Local Government Energy Audit:
Energy Audit Report

Audrey W. Clark Elementary School

Long Branch Board of Education

192 Garfield Avenue
Long Branch, NJ 07740

October 27, 2017

Draft Report by:
TRC Energy Services

Disclaimer

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

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

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

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

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1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for Audrey W. Clark Elementary School.

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

This study was conducted by TRC Energy Services, as part of a comprehensive effort to assist the Long Branch Board of Education in controlling energy costs and protecting our environment by offering a wide range of energy management options and advice.

1.1 Facility Summary

Audrey W. Clark Elementary School is a 46,100 square foot facility comprised of two (2) floors of classroom space, office space and an all-purpose room. The building is was originally constructed in 1964 and is in fair condition. The building is in operation about 10 months in the year and open between 7:30 AM and 6 PM, Monday through Friday with little to no use on the weekends. The average number of occupants in the building on a given day is 110. The building is 100% heated and sporadically cooled by unitary air-conditioning (AC) units.

Per discussions with facility personnel, their maintenance concerns include the all-purpose room lighting, exterior lighting, exhaust fans, the boilers, unit ventilators throughout the building and hydronic distribution system. A thorough description of the facility and our observations are located in Section 2, "Facility Information and Existing Conditions".

1.2 Your Cost Reduction Opportunities

Energy Conservation Measures

TRC Energy Services evaluated 17 measures which together represent an opportunity for Audrey W. Clark Elementary School to reduce annual energy costs by roughly $21,409 and annual greenhouse gas emissions by 125,790 lbs CO_2e. We estimate that if all measures were implemented as recommended, the project would pay for itself in roughly 13.0 years. The breakdown of existing and potential utility costs after project implementation are illustrated in Figure 1 and Figure 2, respectively. Together these measures represent an opportunity to reduce Audrey W. Clark Elementary School's annual energy use by 34%, as measured from existing grid electricity and fuel purchase. This assumes that the PV array will continue providing similar amounts of electric generation. Hypothetically, if we assume the PV array does not exist, then these recommended measures represent an energy use reduction of 27%, as measured from total existing electricity and fuel consumption.

Together these measures represent an opportunity to reduce annual utility costs by 78%. This may seem aggressive – however the actual percent savings is 37% when you consider the actual building electrical consumption as the baseline rather than the electricity that is purchased from the grid (i.e. actual use minus PV system generation).

Figure 1 – Previous 12 Month Utility Costs

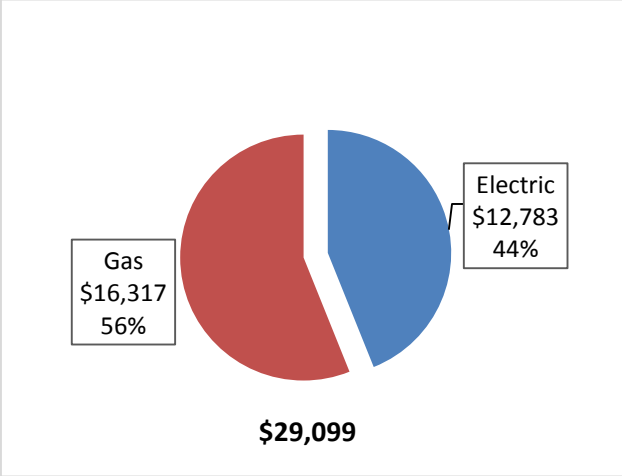


Figure 2b – Potential Post-Implementation Costs – Actual (With the PV System Electric Generation taken into account)

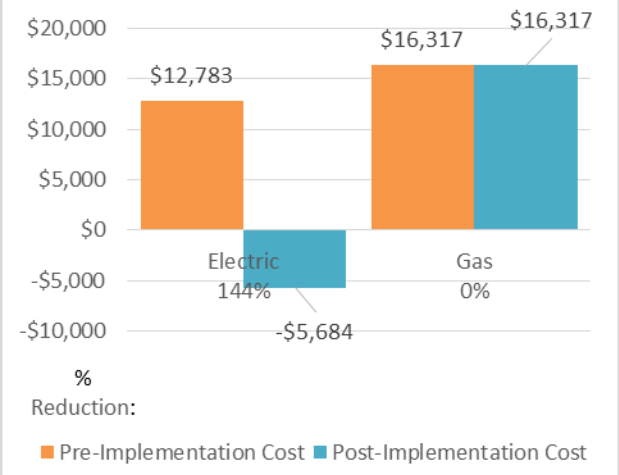
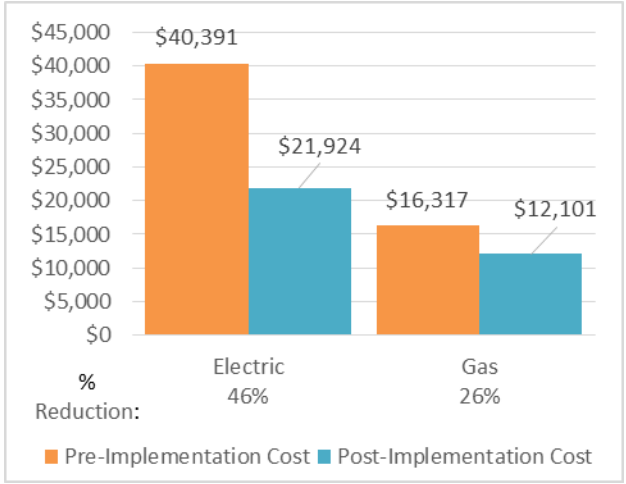


Figure 2a – Potential Post-Implementation Costs – Theoretical (Without the PV System Electric Generation taken into account)



A detailed description of Audrey W. Clark Elementary School's existing energy use can be found in Section 3, "Site Energy Use and Costs". The estimated post-implementation costs shown above is indicative of the energy conservation measures reducing the electrical consumption and the electrical generation from the PV System would in turn add electric back to the grid.

Since there is an existing PV System installed at the facility the actual building electrical consumption and costs are much higher than what is paid for and shown on utility bills. Therefore, in order to demonstrate the post-implementation costs, two (2) figures are shown above. The first shows the theoretical building electrical costs and impact of energy conservation measures. The second shows the actual costs which results in a "net negative costs" which is assumed to equate to a "net positive economic gain" from selling generated electricity back to the grid. It should be noted that this is for demonstration purposes only and the actual feasibility of reducing the building's electrical usage past what it is purchasing from the grid would need to be investigated further.

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, "Energy Conservation Measures".

Figure 3 – Summary of Energy Reduction Opportunities

	Energy Conservation Measure	Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**52,204**	**14.4**	**0.0**	**$10,372.40**	**$124,690.01**	**$9,600.00**	**$115,090.01**	**11.1**	**52,569**
ECM 1	Install LED Fixtures	Yes	16,206	3.3	0.0	$3,227.67	$56,829.42	$3,800.00	$53,029.42	16.4	16,320
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	35,677	11.0	0.0	$7,105.51	$67,591.83	$5,800.00	$61,791.83	8.7	35,927
ECM 3	Retrofit Fixtures with LED Lamps	Yes	197	0.1	0.0	$39.21	$268.77	$0.00	$268.77	6.9	198
Lighting Control Measures			**11,190**	**3.4**	**0.0**	**$2,228.62**	**$11,510.00**	**$1,115.00**	**$10,395.00**	**4.7**	**11,268**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	11,066	3.4	0.0	$2,203.97	$11,450.00	$1,115.00	$10,335.00	4.7	11,144
ECM 5	Install Photocell Controls	Yes	124	0.0	0.0	$24.65	$60.00	$0.00	$60.00	2.4	125
Motor Upgrades			**287**	**0.2**	**0.0**	**$57.12**	**$3,596.76**	**$0.00**	**$3,596.76**	**63.0**	**289**
ECM 6	Replace Exhaust Fan Motors	Yes	287	0.2	0.0	$57.12	$3,596.76	$0.00	$3,596.76	63.0	289
Variable Frequency Drive (VFD) Measures			**8,622**	**2.9**	**0.0**	**$1,717.24**	**$63,368.80**	**$533.33**	**$62,835.47**	**36.6**	**8,683**
ECM 7	Install VFD on AHU Supply Fans and Upgrade Motors	Yes	2,005	0.9	0.0	$399.24	$6,760.31	$0.00	$6,760.31	16.9	2,019
ECM 8	Install Unit Ventilators with EC Motors	Yes	1,126	0.7	0.0	$224.31	$112,188.56	$0.00	$112,188.56	500	1,134
ECM 9	Install VFDs on Hot Water Pumps and Motor Upgrade	Yes	6,431	1.6	0.0	$1,280.77	$8,152.44	$0.00	$8,152.44	6.4	6,476
Electric Unitary HVAC Measures			**1,251**	**0.4**	**0.0**	**$249.24**	**$2,992.44**	**$184.00**	**$2,808.44**	**11.3**	**1,260**
ECM 10	Install High Efficiency Electric AC	Yes	1,251	0.4	0.0	$249.24	$2,992.44	$184.00	$2,808.44	11.3	1,260
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**227.6**	**$2,438.74**	**$65,816.27**	**$7,581.20**	**$58,235.07**	**23.9**	**26,646**
ECM 11	Install High Efficiency Hot Water Boilers	Yes	0	0.0	227.6	$2,438.74	$65,816.27	$7,581.20	$58,235.07	23.9	26,646
HVAC System Improvements			**0**	**0.0**	**1.8**	**$18.92**	**$43.50**	**$0.00**	**$43.50**	**2.3**	**207**
ECM 12	Install Pipe Insulation	Yes	0	0.0	1.8	$18.92	$43.50	$0.00	$43.50	2.3	207
Domestic Water Heating Upgrade			**14,052**	**1.4**	**-28.6**	**$2,492.04**	**$8,136.80**	**$50.00**	**$8,086.80**	**3.2**	**10,801**
ECM 13	Install High Efficiency Gas Water Heater	Yes	14,052	1.4	-47.9	$2,284.76	$8,022.08	$50.00	$7,972.08	3.5	8,536
ECM 14	Install Low-Flow Domestic Hot Water Devices	Yes	0	0.0	19.3	$207.27	$114.72	$0.00	$114.72	0.6	2,265
Custom Measures			**-51,756**	**0.2**	**1,715.5**	**$8,075.11**	**$402,290.00**	**$0.00**	**$402,290.00**	**49.8**	**148,740**
ECM 15	Computer Power Management Software	Yes	2,416	0.0	0.0	$481.14	$3,010.00	$0.00	$3,010.00	6.3	2,433
ECM 16	Replace Refrigeration Equipment with Smaller Energy Star Equipment	Yes	2,035	0.2	0.0	$405.33	$1,300.00	$0.00	$1,300.00	3.2	2,049
ECM 17	Blower Door Testing & Building Envelope Improvements	Yes	667	0.0	76.1	$948.58	$13,830.00	$0.00	$13,830.00	14.6	9,585
	Installation of an Energy Management System	No	666	0.0	116.6	$1,381.79	$69,150.00	$0.00	$69,150.00	50.0	14,319
	Instalation of VRF Systems (Optional)	No	-57,540	0.0	1,522.8	$4,858.27	$315,000.00	$0.00	$315,000.00	64.8	120,354
TOTALS			**93,390**	**22.8**	**393.4**	**$22,791.14**	**$367,444.58**	**$19,063.53**	**$348,381.05**	**15.3**	**140,110**

* - 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).

