Local Government Energy Audit:
Energy Audit Report

Frank Defino Central School

175 State Highway 79

Marlboro, New Jersey 07746

Marlboro Township BOE

October 23, 2018

Final Report by:

TRC Energy Services

Disclaimer

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

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

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

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

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1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for Frank Defino Central School.

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

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

1.1 Facility Summary

Frank Defino Central School is a 70,047 square foot facility comprised of various space types within a single building. The building consists mainly of classrooms but also has a gymnasium, cafeteria, kitchen, and offices in a single-story facility.

Lighting at Frank Defino Central School consists mainly of aging and inefficient T8 fluorescent lighting and HVAC equipment which is approaching the end of its useful life. Heating is supplied by natural gas fired boilers as well as electric resistance heaters. Cooling is provided by a combination of package, split system, and window air conditioning (AC) units. A thorough description of the facility and our observations are provided in Section 2.

1.2 Your Cost Reduction Opportunities

Energy Conservation Measures

TRC evaluated seven measures and recommends six measures which together represent an opportunity for Frank Defino Central School to reduce annual energy costs by roughly $13,631 and annual greenhouse gas emissions by 105,037 lbs CO_2e. We estimate that if all measures were implemented as recommended, the project would pay for itself in roughly 8.1 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 Frank Defino Central School's annual energy use by 5%.

Figure 1 – Previous 12 Month Utility Costs

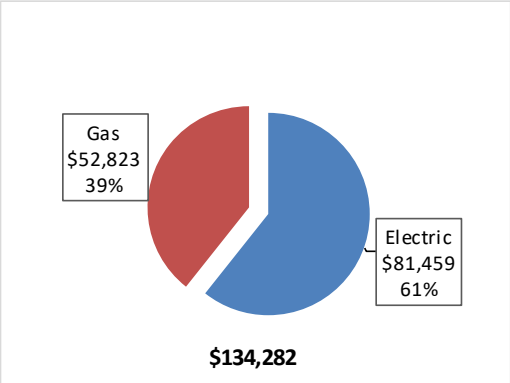
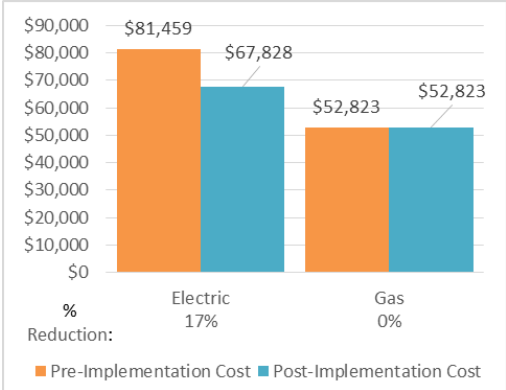


Figure 2 – Potential Post-Implementation Costs



A detailed description of Frank Defino Central School's existing energy use can be found in Section 3.

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

Figure 3 – Summary of Energy Reduction Opportunities

Energy Conservation Measure		Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual 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			**83,662**	**23.9**	**0.0**	**$10,932.89**	**$93,852.90**	**$14,350.00**	**$79,502.90**	**7.3**	**84,247**
ECM 1	Install LED Fixtures	Yes	12,126	1.7	0.0	$1,584.65	$21,366.16	$2,460.00	$18,906.16	11.9	12,211
ECM 2	Retrofit Fixtures with LED Lamps	Yes	61,707	21.5	0.0	$8,063.83	$68,937.43	$11,890.00	$57,047.43	7.1	62,139
ECM 3	Install LED Exit Signs	Yes	9,829	0.6	0.0	$1,284.41	$3,549.32	$0.00	$3,549.32	2.8	9,897
Lighting Control Measures			**16,098**	**5.7**	**0.0**	**$2,103.68**	**$32,132.00**	**$3,655.00**	**$28,477.00**	**13.5**	**16,211**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	16,098	5.7	0.0	$2,103.68	$32,132.00	$3,655.00	$28,477.00	13.5	16,211
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**197.2**	**$2,170.79**	**$118,266.10**	**$3,480.88**	**$114,785.22**	**52.9**	**23,087**
	Install High Efficiency Hot Water Boilers	No	0	0.0	197.2	$2,170.79	$118,266.10	$3,480.88	$114,785.22	52.9	23,087
Food Service Equipment & Refrigeration Measures			**2,593**	**0.3**	**0.0**	**$338.89**	**$2,832.00**	**$300.00**	**$2,532.00**	**7.5**	**2,611**
ECM 5	Replace Refrigeration Equipment	Yes	2,593	0.3	0.0	$338.89	$2,832.00	$300.00	$2,532.00	7.5	2,611
Plug Load Equipment Control - Vending Machine			**1,954**	**0.0**	**0.0**	**$255.39**	**$460.00**	**$0.00**	**$460.00**	**1.8**	**1,968**
ECM 6	Vending Machine Control	Yes	1,954	0.0	0.0	$255.39	$460.00	$0.00	$460.00	1.8	1,968
RECOMMENDED MEASURE TOTALS			**104,308**	**29.9**	**0.0**	**$13,630.86**	**$129,276.90**	**$18,305.00**	**$110,971.90**	**8.1**	**105,037**
TOTALS			104,308	29.9	197.2	$15,801.65	$247,543.00	$21,785.88	$225,757.12	14.3	128,125

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

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

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

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

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.

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

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

Energy Efficient Practices

TRC also identified 12 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 Frank Defino Central School include:

- Perform Proper Lighting Maintenance
- Develop a Lighting Maintenance Schedule
- Ensure Lighting Controls Are Operating Properly
- Practice Proper Use of Thermostat Schedules and Temperature Resets
- Clean Evaporator/Condenser Coils on AC Systems
- Clean and/or Replace HVAC Filters
- Perform Proper Boiler Maintenance
- Perform Proper Furnace Maintenance
- Perform Proper Water Heater Maintenance
- Perform Maintenance on Compressed Air Systems
- Install Plug Load Controls
- Water Conservation

For details on these energy efficient practices, please refer to Section 5.

On-Site Generation Measures

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

Figure 4 – Photovoltaic Potential

Potential	High	
System Potential	198	kW DC STC
Electric Generation	235,892	kWh/yr
Displaced Cost	$20,520	/yr
Installed Cost	$514,800	

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

1.3 Implementation Planning

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

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

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

- SmartStart
- Direct Install
- SREC (Solar Renewable Energy Certificate) Registration Program (SRP)
- Energy Savings Improvement Program (ESIP)

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

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

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

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

2 FACILITY INFORMATION AND EXISTING CONDITIONS

2.1 Project Contacts

Figure 5 – Project Contacts

Name	Role	E-Mail	Phone #
Customer			
Cindy Barr-Rague	Business Administration/Board Secretary	cbarr-rague@mtps.org	(732) 972-2000 Ext 2010
Michael Crivelli	Supervisor of Building & Grounds	mcrivelli@mtps.org	(732) 972-2122
TRC Energy Services			
Smruti Srinivasan	Auditor	Ssrinivasan@trcsolutions.com	(732) 855-0033

2.2 General Site Information

On March 29, 2018, TRC performed an energy audit at Frank Defino Central School located in Marlboro, New Jersey. TRC's team met with Mike Risk, HVAC Specialist to review the facility operations and help focus our investigation on specific energy-using systems.

Frank Defino Central School is a 70,047 square foot facility comprised mainly of classrooms with a gymnasium, cafeteria, kitchen, and offices in a single story building.

The building was constructed in 1956 and has had four additions since then. The first addition added three classrooms, followed by the addition of the cafeteria and kitchen and then the fourth-grade hall. The last edition was in 2011 and included two more classrooms and a new main office.

2.3 Building Occupancy

The school is open Monday through Friday 10 months a year, September through June. The typical schedule is presented in the table below. During a typical day, the facility is occupied by approximately 75 staff and 505 students.

Figure 6 - Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
Frank Defino Central School	Weekday	8:15 AM - 3:20 PM
Frank Defino Central School	Weekend	Sat: 12:30 PM - 5:00 PM Sun: Closed

2.4 Building Envelope

The building is constructed of concrete block and structural steel with a brick facade. The building has a flat foam roof covered with light colored membrane, except for the 2011 addition, which has an ethylene propylene diene monomer (EPDM) rubber roof. The building's three most recent additions have double pane windows which are in good condition and show little sign of excessive infiltration. The original portion of the building still has single pane windows. The majority of the exterior doors are single pane glass with metal frames. The 2011 addition has aluminum framed doors with double pane windows.

