/15	29	17,440	62	\$1,024	\$2,553
12/30/15	35	20,880	61	\$1,020	\$2,828
1/29/16	30	15,920	63	\$1,004	\$2,398
2/29/16	31	18,960	63	\$1,004	\$2,629
3/30/16	30	18,560	62	\$1,051	\$2,669
4/28/16	29	15,360	61	\$1,045	\$2,371
5/27/16	29	15,760	69	\$1,080	\$2,371
6/28/16	32	16,800	71	\$1,760	\$3,286
7/29/16	31	11,920	51	\$1,521	\$2,589
8/29/16	31	12,960	61	\$1,642	\$2,754
9/28/16	30	19,840	74	\$1,815	\$3,465
<b>Totals</b>	<b>366</b>	<b>202,880</b>	<b>73.6</b>	<b>\$15,043</b>	<b>\$32,608</b>
<b>Annual</b>	<b>365</b>	<b>202,326</b>	<b>73.6</b>	<b>\$15,002</b>	<b>\$32,519</b>

### 3.3 Natural Gas Usage

Natural gas is provided by PSE&G. The average natural gas rate over a recent 12-month period was found to be \$0.982/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is shown in the chart below. The high winter use typifies a predominant heating-driven gas use profile.

Figure 10 - Natural Gas Usage

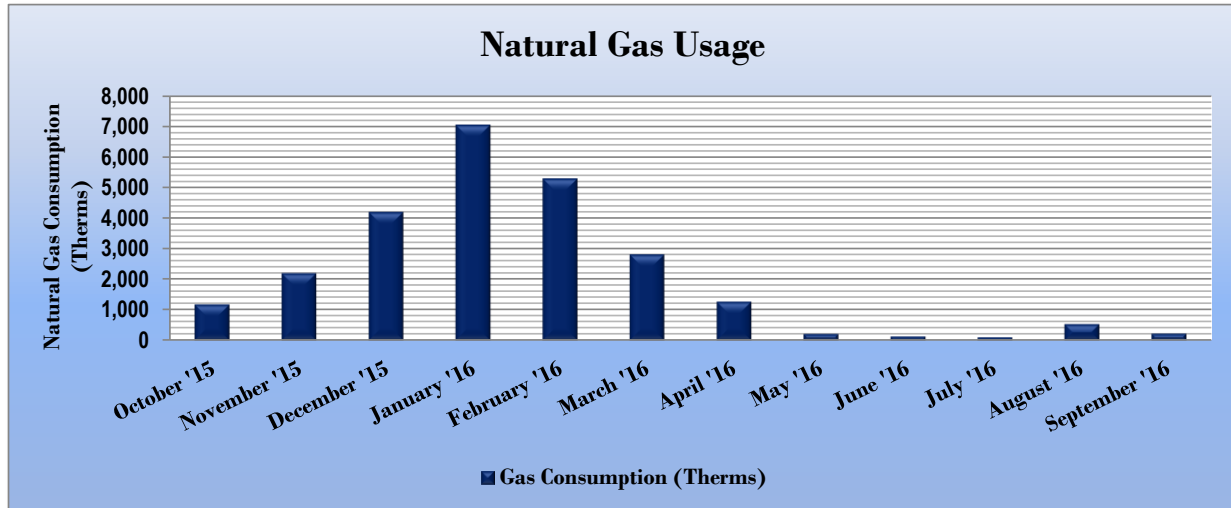


Figure 11 - Natural Gas Usage

Gas Billing Data for Berkeley Elementary School			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
10/27/15	29	1,171	\$734
11/25/15	29	2,200	\$2,356
12/30/15	35	4,205	\$7,361
1/29/16	30	7,060	\$5,312
2/29/16	31	5,295	\$4,200
3/30/16	30	2,808	\$2,706
4/28/16	29	1,262	\$789
5/27/16	29	210	\$221
6/28/16	32	124	\$174
7/29/16	31	96	\$159
8/29/16	31	532	\$395
9/28/16	30	218	\$333
<b>Totals</b>	<b>366</b>	<b>25,182</b>	<b>\$24,741</b>
<b>Annual</b>	<b>365</b>	<b>25,113</b>	<b>\$24,673</b>

### 3.4 Benchmarking

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

The EUI is a measure of a facility’s energy consumption per square foot, and it is the standard metric for comparing buildings’ energy performance. Comparing the EUI of a building with the national median EUI for that building type illustrates whether that building uses more or less energy than similar buildings of its type on a square foot basis. EUI is presented in terms of “site energy” and “source energy.” Site energy is the amount of fuel and electricity consumed by a building as reflected in utility bills. Source energy includes fuel consumed to generate electricity consumed at the site, factoring in electric production and distribution losses for the region.

**Figure 12 - Energy Use Intensity Comparison – Existing Conditions**

Energy Use Intensity Comparison - Existing Conditions		
	Berkeley Elementary School	National Median Building Type: School (K-12)
Source Energy Use Intensity (kBtu/ft <sup>2</sup> )	121.4	141.4
Site Energy Use Intensity (kBtu/ft <sup>2</sup> )	80.9	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 13 - Energy Use Intensity Comparison – Following Installation of Recommended Measures**

Energy Use Intensity Comparison - Following Installation of Recommended Measures		
	Berkeley Elementary School	National Median Building Type: School (K-12)
Source Energy Use Intensity (kBtu/ft <sup>2</sup> )	88.0	141.4
Site Energy Use Intensity (kBtu/ft <sup>2</sup> )	64.2	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% of all similar buildings nationwide and may be eligible for ENERGY STAR® certification. Your building is not is one of the building categories that are eligible to receive a score. 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.

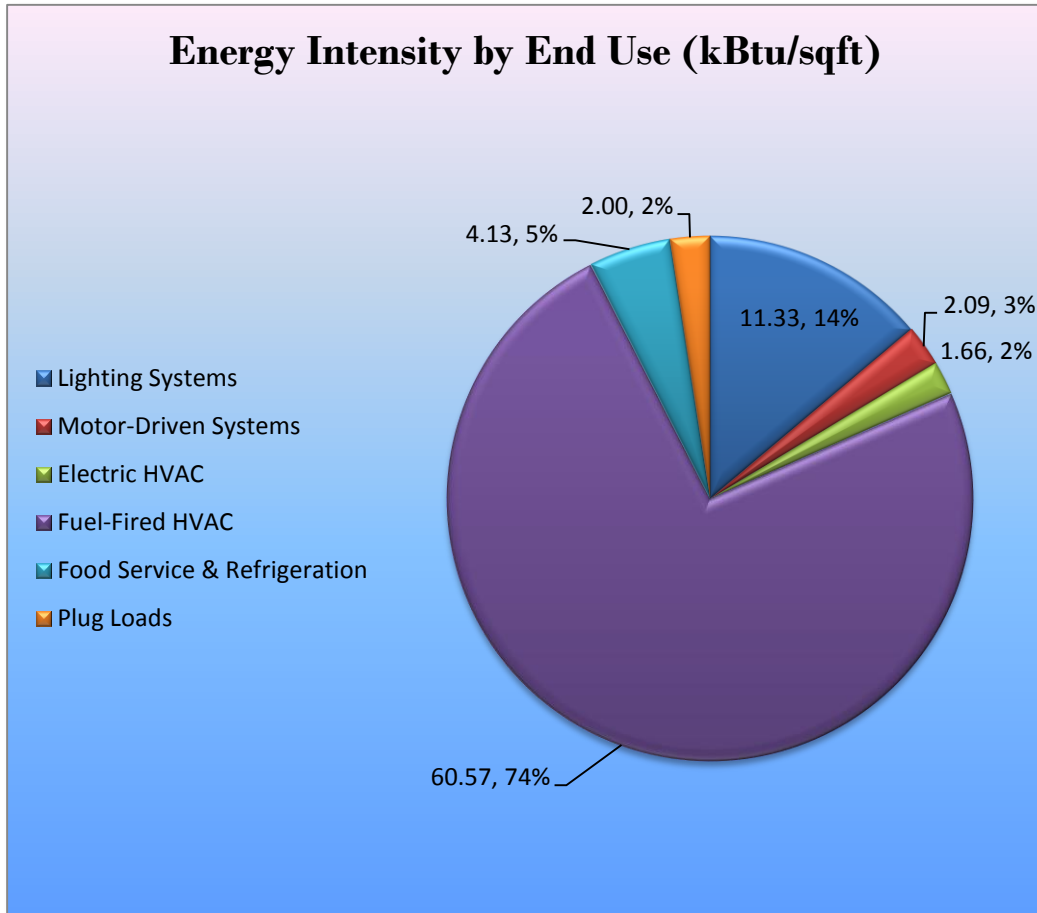
For more information on ENERGY STAR® certification go to: <https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1>.