TOTALS (Recommended)			**92,724**	**22.8**	**276.9**	**$21,409.35**	**$298,294.58**	**$19,063.53**	**$279,231.05**	**13.0**	**125,790**

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

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

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

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

Electric Unitary HVAC measures generally involve replacing older inefficient air conditioning systems with modern energy efficient systems. New air conditioning systems can provide equivalent cooling to older air condition systems at a reduced energy cost. These measures save energy by reducing the power used by the air conditioning systems, due to improved electrical efficiency.

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

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.

Energy Efficient Practices

TRC Energy Services also identified 10 low cost or no cost energy efficient practices. A facility's energy performance can be significantly improved by employing certain behavioral or operational adjustments and by performing better routine maintenance on building systems. These practices can extend equipment lifetime, improve occupant comfort, provide better health and safety, as well as reduce annual energy and O&M costs. Potential opportunities identified at Audrey W. Clark Elementary School include:

- Reduce Air Leakage
- Close Doors and Windows
- Perform Proper Lighting Maintenance
- Develop a Lighting Maintenance Schedule
- Ensure Lighting Controls Are Operating Properly
- Perform Routine Motor Maintenance
- Clean Evaporator/Condenser Coils on AC Systems
- Clean and/or Replace HVAC Filters
- Check for and Seal Duct Leakage
- Perform Proper Boiler Maintenance

For details on these Energy Efficient Practices, please refer to Section 5.

1.3 Implementation Planning

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

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

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

- SmartStart (SS)
- Direct Install (DI)
- Energy Savings Improvement Program (ESIP)
- Demand Response Energy Aggregator

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 SS 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 SS program. More details on this program and others are available in Section 7.

This facility may also qualify for the Direct Install program which can provide turnkey installation of multiple measures, through an authorized network of participating contractors. This program can provide substantially higher incentives that SmartStart, up to 70% of the cost of selected measures, although measure eligibility will have to be assessed and be verified by the designated DI 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 7.3 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 6 for additional information on this program.

Additional information on relevant incentive programs is located in Section 7. You may also check the following website for more details: www.njcleanenergy.com/ci

2 FACILITY INFORMATION AND EXISTING CONDITIONS

2.1 Project Contacts

Figure 4 – Project Contacts

Name	Role	E-Mail	Phone #
Customer			
Ann Degnan	Facilities Manager	adegnan@longbranch.k12.nj.us	732-733-3521
Gary Vecchione	Assistant Facilities Manager	gvecchione@longbranch.k12.nj.us	732-600-7979
Peter Genovese III	Business Administrator	pgenovese@longbranch.k12.nj.us	
TRC Energy Services			
Aimee Lalonde	Auditor	alalonde@trcsolutions.com	(732) 855-0033

2.2 General Site Information

On March 21, 2017, TRC Energy Services performed an energy audit at Audrey W. Clark Elementary School located in Long Branch, NJ. TRC Energy Services' team met with 0 to review the facility operations and help focus our investigation on specific energy-using systems.

Audrey W. Elementary Clark Elementary School is a 46,100 square foot facility comprised of two (2) floors of classroom space, office space and an all-purpose room. The building is was originally constructed in 1964 and is in fair condition. The building is 100% heated and sporadically cooled by unitary air-conditioning (AC) units.

Per discussions with facility personnel, their maintenance concerns include the all-purpose room lighting and the exterior lighting. Fixtures are said to need replacement. The exhaust fans are said to be in poor condition, some inoperable and all need to be replaced. The boilers are over 50 years old, in poor condition and labor intensive. They require replacement. The hydronic heating system serves unit ventilators throughout the building which are in poor condition. They are said to have broken dampers and have low performance. Additionally, the distribution piping is an issue. The underground piping it said to be rusted. There are also many drafts around the unit ventilators which needs to be addressed. The energy conservation measures within this report are aimed to highlight cost-effective energy saving opportunities as well as address these maintenance issues and equipment conditions.

2.3 Building Occupancy

The school building is in operation about 10 months in the year and open between 7:30 AM and 6 PM, Monday through Friday with little to no use on the weekends. The average number of occupants in the building on a given day is 110. The typical schedule is presented in the table below.

Figure 5 - Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
Audrey W. Clark School	Weekday	7:30 AM - 6:00 PM
Audrey W. Clark School	Weekend	No Use

2.4 Building Envelope

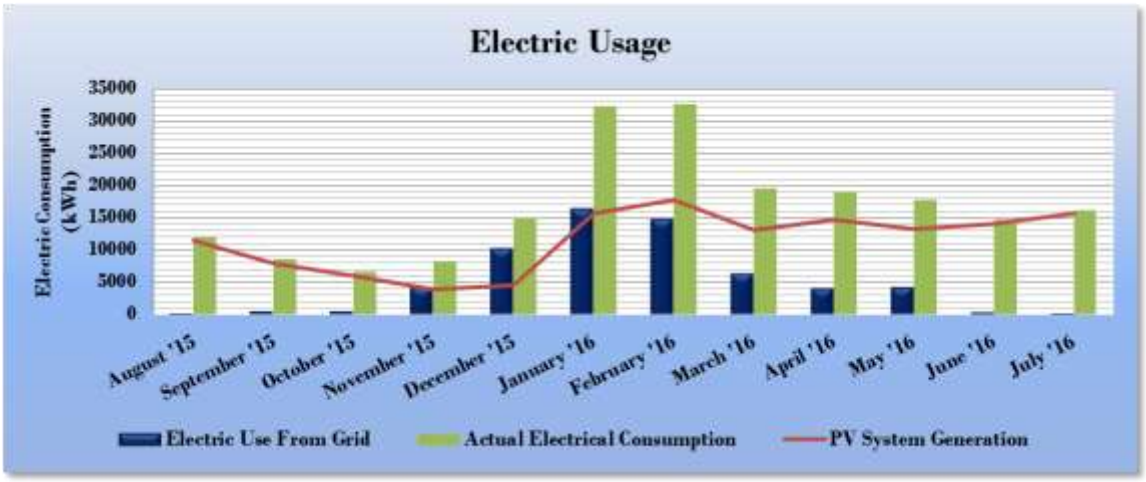
The building is constructed of concrete masonry units with a brick façade. The building has flat roofs which appear in good condition. The building has double pane operable windows with metal frames and interior shades. The exterior doors are typically metal with glass panes and metal frames. Corridor areas have large double pane fixed windows with metal frames. The sealant around these frames is in poor condition and the windows are a main source of air infiltration. The exterior doors have either missing or worn weather-stripping materials which show signs of excessive infiltration. The building envelope has deficiencies and contributes to a significant amount of air infiltration. The unit ventilators, windows and doors are the main contributor to these drafts. There is an opportunity for energy savings by performing blower door testing and implementing air sealing strategies to reduce air infiltration, thus reducing the load on the building's HVAC systems.

2.5 On-Site Generation

Audrey W. Clark Elementary School installed a roof mounted 100.815 kWDC photovoltaic (solar) energy generation system, operating exclusively as a Net Metering Photovoltaic Solar Electric Facility (SEF). This Solar Electric Facility is comprised of thirty-three (33) strings each with thirteen (13) Motech MTPVp-235-MSC 235 Watt poly-crystalline silicon photovoltaic modules in series with a maximum nominal voltage of 600 VDC. These strings are fed through three (3) combiner boxes each with a 210 amp, 600 volt integrated DC disconnect and to one (1) PVPowered 100 kW three-phase 208 VAC inverter.

There is one (1) PVPowered inverter systems. Each inverter system consists of an Inverter Control Switch, a DC Disconnect, a PVPowered 100 kW inverter and an AC Disconnect. The three-phase AC output from each inverter is fed through a three-phase 208 VAC isolation transformer within the inverter, and the output is connected to the line side of an existing Customer distribution panel via one (1) 400 amp, 208 VAC disconnect fused at 350 amps. Power from this net metering system is connected on the Customer side of a JCP&L revenue grade electric meter.

The PV System generates 68% of the total annual electrical consumption for the building. Based on the information provided for the PV system generation and the building utility bills, the chart below demonstrates what the actual electric consumption of the building is in comparison to what is generated and what is paid for from the grid.



2.6 Energy-Using Systems

Lighting – The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Fixtures throughout the building include surface mounted wraps, recessed troffer fixtures or industrial fixtures. Some areas have compact fluorescent lamp fixtures.

The all-purpose room and break out room are lit by metal halide recessed fixtures which each contain 400W lamps. The all-purpose room also recessed troffer fixtures with T8 U-lamps. The all-purpose room lighting is a maintenance concern due to the inaccessibility and current inefficient technology.

The exterior lighting includes wall pack fixtures and pole mounted flood light fixtures which contain 100W and 250W metal halide lamps, respectively. The entrances along the exterior of the building above exterior doors include compact fluorescent lamps which are in poor condition and in need of replacement. There is an opportunity for energy savings by upgrading to LED technology throughout the interior, high bay and exterior applications.

Lighting Controls – The lighting throughout majority of the rooms are manually controlled via wall switches. There is an opportunity for energy savings by the installation of occupancy based sensors in beneficial locations. The exterior lighting is controlled by a timeclock which is in poor condition.

Motors – The HVAC systems that serve the building include fan and pump motors which are generally in poor condition and of standard efficiency. These include hot water pumps, exhaust fans and the fans within air-handling units (AHUs), unit ventilators (UVs) and cabinet unit heaters (CUHs). Majority of equipment appears to be in poor condition. There is an opportunity for energy savings by replacing the hot water pump motors with premium efficient motors and installing variable frequency drives. There is an opportunity for energy savings by replacing the supply fan motors with premium efficient motors and installing variable frequency drives in the air handling units that serve the all-purpose room. There is an opportunity for energy savings by replacing the capacitor supply fan motors in unit ventilators with high efficiency electrically-commutated motors (ECMs) which have variable speed capabilities.