Image 1 Building Envelope

2.5 On-Site Generation

Frank Defino Central School does not have any on-site electric generation capacity.

2.6 Energy-Using Systems

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

Lighting System

Lighting is provided mostly by 32-Watt linear fluorescent T8 lamps with electronic ballasts as well as some compact fluorescent lamps (CFL) and a few linear LED strip lights. The fixtures are a mix of 2-lamp, 3-lamp, or 4-lamp, 4-foot long troffers with diffusers. The majority of the fixtures contain 2-lamps. The cafeteria is lit with a mix of 4-lamp 4-foot long fluorescent fixtures and CFL lamps that are located in recessed can fixtures. The gymnasium is lit with 9-lamp CLF fixtures. Exit signs contain incandescent lamps.

Image 2 Gym Lighting

Image 3 General Lighting

Lighting control in most spaces is provided by manual wall switches. The main office and security area lighting is controlled with occupancy sensors that are either wall or ceiling mounted depending on the space layout.

The building's exterior lighting consists of a mix of fixtures including CFLs, linear fluorescent T8s, and high pressure sodium (HPS) fixtures. Exterior fixtures are controlled by either a photocell and timeclock combination or just a timeclock, with the majority of them controlled by only a timeclock.

Hot Water Heating System

The hot water heating system consists of two Cleaver Brooks forced draft boilers. Boiler 1 has a rated input of 5,230 MBh and boiler 2 has a rated input of 3,347 MBh, both with a nominal combustion efficiency of 80%. Boiler 1 has a 5 hp forced draft fan and boiler 2 has a 2 hp forced draft fan. The boilers provide hot water to the building's hallway and gym radiators, in-room packaged AC units serving classrooms 13 & 14, and the indirect domestic hot water system. The buildings occupied heating setpoint is 68°F.

Image 4 Boilers

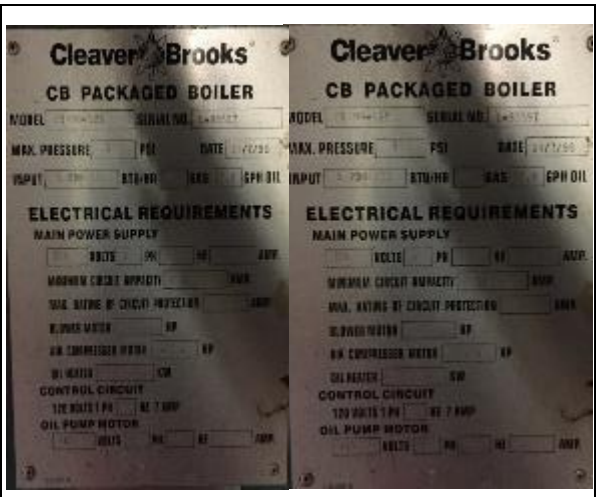


Image 5 Boiler nameplates

Forced Air Space Conditioning Systems

This school is served by a variety of direct-expansion (DX) cooling units including ductless split systems, window AC units, in-room packaged AC units, and rooftop packaged units. The majority of the split system AC units and packaged AC units are located on the roof and serve the classrooms, media center, cafeteria, IT room, teacher's lounge, nurses' office, and the main office. These units range in size from 2 tons to 20 tons, and along with the window AC units provide mechanical cooling to approximately 30% of the facility. The two 15-ton Trane packaged AC units serving the cafeteria also have 18 kW of electric resistance heating each. The 8 and 5-ton units serving the main office area and the two 20-ton units serving classrooms 42 – 47 which are equipped with 80% efficient natural gas furnaces. The two 3-ton Airedale in-room packaged AC units that serve classrooms 13 and 14 are equipped with hot water coils that are served by the boilers. Three of the classrooms have window AC units for cooling. The units operate to maintain a cooling space temperature setpoint of 72°F and a heating setpoint of 68°F.

Image 6 In-classroom package unit w/HW coil

Image 7 Split System Condenser

Image 8 Typical Window AC unit & Radiator

Image 9 Packaged DX Unit

Domestic Hot Water Heating System

There is a small domestic hot water heating system serving the 2011 addition, which consists of a single 19 gallon 2.5 kW A.O. Smith electric water heater. The remainder of the campus receives domestic hot water via an indirect system; heating is provided by the boilers via a heat exchanger. The hot water from the indirect system is stored in a tank.

Food Service Equipment

The school's kitchen is used to prepare lunches daily for the students and staff. The kitchen equipment consists of an ice cream novelty freezer, four solid double door commercial refrigerators, one glass door refrigerator, reach-in milk cooler, four electric convection ovens, warmer, walk-in freezer, and a dishwasher. The kitchen is occupied Monday through Friday from 7:45 AM to 1:45 PM September through June.

Building Plug Load

There are roughly 68 desktop computer work stations throughout the facility. There is no centralized PC power management software installed.

General office equipment and break room amenities contribute to the plug load. Classrooms are outfitted with projectors, starboards, and other audio visual aids

The facility has one refrigerated beverage vending machine and one non-refrigerated vending machine.

2.7 Water-Using Systems

There are 20 restrooms at this facility a faculty lounge with a sink and the kitchen. A sampling of restrooms found the faucets rated for 2.0 gallons per minute (gpm).

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

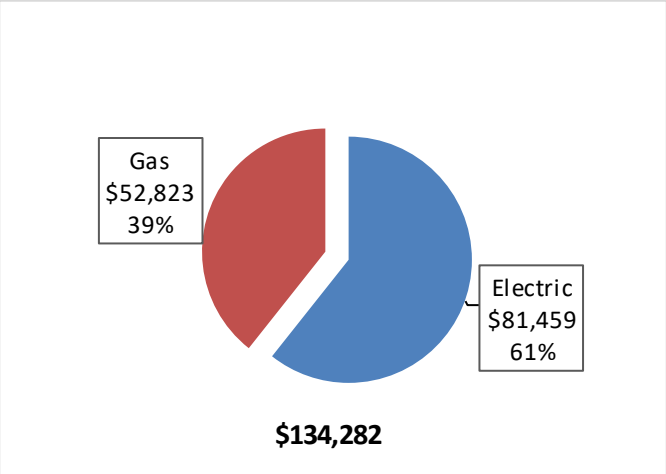
The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. A profile of the annual energy consumption and energy cost of the facility was developed from this information.

Figure 7 - Utility Summary

Utility Summary for Frank Defino Central School		
Fuel	**Usage**	**Cost**
Electricity	623,354 kWh	$81,459
Natural Gas	47,981 Therms	$52,823
Total		**$134,282**

The current annual energy cost for this facility is $134,282 as shown in the chart below.

Figure 8 - Energy Cost Breakdown



3.2 Electricity Usage

Electricity is provided by JCP&L. The average electric cost over the past 12 months was $0.131/kWh, which is the blended rate that includes energy supply, distribution, and other charges, including demand. This rate is used throughout the analyses in this report to assess energy costs and savings. Electric use tends to remain high in the winter. This is likely partially due to the presence of electrical resistance heat. The monthly electricity consumption and peak demand are shown in the chart below.