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 14 - Energy Balance (% and kBtu/SF)



## 4 ENERGY CONSERVATION MEASURES

### Level of Analysis

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

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

*Figure 15 – Summary of Recommended ECMs*

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO <sub>2</sub> e Emissions Reduction (lbs)
<b>Lighting Upgrades</b>		<b>69,069</b>	<b>16.5</b>	<b>0.0</b>	<b>\$11,101.01</b>	<b>\$109,334.95</b>	<b>\$10,165.00</b>	<b>\$99,169.95</b>	<b>8.9</b>	<b>69,552</b>
ECM 1	Install LED Fixtures	14,229	2.5	0.0	\$2,286.93	\$71,848.65	\$4,265.00	\$67,583.65	29.6	14,328
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	697	0.2	0.0	\$111.99	\$647.33	\$0.00	\$647.33	5.8	702
ECM 3	Retrofit Fixtures with LED Lamps	54,143	13.8	0.0	\$8,702.09	\$36,838.97	\$5,900.00	\$30,938.97	3.6	54,522
<b>Lighting Control Measures</b>		<b>15,747</b>	<b>3.1</b>	<b>0.0</b>	<b>\$2,530.94</b>	<b>\$20,814.00</b>	<b>\$2,670.00</b>	<b>\$18,144.00</b>	<b>7.2</b>	<b>15,857</b>
ECM 4	Install Occupancy Sensor Lighting Controls	15,005	3.0	0.0	\$2,411.59	\$20,004.00	\$2,670.00	\$17,334.00	7.2	15,109
ECM 5	Install Daylight Dimming Controls	743	0.0	0.0	\$119.35	\$810.00	\$0.00	\$810.00	6.8	748
<b>Domestic Water Heating Upgrade</b>		<b>0</b>	<b>0.0</b>	<b>1.8</b>	<b>\$18.00</b>	<b>\$64.53</b>	<b>\$0.00</b>	<b>\$64.53</b>	<b>3.6</b>	<b>215</b>
ECM 6	Install Low-Flow Domestic Hot Water Devices	0	0.0	1.8	\$18.00	\$64.53	\$0.00	\$64.53	3.6	215
<b>Food Service Equipment &amp; Refrigeration Measures</b>		<b>1,514</b>	<b>0.1</b>	<b>0.0</b>	<b>\$243.34</b>	<b>\$2,496.00</b>	<b>\$150.00</b>	<b>\$2,346.00</b>	<b>9.6</b>	<b>1,525</b>
ECM 7	Replace Refrigeration Equipment	1,514	0.1	0.0	\$243.34	\$2,496.00	\$150.00	\$2,346.00	9.6	1,525
<b>Custom Measures</b>		<b>1,681</b>	<b>0.0</b>	<b>359.7</b>	<b>\$3,804.27</b>	<b>\$14,650.00</b>	<b>\$0.00</b>	<b>\$14,650.00</b>	<b>3.9</b>	<b>43,810</b>
ECM 8	Computer Power Management Software	1,681	0.0	0.0	\$270.20	\$3,190.00	\$0.00	\$3,190.00	11.8	1,693
ECM 9	Building Envelope Weatherization	0	0.0	71.9	\$706.81	\$2,790.00	\$0.00	\$2,790.00	3.9	8,423
ECM 10	Steam Trap Survey and Replacements	0	0.0	287.8	\$2,827.26	\$8,670.00	\$0.00	\$8,670.00	3.1	33,694
<b>TOTALS</b>		<b>88,011</b>	<b>19.6</b>	<b>361.5</b>	<b>\$17,697.56</b>	<b>\$147,359.48</b>	<b>\$12,985.00</b>	<b>\$134,374.48</b>	<b>7.6</b>	<b>130,958</b>

## 4.1.1 Lighting Upgrades

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

*Figure 16 – Summary of Lighting Upgrade ECMs*

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)	Estimated Net Cost (\$)	Simple Payback Period (yrs)	CO <sub>2</sub> e Emissions Reduction (lbs)
<b>Lighting Upgrades</b>		<b>69,069</b>	<b>16.5</b>	<b>0.0</b>	<b>\$11,101.01</b>	<b>\$109,334.95</b>	<b>\$10,165.00</b>	<b>\$99,169.95</b>	<b>8.9</b>	<b>69,552</b>
ECM 1	Install LED Fixtures	14,229	2.5	0.0	\$2,286.93	\$71,848.65	\$4,265.00	\$67,583.65	29.6	14,328
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	697	0.2	0.0	\$111.99	\$647.33	\$0.00	\$647.33	5.8	702
ECM 3	Retrofit Fixtures with LED Lamps	54,143	13.8	0.0	\$8,702.09	\$36,838.97	\$5,900.00	\$30,938.97	3.6	54,522

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 <sub>2</sub> e Emissions Reduction (lbs)
Interior	12,793	2.3	0.0	\$2,056.18	\$70,893.49	\$4,155.00	\$66,738.49	32.5	12,883
Exterior	1,436	0.2	0.0	\$230.75	\$955.16	\$110.00	\$845.16	3.7	1,446

#### *Measure Description*

We recommend replacing the metal halide high bay fixtures in the gym one-for-one with new LED high bay fixtures. This measure includes the replacement of fixtures and assumes the ability to reuse the existing mounting configuration. The existing lamps frequently burn out and the maintenance is problematic due to the need to use a lift. The proposed fixtures are new high performance LEDs which have much longer lifespans. Therefore, this measure saves energy by reducing the electrical demand. The new gymnasium light fixtures will improve light output as well as significantly reduce required maintenance.

This measure also recommends replacing the linear fluorescent fixtures that are in poor condition in the lounge and stairwell with new LED fixtures and replacing the exterior HID fixtures with LED fixtures. This measure saves energy by installing LEDs which use less power than other technologies with a comparable or improved light output. Additional savings from lighting maintenance can be anticipated since LEDs have lifetimes which are more than twice than older technologies.

The measure includes the replacement of exterior metal halide light fixtures with new LED sources. This measure is recommended based on the energy savings potential as well as the condition of the existing interior fixtures. The fixtures included in this measure are in poor condition and/or were missing lenses.

## **ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers**

### *Summary of Measure Economics*

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)	Estimated Net Cost (\$)	Simple Payback Period (yrs)	CO <sub>2</sub> e Emissions Reduction (lbs)
Interior	697	0.2	0.0	\$111.99	\$647.33	\$0.00	\$647.33	5.8	702
Exterior	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	0.0	0

### *Measure Description*

We recommend retrofitting existing fluorescent fixtures by removing fluorescent tubes and ballasts and replacing them with LEDs and LED drivers (if necessary), which are designed to be used retrofitted fluorescent fixtures. The measure uses the existing fixture housing but replaces the rest of the components with more efficient lighting technology. This measure saves energy by installing LEDs which use less power than other lighting technologies yet provide equivalent lighting output for the space.