Domestic Hot Water – The building is supplied domestic hot water by an electric storage tank water heater. This 50 gallon unit is of standard efficiency and fair condition. There is an opportunity for energy savings by replacing the existing water heater with a high efficiency gas-fired condensing hot water heater. The sink aerators throughout the building are fit with higher flow devices (2.2 gallon per minute). There is an opportunity for energy savings by replacing these aerators with low flow devices.

HVAC Systems and Equipment – The building is heated by a hydronic heating system served by two (2) gas-fired cast iron hot water boilers. The boilers are over 50 years old and past their useful life. They are in poor condition and have mechanical linkage boiler burner controls. Hot water is supplied through the system serving unit ventilators, perimeter radiators and the air handling units that serve the all-purpose room. The chiller is in poor condition and has rusted coils. There is an opportunity for energy savings by replacing with a gas-fired high efficiency condensing hot water boiler with electronic burner controls.

The unit ventilators in the building are in poor condition and many of the fresh air dampers are broken. The motors need frequent replacement and there are wiring issues. The filters are also in poor condition which negatively affects the equipment performance. There is an opportunity to replace unit ventilators

with new unit ventilators equipped with EC Motors throughout the building. There are air-handling units (AHUs) that serve a large all-purpose room are in fair condition.

There are two split AC Systems that are of standard efficiency and fair condition. These serve the server room and an office area. There is an opportunity for energy savings by replacing the outdoor condensing unit that serves the server room with a high efficiency unit.


HVAC Controls – The building has basic HVAC controls with a few points. The old Johnson controls are the original pneumatic control system that is no longer operational. There is an opportunity for energy savings by installing an Energy Management System, however this is cost prohibitive.


Plug Load Equipment – There is general office and café equipment throughout the building. There are also gas-fired and electric meal prep equipment, as well as a number of refrigeration equipment. There were some empty refrigeration equipment which provides an opportunity for energy savings by replacing with compact high efficiency equipment. The computers throughout the building also provide a potential for implementing energy management software.


2.7 Water-Using Systems

There are many restrooms at this facility. A sampling of restrooms found that all of the faucets are rated for 2.2 gpm or higher. There is an opportunity for energy savings by installing low flow (0.5 gallon per minute) aerators on sinks throughout the building.

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

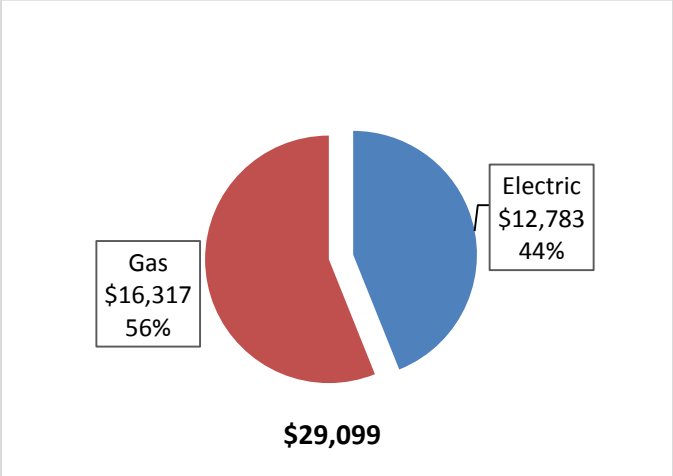
The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. A profile of the annual energy consumption and energy cost of the facility was developed from this information.

Figure 6 - Utility Summary

Utility Summary for Audrey W. Clark School		
Fuel	**Usage**	**Cost**
Electricity	64,182 kWh	$12,783
Natural Gas	15,226 Therms	$16,317
Total		**$29,099**

The current annual energy cost for this facility is $29,099 as shown in the chart below.

Figure 7 - Energy Cost Breakdown



3.2 Electricity Usage

Electricity is provided by JCP&L. The average electric cost over the past 12 months was $0.199/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 demand charges. The monthly electricity consumption and peak demand are shown in the chart below.

Figure 8 - Graph of 12 Months Electric Usage & Demand

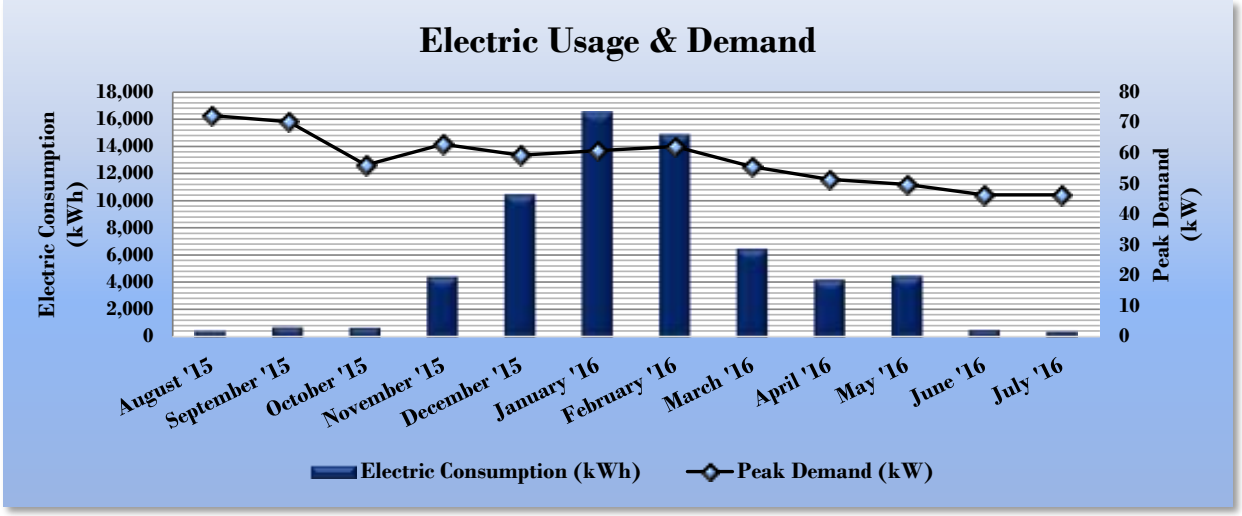


Figure 9 - Table of 12 Months Electric Usage & Demand

Electric Billing Data for Audrey W. Clark School					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
9/2/15	33	442	72	$197	$307
10/2/15	30	727	70	$366	$968
11/3/15	32	703	56	$298	$876
12/4/15	31	4,421	63	$336	$1,449
1/5/16	32	10,458	59	$316	$1,494
2/2/16	28	16,497	61	$324	$2,122
3/2/16	29	14,842	62	$343	$1,979
3/31/16	29	6,468	56	$306	$1,088
4/29/16	29	4,219	51	$288	$849
5/31/16	32	4,483	50	$298	$881
7/1/16	31	523	46	$263	$395
7/30/16	29	399	46	$263	$375
Totals	**365**	**64,182**	**72.3**	**$3,599**	**$12,783**
Annual	**365**	**64,182**	**72.3**	**$3,599**	**$12,783**

3.3 Natural Gas Usage

Natural Gas is provided by NJ Natural Gas. The average gas cost for the past 12 months is $1.072/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is shown in the chart below.

Figure 10 - Graph of 12 Months Natural Gas Usage

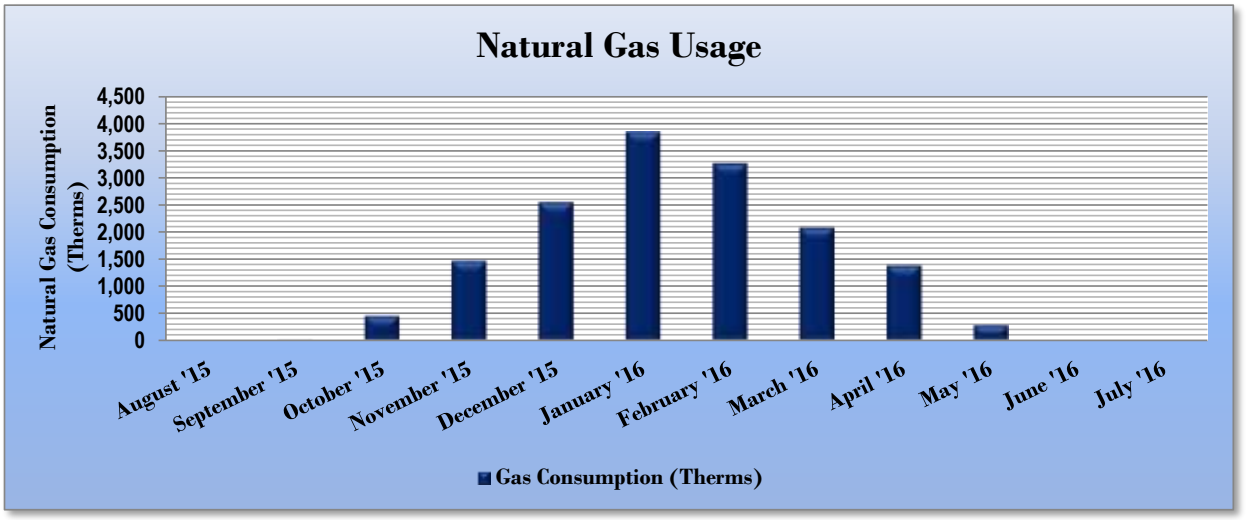


Figure 11 - Table of 12 Months Natural Gas Usage

Gas Billing Data for Audrey W. Clark School			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
9/10/15	30	0	$349
10/8/15	28	2	$351
11/9/15	32	448	$701
12/10/15	31	1,465	$1,518
1/12/16	33	2,546	$2,381
2/12/16	31	3,846	$3,420
3/15/16	32	3,267	$2,958
4/11/16	27	2,080	$2,009
5/11/16	30	1,381	$1,452
6/13/16	33	276	$570
7/14/16	31	0	$349
8/12/16	29	0	$349
Totals	**367**	**15,310**	**$16,406**
Annual	**365**	**15,226**	**$16,317**

3.4 Benchmarking

This facility was benchmarked using *Portfolio Manager*, an online tool created and managed by the U.S. 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.