Figure 9 - Electric Usage & Demand

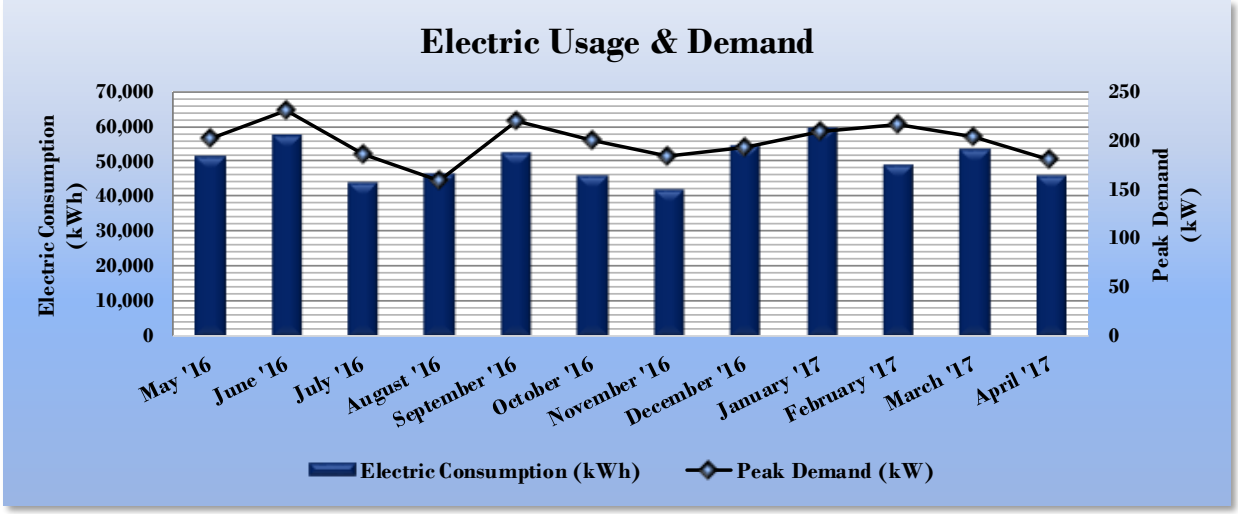


Figure 10 - Electric Usage & Demand

Electric Billing Data for Frank Defino Central School					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
5/31/16	30	51,680	203	$0	$6,417
6/30/16	29	57,520	231	$0	$7,366
7/31/16	30	44,160	185	$0	$5,770
8/31/16	30	46,400	159	$0	$5,861
9/30/16	29	52,320	220	$0	$6,920
10/31/16	30	45,820	200	$0	$6,019
11/30/16	29	41,920	184	$0	$5,559
12/31/16	30	54,640	193	$0	$6,950
1/31/17	30	59,600	209	$0	$7,740
2/28/17	27	48,960	216	$0	$6,759
3/31/17	30	53,760	203	$0	$7,189
4/30/17	29	46,080	181	$0	$6,231
Totals	**353**	**602,860**	**230.6**	**$0**	**$78,781**
Annual	**365**	**623,354**	**230.6**	**$0**	**$81,459**

3.3 Natural Gas Usage

Natural gas is provided by NJ Natural Gas. The average gas cost for the past 12 months is $1.101/therm, which is the blended rate used throughout the analyses in this report. The gas use profile is consistent with sites where heating energy is the dominant factor in gas consumption. The monthly gas consumption is shown in the chart below.

Figure 11 - Natural Gas Usage

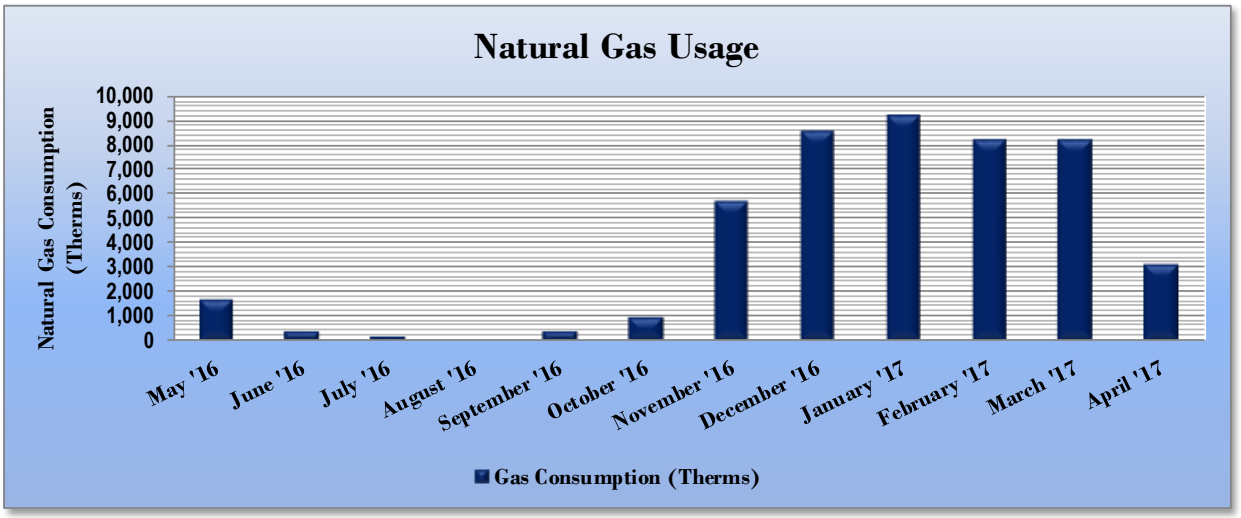


Figure 12 - Natural Gas Usage

Gas Billing Data for Frank Defino Central School				
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost	TRC Estimated Usage?
5/27/16	27	1,665	$1,790	No
6/29/16	32	393	$881	No
7/27/16	27	196	$88	Yes
8/26/16	29	0	$590	No
9/27/16	31	355	$843	No
10/26/16	28	961	$1,482	No
11/28/16	32	5,701	$5,306	No
12/29/16	30	8,607	$8,895	No
1/30/17	31	9,257	$10,542	No
2/28/17	28	8,191	$9,015	No
3/30/17	29	8,205	$8,183	No
5/1/17	31	3,135	$3,760	No
Totals	**355**	**46,667**	**$51,376**	
Annual	**365**	**47,981**	**$52,823**	

3.4 Benchmarking

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

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

Figure 13 - Energy Use Intensity Comparison – Existing Conditions

Energy Use Intensity Comparison - Existing Conditions		
	Frank Defino Central School	National Median Building Type: School (K-12)
Source Energy Use Intensity (kBtu/ft^2)	167.3	141.4
Site Energy Use Intensity (kBtu/ft^2)	98.9	58.2

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

Figure 14 - Energy Use Intensity Comparison – Following Installation of Recommended Measures

Energy Use Intensity Comparison - Following Installation of Recommended Measures		
	Frank Defino Central School	National Median Building Type: School (K-12)
Source Energy Use Intensity (kBtu/ft^2)	151.3	141.4
Site Energy Use Intensity (kBtu/ft^2)	93.8	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. This facility has a current score of 15.

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

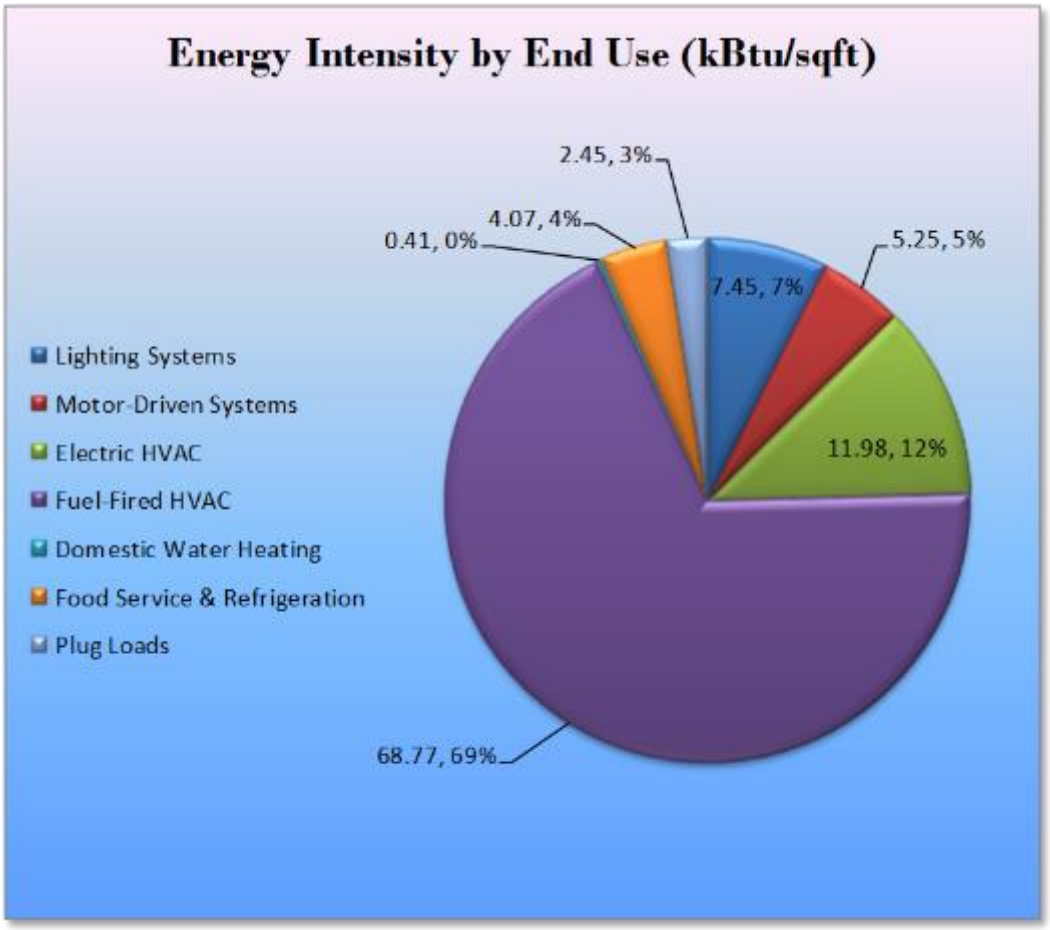
For more information on ENERGY STAR® certification go to: https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1.