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

## **ECM 3: Retrofit Fixtures with LED Lamps**

### *Summary of Measure Economics*

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)	Estimated Net Cost (\$)	Simple Payback Period (yrs)	CO <sub>2</sub> e Emissions Reduction (lbs)
Interior	53,723	13.7	0.0	\$8,634.51	\$36,408.94	\$5,900.00	\$30,508.94	3.5	54,098
Exterior	420	0.0	0.0	\$67.58	\$430.02	\$0.00	\$430.02	6.4	423

### *Measure Description*

We recommend retrofitting existing incandescent, halogen, compact fluorescent and T8 lighting technologies with LED lamps. Many LED tube lamps are direct replacements for existing fluorescent lamps and can be installed while leaving the fluorescent fixture ballast in place. LED bulbs can be used in existing fixtures as a direct replacement for most other lighting technologies. This measure saves energy by installing LEDs which use less power than other lighting technologies yet provide equivalent lighting output for the space.

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

## 4.1.2 Lighting Control Measures

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

*Figure 17 – Summary of Lighting Control ECMs*

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)	Estimated Net Cost (\$)	Simple Payback Period (yrs)	CO <sub>2</sub> e Emissions Reduction (lbs)
<b>Lighting Control Measures</b>		<b>15,747</b>	<b>3.1</b>	<b>0.0</b>	<b>\$2,530.94</b>	<b>\$20,814.00</b>	<b>\$2,670.00</b>	<b>\$18,144.00</b>	<b>7.2</b>	<b>15,857</b>
ECM 4	Install Occupancy Sensor Lighting Controls	15,005	3.0	0.0	\$2,411.59	\$20,004.00	\$2,670.00	\$17,334.00	7.2	15,109
ECM 5	Install Daylight Dimming Controls	743	0.0	0.0	\$119.35	\$810.00	\$0.00	\$810.00	6.8	748

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 <sub>2</sub> e Emissions Reduction (lbs)
15,005	3.0	0.0	\$2,411.59	\$20,004.00	\$2,670.00	\$17,334.00	7.2	15,109

#### *Measure Description*

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

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



## **ECM 5: Install Photocell 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 <sub>2</sub> e Emissions Reduction (lbs)
743	0.0	0.0	\$119.35	\$810.00	\$0.00	\$810.00	6.8	748

### *Measure Description*

We recommend installing photocell controls that use photo sensors to reduce electric lighting run hours for exterior light fixtures during the daytime. This will limit the operation of exterior fixtures to dusk to dawn hours.

### 4.1.3 Domestic Hot Water Heating System Upgrades

Our recommendation for domestic hot water heating system improvements are summarized in Figure 18 below.

*Figure 18 - Summary of Domestic Water Heating ECMs*

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)	Estimated Net Cost (\$)	Simple Payback Period (yrs)	CO <sub>2</sub> e Emissions Reduction (lbs)
<b>Domestic Water Heating Upgrade</b>		<b>0</b>	<b>0.0</b>	<b>1.8</b>	<b>\$18.00</b>	<b>\$64.53</b>	<b>\$0.00</b>	<b>\$64.53</b>	<b>3.6</b>	<b>215</b>
ECM 8	Install Low-Flow Domestic Hot Water Devices	0	0.0	1.8	\$18.00	\$64.53	\$0.00	\$64.53	3.6	215

#### **ECM 6: Install Low-Flow DHW Devices**

*Summary of Measure Economics*

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)	Estimated Net Cost (\$)	Simple Payback Period (yrs)	CO <sub>2</sub> e Emissions Reduction (lbs)
0	0.0	1.8	\$18.00	\$64.53	\$0.00	\$64.53	3.6	215

*Measure Description*

We recommend installing low-flow domestic hot water devices to reduce overall hot water demand. Energy demand from domestic hot water heating systems can be reduced by reducing water usage in general. Low-flow faucet aerators can reduce hot water usage, relative to standard aerators, which saves energy. Low-flow devices reduce the overall water flow from the fixture, while still providing adequate pressure for washing. This reduces the amount of water used per day resulting in energy and water savings.

#### 4.1.4 Food Service Equipment & Refrigeration Measures

Our recommendation for upgrades for food service and refrigeration measures is summarized in Figure 19 below.

*Figure 19 - Summary of Food Service Equipment & Refrigeration 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 <sub>2</sub> e Emissions Reduction (lbs)
<b>Food Service Equipment &amp; Refrigeration Measures</b>		<b>1,514</b>	<b>0.1</b>	<b>0.0</b>	<b>\$243.34</b>	<b>\$2,496.00</b>	<b>\$150.00</b>	<b>\$2,346.00</b>	<b>9.6</b>	<b>1,525</b>
ECM 9	Replace Refrigeration Equipment	1,514	0.1	0.0	\$243.34	\$2,496.00	\$150.00	\$2,346.00	9.6	1,525

#### ECM 7: Replace Refrigeration Equipment

##### *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 <sub>2</sub> e Emissions Reduction (lbs)
1,514	0.1	0.0	\$243.34	\$2,496.00	\$150.00	\$2,346.00	9.6	1,525

##### *Measure Description*

We recommend replacing existing refrigerators in the lounge and maintenance shop with new ENERGY STAR® high efficiency equipment. There have been many improvements in refrigeration system equipment, operation, and insulation. The energy savings associated with this measure come from reduced energy usage, due to more efficient technology, and reduced run times.

## 4.1.5 Custom Measures

Additional custom measure energy saving opportunities are addressed in this section. Our recommendations for custom measures are summarized in Figure 20 below.

*Figure 20 - Summary of Custom 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 <sub>2</sub> e Emissions Reduction (lbs)
<b>Custom Measures</b>		<b>1,681</b>	<b>0.0</b>	<b>359.7</b>	<b>\$3,804.27</b>	<b>\$14,650.00</b>	<b>\$0.00</b>	<b>\$14,650.00</b>	<b>3.9</b>	<b>43,810</b>
ECM 9	Computer Power Management Software	1,681	0.0	0.0	\$270.20	\$3,190.00	\$0.00	\$3,190.00	11.8	1,693
ECM 10	Building Envelope Weatherization	0	0.0	71.9	\$706.81	\$2,790.00	\$0.00	\$2,790.00	3.9	8,423
ECM 11	Steam Trap Survey and Replacements	0	0.0	287.8	\$2,827.26	\$8,670.00	\$0.00	\$8,670.00	3.1	33,694

### ECM 8: Computer Power Management Software

#### *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 <sub>2</sub> e Emissions Reduction (lbs)
1,681	0.0	0.0	\$270.20	\$3,190.00	\$0.00	\$3,190.00	11.8	1,693

#### *Measure Description*

We recommend the implementation of computer power management software. The computing environment in most school and office facilities includes desktops, which are typically left on overnight and on weekends and holidays. Screen savers are commonly confused as a power management strategy. This contributes to excessive electrical energy consumption, which may be avoided by proper management.

There are innovative software packages available in the market today that are designed to deliver significant energy saving and provide ongoing tracking measurements. Operational and maintenance benefits are captured through the use of a central power management platform where issues may be diagnosed and problematic devices may be isolated. Energy savings policies may be enforced as well as identifying and eliminating underutilized devices. This measure investigates the potential benefits to implementing computer power management software to better match the energy use to user needs.