Energy Use Intensity 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		
	Audrey W. Clark School	National Median Building Type: School (K-12)
Source Energy Use Intensity (kBtu/ft^2)	49.6	141.4
Site Energy Use Intensity (kBtu/ft^2)	37.8	58.2

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

Figure 13 - Energy Use Intensity Comparison – Following Installation of Recommended Measures

Energy Use Intensity Comparison - Following Installation of Recommended Measures		
	Audrey W. Clark School	National Median Building Type: School (K-12)
Source Energy Use Intensity (kBtu/ft^2)	21.5	141.4
Site Energy Use Intensity (kBtu/ft^2)	24.8	58.2

Many types of commercial buildings are also eligible to receive an ENERGY STAR™ score. This score is a percentile ranking from 1 to 100. It compares your building's energy performance to similar buildings nationwide. A score of 50 represents median energy performance, while a score of 75 means your building performs better than 75 percent of all similar buildings nationwide and may be eligible for ENERGY STAR® certification. Your building is not is one of the building categories that are eligible to receive a score.

This facility has a current score of 95.

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

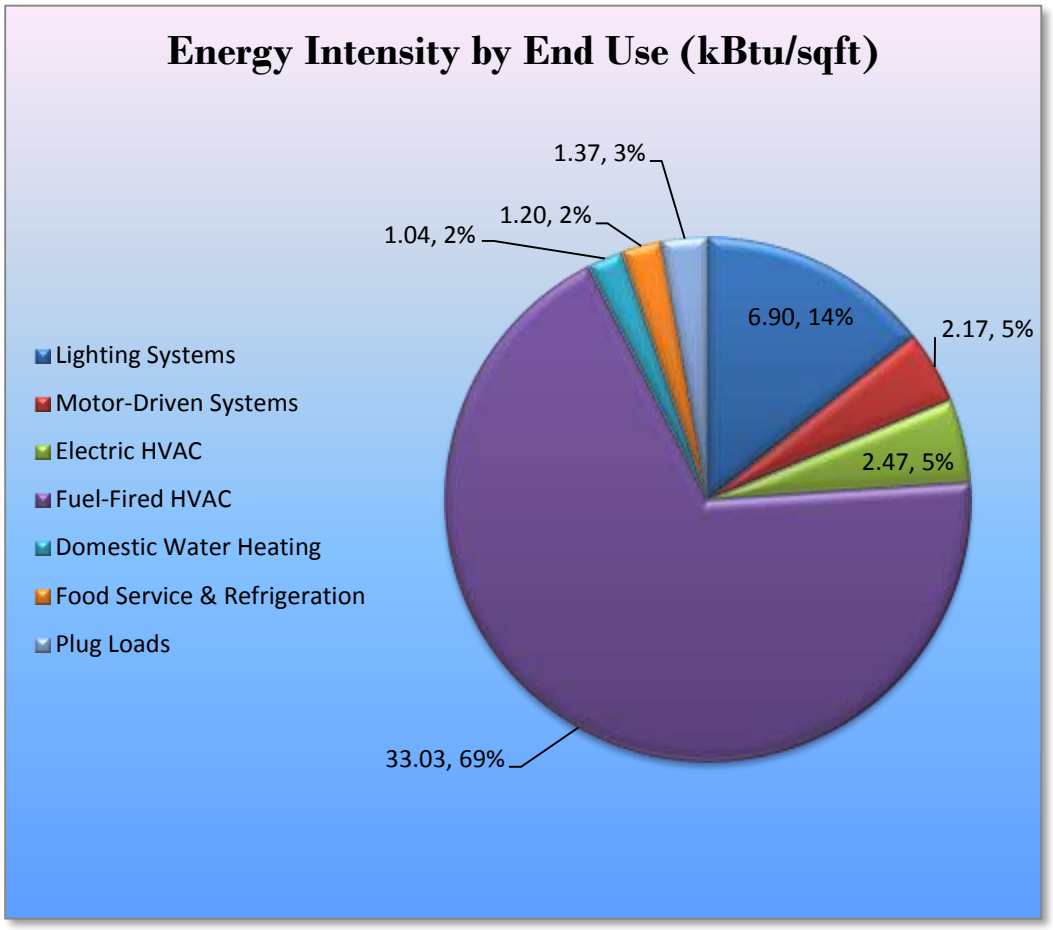
For more information on Energy Star certification go to: https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1

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 Audrey W. Clark 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 March 17, 2014, 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 7.

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		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**52,204**	**14.4**	**0.0**	**$10,372.40**	**$124,690.01**	**$9,600.00**	**$115,090.01**	**11.1**	**52,569**
ECM 1	Install LED Fixtures	Yes	16,206	3.3	0.0	$3,227.67	$56,829.42	$3,800.00	$53,029.42	16.4	16,320
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	35,677	11.0	0.0	$7,105.51	$67,591.83	$5,800.00	$61,791.83	8.7	35,927
ECM 3	Retrofit Fixtures with LED Lamps	Yes	197	0.1	0.0	$39.21	$268.77	$0.00	$268.77	6.9	198
Lighting Control Measures			**11,190**	**3.4**	**0.0**	**$2,228.62**	**$11,510.00**	**$1,115.00**	**$10,395.00**	**4.7**	**11,268**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	11,066	3.4	0.0	$2,203.97	$11,450.00	$1,115.00	$10,335.00	4.7	11,144
ECM 5	Install Photocell Controls	Yes	124	0.0	0.0	$24.65	$60.00	$0.00	$60.00	2.4	125
Motor Upgrades			**287**	**0.2**	**0.0**	**$57.12**	**$3,596.76**	**$0.00**	**$3,596.76**	**63.0**	**289**
ECM 6	Replace Exhaust Fan Motors	Yes	287	0.2	0.0	$57.12	$3,596.76	$0.00	$3,596.76	63.0	289
Variable Frequency Drive (VFD) Measures			**8,622**	**2.9**	**0.0**	**$1,717.24**	**$63,368.80**	**$533.33**	**$62,835.47**	**36.6**	**8,683**
ECM 7	Install VFD on AHU Supply Fans and Upgrade Motors	Yes	2,005	0.9	0.0	$399.24	$6,760.31	$0.00	$6,760.31	16.9	2,019
ECM 8	Install Unit Ventilators with EC Motors	Yes	1,126	0.7	0.0	$224.31	$112,188.56	$0.00	$112,188.56	500	1,134
ECM 9	Install VFDs on Hot Water Pumps and Motor Upgrade	Yes	6,431	1.6	0.0	$1,280.77	$8,152.44	$0.00	$8,152.44	6.4	6,476
Electric Unitary HVAC Measures			**1,251**	**0.4**	**0.0**	**$249.24**	**$2,992.44**	**$184.00**	**$2,808.44**	**11.3**	**1,260**
ECM 10	Install High Efficiency Electric AC	Yes	1,251	0.4	0.0	$249.24	$2,992.44	$184.00	$2,808.44	11.3	1,260
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**227.6**	**$2,438.74**	**$65,816.27**	**$7,581.20**	**$58,235.07**	**23.9**	**26,646**
ECM 11	Install High Efficiency Hot Water Boilers	Yes	0	0.0	227.6	$2,438.74	$65,816.27	$7,581.20	$58,235.07	23.9	26,646
HVAC System Improvements			**0**	**0.0**	**1.8**	**$18.92**	**$43.50**	**$0.00**	**$43.50**	**2.3**	**207**
ECM 12	Install Pipe Insulation	Yes	0	0.0	1.8	$18.92	$43.50	$0.00	$43.50	2.3	207
Domestic Water Heating Upgrade			**14,052**	**1.4**	**-28.6**	**$2,492.04**	**$8,136.80**	**$50.00**	**$8,086.80**	**3.2**	**10,801**
ECM 13	Install High Efficiency Gas Water Heater	Yes	14,052	1.4	-47.9	$2,284.76	$8,022.08	$50.00	$7,972.08	3.5	8,536
ECM 14	Install Low-Flow Domestic Hot Water Devices	Yes	0	0.0	19.3	$207.27	$114.72	$0.00	$114.72	0.6	2,265
Custom Measures			**-51,756**	**0.2**	**1,715.5**	**$8,075.11**	**$402,290.00**	**$0.00**	**$402,290.00**	**49.8**	**148,740**
ECM 15	Computer Power Management Software	Yes	2,416	0.0	0.0	$481.14	$3,010.00	$0.00	$3,010.00	6.3	2,433
ECM 16	Replace Refrigeration Equipment with Smaller Energy Star Equipment	Yes	2,035	0.2	0.0	$405.33	$1,300.00	$0.00	$1,300.00	3.2	2,049
ECM 17	Blower Door Testing & Building Envelope Improvements	Yes	667	0.0	76.1	$948.58	$13,830.00	$0.00	$13,830.00	14.6	9,585
TOTALS (Recommended)			**92,724**	**22.8**	**276.9**	**$21,409.35**	**$298,294.58**	**$19,063.53**	**$279,231.05**	**13.0**	**125,790**

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

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

4.1.1 Lighting Upgrades

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

Figure 16 – Summary of Lighting Upgrade ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**52,080**	**14.4**	**0.0**	**$10,372.40**	**$124,690.01**	**$9,600.00**	**$115,090.01**	**11.1**	**52,444**
ECM 1	Install LED Fixtures	16,206	3.3	0.0	$3,227.67	$56,829.42	$3,800.00	$53,029.42	16.4	16,320
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	35,677	11.0	0.0	$7,105.51	$67,591.83	$5,800.00	$61,791.83	8.7	35,927
ECM 3	Retrofit Fixtures with LED Lamps	197	0.1	0.0	$39.21	$268.77	$0.00	$268.77	6.9	198

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. Please see **Appendix A: Equipment Inventory & Recommendations** for a detailed list of the locations and recommended upgrades for each lighting measure.

ECM 1: Install LED Fixtures

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	11,600	3.3	0.0	$2,310.27	$53,704.00	$3,000.00	$50,704.00	21.9	11,681
Exterior	4,606	0.0	0.0	$917.40	$3,125.42	$800.00	$2,325.42	2.5	4,639

Measure Description

We recommend replacing the compact fluorescent lamp 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 and use of the gymnasium light fixtures, improves light output as well as significantly reduces required maintenance.

This measure also recommends replacing the exterior metal halide lamp fixtures with LED fixtures. This measure also includes the replacement of exterior wall mounted and flood fixtures one-for-one with new LED wall pack and flood 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.

ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	35,677	11.0	0.0	$7,105.51	$67,591.83	$5,800.00	$61,791.83	8.7	35,927
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.

For the purpose of this report, we recommend retrofitting the existing fixtures rather than just replacing the lamps. It should be noted that the existing T8 electronic ballasts may be compatible with turn-key LED lamp replacements which would reduce the estimated installation costs and provide comparable energy savings.

ECM 3: Retrofit Fixtures with LED Lamps

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	197	0.1	0.0	$39.21	$268.77	$0.00	$268.77	6.9	198
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.0	0

Measure Description

We recommend replacing existing compact fluorescent lamps with LED lamps. Existing fixtures in the interior applications are included within this measure. 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 lamps and more than 10 times longer than many incandescent lamps.