A Portfolio Manager® account has been created online for your facility and you will be provided with the login information for the account. We encourage you to update your utility information in Portfolio Manager® regularly, so that you can keep track of your building's performance. Free online training is available to help you use ENERGY STAR® Portfolio Manager® to track your building's performance at: https://www.energystar.gov/buildings/training.

3.5 Energy End-Use Breakdown

In order to provide a complete overview of energy consumption across building systems, an energy balance was performed at this facility. An energy balance utilizes standard practice engineering methods to evaluate all components of the various electric and fuel-fired systems found in a building to determine their proportional contribution to overall building energy usage. This chart of energy end uses highlights the relative contribution of each equipment category to total energy usage. This can help determine where the greatest benefits might be found from energy efficiency measures.

Figure 15 - 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 Frank Defino Central School regarding financial incentives for which they may qualify to implement the recommended measures. For this audit report, most measures have received only a preliminary analysis of feasibility which identifies expected ranges of savings and costs. This level of analysis is usually considered sufficient to demonstrate project cost-effectiveness and help prioritize energy measures. Savings are based on the New Jersey Clean Energy Program Protocols to Measure Resource Savings dated June 29, 2016, approved by the New Jersey Board of Public Utilities. Further analysis or investigation may be required to calculate more precise savings based on specific circumstances. A higher level of investigation may be necessary to support any custom SmartStart or Pay for Performance, or Direct Install incentive applications. Financial incentives for the ECMs identified in this report have been calculated based the NJCEP prescriptive SmartStart program. Some measures and proposed upgrade projects may be eligible for higher incentives than those shown below through other NJCEP programs as described in Section 8. The following sections describe the evaluated measures.

4.1 Recommended ECMs

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

Figure 16 – Summary of Recommended ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**83,662**	**23.9**	**0.0**	**$10,932.89**	**$93,852.90**	**$14,350.00**	**$79,502.90**	**7.3**	**84,247**
ECM 1	Install LED Fixtures	12,126	1.7	0.0	$1,584.65	$21,366.16	$2,460.00	$18,906.16	11.9	12,211
ECM 2	Retrofit Fixtures with LED Lamps	61,707	21.5	0.0	$8,063.83	$68,937.43	$11,890.00	$57,047.43	7.1	62,139
ECM 3	Install LED Exit Signs	9,829	0.6	0.0	$1,284.41	$3,549.32	$0.00	$3,549.32	2.8	9,897
Lighting Control Measures		**16,098**	**5.7**	**0.0**	**$2,103.68**	**$32,132.00**	**$3,655.00**	**$28,477.00**	**13.5**	**16,211**
ECM 4	Install Occupancy Sensor Lighting Controls	16,098	5.7	0.0	$2,103.68	$32,132.00	$3,655.00	$28,477.00	13.5	16,211
Food Service Equipment & Refrigeration Measures		**2,593**	**0.3**	**0.0**	**$338.89**	**$2,832.00**	**$300.00**	**$2,532.00**	**7.5**	**2,611**
ECM 5	Replace Refrigeration Equipment	2,593	0.3	0.0	$338.89	$2,832.00	$300.00	$2,532.00	7.5	2,611
Plug Load Equipment Control - Vending Machine		**1,954**	**0.0**	**0.0**	**$255.39**	**$460.00**	**$0.00**	**$460.00**	**1.8**	**1,968**
ECM 6	Vending Machine Control	1,954	0.0	0.0	$255.39	$460.00	$0.00	$460.00	1.8	1,968
TOTALS		**104,308**	**29.9**	**0.0**	**$13,630.86**	**$129,276.90**	**$18,305.00**	**$110,971.90**	**8.1**	**105,037**

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

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

4.1.1 Lighting Upgrades

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

Figure 17 – 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		**83,662**	**23.9**	**0.0**	**$10,932.89**	**$93,852.90**	**$14,350.00**	**$79,502.90**	**7.3**	**84,247**
ECM 1	Install LED Fixtures	12,126	1.7	0.0	$1,584.65	$21,366.16	$2,460.00	$18,906.16	11.9	12,211
ECM 2	Retrofit Fixtures with LED Lamps	61,707	21.5	0.0	$8,063.83	$68,937.43	$11,890.00	$57,047.43	7.1	62,139
ECM 3	Install LED Exit Signs	9,829	0.6	0.0	$1,284.41	$3,549.32	$0.00	$3,549.32	2.8	9,897

During lighting upgrade planning and design, we recommend a comprehensive approach that considers both the efficiency of the lighting fixtures and how they are controlled.

ECM 1: Install LED Fixtures

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	681	0.2	0.0	$88.98	$7,302.96	$60.00	$7,242.96	81.4	686
Exterior	11,445	1.5	0.0	$1,495.67	$14,063.20	$2,400.00	$11,663.20	7.8	11,525

Measure Description

We recommend replacing interior fixtures containing multiple pin base CFLs, such as the high bay fixtures in the gymnasium, and exterior high pressure sodium fixtures with new high performance LED light fixtures. This measure saves energy by installing LEDs which use less power than other technologies with a comparable light output.

Additional savings from lighting maintenance can be anticipated since LEDs have lifetimes which are more than twice that of fluorescent or high pressure sodium lamps.

ECM 2: Retrofit Fixtures with LED Lamps

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	60,480	21.4	0.0	$7,903.45	$67,928.43	$11,850.00	$56,078.43	7.1	60,903
Exterior	1,227	0.2	0.0	$160.38	$1,009.00	$40.00	$969.00	6.0	1,236

Measure Description

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

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

ECM 3: Install LED Exit Signs

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	9,829	0.6	0.0	$1,284.41	$3,549.32	$0.00	$3,549.32	2.8	9,897
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.0	0

Measure Description

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

4.1.2 Lighting Control Measures

Our recommendations for lighting control measures are summarized in Figure 18 below.

Figure 18 – 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		16,098	5.7	0.0	$2,103.68	$32,132.00	$3,655.00	$28,477.00	13.5	16,211
ECM 4	Install Occupancy Sensor Lighting Controls	16,098	5.7	0.0	$2,103.68	$32,132.00	$3,655.00	$28,477.00	13.5	16,211

During lighting upgrade planning and design, we recommend a comprehensive approach that considers both the efficiency of the lighting fixtures and how they are controlled.

ECM 4: Install Occupancy Sensor Lighting Controls

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
16,098	5.7	0.0	$2,103.68	$32,132.00	$3,655.00	$28,477.00	13.5	16,211

Measure Description

We recommend installing occupancy sensors to control lighting fixtures that are currently controlled by manual switches in restrooms, storage rooms, classrooms, offices areas, gymnasium, and in the cafeteria. 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. Consider obtaining replacement gymnasium fixtures equipped with on-board occupancy sensors. We recommend a comprehensive approach to lighting design that upgrades both the lighting fixtures and the controls together for maximum energy savings and improved lighting for occupants.

4.1.3 Food Service Equipment & Refrigeration Measures

Food service and refrigeration measures recommendations are summarized in Figure 19 below.

Figure 19 - Summary of Food Service Equipment & Refrigeration ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Food Service Equipment & Refrigeration Measures		**2,593**	**0.3**	**0.0**	**$338.89**	**$2,832.00**	**$300.00**	**$2,532.00**	**7.5**	**2,611**
ECM 5	Replace Refrigeration Equipment	2,593	0.3	0.0	$338.89	$2,832.00	$300.00	$2,532.00	7.5	2,611

ECM 5: Replace Refrigeration Equipment

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
2,593	0.3	0.0	$338.89	$2,832.00	$300.00	$2,532.00	7.5	2,611

Measure Description

At the site's request the replacement of their Glenco Guardian solid double door commercial refrigerator was evaluated. We recommend replacing this existing commercial refrigerator with a new ENERGY STAR® high efficiency commercial refrigerator. There have been many improvements in refrigeration system equipment, operation, and insulation. The energy savings associated with this measure come from reduced energy usage, due to more efficient technology, and reduced run times.

4.1.4 Plug Load Equipment Control - Vending Machines

Our recommendations for plug load equipment control measures are summarized in Figure 20 below.