## **ECM 9: Building Envelope Weatherization**

### *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 <sub>2</sub> e Emissions Reduction (lbs)
0	0.0	71.9	\$706.81	\$2,790.00	\$0.00	\$2,790.00	3.9	8,423

### *Measure Description*

We recommend weather-stripping the exterior doors throughout the building. There are four double doors and three single doors which were noted to have missing or worn weather-stripping with clear air gaps. There is approximately 224 linear feet of window frames which is recommended to be caulked. Building envelopes that limit air infiltration and that have adequate insulation play a key role in optimizing heating and cooling efficiency, controlling moisture, and providing occupant comfort. Cracks and gaps throughout your building such as around windows and doors, through utility openings, at the foundation and roof, may not seem significant, but their effects add up. Reducing uncontrolled air infiltration through air sealing is a cost effective way to improve the performance and energy efficiency of your facility. The proper sealing of sources for air infiltration and exfiltration will mitigate the air through the building and thus reduce the load on the facility's heating and cooling equipment. Exterior doors should be properly weather-stripped which may include the installation of a bottom sweep, center sweep and weather-stripping around the perimeter of the door.

## **ECM 10: Steam Trap Survey and Replacements**

### *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 <sub>2</sub> e Emissions Reduction (lbs)
0	0.0	287.8	\$2,827.26	\$8,670.00	\$0.00	\$8,670.00	3.1	33,694

### *Measure Description*

Properly functioning steam traps ensure that all latent heat in the steam is delivered to the end use by preventing pressurized steam from leaking. Steam traps should be inspected as part of the regular steam system maintenance. Traps that are blocked, venting, or allowing steam to leak through should be repaired or replaced. Repairing or replacing existing steam traps will reduce steam losses. The savings associated with this measure are based on percent savings associated with remediating steam leaks throughout the system.

## 4.1 ECMs Evaluated But Not Recommended

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

*Figure 21 – Summary of Measures Evaluated, But Not Recommended*

Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated Install Cost (\$)	Estimated Incentive (\$)*	Estimated Net Cost (\$)	Simple Payback Period (yrs)**	CO <sub>2</sub> e Emissions Reduction (lbs)
<b>Electric Unitary HVAC Measures</b>	<b>1,184</b>	<b>0.8</b>	<b>0.0</b>	<b>\$190.29</b>	<b>\$3,946.76</b>	<b>\$0.00</b>	<b>\$3,946.76</b>	<b>20.7</b>	<b>1,192</b>
Install High Efficiency Electric AC	1,184	0.8	0.0	\$190.29	\$3,946.76	\$0.00	\$3,946.76	20.7	1,192
<b>HVAC System Improvements</b>	<b>8,048</b>	<b>0.0</b>	<b>81.5</b>	<b>\$2,094.52</b>	<b>\$43,814.75</b>	<b>\$0.00</b>	<b>\$43,814.75</b>	<b>20.9</b>	<b>17,651</b>
Install Programmable Thermostats and EC Motors	8,048	0.0	81.5	\$2,094.52	\$43,814.75	\$0.00	\$43,814.75	20.9	17,651
<b>TOTALS</b>	<b>9,232</b>	<b>0.8</b>	<b>81.5</b>	<b>\$2,284.81</b>	<b>\$47,761.50</b>	<b>\$0.00</b>	<b>\$47,761.50</b>	<b>20.9</b>	<b>18,843</b>

\* - 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 <sub>2</sub> e Emissions Reduction (lbs)
1,184	0.8	0.0	\$190.29	\$3,946.76	\$0.00	\$3,946.76	20.7	1,192

#### *Measure Description*

In many cases we recommend 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 is cost prohibitive. Replacement of the unit now is not recommended on the basis of energy savings alone because the payback period for replacing them exceeds the useful life of the equipment. However, this measure was at least evaluated to demonstrate the potential savings by upgrading to high efficiency equipment that may be beneficial once the unit reaches the end of its useful life. We recommend considering this measure in the future, perhaps as a capital improvement measure.

## Install Programmable Thermostats and EC 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 <sub>2</sub> e Emissions Reduction (lbs)
8,048	0.0	81.5	\$2,094.52	\$43,814.75	\$0.00	\$43,814.75	20.9	17,651

### *Measure Description*

In many cases we recommend replacing manual thermostats with programmable thermostats. Manual thermostats are generally adjusted to a single heating and cooling setpoint and left at that setting regardless of occupancy in the area served by the HVAC equipment. As a result, the same level of heating and cooling is provided regardless of the occupancy in the space. Programmable thermostats can be set to maintain different temperature settings for different times of day and for different days of the week. By reducing heating temperature setpoints and raising cooling temperature setpoints when spaces are unoccupied, the operation of the HVAC equipment is reduced while still maintaining reasonable space temperatures for building usage at all times. Programmable thermostats provide energy savings by reducing heating and cooling energy usage when a room is unoccupied.

We evaluated replacing standard efficiency motors with high efficiency EC motors in the unit ventilators throughout the building. The advantages of replacing existing permanent split capacity (PSC) motors with electronically commutated motors (ECM) is the increase in control ability of the motor. EC motors may be programmed to vary speed and can reach efficiencies up to 80% above standard PSC motors. 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 ECM motors in the market today which have capabilities to vary in speed to meet the needs of the space with less energy consumption. Savings are based on the difference between baseline and proposed efficiencies, variable speed impacts and the assumed annual operating hours.

### *Reasons for not Recommending*

This measure is cost prohibitive. Installation of a controls tailored to the existing HVAC equipment on a room by room basis is not recommended on the basis of energy savings alone due to the poor payback period. However, this measure was at least evaluated to demonstrate the potential savings and that adding controls should be considered future and in the future, perhaps as a capital improvement measure.

## 5 ENERGY EFFICIENT PRACTICES

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

### **Reduce Air Leakage**

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

### **Close Doors and Windows**

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

### **Perform Proper Lighting Maintenance**

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

### **Develop a Lighting Maintenance Schedule**

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

### **Perform Routine Motor Maintenance**

Motors consist of many moving parts whose collective degradation can contribute to a significant loss of motor efficiency. In order to prevent damage to motor components, routine maintenance should be performed. This maintenance consists of cleaning surfaces and ventilation openings on motors to prevent overheating, lubricating moving parts to reduce friction, inspecting belts and pulleys for wear and to ensure they are at proper alignment and tension, and cleaning and lubricating bearings. Consult a licensed technician to assess these and other motor maintenance strategies.



## **Use Fans to Reduce Cooling Load**

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

## **Install Destratification Fans**

Allowing air to thermally stratify in spaces with high ceilings results in additional energy consumption by requiring the heating system to heat a volume of space much larger than the actual occupied space. Additional inefficiencies also occur because there are higher temperatures at the ceiling level than at the floor level. Higher temperatures at the ceiling accelerate heat loss through the roof, requiring additional energy consumption by the heating equipment in order to compensate for the accelerated heat transfer.

Destratification fans are specially designed to deliver a columnar, laminar flow of air balancing the air temperature from floor to ceiling. In addition to fuel savings, the use of destratification fans will reduce the recovery time necessary to warm the space after nightly temperature setbacks and will increase the comfort level of the occupants.

## **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.

## **Perform Proper Water Heater Maintenance**

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

## **Plug Load Controls**

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

## **Water Conservation**

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

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

Refer to Section 4.1.3 for any low-flow ECM recommendations.

## 6 ON-SITE GENERATION MEASURES

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

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

Preliminary screenings were performed to determine the potential that a generation project could provide a cost-effective solution for your facility. Before making a decision to implement, a feasibility study should be conducted that would take a detailed look at existing energy profiles, siting, interconnection, and the costs associated with the generation project including interconnection costs, departing load charges, and any additional special facilities charges.