4.1.2 Lighting Control Measures

Figure 17 – Summary of Lighting Control ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**11,190**	**3.4**	**0.0**	**$2,228.62**	**$11,510.00**	**$1,115.00**	**$10,395.00**	**4.7**	**11,268**
ECM 4	Install Occupancy Sensor Lighting Controls	11,066	3.4	0.0	$2,203.97	$11,450.00	$1,115.00	$10,335.00	4.7	11,144
ECM 5	Install Daylight Dimming Controls	124	0.0	0.0	$24.65	$60.00	$0.00	$60.00	2.4	125

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. Please see **Appendix A: Equipment Inventory & Recommendations** for a detailed list of the locations and recommended lighting controls upgrades for each lighting measure.

ECM 4: Install Occupancy Sensor Lighting Controls

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
11,066	3.4	0.0	$2,203.97	$11,450.00	$1,115.00	$10,335.00	4.7	11,144

Measure Description

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

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

ECM 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_2e Emissions Reduction (lbs)
124	0.0	0.0	$24.65	$60.00	$0.00	$60.00	2.4	125

Measure Description

We recommend installing photocell controls on exterior lighting fixtures which were noted to be on during the day. These controls use photosensors to reduce electric lighting in during daylight hours. This is a cost effective way to ensure exterior lighting is only operating between dusk to dawn hours, as appropriate. Mounting configuration will need to be investigated further prior to implementation.

4.1.3 Motor Upgrades

ECM 6: Replace Exhaust Fan Motors

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
287	0.2	0.0	$57.12	$3,596.76	$0.00	$3,596.76	63.0	289

Measure Description

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

Per discussions with facility personnel the exhaust fans are all in poor condition and in need of replacement. Although this measure results in a poor payback period, it is recommended based on the potential for energy savings, improved occupant comfort and safety concerns.

Please see **Appendix A: Equipment Inventory & Recommendations** for more information on existing and proposed motor upgrades.

4.1.4 Variable Frequency Drive Measures

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

Figure 18 – Summary of Variable Frequency Drive ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**9,562**	**3.2**	**0.0**	**$1,904.32**	**$127,101.31**	**$0.00**	**$127,101.31**	**66.7**	**9,629**
ECM 7	Install VFD on Variable Air Volume (VAV) HVAC	2,005	0.9	0.0	$399.24	$6,760.31	$0.00	$6,760.31	16.9	2,019
ECM 8	Install VFDs on Constant Volume (CV) HVAC	1,126	0.7	0.0	$224.31	$112,188.56	$0.00	$112,188.56	500.1	1,134
ECM 9	Install VFDs on Hot Water Pumps	6,431	1.6	0.0	$1,280.77	$8,152.44	$0.00	$8,152.44	6.4	6,476

Please see **Appendix A: Equipment Inventory & Recommendations** for more information about current motors systems and VFD recommendations.

ECM 7: Install VFD on AHU Supply Fans and Upgrade Motors

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
2,005	0.9	0.0	$399.24	$6,760.31	$0.00	$6,760.31	16.9	2,019

Measure Description

We recommend replacing existing air volume control devices on air handling units (AHUs), such as inlet vanes and variable pitch fan blades, with variable frequency drives (VFDs). Inlet guide vanes and variable pitch fan blades are an inefficient means of controlling the air volume compared to VFDs. The existing volume control device would be removed, or permanently disabled, and the control signal would be redirected to the VFD to determine proper fan motor speed. Energy savings results from more efficient control of motor energy usage when fan motors are operated at partial load. The magnitude of energy savings is based on the estimated amount of time that fan motors would be operated at partial load.

Additional maintenance savings may result from this measure as well, since VFDs are solid state electronic device, which generally requires less maintenance than mechanical air volume control devices.

ECM 8: Install Unit Ventilators with 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_2e Emissions Reduction (lbs)
1,126	0.7	0.0	$224.31	$112,188.56	$0.00	$112,188.56	500.1	1,134

Measure Description

We recommend 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. Based on discussions with facility personnel and the inspection of existing unit ventilators throughout the building, they are in poor condition and in need of replacement. We therefore recommend replacement with new unit ventilators equipped with EC Motors. The estimated installation costs are from RS Means for classroom unit ventilators with standard controls. Although this measure results in a very poor payback period, it is recommended based on the poor condition of the existing units, improved occupant comfort with slight potential energy savings.

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.

ECM 9: Install VFDs on Hot Water Pumps and Motor Upgrade

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
6,431	1.6	0.0	$1,280.77	$8,152.44	$0.00	$8,152.44	6.4	6,476

Measure Description

We recommend installing a variable frequency drives (VFD) to control a hot water pumps and replace the existing motors with NEMA Premium Efficiency 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 *New Jersey's Clean Energy Program Protocols to Measure Resource Savings (2016)*. Savings are based on the difference between baseline and proposed efficiencies and the assumed annual operating hours.

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

4.1.5 Electric Unitary HVAC Measures

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

Figure 19 - Summary of Unitary HVAC ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Electric Unitary HVAC Measures		**1,251**	**0.4**	**0.0**	**$249.24**	**$2,992.44**	**$184.00**	**$2,808.44**	**11.3**	**1,260**
ECM 10	Install High Efficiency Electric AC	1,251	0.4	0.0	$249.24	$2,992.44	$184.00	$2,808.44	11.3	1,260

Please see **Appendix A: Equipment Inventory & Recommendations** for more information about existing HVAC equipment and proposed upgrades.

ECM 10: Install High Efficiency Air Conditioning Units

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
1,251	0.4	0.0	$249.24	$2,992.44	$184.00	$2,808.44	11.3	1,260

Measure Description

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

4.1.6 Gas-Fired Heating System Replacements

Our recommendations for gas-fired heating system replacements are summarized in Figure 20 below.

Figure 20 - Summary of Gas-Fired Heating Replacement ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**227.6**	**$2,438.74**	**$65,816.27**	**$7,581.20**	**$58,235.07**	**23.9**	**26,646**
ECM 11	Install High Efficiency Hot Water Boilers	0	0.0	227.6	$2,438.74	$65,816.27	$7,581.20	$58,235.07	23.9	26,646

Please see **Appendix A: Equipment Inventory & Recommendations** for more details on existing equipment and proposed replaced measure.

ECM 11: Install High Efficiency Hot Water Boilers

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
0	0.0	227.6	$2,438.74	$65,816.27	$7,581.20	$58,235.07	23.9	26,646

Measure Description

The existing boilers are over 50 years old, reached the end of their useful life and in need of replacement. We recommend replacing older inefficient hot water boilers with high efficiency condensing hot water boilers. Significant improvements have been made in combustion technology resulting in increased overall boiler efficiency. Energy savings results from improved combustion efficiency and reduced standby losses at low loads. Although there may be operational and maintenance (O&M) cost savings associated with this measure, they are not quantified as part of the economics.

The most notable efficiency improvement is condensing hydronic boilers that can achieve over 90% efficiency under the proper conditions. Condensing hydronic boilers typically operate at efficiencies between 85% and 87% (comparable to other high efficiency boilers) when the return water temperature is above 130°F. The boiler efficiency increases as the return water temperature drops below 130°F. Therefore, condensing hydronic boilers were only evaluated when the return water temperature is less than 130°F during most of the operating hours. As a result condensing hydronic boilers are recommended for this site.

4.1.7 HVAC System Upgrades

Our recommendation for HVAC system improvement are summarized in Figure 21 below.

Figure 21 - Summary of HVAC System Improvement ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
HVAC System Improvements		**0**	**0.0**	**1.8**	**$18.92**	**$43.50**	**$0.00**	**$43.50**	**2.3**	**207**
ECM 12	Install Pipe Insulation	0	0.0	1.8	$18.92	$43.50	$0.00	$43.50	2.3	207

ECM 12: Install Pipe Insulation

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
0	0.0	1.8	$18.92	$43.50	$0.00	$43.50	2.3	207

Measure Description

We recommend installing insulation on domestic heating system piping. Distribution system losses are dependent on heating water system temperature, the size of the distribution system, and the level of insulation of the piping. Significant energy savings can be achieved when insulation has not been well maintained. When the insulation is exposed to water, when the insulation has been removed from some areas of the pipe, or when valves have not been properly insulated system efficiency can be significantly reduced.

This measure saves energy by reducing heat losses from the heating distribution system. Based on the proposed gas-fired domestic water heating equipment, the estimated energy savings provided assume that the equipment replacement moves forward in order to take interactive effects into account.

4.1.8 Domestic Hot Water Heating System Upgrades

Our recommendations for domestic water heating system improvements are summarized in Figure 22 below.

Figure 22 - Summary of Domestic Water Heating ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**14,052**	**1.4**	**-28.6**	**$2,492.04**	**$8,136.80**	**$50.00**	**$8,086.80**	**3.2**	**10,801**
ECM 13	Install High Efficiency Gas Water Heater	14,052	1.4	-47.9	$2,284.76	$8,022.08	$50.00	$7,972.08	3.5	8,536
ECM 14	Install Low-Flow Domestic Hot Water Devices	0	0.0	19.3	$207.27	$114.72	$0.00	$114.72	0.6	2,265

Please see **Appendix A: Equipment Inventory & Recommendations** for more details on the facility's existing domestic hot water equipment and recommended system upgrades.

ECM 13: Install High Efficiency Gas-Fired Water Heater

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
14,052	1.4	-47.9	$2,284.76	$8,022.08	$50.00	$7,972.08	3.5	8,536

Measure Description

We recommend replacing the existing tank water heater with a high efficiency gas-fired tank water heater. Improvements in combustion efficiency and reductions in heat losses have improved the overall efficiency of storage water heaters. Energy savings results from using less gas to heat water, due to higher unit efficiency, and fewer run hours to maintain the tank water temperature. Additional cost savings associated with this measure are driven by the fuel switch. The cost for electricity is much more expensive on a per unit of energy basis in comparison to natural gas.

Electric	$58.35	per MMBtu
Natural Gas	$10.72	per MMBtu

ECM 14: Install Low-Flow DHW Devices

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
0	0.0	19.3	$207.27	$114.72	$0.00	$114.72	0.6	2,265

Measure Description

We recommend installing low-flow domestic hot water devices to reduce overall hot water demand. Energy demand from domestic hot water heating systems can be reduced by reducing water usage in general. Faucet aerators can reduce hot water usage, relative to standard aerators, which saves energy. Installing low-flow sink aerators is a cost-effective approach to reducing hot water energy consumption.

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

4.1.9 Custom Measures

Additional custom measure energy saving opportunities are addressed in this section. Recommended custom measures are summarized in Figure 23 below.