Figure 20-Summary of Plug Load Equipment Control ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Plug Load Equipment Control - Vending Machine		**1,954**	**0.0**	**0.0**	**$255.39**	**$460.00**	**$0.00**	**$460.00**	**1.8**	**1,968**
ECM 6	Vending Machine Control	1,954	0.0	0.0	$255.39	$460.00	$0.00	$460.00	1.8	1,968

ECM 6: Vending Machine Control

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
1,954	0.0	0.0	$255.39	$460.00	$0.00	$460.00	1.8	1,968

Measure Description

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

4.2 ECMs Evaluated But Not Recommended

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

Figure 21 – Summary of Measures Evaluated, But Not Recommended

Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Gas Heating (HVAC/Process) Replacement	**0**	**0.0**	**197.2**	**$2,170.79**	**$118,266.10**	**$3,480.88**	**$114,785.22**	**52.9**	**23,087**
Install High Efficiency Hot Water Boilers	0	0.0	197.2	$2,170.79	$118,266.10	$3,480.88	$114,785.22	52.9	23,087
TOTALS	**0**	**0.0**	**197.2**	**$2,170.79**	**$118,266.10**	**$3,480.88**	**$114,785.22**	**52.9**	**23,087**

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

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

Install High Efficiency 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	197.2	$2,170.79	$118,266.10	$3,480.88	$114,785.22	52.9	23,087

Measure Description

We typically recommend replacing older inefficient hot water boilers with high efficiency hot water boilers when cost effective. 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.

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 should only be considered when the return water temperature is less than 130°F during most of the operating hours. Condensing hydronic boilers are not recommended for this site.

Reasons for not Recommending

The simple payback for replacing the existing boilers at this site with new high efficiency boilers, at approximately 50 years, exceeds the expected useful life of the equipment and is therefore not recommended at this time.

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.

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.

Practice Proper Use of Thermostat Schedules and Temperature Resets

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

Clean and/or Replace HVAC Filters

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

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.

Perform Proper Boiler Maintenance

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

Perform Proper Furnace Maintenance

Preventative furnace maintenance can extend the life of the system, maintain energy efficiency, and ensure safe operation. Following the manufacturer's instructions, a yearly tune-up should include tasks such as checking for gas / carbon monoxide leaks; changing the air and fuel filters; checking components for cracks, corrosion, dirt, or debris build-up; ensuring the ignition system is working properly; testing and adjusting operation and safety controls; inspecting the electrical connections; and ensuring proper lubrication for motors and bearings.

Perform Proper Water Heater Maintenance

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

Perform Maintenance on Compressed Air Systems

Like all electro-mechanical equipment, compressed air systems require periodic maintenance to operate at peak efficiency. A maintenance plan should be developed for process related compressed air systems to include inspection, cleaning, and replacement of inlet filter cartridges, cleaning of drain traps, daily inspection of lubricant levels to reduce unwanted friction, inspection of belt condition and tension, checking for system leaks and adjustment of loose connections, and overall system cleaning. Contact a qualified technician for help with setting up periodic maintenance schedule.

Plug Load Controls

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

Water Conservation

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

Installing dual flush or low-flow toilets and low-flow or waterless urinals are additional ways to reduce the sites water use, however, these devices do not provide energy savings at the site level. Any reduction in water use does however ultimately reduce grid level electricity use since a significant amount of electricity is used to deliver water from reservoirs to end users. The EPA WaterSense™ ratings for urinals is 0.5 gallons per flush (gpf) and toilets that use as little as 1.28 gpf (this is lower than the current 1.6 gpf federal standard).

6 On-Site Generation Measures

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

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

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

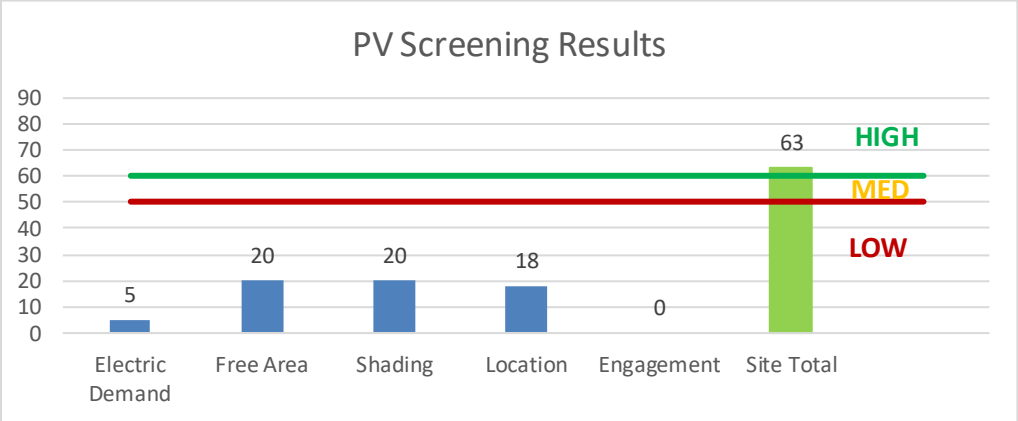
6.1 Photovoltaic

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

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

The amount of free area, ease of installation (location), and the lack of shading elements contribute to the high potential for PV at the site. A PV array located on the roof of the main building may be feasible. If the Frank Defino Central School is interested in pursuing the installation of PV, we recommended a full feasibility study be conducted.

Figure 22 - Photovoltaic Screening



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

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

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

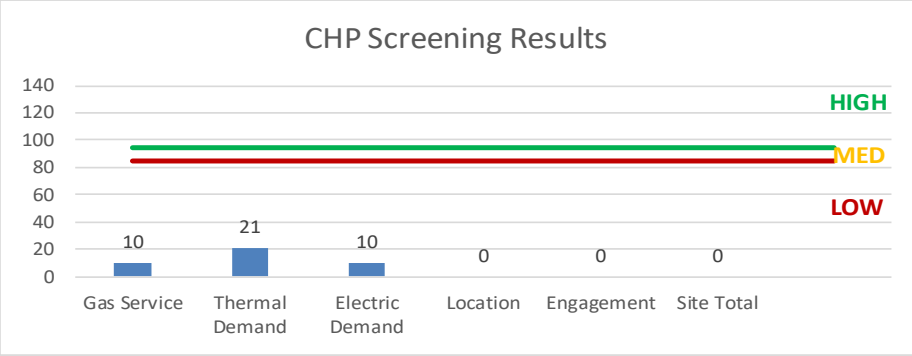
6.2 Combined Heat and Power

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

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

A preliminary screening based on heating and electrical demand, siting, and interconnection shows that the facility has a **Low** potential for installing a cost-effective CHP system. Low or infrequent thermal load, and lack of space near the existing boilers are the most significant factors contributing to the potential for CHP at the site. In our opinion, the facility does not appear to meet the minimum requirements for a cost-effective CHP installation. For a list of qualified firms in New Jersey specializing in commercial CHP cost assessment and installation, go to: http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/.

Figure 23 - Combined Heat and Power Screening



7 DEMAND RESPONSE

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

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

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

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

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

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

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

In our opinion, this site is not a good candidate for DR.

8 PROJECT FUNDING / INCENTIVES

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

Figure 24 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive	Direct Install
ECM 1	Install LED Fixtures	X	X
ECM 2	Retrofit Fixtures with LED Lamps	X	X
ECM 3	Install LED Exit Signs		X
ECM 4	Install Occupancy Sensor Lighting Controls	X	X
ECM 5	Replace Refrigeration Equipment	X	

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

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

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

8.1 SmartStart

Overview

The SmartStart program offers incentives for installing prescriptive and custom energy efficiency measures at your facility. Routinely the program adds, removes or modifies incentives from year to year for various energy efficiency equipment based on market trends and new technologies.

Equipment with Prescriptive Incentives Currently Available:

Electric Chillers
Electric Unitary HVAC
Gas Cooling
Gas Heating
Gas Water Heating
Ground Source Heat Pumps
Lighting
Lighting Controls
Refrigeration Doors
Refrigeration Controls
Refrigerator/Freezer Motors
Food Service Equipment
Variable Frequency Drives

Most equipment sizes and types are served by this program. This program provides an effective mechanism for securing incentives for energy efficiency measures installed individually or as part of a package of energy upgrades.

Incentives

The SmartStart prescriptive incentive program provides fixed incentives for specific energy efficiency measures, whereas the custom SmartStart program provides incentives for more unique or specialized technologies or systems that are not addressed through prescriptive incentive offerings for specific devices.

Since your facility is an existing building, only the retrofit incentives have been applied in this report. Custom measure incentives are calculated at $0.16/kWh and $1.60/therm based on estimated annual savings, capped at 50% of the total installed incremental project cost, or a project cost buy down to a one year payback (whichever is less). Program incentives are capped at $500,000 per electric account and $500,000 per natural gas account, per fiscal year.