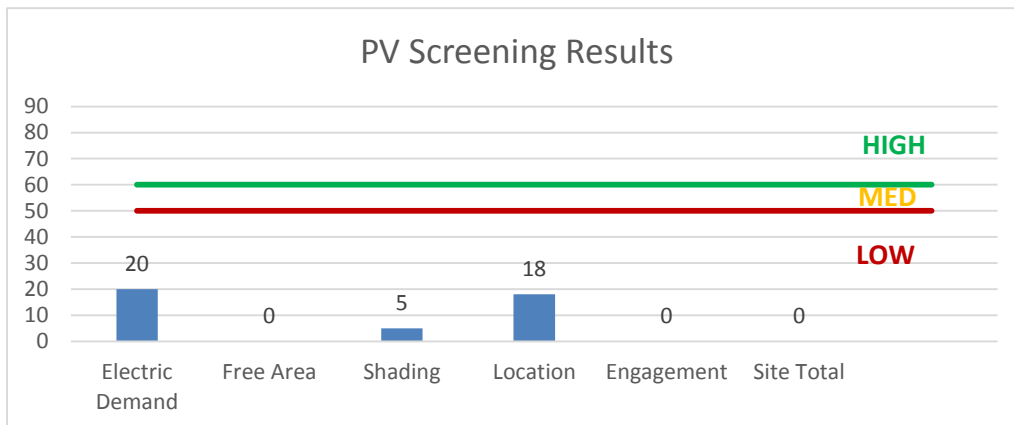
### 6.1 Photovoltaic

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

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

In order to be cost-effective, a solar PV array needs certain minimum criteria, such as flat or south-facing rooftop or other unshaded space on which to place the PV panels. In our opinion, the facility does appear not meet these minimum criteria for cost-effective PV installation.

*Figure 22 - Photovoltaic Screening*



## 6.2 Combined Heat and Power

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

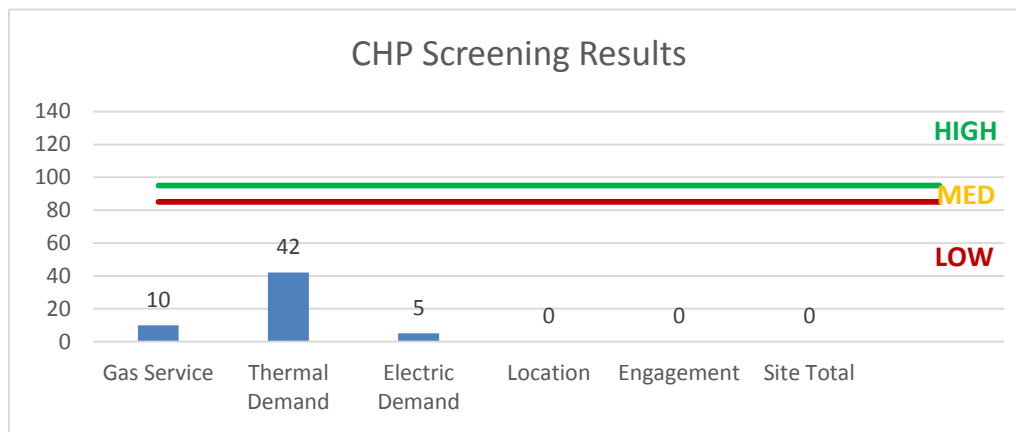
CHP systems are typically used to produce a portion of the electric power used onsite by a facility, with the balance of electric power needs supplied by grid purchases. The heat is used to supplement (or supplant) existing boilers for the purpose of space heating and/or domestic hot water heating. Waste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

A preliminary screening based on heating and electrical demand, siting, and interconnection shows that the facility has a Low potential for installing a cost-effective CHP system.

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

For a list of qualified firms in New Jersey specializing in commercial CHP cost assessment and installation, go to: [http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved\\_vendorsearch/](http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/).

**Figure 23 - Combined Heat and Power Screening**



## 7 DEMAND RESPONSE

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

By enabling grid operators to call upon Curtailment Service Providers and commercial facilities to reduce electric usage during times of peak demand, the grid is made more reliable and overall transmission costs are reduced for all ratepayers. Curtailment Service Providers provide regular payments to medium and large consumers of electric power for their participation in DR programs. Program participation is voluntary and participants receive payments whether or not their facility is called upon to curtail their electric usage.

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

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

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

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

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

## 8 PROJECT FUNDING / INCENTIVES

The NJCEP is able to provide the incentive programs described below, and other benefits to ratepayers, because of the Societal Benefits Charge (SBC) Fund. The SBC was created by the State of New Jersey’s Electricity Restructuring Law (1999), which requires all customers of investor-owned electric and gas utilities to pay a surcharge on their monthly energy bills. As a customer of a state-regulated electric or gas utility and therefore a contributor to the fund your organization is eligible to participate in the LGEA program and also eligible to receive incentive payment for qualifying energy efficiency measures. Also available through the NJBPU are some alternative financing programs described later in this section. Please refer to Figure 24 for a list of the eligible programs identified for each recommended ECM.

*Figure 24 - ECM Incentive Program Eligibility*

Energy Conservation Measure		SmartStart Prescriptive	SmartStart Custom	Direct Install	Pay For Performance Existing Buildings	Large Energy Users Program	Combined Heat & Power and Fuel Cell
ECM 1	Install LED Fixtures	x		x			
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	x		x			
ECM 3	Retrofit Fixtures with LED Lamps	x		x			
ECM 4	Install Occupancy Sensor Lighting Controls	x		x			
ECM 5	Install Photocell Controls	x		x			
ECM 6	Install High Efficiency Electric AC			x			
ECM 7	Install Programmable Thermostats and EC Motors			x			
ECM 8	Install Low-Flow Domestic Hot Water Devices			x			
ECM 9	Replace Refrigeration Equipment						
ECM 10	Vending Machine Control			x			
ECM 11	Computer Power Management Software						
ECM 12	Building Envelope Weatherization						
ECM 13	Steam Trap Survey and Replacements						

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

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

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

## 8.2 Direct Install

### Overview

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

### Incentives

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

### How to Participate

To participate in Direct Install, you will need to contact the participating contractor assigned to the region of the state where your facility is located. A complete list of Direct Install program partners is provided on the 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.

Detailed program descriptions and applications can be found at: [www.njcleanenergy.com/DI](http://www.njcleanenergy.com/DI).



### 8.3 Energy Savings Improvement Program

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

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

- (1) Use an Energy Services Company or "ESCO."
- (2) Use independent engineers and other specialists, or your own qualified staff, to provide and manage the requirements of the program through bonds or lease obligations.
- (3) Use a hybrid approach of the two options described above where the ESCO is utilized for some services and independent engineers, or other specialists or qualified staff, are used to deliver other requirements of the program.

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

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

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

## 8.4 Demand Response Energy Aggregator

The first step toward participation in a Demand Response (DR) program is to contact a Curtailment Service Provider. A list of these providers is available on PJM's website and it includes contact information for each company, as well as the states where they have active business (<http://www.pjm.com/markets-and-operations/demand-response/csps.aspx>). PJM also posts training materials that are developed for program members interested in specific rules and requirements regarding DR activity (<http://www.pjm.com/training/training%20material.aspx>), along with a variety of other 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 the program rules and requirements for metering and controls, a facility's ability to temporarily reduce electric load, as well as the payments involved in participating in the program. Also, these providers usually offer multiple options for DR to larger facilities and may also install controls or remote monitoring equipment to help ensure compliance of all terms and conditions of a DR contract.

See Section 7 for additional information.