Figure 23 - 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_2e Emissions Reduction (lbs)
Custom Measures		**5,118**	**0.2**	**76.1**	**$1,835.05**	**$18,140.00**	**$0.00**	**$18,140.00**	**9.9**	**14,067**
ECM 15	Computer Power Management Software	2,416	0.0	0.0	$481.14	$3,010.00	$0.00	$3,010.00	6.3	2,433
ECM 16	Replace Refrigeration Equipment with Smaller Energy Star Equipment	2,035	0.2	0.0	$405.33	$1,300.00	$0.00	$1,300.00	3.2	2,049
ECM 17	Blower Door Testing & Building Envelope Improvements	667	0.0	76.1	$948.58	$13,830.00	$0.00	$13,830.00	14.6	9,585

ECM 15: 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_2e Emissions Reduction (lbs)
2,416	0.0	0.0	$481.14	$3,010.00	$0.00	$3,010.00	6.3	2,433

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 over nights, 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. The image to the right is for demonstration purposes only and represents the difference between potential duration of devices being in Power-On States vs. the duration of User Activity. This difference provides an opportunity for energy savings by implementing power management software.

Please see **Appendix A: Equipment Inventory & Recommendations** for more details on existing equipment and proposed measures.

ECM 16: Replace Refrigeration Equipment with Smaller Energy Star 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_2e Emissions Reduction (lbs)
2,035	0.2	0.0	$405.33	$1,300.00	$0.00	$1,300.00	3.2	2,049

Measure Description

There were two (2) refrigerators located in the lounge and life skills room that were noted to be 50% and 70% empty, respectively. There is an opportunity for energy savings by replacing these with compact energy star refrigeration units that are high efficiency.

Please see **Appendix A: Equipment Inventory & Recommendations** for more details on existing equipment and proposed measures.

ECM 17: Blower Door Testing & Building Envelope Improvements

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
667	0.0	76.1	$948.58	$13,830.00	$0.00	$13,830.00	14.6	9,585

Measure Description

There is an energy savings opportunity by reducing the uncontrolled air exchange between the outside and inside of the building. Blower door assisted comprehensive building air sealing will reduce the amount of air exchange which will in turn reduce the load on the buildings heating and cooling equipment and thus providing energy savings and increased occupant comfort. During the energy assessment, many sources of air leaks were observed. This is typical in a building of this age with original construction including cracks/gaps around windows/doors, ceiling paneling and exterior wall surfaces/joints. The existing building is extremely leaky and would greatly benefit from blower door testing and air sealing. The blower door assisted air sealing is a cost effective approach to identify and prioritize areas of highest leakage to be sealed. Materials may include caulk, polyurethane foam, weather-stripping materials, etc.

Please see **Appendix A: Equipment Inventory & Recommendations** for more details on existing equipment and proposed measures.

4.2 ECMs Evaluated But Not Recommended

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

Figure 24 – Summary of Measures Evaluated, But Not Recommended

Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Custom Measures	**-56,874**	**0.0**	**1,639.3**	**$6,240.06**	**$384,150.00**	**$0.00**	**$384,150.00**	**61.6**	**134,673**
Installation of an Energy Management System	666	0.0	116.6	$1,381.79	$69,150.00	$0.00	$69,150.00	50.0	14,319
Instalation of VRF Systems (Optional)	-57,540	0.0	1,522.8	$4,858.27	$315,000.00	$0.00	$315,000.00	64.8	120,354
TOTALS	**-56,874**	**0.0**	**1,639.3**	**$6,240.06**	**$384,150.00**	**$0.00**	**$384,150.00**	**61.6**	**134,673**

* - 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).

Installation of an Energy Management System

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
666	0.0	116.6	$1,381.79	$69,150.00	$0.00	$69,150.00	50.0	14,319

Measure Description

The installation of an Energy Management System (EMS) increases the efficiency of the building HVAC system operation. Upgrade of controls to optimize the start/stop of all key HVAC equipment, tying in all space temperature controls will minimize the amount of waste energy. Schedules may be put in place to limit system operation when the building is closed. Temperature set back controls may be applied to operate systems only to the point necessary. Ventilation and economizer controls and programming would allow air handling units to operate according to room schedules, occupancy and availability for "free cooling" or "free heating". Some EMS may also tie in lighting control based on occupancy and schedules. This measure is not recommended based on the energy and economic results, however it should be considered as a capital improvement measure for future implementation. Also,if other measures are installed at the same time, with shorter payback periods, this may balance out the longer payback period of this measure. As such, it would be recommend that an HVAC contractor who specializes in energy management systems be contacted for a detailed evaluation and implementation costs. For the purposes of this report, the potential energy savings and measure costs were estimated based on industry standards and previous project experience.

Please see **Appendix A: Equipment Inventory & Recommendations** for more details on existing equipment and proposed measures.

Reasons for not Recommending

This measure is not recommended based on the energy and economic results, however it should be considered as a capital improvement measure for future implementation. If proposed EMS controls two distinct systems (e.g. HVAC and lighting) and savings identified exceed 75,000 kWh annually or 1,500 therms this measure may qualify for a SmartStart Custom Measure incentive.

Installation of VRF Systems

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
-57,540	0.0	1,522.8	$4,858.27	$315,000.00	$0.00	$315,000.00	64.8	120,354

Measure Description

Variable refrigerant flow systems are a multi-split type HVAC system to provide the ability to condition the building and maintain individual zone control in each room, floor and area of the building. This type of system has precise individual controls and technology designed to minimize energy consumption and optimize energy savings above traditional HVAC systems. A modular design of outdoor units with a variety of indoor units allow for specified design and installation. A heat recovery system has a high initial cost, however the potential savings are significant. The system allows for the ability to provide heating and cooling to different spaces at the same time. Heat is essentially transferred to wherever in the system it is needed, without requiring the use of hot water or chilled water to be supplied to the space. Using this type of system requires electric heating and cooling. The coefficient of performance (COP) for heating is greater than 4.0, in comparison to a traditional electric resistance heating COP of 1.0. The integrated energy efficiency rating (IEER) are higher than 24, in comparison to water cooled air conditioners rated at 13.6 IEER as recommended by ASHRAE Standard 90.1-2013.

Per discussions with a representative from the leading manufacturer, the proposed system could utilize ceiling units integrated into the existing drop in ceiling. One of the biggest benefits of installing VRF in a situation like this is that the existing system and infrastructure can remain intact and untouched while VRF is being installed. It can be done where one day the hot water / chilled water is on and the next the VRF is on and the existing is off.

Please see **Appendix A: Equipment Inventory & Recommendations** for more details on existing equipment and proposed measures.

Reasons for not Recommending

This measure is not recommended for implementation due to the economic results. This measure was compared to the aggregate of all HVAC related measures that are recommended to upgrade the existing systems in the building. However, this type of system is an extremely energy efficient option worth considering for future implementation. If final savings identified exceed 75,000 kWh annually or 1,500 therms this measure may qualify for a SmartStart Custom Measure incentive.

5 ENERGY EFFICIENT PRACTICES

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

Reduce Air Leakage

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

Close Doors and Windows

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

Perform Proper Lighting Maintenance

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

Develop a Lighting Maintenance Schedule

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

Ensure Lighting Controls Are Operating Properly

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

Perform Routine Motor Maintenance

Motors consist of many moving parts whose collective degradation can contribute to a significant loss of motor efficiency. 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.

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.

Check for and Seal Duct Leakage

Duct leakage in commercial buildings typically accounts for 5 to 25 percent of the supply airflow. In the case of rooftop air handlers, duct leakage can occur to the outside of the building, significantly increasing cooling and heating costs. By sealing sources of leakage, cooling, heating, and ventilation energy use can be reduced significantly, depending on the severity of air leakage.

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.

6 DEMAND RESPONSE

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

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

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

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

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

The first step toward participation in a DR program is to contact a Curtailment Service Provider. A list of these providers is available on PJM's website and it includes contact information for each company, as well as the states where they have active business (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 (www.pjm.com/training/trainingmaterial.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.

7 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 25 for a list of the eligible programs identified for each recommended ECM.

Figure 255 - 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			
ECM 6	Replace Exhaust Fan Motors			x			
ECM 7	Install VFD on AHU Supply Fans and Upgrade Motors						
ECM 8	Install Unit Ventilators with EC Motors						
ECM 9	Install VFDs on Hot Water Pumps and Motor Upgrade			x			
ECM 10	Install High Efficiency Electric AC	x		x			
ECM 11	Install High Efficiency Hot Water Boilers	x		x			
ECM 12	Install Pipe Insulation			x			
ECM 13	Install High Efficiency Gas Water Heater	x					
ECM 14	Install Low-Flow Domestic Hot Water Devices			x			
ECM 15	Computer Power Management Software						
ECM 16	Replace Refrigeration Equipment with Smaller Energy Star Equipment						
ECM 17	Blower Door Testing & Building Envelope Improvements						

SmartStart (SS) 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 (DI) 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 SS 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

7.1 SmartStart

Overview

The SmartStart (SS) 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 SS prescriptive incentive program provides fixed incentives for specific energy efficiency measures, whereas the SS custom program provides incentives for new and innovative technologies, or process improvements not defined through one of the prescriptive incentives listed above.

Although your facility is an existing building, and only the prescriptive incentives have been applied in the calculations, the SS custom measure path is recommended for ECM 4 (Install VFDs on Well Pumps). These incentives are calculated utilizing a number of factors, including project cost, energy savings and comparison to existing conditions or a defined standard. To qualify, the proposed measure(s) must be at least 2% more efficient than current energy code or recognized industry standard, and save at least 75,000 kWh or 1,500 therms annually.

SS 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 in the SS program (inclusive of prescriptive and custom) 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 SS prescriptive program you will need to submit an application for the specific equipment installed or 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. Please note that SS custom application requirements are different from the prescriptive applications and will most likely require additional effort to complete.

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

7.2 Direct Install

Overview

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

Incentives

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

How to Participate

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

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

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

7.3 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 descriptions and application can be found at: www.njcleanenergy.com/ESIP

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

7.4 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 (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 (www.pjm.com/training/trainingmaterial.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 6 for additional information.

8 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

8.1 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.

8.2 Retail Natural Gas Supply Options

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

A customer's decision about whether to buy natural gas from a retail supplier is typically dependent upon whether a customer seeks budget certainty and/or longer-term rate stability. Customers can secure longer-term fixed prices by signing up for service through a third party retail natural gas supplier. Many larger natural gas customers may seek the assistance of a professional consultant to assist in their procurement process.