How to Participate

To participate in the SmartStart program you will need to submit an application for the specific equipment to be installed. Many applications are designed as rebates, although others require application approval prior to installation. Applicants may work with a contractor of their choosing and can also utilize internal personnel, which provides added flexibility to the program. Using internal personnel also helps improve the economics of the ECM by reducing the labor cost that is included in the tables in this report.

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

8.2 Direct Install

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

Incentives

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

How to Participate

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

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

8.3 SREC Registration Program

The SREC (Solar Renewable Energy Certificate) Registration Program (SRP) is used to register the intent to install solar projects in New Jersey. Rebates are not available for solar projects, but owners of solar projects MUST register their projects in the SRP prior to the start of construction in order to establish the project's eligibility to earn SRECs. Registration of the intent to participate in New Jersey's solar marketplace provides market participants with information about the pipeline of anticipated new solar capacity and insight into future SREC pricing.

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

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

Electricity suppliers, the primary purchasers of SRECs, are required to pay a Solar Alternative Compliance Payment (SACP) if they do not meet the requirements of New Jersey's Solar RPS. One way they can meet the RPS requirements is by purchasing SRECs. As SRECs are traded in a competitive market, the price may vary significantly. The actual price of an SREC during a trading period can and will fluctuate depending on supply and demand.

Information about the SRP can be found at: www.njcleanenergy.com/srec.

8.4 Energy Savings Improvement Program

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

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

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

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

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

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

9 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

9.1 Retail Electric Supply Options

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

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

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

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

9.2 Retail Natural Gas Supply Options

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

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

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

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

Appendix A: Equipment Inventory & Recommendations

Lighting Inventory & Recommendations

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	12	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.23	640	0.0	$83.66	$702.00	$120.00	6.96
Custodian Office	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.11	310	0.0	$40.52	$350.00	$60.00	7.16
Gym	12	Compact Fluorescent: CFL (13W) - 9L	Wall Switch	117	1,617	Fixture Replacement	Yes	12	LED - Fixtures: Downlight Pendant	Occupancy Sensor	82	1,132	0.47	1,331	0.0	$173.96	$7,302.96	$480.00	39.22
Stage	3	Halogen Incandescent: (60W) - 1L	Wall Switch	60	1,617	Relamp	Yes	3	LED Screw-In Lamps: Downlight Pendant	Occupancy Sensor	9	1,132	0.11	300	0.0	$39.14	$277.26	$50.00	5.81
Door 8 entrance	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.05	155	0.0	$20.26	$387.00	$20.00	18.11
Room by door	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.05	155	0.0	$20.26	$387.00	$20.00	18.11
Boys lockeroom	9	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	1,617	Relamp	Yes	9	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,132	0.13	366	0.0	$47.78	$593.10	$80.00	10.74
Gym office	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,617	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,132	0.10	273	0.0	$35.67	$460.27	$75.00	10.80
Gym storage	3	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	1,617	Relamp	No	3	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,617	0.03	98	0.0	$12.76	$107.70	$15.00	7.27
School supplies	5	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	1,617	Relamp	No	5	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,617	0.06	163	0.0	$21.26	$179.50	$25.00	7.27
School supplies	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	1,617	Relamp	No	2	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,617	0.02	65	0.0	$8.50	$71.80	$10.00	7.27
Janitorial supply	1	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	1,617	Relamp	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,617	0.01	33	0.0	$4.25	$35.90	$5.00	7.27
Girls lockeroom	10	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	1,617	Relamp	Yes	10	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,132	0.14	406	0.0	$53.09	$629.00	$85.00	10.25
Main office copy room	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.16	465	0.0	$60.79	$621.00	$95.00	8.65
Main office hallway	4	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Occupancy Sensor	33	1,132	Relamp	No	4	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	1,132	0.04	83	0.0	$10.88	$192.80	$40.00	14.04
Main office suite	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.16	465	0.0	$60.79	$621.00	$95.00	8.65
Secure waiting room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	1,132	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.02	43	0.0	$5.61	$58.50	$10.00	8.64
Secure restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	1,132	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.02	43	0.0	$5.61	$58.50	$10.00	8.64
Main office kitchenette	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.16	465	0.0	$60.79	$621.00	$95.00	8.65
Main office closet	1	Incandescent: (75W) - 1L	Wall Switch	75	1,617	Relamp	No	1	LED Screw-In Lamps: Downlight Recessed	Wall Switch	12	1,617	0.04	117	0.0	$15.31	$53.75	$5.00	3.19
Main office RR	1	Incandescent: (75W) - 1L	Wall Switch	75	1,617	Relamp	No	1	LED Screw-In Lamps: Downlight Recessed	Wall Switch	12	1,617	0.04	117	0.0	$15.31	$53.75	$5.00	3.19
Main office closet	2	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	1,617	Relamp	No	2	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	1,617	0.02	59	0.0	$7.77	$96.40	$20.00	9.83
VP office	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.11	310	0.0	$40.52	$350.00	$60.00	7.16
Pricne office	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.11	310	0.0	$40.52	$504.00	$75.00	10.59
Prince offfice closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	1,132	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.02	43	0.0	$5.61	$58.50	$10.00	8.64

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Main office work room	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.16	465	0.0	$60.79	$621.00	$95.00	8.65
Main office RR	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	1,617	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	1,617	0.01	30	0.0	$3.89	$48.20	$10.00	9.83
Main office conference room	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,617	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,132	0.12	349	0.0	$45.59	$495.60	$80.00	9.12
Main entrance vestibule	6	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	1,617	Relamp	Yes	6	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	1,132	0.08	235	0.0	$30.76	$559.20	$95.00	15.09
Main entrance	6	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.13	368	0.0	$48.10	$351.00	$60.00	6.05
Speech and language	8	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,617	Relamp	Yes	8	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,132	0.33	930	0.0	$121.57	$871.60	$155.00	5.89
Speech and language hallway	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,617	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,132	0.29	819	0.0	$107.00	$840.80	$120.00	6.74
CR 16 to 23	96	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	112	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	2.41	6,839	0.0	$893.68	$10,062.00	$1,575.00	9.50
New wing hall	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.14	388	0.0	$50.66	$562.50	$50.00	10.12
CR 24,25	11	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,617	Relamp	Yes	11	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,132	0.45	1,279	0.0	$167.16	$1,367.20	$235.00	6.77
CR 26,27	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,617	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,132	0.29	819	0.0	$107.00	$840.80	$155.00	6.41
CR 13,14	16	LED - Fixtures: Ambient - 4' - Direct Fixture	Occupancy Sensor	75	1,132	None	No	16	LED - Fixtures: Ambient - 4' - Direct Fixture	Occupancy Sensor	75	1,132	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Storage	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.13	368	0.0	$48.10	$351.00	$60.00	6.05
Fac restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.02	61	0.0	$8.02	$58.50	$10.00	6.05
Office-school counsellor	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.16	465	0.0	$60.79	$621.00	$95.00	8.65
Office closet	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.04	123	0.0	$16.03	$117.00	$20.00	6.05
Tech closet	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.04	123	0.0	$16.03	$117.00	$20.00	6.05
Art classroom	30	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	30	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.82	2,326	0.0	$303.94	$2,565.00	$405.00	7.11
CR 13,14 hall	11	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	11	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.30	853	0.0	$111.44	$1,183.50	$110.00	9.63
Media center	50	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	50	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	1.37	3,876	0.0	$506.56	$4,275.00	$675.00	7.11
GRR and BRR	11	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	11	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.30	853	0.0	$111.44	$1,183.50	$180.00	9.00
Janitorail closet	1	Linear Fluorescent - T8: 2' T8 (17W) - 1L	Wall Switch	22	1,617	Relamp	No	1	LED - Linear Tubes: (1) 2' Lamp	Wall Switch	9	1,617	0.01	25	0.0	$3.28	$31.90	$5.00	8.20
Copy room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.05	155	0.0	$20.26	$387.00	$20.00	18.11
Music room	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.49	1,395	0.0	$182.36	$1,593.00	$250.00	7.36
Parness hall	11	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	11	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.30	853	0.0	$111.44	$1,183.50	$110.00	9.63