## 9 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

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### 9.1 Retail Electric Supply Options

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

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

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

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

# Appendix A: Equipment Inventory & Recommendations

## Lighting Inventory & Recommendations

Location	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,742	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,742	0.08	230	0.0	\$36.96	\$234.00	\$40.00	5.25
Boiler Room	1	Incandescent: Screw in Lamp	Wall Switch	100	1,742	Relamp	No	1	LED Screw-In Lamps: Screw in Lamp	Wall Switch	9	1,742	0.06	182	0.0	\$29.30	\$53.75	\$5.00	1.66
Maintenance Shop	4	Linear Fluorescent - T12: 8' T12 (75W) - 2L	Wall Switch	158	1,742	Relamp & Reballast	No	4	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,742	0.26	801	0.0	\$128.79	\$647.33	\$0.00	5.03
Maintenance Shop	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,742	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,742	0.02	66	0.0	\$10.63	\$58.50	\$10.00	4.56
Stairs	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,484	Fixture Replacement	No	1	LED - Fixtures: Ambient - 4' - Direct Fixture	Wall Switch	29	3,484	0.02	132	0.0	\$21.25	\$418.17	\$45.00	17.56
Storage	1	Incandescent: Screw in Lamp	Wall Switch	100	500	Relamp	No	1	LED Screw-In Lamps: Screw in Lamp	Wall Switch	9	500	0.06	52	0.0	\$8.41	\$53.75	\$5.00	5.80
Storage	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	500	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	500	0.04	38	0.0	\$6.10	\$117.00	\$20.00	15.90
Storage	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	500	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	500	0.04	38	0.0	\$6.10	\$117.00	\$20.00	15.90
Lounge	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,484	Fixture Replacement	Yes	8	LED - Fixtures: Ambient - 4' - Direct Fixture	Occupancy Sensor	29	2,439	0.22	1,337	0.0	\$214.82	\$3,615.33	\$395.00	14.99
Open Room	19	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	3,484	Relamp	Yes	19	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	2,439	0.91	5,588	0.0	\$898.06	\$2,347.53	\$450.00	2.11
Hallway	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	3,484	Relamp	No	3	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	3,484	0.10	595	0.0	\$95.63	\$225.60	\$45.00	1.89
Kitchen	14	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	3,484	Relamp	No	14	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	3,484	0.45	2,777	0.0	\$446.26	\$1,052.80	\$210.00	1.89
Hallway	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	3,484	Relamp	No	3	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	3,484	0.10	595	0.0	\$95.63	\$225.60	\$45.00	1.89
Classroom/Aud	20	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,613	Relamp	No	20	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,613	0.73	3,366	0.0	\$540.92	\$1,902.67	\$400.00	2.78
APR Room	5	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	5	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,829	0.13	584	0.0	\$93.94	\$548.00	\$40.00	5.41
Stage	28	Halogen Incandescent: Screw in Lamp	High/Low Control	150	100	Relamp	No	28	LED Screw-In Lamps: Screw in Flood Lamps	High/Low Control	12	100	2.53	444	0.0	\$71.42	\$3,014.28	\$140.00	40.25
Life Skills Room 207	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,613	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,829	0.16	752	0.0	\$120.84	\$416.80	\$80.00	2.79
Stairs	1	Incandescent: Screw in Lamp	Wall Switch	60	3,484	Relamp	No	1	LED Screw-In Lamps: Screw in Lamp	Wall Switch	7	3,484	0.03	212	0.0	\$34.13	\$53.75	\$5.00	1.43
Stairs	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,484	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,484	0.02	132	0.0	\$21.25	\$58.50	\$10.00	2.28
1st Floor Hallway	7	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	3,484	Relamp	Yes	7	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	2,439	0.29	1,754	0.0	\$281.96	\$796.40	\$105.00	2.45
Girl's Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,090	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,463	0.10	353	0.0	\$56.72	\$460.27	\$75.00	6.79
Boy's Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,090	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,463	0.10	353	0.0	\$56.72	\$460.27	\$75.00	6.79
Classroom 1	25	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	25	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,829	0.68	3,133	0.0	\$503.49	\$2,002.50	\$320.00	3.34
Coat Room	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,000	Relamp	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.06	114	0.0	\$18.30	\$175.50	\$30.00	7.95

Location	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
	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
Restroom	1	Incandescent Screw in Lamp	Wall Switch	100	2,090	Relamp	No	1	LED Screw-In Lamps: Screw in Lamp	Wall Switch	9	2,090	0.06	219	0.0	\$35.16	\$53.75	\$5.00	1.39
Closet	1	Incandescent Screw in Lamp	Wall Switch	100	500	Relamp	No	1	LED Screw-In Lamps: Screw in Lamp	Wall Switch	9	500	0.06	52	0.0	\$8.41	\$53.75	\$5.00	5.80
Classroom 2	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,829	0.49	2,256	0.0	\$362.51	\$1,593.00	\$250.00	3.70
Classroom 3	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,829	0.49	2,256	0.0	\$362.51	\$1,593.00	\$250.00	3.70
Storage Room	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	\$3.05	\$58.50	\$10.00	15.90
Classroom 4	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,829	0.49	2,256	0.0	\$362.51	\$1,593.00	\$250.00	3.70
Classroom 5	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,829	0.49	2,256	0.0	\$362.51	\$1,593.00	\$250.00	3.70
Faculty Lounge 6	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,613	Relamp	No	3	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,613	0.10	446	0.0	\$71.72	\$225.60	\$45.00	2.52
Restroom	1	Incandescent Screw in Lamp	Wall Switch	100	2,090	Relamp	No	1	LED Screw-In Lamps: Screw in Lamp	Wall Switch	9	2,090	0.06	219	0.0	\$35.16	\$53.75	\$5.00	1.39
Display Case	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	3,484	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	3,484	0.01	70	0.0	\$11.27	\$35.90	\$5.00	2.74
Hallway	1	Incandescent Screw in Lamp	Wall Switch	270	3,484	Relamp	No	1	LED Screw-In Lamps: Screw in Lamp	Wall Switch	24	3,484	0.16	986	0.0	\$158.41	\$53.75	\$5.00	0.31
Vestibule	1	Incandescent Screw in Lamp	Wall Switch	100	3,484	Relamp	No	1	LED Screw-In Lamps: Screw in Lamp	Wall Switch	9	3,484	0.06	365	0.0	\$58.60	\$53.75	\$5.00	0.83
Main Office	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,829	0.27	1,253	0.0	\$201.40	\$855.00	\$135.00	3.58
Office	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,613	Relamp	No	4	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,613	0.13	595	0.0	\$95.63	\$300.80	\$60.00	2.52
Restroom	1	Incandescent Screw in Lamp	Wall Switch	100	2,090	Relamp	No	1	LED Screw-In Lamps: Screw in Lamp	Wall Switch	9	2,090	0.06	219	0.0	\$35.16	\$53.75	\$5.00	1.39
Closet	1	Incandescent Screw in Lamp	Wall Switch	100	100	Relamp	No	1	LED Screw-In Lamps: Screw in Lamp	Wall Switch	9	100	0.06	10	0.0	\$1.68	\$53.75	\$5.00	28.99
Classroom 7	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,829	0.49	2,256	0.0	\$362.51	\$1,593.00	\$250.00	3.70
Nurse's Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,613	Relamp	No	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,613	0.06	297	0.0	\$47.81	\$150.40	\$30.00	2.52
IT Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,000	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,000	0.03	114	0.0	\$18.30	\$75.20	\$15.00	3.29
Storage	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	100	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	100	0.02	4	0.0	\$0.61	\$58.50	\$10.00	79.52
Classroom 22	27	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	27	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,829	0.74	3,383	0.0	\$543.77	\$2,389.50	\$375.00	3.70
Restroom	1	Incandescent Screw in Lamp	Wall Switch	60	2,090	Relamp	No	1	LED Screw-In Lamps: Screw in Lamp	Wall Switch	7	2,090	0.03	127	0.0	\$20.48	\$53.75	\$5.00	2.38
Storage	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	500	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	500	0.04	32	0.0	\$5.18	\$95.13	\$20.00	14.52
Stairs	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,484	Relamp	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	3,484	0.06	397	0.0	\$63.75	\$175.50	\$30.00	2.28
Stairs	1	Incandescent Screw in Lamp	Wall Switch	60	3,484	Relamp	No	1	LED Screw-In Lamps: Screw in Lamp	Wall Switch	7	3,484	0.03	212	0.0	\$34.13	\$53.75	\$5.00	1.43