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

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

Appendix A: Equipment Inventory & Recommendations

Lighting Inventory & Recommendations

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Office	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	2,000	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,000	0.01	32	0.0	$6.37	$107.00	$10.00	15.22
Lounge	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,000	Relamp & Reballast	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,400	0.16	575	0.0	$114.61	$818.00	$80.00	6.44
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	1,000	None	No	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	1,000	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	1,000	None	No	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	1,000	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Principals Office	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,000	Relamp & Reballast	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,400	0.16	575	0.0	$114.61	$818.00	$80.00	6.44
Closet	1	Compact Fluorescent: <Enter Fixture Description>	Wall Switch	26	50	None	No	1	Compact Fluorescent: <Enter Fixture Description>	Wall Switch	26	50	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Main Office	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,000	Relamp & Reballast	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,400	0.16	575	0.0	$114.61	$642.00	$80.00	4.90
Nurse's Office	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,000	Relamp & Reballast	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,400	0.11	384	0.0	$76.41	$584.00	$60.00	6.86
Nurse's Office	2	Compact Fluorescent: <Enter Fixture Description>	Wall Switch	13	2,000	Relamp	No	1	LED Screw-In Lamps: <Enter Fixture Description>	Wall Switch	7	2,000	0.01	44	0.0	$8.70	$53.75	$0.00	6.18
Hallway	1	Compact Fluorescent: <Enter Fixture Description>	Wall Switch	26	2,258	Relamp	No	1	LED Screw-In Lamps: <Enter Fixture Description>	Wall Switch	7	2,258	0.01	49	0.0	$9.82	$107.51	$0.00	10.94
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	1,000	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	1,000	0.01	18	0.0	$3.66	$107.00	$10.00	26.47
Hallway	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,258	Relamp & Reballast	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,258	0.04	145	0.0	$28.95	$161.83	$20.00	4.90
Men's Restroom	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,000	Relamp & Reballast	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	700	0.11	192	0.0	$38.20	$738.00	$75.00	17.35
Women's Restroom	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,000	Relamp & Reballast	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	700	0.11	192	0.0	$38.20	$738.00	$75.00	17.35
Closet	1	Compact Fluorescent: <Enter Fixture Description>	Wall Switch	22	50	None	No	1	Compact Fluorescent: <Enter Fixture Description>	Wall Switch	22	50	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Hallway	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,258	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,258	0.02	86	0.0	$17.06	$117.00	$10.00	6.27
Stairs	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,258	Relamp & Reballast	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,580	0.22	866	0.0	$172.49	$2,016.00	$80.00	11.22
Boiler Room	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	100	None	No	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	100	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
1st Floor Hallways	41	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,258	Relamp & Reballast	Yes	41	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,580	1.12	4,439	0.0	$884.00	$5,877.00	$410.00	6.18
Lobby	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,258	Relamp & Reballast	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,580	0.29	1,132	0.0	$225.54	$972.00	$60.00	4.04
Classroom #1	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.57	1,813	0.0	$361.02	$2,727.00	$245.00	6.87
Classroom #2	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.57	1,813	0.0	$361.02	$2,727.00	$245.00	6.87
Classroom #3	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.57	1,813	0.0	$361.02	$2,727.00	$245.00	6.87
Classroom #4	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.49	1,554	0.0	$309.45	$2,376.00	$215.00	6.98
Classroom #5	25	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	25	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.68	2,158	0.0	$429.79	$3,195.00	$285.00	6.77

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Classroom #6	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.66	2,072	0.0	$412.59	$3,078.00	$275.00	6.79
Classroom #7	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.66	2,072	0.0	$412.59	$3,078.00	$275.00	6.79
Classroom #8	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.57	1,813	0.0	$361.02	$2,727.00	$245.00	6.87
Restrooms	4	Compact Fluorescent: <Enter Fixture Description>	Wall Switch	26	1,000	Relamp	No	1	LED Screw-In Lamps: <Enter Fixture Description>	Wall Switch	7	1,000	0.06	112	0.0	$22.22	$53.75	$0.00	2.42
Storage Closets	4	Compact Fluorescent: <Enter Fixture Description>	Wall Switch	26	50	None	No	4	Compact Fluorescent: <Enter Fixture Description>	Wall Switch	26	50	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Classroom #9	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.57	1,813	0.0	$361.02	$2,727.00	$245.00	6.87
Classroom #10	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.57	1,813	0.0	$361.02	$2,727.00	$245.00	6.87
Classroom #11	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.57	1,813	0.0	$361.02	$2,727.00	$245.00	6.87
Classroom #12	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.57	1,813	0.0	$361.02	$2,727.00	$245.00	6.87
Time Out Room	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	100	None	No	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	100	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
2nd Floor Hallways	26	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,258	Relamp & Reballast	Yes	26	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,580	0.71	2,815	0.0	$560.58	$3,852.00	$260.00	6.41
Classroom #13	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.57	1,813	0.0	$361.02	$2,727.00	$245.00	6.87
Classroom #14	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.57	1,813	0.0	$361.02	$2,727.00	$245.00	6.87
Classroom #15	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.57	1,813	0.0	$361.02	$2,727.00	$245.00	6.87
Classroom #16	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.49	1,554	0.0	$309.45	$2,376.00	$215.00	6.98
Classroom #17	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.49	1,554	0.0	$309.45	$2,376.00	$215.00	6.98
Classroom #18	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.49	1,554	0.0	$309.45	$2,376.00	$215.00	6.98
Classroom #19	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.49	1,554	0.0	$309.45	$2,376.00	$215.00	6.98
Classroom #20	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.49	1,554	0.0	$309.45	$2,376.00	$215.00	6.98
Room #21	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.22	691	0.0	$137.53	$1,052.00	$100.00	6.92
Life Skills Room	23	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,800	Relamp & Reballast	Yes	23	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,260	0.63	1,985	0.0	$395.40	$2,961.00	$265.00	6.82
Server Room	1	Compact Fluorescent: <Enter Fixture Description>	Wall Switch	26	50	None	No	1	Compact Fluorescent: <Enter Fixture Description>	Wall Switch	26	50	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Restroom	1	Compact Fluorescent: <Enter Fixture Description>	Wall Switch	26	1,000	Relamp	No	1	LED Screw-In Lamps: <Enter Fixture Description>	Wall Switch	7	1,000	0.01	22	0.0	$4.35	$53.75	$0.00	12.35
Closet	1	Compact Fluorescent: <Enter Fixture Description>	Wall Switch	22	50	None	No	1	Compact Fluorescent: <Enter Fixture Description>	Wall Switch	22	50	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Women's Restroom	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,000	Relamp & Reballast	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	700	0.11	192	0.0	$38.20	$738.00	$75.00	17.35

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Men's Restroom	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,000	Relamp & Reballast	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	700	0.11	192	0.0	$38.20	$738.00	$75.00	17.35
Mechcanical Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	50	None	No	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	50	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Gym	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	2,000	Relamp & Reballast	No	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,000	0.09	304	0.0	$60.47	$468.00	$40.00	7.08
Gym	20	Metal Halide: (1) 400W Lamp	Wall Switch	458	2,000	Fixture Replacement	Yes	20	LED - Fixtures: High-Bay	Occupancy Sensor	168	1,400	4.46	15,658	0.0	$3,118.55	$54,584.00	$3,140.00	16.50
Prep Room	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,400	Relamp & Reballast	No	9	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,400	0.19	478	0.0	$95.23	$1,053.00	$90.00	10.11
Exterior	2	Metal Halide: (1) 250W Lamp	None	295	3,650	Fixture Replacement	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	None	12	3,650	0.37	2,376	0.0	$473.17	$781.35	$200.00	1.23
Exterior	6	Metal Halide: (1) 100W Lamp	None	128	3,650	Fixture Replacement	No	6	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	None	12	3,650	0.46	2,921	0.0	$581.84	$2,344.06	$600.00	3.00
Exterior	7	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	None	70	3,650	None	No	7	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	None	70	3,650	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Exterior	2	Compact Fluorescent: <Enter Fixture Description>	None	26	3,650	None	No	2	Compact Fluorescent: <Enter Fixture Description>	None	26	3,650	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Exterior	7	Compact Fluorescent: <Enter Fixture Description>	None	23	3,650	None	No	7	Compact Fluorescent: <Enter Fixture Description>	None	23	3,650	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Exterior	4	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	None	10	3,650	None	No	4	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	None	10	3,650	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Exterior	1	Compact Fluorescent: <Enter Fixture Description>	None	26	8,760	None	Yes	1	Compact Fluorescent: <Enter Fixture Description>	Daylight Dimming	26	4,000	0.01	142	0.0	$28.35	$60.00	$0.00	2.12

Motor Inventory & Recommendations

		Existing Conditions						Proposed Conditions				Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Annual Operating Hours	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Roof	Exhaust	9	Exhaust Fan	0.3	60.0%	No	1,000	Yes	69.5%	No		0.21	287	0.0	$57.12	$3,596.76	$0.00	62.97
Boiler Room	Boiler Burner Motors	4	Other	1.0	82.0%	No	2,059	No	82.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Hot Water System	2	Heating Hot Water Pump	5.0	83.5%	No	2,059	Yes	89.5%	Yes	2	1.56	6,431	0.0	$1,280.77	$8,152.44	$0.00	6.37
Various	Unit Ventilators	22	Supply Fan	0.2	60.0%	No	1,373	Yes	60.0%	Yes	22	0.74	1,126	0.0	$224.31	$63,507.18	$293.33	281.81
Mechanical Room	Air Handling Units	2	Supply Fan	1.5	84.0%	No	2,059	Yes	86.5%	Yes	2	0.91	2,005	0.0	$399.24	$6,760.31	$240.00	16.33

Electric HVAC Inventory & Recommendations

		Existing Conditions				Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Cooling Mode Efficiency (SEER/EER)	Heating Mode Efficiency (COP)	Install Dual Enthalpy Economizer?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Various	Classrooms	19	Window AC	1.26		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Outdoor	Split AC - Server Room	1	Split-System AC	2.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Various	Office	3	Window AC	0.67		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Outdoor	Split AC - Office	1	Split-System AC	2.00		Yes	1	Split-System AC	2.00		14.00		No	0.38	1,251	0.0	$249.24	$2,992.44	$184.00	11.27

Fuel Heating Inventory & Recommendations

		Existing Conditions			Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Whole Building	2	Non-Condensing Hot Water Boiler	1,723.00	Yes	2	Condensing Hot Water Boiler	1,723.00	91.00%	Et	0.00	0	227.6	$2,438.74	$65,816.27	$7,581.20	23.88