	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
CR 29 to 41	180	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	180	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	4.92	13,955	0.0	$1,823.61	$15,390.00	$2,430.00	7.11
CR 30	18	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	18	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.49	1,395	0.0	$182.36	$1,593.00	$250.00	7.36
2011 wing and hallway	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	7	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.19	543	0.0	$70.92	$679.50	$70.00	8.59
Electric closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.02	61	0.0	$8.02	$58.50	$10.00	6.05
Fac restroom + custodial closet	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.04	123	0.0	$16.03	$117.00	$20.00	6.05
GRR+BRR	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	62	1,132	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.13	258	0.0	$33.67	$351.00	$60.00	8.64
2011 wing CR43 hallway	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.22	620	0.0	$81.05	$738.00	$80.00	8.12
CR 42 to 47	108	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,617	Relamp	Yes	108	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,132	4.43	12,559	0.0	$1,641.25	$11,091.60	$2,005.00	5.54
CR43 hallway	8	Compact Fluorescent: (42W) - 1L	Wall Switch	42	1,617	Relamp	No	8	LED Screw-In Lamps: Stairwell/Passageway Lighting	Wall Switch	29	1,617	0.07	187	0.0	$24.49	$430.02	$0.00	17.56
Door 15 vestibule	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.02	61	0.0	$8.02	$58.50	$10.00	6.05
citizenship hall	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.05	155	0.0	$20.26	$387.00	$20.00	18.11
citizenship hall	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,617	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,132	0.10	273	0.0	$35.67	$460.27	$40.00	11.78
caferteria	28	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,617	Relamp	Yes	28	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,132	1.35	3,821	0.0	$499.32	$3,473.73	$665.00	5.63
cafeteria	14	Compact Fluorescent: CFL (42W) - 2L	Wall Switch	84	1,617	Relamp	Yes	14	LED Screw-In Lamps: Downlight Recessed	Occupancy Sensor	59	1,132	0.39	1,115	0.0	$145.71	$1,853.08	$60.00	12.31
CR3	21	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,617	Relamp	Yes	21	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,132	0.86	2,442	0.0	$319.13	$2,389.20	$420.00	6.17
CR3 RR	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.02	61	0.0	$8.02	$58.50	$10.00	6.05
CR2	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,617	Relamp	Yes	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,132	0.62	1,744	0.0	$227.95	$1,668.00	$295.00	6.02
CR2 RR	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.02	61	0.0	$8.02	$58.50	$10.00	6.05
CR1	16	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,617	Relamp	Yes	16	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,132	0.66	1,861	0.0	$243.15	$1,743.20	$310.00	5.89
CR1 RR	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.02	61	0.0	$8.02	$58.50	$10.00	6.05
Electric closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.02	61	0.0	$8.02	$58.50	$10.00	6.05
GRR+BRR	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.11	310	0.0	$40.52	$504.00	$75.00	10.59
Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.02	61	0.0	$8.02	$58.50	$10.00	6.05
IT office	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.11	310	0.0	$40.52	$504.00	$75.00	10.59
Room 5	12	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,617	Relamp	Yes	12	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,132	0.58	1,638	0.0	$213.99	$1,681.60	$310.00	6.41

	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
Nurse's office	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,617	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	1,617	0.03	92	0.0	$12.03	$75.20	$15.00	5.01
Nurse's office	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,617	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,132	0.29	819	0.0	$107.00	$840.80	$155.00	6.41
Nurse's office	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.05	155	0.0	$20.26	$117.00	$20.00	4.79
Nurse's office RR	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.05	155	0.0	$20.26	$387.00	$55.00	16.39
CR 6 to 11	12	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,617	Relamp	Yes	12	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,132	0.49	1,395	0.0	$182.36	$1,442.40	$250.00	6.54
CR 6 -11 hallway	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.27	775	0.0	$101.31	$855.00	$100.00	7.45
Door 19 vestibule	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.02	61	0.0	$8.02	$58.50	$10.00	6.05
Gym hallway	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	8	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.17	491	0.0	$64.14	$468.00	$80.00	6.05
Fire closet	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.02	61	0.0	$8.02	$58.50	$10.00	6.05
Faculty lounge	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.27	775	0.0	$101.31	$855.00	$135.00	7.11
Faculty lounge entrance	2	Incandescent: (60W) - 1L	Wall Switch	60	1,617	Relamp	No	2	LED Screw-In Lamps: Downlight Pendant	Wall Switch	9	1,617	0.07	190	0.0	$24.78	$107.51	$10.00	3.93
Faculty lounge RR	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.05	155	0.0	$20.26	$387.00	$55.00	16.39
Storage closet	1	Linear Fluorescent - T8: 2' T8 (17W) - 1L	Wall Switch	22	1,617	Relamp	No	1	LED - Linear Tubes: (1) 2' Lamp	Wall Switch	9	1,617	0.01	25	0.0	$3.28	$31.90	$5.00	8.20
CR 12	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.33	930	0.0	$121.57	$1,242.00	$190.00	8.65
CR 13	6	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,617	Relamp	Yes	6	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,132	0.29	819	0.0	$107.00	$840.80	$155.00	6.41
Turst hallway	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.33	930	0.0	$121.57	$1,242.00	$120.00	9.23
GRR+BRR	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,617	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,132	0.19	546	0.0	$71.33	$650.53	$115.00	7.51
Janitor closet	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.02	61	0.0	$8.02	$58.50	$10.00	6.05
Staff RR	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.02	61	0.0	$8.02	$58.50	$10.00	6.05
CR 15	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.22	620	0.0	$81.05	$738.00	$115.00	7.69
CR 15 hallway	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.02	61	0.0	$8.02	$58.50	$10.00	6.05
CR 15 RR	1	Incandescent: (40W) - 2L	Wall Switch	80	1,617	Relamp	No	1	LED Screw-In Lamps: Downlight Recessed	Wall Switch	12	1,617	0.04	126	0.0	$16.52	$107.51	$10.00	5.90
CR 15 hallway	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.06	184	0.0	$24.05	$175.50	$30.00	6.05
Confeence room	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.11	310	0.0	$40.52	$504.00	$75.00	10.59
Room 14	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,132	0.16	465	0.0	$60.79	$621.00	$95.00	8.65

	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
Building	33	Exit Signs: Incandescent	None	40	8,760	Fixture Replacement	No	33	LED Exit Signs: 2 W Lamp	None	6	8,760	0.74	11,303	0.0	$1,477.07	$3,549.32	$0.00	2.40
Kitchen	22	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,617	Relamp	Yes	22	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,132	1.06	3,002	0.0	$392.32	$2,632.93	$510.00	5.41
Kitchen	6	Incandescent: (75W) - 1L	Wall Switch	75	1,617	Relamp	Yes	6	LED Screw-In Lamps: (11W) - 1L	Occupancy Sensor	11	1,132	0.26	749	0.0	$97.85	$2,051.11	$200.00	18.92
Kitchen Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.02	61	0.0	$8.02	$58.50	$10.00	6.05
Kitchen Storage	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,617	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,617	0.04	123	0.0	$16.03	$117.00	$20.00	6.05
Canopy	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Timer	62	4,380	Relamp	No	4	LED - Linear Tubes: (2) 4' Lamps	Timer	29	4,380	0.09	665	0.0	$86.89	$234.00	$40.00	2.23
Spot Lights	20	LED - Fixtures: Architectural Flood/Spot Luminaire	Photocell/Timer	20	4,380	None	No	20	LED - Fixtures: Architectural Flood/Spot Luminaire	Photocell/Timer	20	4,380	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Pole w/1fixt	2	High-Pressure Sodium: (1) 250W Lamp	Photocell/Timer	295	4,380	Fixture Replacement	No	2	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Photocell/Timer	89	4,380	0.27	2,080	0.0	$271.85	$3,905.99	$200.00	13.63
Pole w/2fixt	1	High-Pressure Sodium: (1) 250W Lamp	Timer	590	4,380	Fixture Replacement	No	1	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	Timer	177	4,380	0.27	2,080	0.0	$271.85	$1,952.99	$100.00	6.82
Wallpacks	6	High-Pressure Sodium: (1) 150W Lamp	Timer	188	4,380	Fixture Replacement	No	6	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timer	56	4,380	0.52	3,977	0.0	$519.74	$2,344.06	$600.00	3.36
Canopy under door	5	Compact Fluorescent: (26W) - 1L	Timer	26	4,380	Relamp	No	5	LED Screw-In Lamps: (18W) - 1L	Timer	18	4,380	0.03	196	0.0	$25.67	$250.00	$0.00	9.74
Wallpacks	15	High-Pressure Sodium: (1) 70W Lamp	Timer	95	4,380	Fixture Replacement	No	15	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timer	29	4,380	0.65	5,024	0.0	$656.58	$5,860.16	$1,500.00	6.64
Wall mounted	7	Compact Fluorescent: (26W) - 2L	Timer	52	4,380	Relamp	No	7	LED Screw-In Lamps: (18W) - 2L	Timer	36	4,380	0.07	550	0.0	$71.88	$525.00	$0.00	7.30