Location	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
	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
Stairs	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	3,484	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	3,484	0.02	116	0.0	\$18.67	\$63.20	\$0.00	3.38
Hallway	10	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	3,484	Relamp	Yes	10	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	2,439	0.25	1,559	0.0	\$250.50	\$902.00	\$0.00	3.60
Vestibule	2	Incandescent: Screw in Lamp	Wall Switch	60	3,484	Relamp	No	2	LED Screw-In Lamps: Screw in Lamp	Wall Switch	7	3,484	0.07	425	0.0	\$68.26	\$107.51	\$10.00	1.43
Gym	25	Metal Halide: (1) 250W Lamp	Wall Switch	295	3,136	Fixture Replacement	Yes	25	LED - Fixtures: High-Bay	Occupancy Sensor	145	2,195	3.17	17,444	0.0	\$2,803.62	\$72,630.00	\$4,625.00	24.26
Classroom 23	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,829	0.57	2,631	0.0	\$422.93	\$2,038.50	\$315.00	4.08
Classroom 24	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,829	0.57	2,631	0.0	\$422.93	\$2,038.50	\$315.00	4.08
Classroom 25	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,829	0.57	2,631	0.0	\$422.93	\$2,038.50	\$315.00	4.08
Girl's Restroom	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,829	0.10	468	0.0	\$75.15	\$522.80	\$35.00	6.49
Boy's Restroom	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,829	0.10	468	0.0	\$75.15	\$522.80	\$35.00	6.49
Classroom 21	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,829	0.03	125	0.0	\$20.14	\$85.50	\$13.50	3.58
Classroom 21	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,613	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,829	0.16	752	0.0	\$120.84	\$543.80	\$91.50	3.74
Slop Sink	1	Incandescent: Screw in Lamp	Wall Switch	100	500	Relamp	No	1	LED Screw-In Lamps: Screw in Lamp	Wall Switch	9	500	0.06	52	0.0	\$8.41	\$53.75	\$5.00	5.80
Gym Storage	4	Incandescent: Screw in Lamp	Wall Switch	60	500	Relamp	No	4	LED Screw-In Lamps: Screw in Lamp	Wall Switch	7	500	0.14	122	0.0	\$19.59	\$215.01	\$20.00	9.95
2nd Floor Hallway	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	3,484	Relamp	Yes	7	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	2,439	0.19	1,170	0.0	\$187.97	\$679.50	\$70.00	3.24
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,613	Relamp	No	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,613	0.06	297	0.0	\$47.81	\$150.40	\$30.00	2.52
Slop Sink	1	Incandescent: Screw in Lamp	Wall Switch	60	500	Relamp	No	1	LED Screw-In Lamps: Screw in Lamp	Wall Switch	7	500	0.03	30	0.0	\$4.90	\$53.75	\$5.00	9.95
Storage	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	\$3.05	\$58.50	\$10.00	15.90
Girl's Restroom	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,613	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,829	0.12	564	0.0	\$90.63	\$495.60	\$80.00	4.59
Boy's Restroom	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,613	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,829	0.12	564	0.0	\$90.63	\$495.60	\$80.00	4.59
Storage	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	\$3.05	\$58.50	\$10.00	15.90
Computer Room	16	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,613	Relamp	Yes	16	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,829	0.77	3,529	0.0	\$567.20	\$2,062.13	\$390.00	2.95
Library	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,613	Relamp	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,829	0.58	2,647	0.0	\$425.40	\$1,681.60	\$310.00	3.22
Small Room 8	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,613	Relamp	No	2	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,613	0.06	297	0.0	\$47.81	\$150.40	\$30.00	2.52
Classroom 9	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,829	0.49	2,256	0.0	\$362.51	\$1,593.00	\$250.00	3.70
Classroom 10	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,829	0.49	2,256	0.0	\$362.51	\$1,593.00	\$250.00	3.70

Location	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
	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
Classroom 11	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,829	0.49	2,256	0.0	\$362.51	\$1,593.00	\$250.00	3.70
Classroom 12	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,829	0.49	2,256	0.0	\$362.51	\$1,593.00	\$250.00	3.70
Classroom 13	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,613	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,829	0.49	2,256	0.0	\$362.51	\$1,593.00	\$250.00	3.70
Small Room 18	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,613	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,829	0.16	752	0.0	\$120.84	\$416.80	\$80.00	2.79
Exterior	4	Compact Fluorescent: Plug in Lamps	None	26	8,760	Relamp	Yes	4	LED Screw-In Lamps: Plug in Lamps	Daylight Dimming	14	4,000	0.05	790	0.0	\$126.99	\$790.02	\$0.00	6.22
Exterior	1	Metal Halide: (1) 100W Lamp	None	128	8,760	Fixture Replacement	Yes	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	60	4,000	0.06	1,013	0.0	\$162.89	\$480.68	\$100.00	2.34
Exterior	4	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	None	10	8,760	None	Yes	4	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	10	4,000	0.01	219	0.0	\$35.19	\$360.00	\$0.00	10.23
Exterior	2	Metal Halide: (1) 250W Lamp	None	295	4,000	Fixture Replacement	No	2	LED - Fixtures: Other	None	190	4,000	0.14	966	0.0	\$155.26	\$564.48	\$10.00	3.57

### Motor Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions						Proposed Conditions				Energy Impact & Financial Analysis						
		Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Annual Operating Hours	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Boiler Burners	2	Other	1.0	75.5%	No	2,059	No	75.5%	No		0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Boiler Room	Air Compressor for Pneumatic Controls	1	Air Compressor	1.5	84.0%	No	2,059	No	84.0%	No		0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Boiler Room	Condensate Return	3	Other	0.5	72.0%	No	1,647	No	72.0%	No		0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Roof	Exhaust for Kitchen	1	Exhaust Fan	0.3	72.0%	No	1,373	No	72.0%	No		0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Roof	Exhaust for Gym	1	Exhaust Fan	0.5	72.0%	No	1,373	No	72.0%	No		0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Unit Ventilators	Unit Ventilators	36	Supply Fan	0.2	45.0%	No	2,196	No	45.0%	No		0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00

### Electric HVAC Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions		Proposed Conditions									Energy Impact & Financial Analysis							
		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
Classrooms	Classrooms - Newer	4	Window AC	2.00		No							No	0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Classrooms	Classrooms - Older	3	Window AC	1.00		Yes	3	Window AC	1.00		12.00		No	0.58	893	0.0	\$143.51	\$3,266.28	\$0.00	22.76
Classrooms	Classrooms - Newer	1	Window AC	1.25		No							No	0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Classrooms	Classrooms - Older	1	Window AC	0.63		Yes	1	Window AC	0.63		12.00		No	0.19	291	0.0	\$46.78	\$680.48	\$0.00	14.55
Classrooms	IT Room	1	Split-System Air-Source HP	1.00	10.00	No							No	0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00

### Fuel Heating Inventory & Recommendations

Location	Area(s)/System(s) Served	Existing Conditions		Proposed Conditions							Energy Impact & Financial Analysis								
		System Quantity	System Type	Output Capacity per Unit (MBh)	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years		
Boiler Room	Whole Building	2	Forced Draft Steam Boiler	2,776.00	No								0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00