Pipe Insulation Recommendations

		Recommendation Inputs		Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	Length of Uninsulated Pipe (ft)	Pipe Diameter (in)	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
Mechanical Room	Domestic Hot Water	10	1.25	0.00	0	1.8	$18.92	$43.50	$0.00	2.30

DHW Inventory & Recommendations

		Existing Conditions		Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Room	Restrooms	1	Storage Tank Water Heater (≤ 50 Gal)	Yes	1	Storage Tank Water Heater (≤ 50 Gal)	Natural Gas	92.00%	Et	1.35	14,052	-47.9	$2,284.76	$8,022.08	$50.00	3.49

Low-Flow Device Recommendations

	Recommedation Inputs				Energy Impact & Financial Analysis						
Location	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Restroom	6	Faucet Aerator (Lavatory)	2.20	1.00	0.00	0	7.3	$77.73	$43.02	$0.00	0.55
Restroom	6	Faucet Aerator (Lavatory)	2.20	1.00	0.00	0	7.3	$77.73	$43.02	$0.00	0.55
Classrooms	4	Faucet Aerator (Lavatory)	2.20	1.00	0.00	0	4.8	$51.82	$28.68	$0.00	0.55

Commercial Refrigerator/Freezer Inventory & Recommendations

	Existing Conditions			Proposed Condi	Energy Impact & Financial Analysis						
Location	Quantity	Refrigerator/ Freezer Type	ENERGY STAR Qualified?	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen Prep	1	Refrigerator Chest	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Kitchen Prep	1	Freezer Chest	No	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	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Life Skills Room	1	Stand-Up Refrigerator, Solid Door (16 - 30 cu. ft.)	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Cooking Equipment Inventory & Recommendations

	Existing Conditions			Proposed Conditions	Energy Impact & Financial Analysis						
Location	Quantity	Equipment Type	High Efficiency Equipement?	Install High Efficiency Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen Prep	3	Insulated Food Holding Cabinet (1/2 Size)	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Kitchen Prep	1	Insulated Food Holding Cabinet (Full Size)	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Plug Load Inventory

	Existing Conditions			
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
Various	34	Computers	120.0	
Various	25	Printers	250.0	
Classrooms	22	Projectors	350.0	
Various	15	Microwave	1,500.0	
Various	1	Toaster	1,200.0	
Various	6	Coffee Maker	900.0	
Various	18	Mini Fridge	260.0	
Classrooms	22	Fans	100.0	
Gym	2	Speakers	200.0	
Various	2	Electric Unit Heaters	1,500.0	

Custom Recommendations

Computer Power Management Software

# of Desktops	Normal Running Mode					Idle Running Mode					Suspended/Off Mode				
34	*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*
Existing Conditions	60%	5%	5%	120	**30**	5%	30%	10%	80	**31**	35%	65%	85%	5	**107**
Proposed Conditions	60%	5%	0%	120	**28**	5%	10%	0%	80	**10**	35%	85%	100%	5	**130**

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)
43	286	90%	2,416	$481	$15.00	$2,500.0	$3,010	6.26
43	207							

Replace Refrigeration Equipment with Smaller Energy Star Equipment

Existing Conditions					Proposed Conditions					Energy Impact & Financial Analysis					
Description	*Total Volume (cu. ft.)*	*Total kW*	*Total Annual kWh*	% Empty as Noted on Site	Description	Qty of Energy Star Compact Fridge	Total Volume (cu. ft.)	Total kW	Total Annual kWh	Total Annual kW Savings	Total Annual kWh Savings	Total Annual Energy Cost Savings		Total Installation Cost	Simple Payback Period (Years)
Replace	32	0.3	2,657	60%	Replace	2	23	0.07	622	0.2	2,035	$405		$1,300	3.21

Installation of an Energy Management System

Baseline (Proposed Energy Use after ECMs)					Proposed Conditions					Energy Impact & Financial Analysis					
	Annual AC Energy Use (kWh)	*Annual HVAC Motor Energy Use (kWh)*	*Annual Heating Energy Use (mmBtu)*	*Total Proposed Costs*		Assumed % Cooling Savings	Assumed % Heating Savings	Assumed % Motor Savings		Assumed $/sqft	Total Annual kWh Savings	Total Annual mmBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Simple Payback Period (Years)
	1,992	10,931	1,295	$16,453		6%	9%	5%		$1.50	666	117	$1,382	$69,150	50.04

Equations: (Based on Industry Standards)
Average Cost for installation of an Energy management system is $1.50/sqft
Energy savings range between 5% and 30%

Blower Door Testing & Building Envelope Improvements

Existing Conditions					Proposed Conditions					Energy Impact & Financial Analysis					
	Annual Cooling Energy Use (kWh)	*Annual Heating Energy Use (mmBtu)*				Assumed % Cooling Savings	Assumed % Heating Savings				Total Annual kWh Savings	Total Annual mmBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Simple Payback Period (Years)
	33,327	1,522.6				2%	5%				667	76	$949	$13,830	14.58

Equations: (Based on Industry Standards)
Average Cost for blower door testing and whole building air sealing is $0.30/sqft
Energy savings vary based on the existing building condition, envelope deficiencies and geographic location
https://energy.gov/energysaver/blower-door-tests

Optional HVAC Measure - VRF System Installation - Back of the Envelope Calculation

Existing Conditions																
Cooling Capacity per Unit (Tons)	Full Load Efficiency (kW/Ton)		Annual Cooling EFLH	Total kW	Total Annual kWh	Total Annual Costs	Output Capacity per Unit (MBh)	Heating Efficiency	Actual Heating EFLH (if different)	Total Annual mmBtu	Total Annual Costs	Total Motor HP	Total kW	Total Annual kWh	Total Annual Costs	Total Annual HVAC Costs
23.9	1.12		905	27	24,260	$4,832	3,446	74%	327	1,523	$16,318	14	10	18,488	$3,682	$24,832
(Window Acs)							(Boiler)					(Primary Pumps and UV Fans)				

Proposed Conditions		Option - Energy Impact & Financial Analysis			
Total Annual kWh	Total Annual HVAC Costs	Total Annual Energy Cost Savings	*Estimated M&L Cost per Ton*	Total Installation Cost	Simple Payback Period (Years)
100,288	$19,974	$4,858	$10,500	$315,000	64.84

(assumes 35% savings of electrical use and 35% savings of natural gas converted to electric with 4.0 COP efficiency increase)

Energy Impact & Financial Analysis			
ECM: Boiler, UVs, Motors & VFDs	Total Annual Energy Cost Savings	Total Installation Cost	Simple Payback Period (Years)
Included	$3,944	$186,157	47.20

(as calculated from the LGEA Tool)

Equations: (Based on Industry Standards)

Energy savings 30% to 40%

Costs are 5% to 20% higher than traditional chilled water systems

Appendix B: EPA Statement of Energy Performance

ENERGY STAR® Data Verification Checklist

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ENERGY STAR ® Score[1]

Audrey W. Clark School

Registry Name: Audrey W. Clark School
Property Type: K-12 School
Gross Floor Area (ft²): 41,600
Built: 1964

For Year Ending: 12/31/2016
Date Generated: 05/15/2017

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

Property & Contact Information

Property Address	Property Owner	Primary Contact
Audrey W. Clark School 192 Garfield Avenue Long Branch, New Jersey 07740 **Property ID:** 5841608	Long Branch Public Schools 540 Broadway Long Branch, NJ 07740 732-571-2868 x 40710	Ann Degnan 540 Broadway Long Branch, NJ 07740 732-571-2868 x 40710 adegnan@longbranch.k12.nj.us

1. Review of Whole Property Characteristics

Basic Property Information

1) **Property Name:** Audrey W. Clark School
Is this the official name of the property? ☐ Yes ☐ No

If "No", please specify: _____

2) **Property Type:** K-12 School
Is this an accurate description of the primary use of this property? ☐ Yes ☐ No

3) **Location:**
192 Garfield Avenue
Long Branch, New Jersey 07740

Is this correct and complete? ☐ Yes ☐ No

4) **Gross Floor Area:** 41,600 ft² ☐ Yes ☐ No

Page 1 of 10

ENERGY STAR® Statement of Energy Performance

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ENERGY STAR® Score[1]

Audrey W. Clark School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 41,600
Built: 1964

For Year Ending: December 31, 2016
Date Generated: May 15, 2017

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

Property & Contact Information

Property Address	Property Owner	Primary Contact
Audrey W. Clark School 192 Garfield Avenue Long Branch, New Jersey 07740	Long Branch Public Schools 540 Broadway Long Branch, NJ 07740 732-571-2868 x 40710	Ann Degnan 540 Broadway Long Branch, NJ 07740 732-571-2868 x 40710 adegnan@longbranch.k12.nj.us

Property ID: 5841608

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
47.1 kBtu/ft²

Source EUI
60.9 kBtu/ft²

Annual Energy by Fuel		National Median Comparison	
Natural Gas (kBtu)	1,730,318 (88%)	National Median Site EUI (kBtu/ft²)	87.8
Electric - Grid (kBtu)	228,457 (12%)	National Median Source EUI (kBtu/ft²)	113.6
		% Diff from National Median Source EUI	-46%
		Annual Emissions	
		Greenhouse Gas Emissions (Metric Tons CO2e/year)	118

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

Ann Degnan
540 Broadway
Long Branch, NJ 07740
732-571-2868 x 40710
adegnan@longbranch.k12.nj.us

Professional Engineer Stamp (if applicable)

ENERGY STAR® Scorecard

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ENERGY STAR® Score

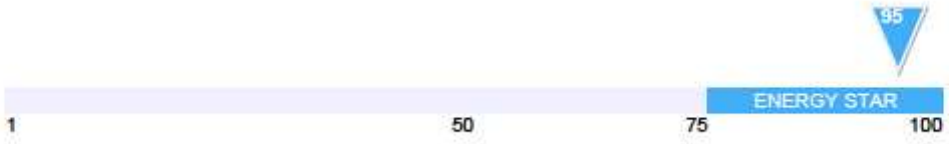
Audrey W. Clark School

Primary Function: K-12 School
Gross Floor Area (ft²): 41,600
Built: 1964

For Year Ending: December 31, 2016
Date Generated: May 15, 2017

Property Address:
Audrey W. Clark School
192 Garfield Avenue
Long Branch, New Jersey 07740

For the year ending in December 2016, this building used 60.9 (kBtu/ft²) on a source energy basis. The Environmental Protection Agency's (EPA's) 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.



Buildings with a score of 75 or higher may qualify for EPA's ENERGY STAR.

Signature of Verifying Professional

I _____ (Name) verify that the information regarding energy use and property use details is true and correct to the best of my knowledge.

Signature: _____Date: _____