### Programmable Thermostat Recommendations

Location	Area(s)/System(s) Affected	Recommendation Inputs				Energy Impact & Financial Analysis						
		Thermostat Quantity	Motor Total Existing Demand of System to Control (kW)	Annual Operating Hours	Output Heating Capacity of Controlled System (MBh)	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
Entire Building	Heating System and UV Supply Fan Motors	36	7.46	2,196.00	2,776.00	0.00	8,048	81.5	\$2,094.52	\$43,814.75	\$0.00	20.92



### Low-Flow Device Recommendations

Location	Recommendation Inputs				Energy Impact & Financial Analysis						
	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Restrooms	2	Faucet Aerator (Lavatory)	2.20	1.00	0.00	0	0.5	\$4.60	\$14.34	\$0.00	3.12
Restrooms	7	Faucet Aerator (Lavatory)	2.00	1.00	0.00	0	1.4	\$13.41	\$50.19	\$0.00	3.74

### Commercial Refrigerator/Freezer Inventory & Recommendations

Location	Existing Conditions			Proposed Condi	Energy Impact & Financial Analysis						
	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
Kitchen	1	Refrigerator Chest	No	No	0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Kitchen	1	Stand-Up Refrigerator, Solid Door (16 - 30 cu. ft.)	Yes	No	0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Kitchen	1	Freezer Chest	No	No	0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Kitchen	1	Stand-Up Refrigerator, Glass Door (16 - 30 cu. ft.)	Yes	No	0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Lounge	1	Stand-Up Refrigerator, Solid Door (16 - 30 cu. ft.)	No	Yes	0.04	711	0.0	\$114.28	\$1,216.00	\$75.00	9.98
Maintenance Shop	1	Stand-Up Refrigerator, Solid Door (16 - 30 cu. ft.)	No	Yes	0.05	803	0.0	\$129.06	\$1,280.00	\$75.00	9.34
Classroom	1	Stand-Up Refrigerator, Solid Door (16 - 30 cu. ft.)	Yes	No	0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00

### Cooking Equipment Inventory & Recommendations

Location	Existing Conditions			Proposed Conditions	Energy Impact & Financial Analysis						
	Quantity	Equipment Type	High Efficiency Equipment?	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	1	Gas Combination Oven/Steam Cooker (<15 Pans)	Yes	No	0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00
Kitchen	2	Insulated Food Holding Cabinet (3/4 Size)	Yes	No	0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00

### Plug Load Inventory

Location	Existing Conditions			
	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
Berkeley Elementary	46	Computers	120.0	
Berkeley Elementary	7	Projector	250.0	
Berkeley Elementary	3	TV	120.0	
Berkeley Elementary	14	Printer	250.0	
Berkeley Elementary	14	Smart Board	200.0	
Berkeley Elementary	1	Mini Fridge	260.0	
Berkeley Elementary	2	Coffee Maker	1,100.0	
Berkeley Elementary	5	Microwave	1,500.0	
Berkeley Elementary	34	Fan	100.0	
Berkeley Elementary	15	Speakers	150.0	

### Vending Machine Inventory & Recommendations

Location	Existing Conditions		Proposed Conditions	Energy Impact & Financial Analysis						
	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
Lounge	1	Non-Refrigerated	No	0.00	0	0.0	\$0.00	\$0.00	\$0.00	0.00

## Custom Recommendations

### Computer Power Management Software

# of Desktops 46	Normal Running Mode					Idle Running Mode					Suspended/Off Mode				
	Mon - Fri 8AM-5PM	Mon - Fri 5PM-8AM	Weekends & Holidays	Energy Rate (W)*	Weekly Run Hours	Mon - Fri 8AM-5PM	Mon - Fri 5PM-8AM	Weekends & Holidays	Energy Rate (W)*	Weekly Run Hours	Mon - Fri 8AM-5PM	Mon - Fri 5PM-8AM	Weekends & Holidays	Energy Rate (W)*	Weekly Run Hours
<b>Existing Conditions</b>	50%	10%	0%	120	28	5%	5%	5%	80	8	45%	85%	95%	5	132
<b>Proposed Conditions</b>	50%	5%	0%	120	24	5%	0%	0%	80	2	45%	95%	100%	5	142

Usage per Device			Energy Impact & Financial Analysis					
Weeks of Use	Annual kWh Usage	Diversity Factor**	Total Annual kWh Savings	Total Annual Energy Cost Savings	Cost per Desktop	Add'l Hardware Cost	Total Installation Cost	Simple Payback Period (Years)
48	225	90%	1,681	\$270	\$15.00	\$2,500.0	\$3,190	11.81
48	185							

### Steam Trap Survey and Replacements

Existing Conditions		Proposed Conditions			Energy Impact & Financial Analysis				
Annual Heating Energy Use (mmBtu)		Assumed % Cooling Savings	Assumed % Heating Savings	Assumed % Motor Savings	Total Annual kWh Savings	Total Annual mmBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Simple Payback Period (Years)
2,398.0		0%	12%	0%	0	288	\$2,827	\$8,670	3.07

#### Equations: (Based on Case Studies)

Estimated Savings and Costs based on Case Studies

\$1350/day for a steam trap survey

\$150/trap to replace

36 UV

25 Rad

61 Estimated steam traps


80% Estimated failed

### Building Envelope Weatherization

Existing Conditions		Proposed Conditions		Energy Impact & Financial Analysis				
Annual Electric HVAC Energy Use (kWh)	Annual Heating Energy Use (mmBtu)	Assumed % Electric HVAC Savings	Assumed % Gas HVAC Savings	Total Annual kWh Savings	Total Annual mmBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Simple Payback Period (Years)
0	2,398.0	0.1%	3.0%	0	72	\$707	\$2,790	3.95

	qty	unit	\$/unit	est costs
Weather-strip Exterior Double Doors	4	EA	100	\$ 400
Weather-strip Exterior Single Doors	3	EA	50	\$ 150
Replace Frames & Caulk the Perimeter of Windows	224	LF	10	\$ 2,240
<b>Total Estimated Costs</b>			<b>\$</b>	<b>2,790</b>

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



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# ENERGY STAR® Statement of Energy Performance

## 65

**ENERGY STAR® Score<sup>1</sup>**

### Berkeley Elementary School

**Primary Property Type:** K-12 School  
**Gross Floor Area (ft<sup>2</sup>):** 39,590  
**Built:** 1929

**For Year Ending:** August 31, 2016  
**Date Generated:** August 02, 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		
<b>Property Address</b> Berkeley Elementary School 35 Berkeley Ave Westwood, New Jersey 07676	<b>Property Owner</b> Westwood BOE 701 Ridgewood Rd Township of Washington, NJ 07675 201-864-0880 ext 2010	<b>Primary Contact</b> John Baumann 701 Ridgewood Rd Township of Washington, NJ 07675 201-864-0880 ext 2010 <a href="mailto:john.baumann@wvrsd.org">john.baumann@wvrsd.org</a>
<b>Property ID:</b> 5969176		

Energy Consumption and Energy Use Intensity (EUI)			
<b>Site EUI</b> 80.6 kBtu/ft <sup>2</sup>	<b>Annual Energy by Fuel</b>		<b>National Median Comparison</b>
	Natural Gas (kBtu)	2,509,816 (79%)	National Median Site EUI (kBtu/ft <sup>2</sup> )
	Electric - Grid (kBtu)	679,667 (21%)	National Median Source EUI (kBtu/ft <sup>2</sup> )
			% Diff from National Median Source EUI
<b>Source EUI</b> 120.5 kBtu/ft <sup>2</sup>			-14%
	<b>Annual Emissions</b>		
	Greenhouse Gas Emissions (Metric Tons CO <sub>2</sub> e/year)		211

### 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

Aimee Lalonde  
 1430 Broadway  
 10th Floor  
 New York, NY 10018  
 347-913-2422  
[alalonde@trcsolutions.com](mailto:alalonde@trcsolutions.com)



Professional Engineer Stamp  
 (if applicable)