Motor Inventory & Recommendations

		Existing Conditions						Proposed Conditions				Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Annual Operating Hours	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Front Wing	2	Heating Hot Water Pump	1.5	78.5%	No	2,745	No	78.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	2nd Wing	2	Heating Hot Water Pump	2.0	78.5%	No	2,745	No	78.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Gym	1	Heating Hot Water Pump	0.8	84.0%	No	2,745	No	84.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Cafeteria	1	Heating Hot Water Pump	2.0	86.5%	No	2,745	No	86.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Boiler to DHW holding tank	1	Other	0.8	84.0%	No	2,745	No	84.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Gym	1	Heating Hot Water Pump	0.8	82.0%	No	2,745	No	82.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Cafeteria	1	Heating Hot Water Pump	2.0	86.5%	No	2,745	No	86.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Air Compressor	2	Air Compressor	1.0	82.5%	No	4,957	No	82.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	DHW	1	Other	0.3	84.5%	No	2,745	No	84.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Boiler	1	Combustion Air Fan	5.0	85.5%	No	2,745	No	85.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Boiler	1	Combustion Air Fan	2.0	84.0%	No	2,745	No	84.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	2011 Addition	2	Supply Fan	7.5	91.7%	Yes	3,391	No	91.7%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Main Office Area	1	Supply Fan	3.0	89.5%	Yes	2,745	No	89.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Main Office Area	1	Supply Fan	2.0	86.5%	No	2,745	No	86.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	building	1	Heating Hot Water Pump	1.0	84.0%	No	2,745	No	84.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Cafeteria	2	Supply Fan	5.0	87.5%	No	2,745	No	87.5%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Stage	1	Supply Fan	2.0	84.0%	No	2,745	No	84.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Electric HVAC Inventory & Recommendations

		Existing Conditions				Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Cooling Mode Efficiency (SEER/EER)	Heating Mode Efficiency (COP)	Install Dual Enthalpy Economizer?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Roof	New Wing (2011)	1	Packaged AC	19.17		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	New Wing (2011)	1	Packaged AC	19.17		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Media Center	1	Packaged AC	4.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Media Center	1	Packaged AC	4.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	IT	1	Packaged AC	2.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Guidance	1	Packaged AC	3.50		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Teacher's Lounge	1	Packaged AC	4.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Nurses' Office	1	Packaged AC	2.50		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Special Needs Classroom	1	Split-System AC	3.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Classrooms	1	Split-System AC	3.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Classrooms	1	Split-System AC	3.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Main Office Area	1	Packaged AC	7.67		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Main Office Area	1	Packaged AC	5.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Cafeteria	2	Packaged AC	15.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Cafeteria	1	Electric Resistance Heat		122.83	No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Room 5	Room 5	1	Window AC	1.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Room 12	Room 12	2	Window AC	1.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Classroom 13 & 14	Room 13 & 14	2	Packaged AC	3.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Room 28	Room 28	1	Window AC	0.83		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Elec Closet	Electric Closet	1	Electric Resistance Heat		11.26	No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

		Existing Conditions				Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Cooling Mode Efficiency (SEER/EER)	Heating Mode Efficiency (COP)	Install Dual Enthalpy Economizer?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
2011 Addition Classrooms	Classrooms 42 - 47	6	Electric Resistance Heat		44.36	No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Classroom	Classroom	1	Split-System AC	2.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Conference Room	Conference Room	1	Electric Resistance Heat		2.56	No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Fuel Heating Inventory & Recommendations

		Existing Conditions			Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Building	1	Non-Condensing Hot Water Boiler	2,677.60	Yes	1	Non-Condensing Hot Water Boiler	2,677.60	85.00%	Ec	0.00	0	130.7	$1,439.22	$46,571.91	$3,480.88	29.94
Boiler Room	Building	1	Non-Condensing Hot Water Boiler	4,184.00	Yes	1	Non-Condensing Hot Water Boiler	4,184.00	85.00%	Ec	0.00	0	66.5	$731.57	$71,694.19	$0.00	98.00
Roof	2011 Wing	2	Furnace	384.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Main Office	1	Furnace	144.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Main Office	1	Furnace	120.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00

DHW Inventory & Recommendations

		Existing Conditions		Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
2011 Wing Custodian Closet	2011 Wing	1	Storage Tank Water Heater (≤ 50 Gal)	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	All but 2011 Wing	1	Indirect System	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Walk-In Cooler/Freezer Inventory & Recommendations

	Existing Conditions		Proposed Conditions			Energy Impact & Financial Analysis						
Location	Cooler/ Freezer Quantity	Case Type/Temperature	Install EC Evaporator Fan Motors?	Install Electric Defrost Control?	Install Evaporator Fan Control?	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
Cafeteria	1	Medium Temp Freezer (0F to 30F)	No	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Commercial Refrigerator/Freezer Inventory & Recommendations

	Existing Conditions			Proposed Condi	Energy Impact & Financial Analysis						
Location	Quantity	Refrigerator/ Freezer Type	ENERGY STAR Qualified?	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Cafeteria	2	Stand-Up Refrigerator, Solid Door (>50 cu. ft.)	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Cafeteria	1	Stand-Up Freezer, Solid Door (31 - 50 cu. ft.)	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Cafeteria	1	Stand-Up Freezer, Solid Door (31 - 50 cu. ft.)	No	Yes	0.30	2,593	0.0	$338.89	$2,832.00	$300.00	7.47
Cafeteria	1	Stand-Up Refrigerator, Glass Door (16 - 30 cu. ft.)	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Cafeteria	2	Refrigerator Chest	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Cafeteria	1	Freezer Chest	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
Cafeteria	4	Electric Convection Oven (Full Size)	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Cafeteria	1	Electric Griddle (4 Feet Width)	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Cafeteria	1	Electric Steamer	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Cafeteria	3	Insulated Food Holding Cabinet (Full Size)	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Dishwasher Inventory & Recommendations

	Existing Conditions					Proposed Conditions	Energy Impact & Financial Analysis						
Location	Quantity	Dishwasher Type	Water Heater Fuel Type	Booster Heater Fuel Type	ENERGY STAR Qualified?	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Payback w/ Incentives in Years
Cafeteria	1	Single Tank Conveyor (High Temp)	Electric	Electric	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?
Classrooms/Offices	68	Desktop Computers	270.0	
Classrooms/Offices	17	small - Printer/Copier	50.0	
Offices	8	medium - Printer/Copier	100.0	
Copy Rooms	4	large - Printer/Copier	150.0	
Copy Room	1	Paper Shredder	146.0	
Classrooms	49	Projector	350.0	
Faculty Lounge	3	Microwave	1,500.0	
Faculty Lounge	3	large - Refrigerator	509.0	
Faculty Lounge	3	Coffee Machine	900.0	
Faculty Lounge	2	Toaster	1,000.0	
Faculty Lounge	3	Toaster Ovens	1,500.0	
Conference	2	42" LCD TV	220.0	
Classrooms/Offices	57	Fans	200.0	
Classrooms	47	Smartboards	2.0	

Vending Machine Inventory & Recommendations

	Existing Conditions		Proposed Conditions	Energy Impact & Financial Analysis						
Location	Quantity	Vending Machine Type	Install Controls?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Hallway	1	Refrigerated	Yes	0.00	1,612	0.0	$210.63	$230.00	$0.00	1.09
Hallway	1	Non-Refrigerated	Yes	0.00	343	0.0	$44.76	$230.00	$0.00	5.14

Appendix B: ENERGY STAR® Statement of Energy Performance

ENERGY STAR® Statement of Energy Performance

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ENERGY STAR® Score[1]

Frank Defino Central Elementary School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 70,047
Built: 1956

For Year Ending: April 30, 2017
Date Generated: April 04, 2018

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
Frank Defino Central Elementary School 175 State Highway 79 Marlboro, New Jersey 07746	Marlboro Township Board of Education 1980 Township Drive Marlboro, NJ 07746 (732) 972-2000	Cindy Barr-Rague 1980 Township Drive Marlboro, NJ 07746 (732) 972-2000 Ext. 2010 cbarr-rague@mtps.org

Property ID: 6277916

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
95.8 kBtu/ft²

Source EUI
161.9 kBtu/ft²

Annual Energy by Fuel		
Natural Gas (kBtu)	4,650,914 (69%)
Electric - Grid (kBtu)	2,056,958 (31%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	69.6
National Median Source EUI (kBtu/ft²)	117.7
% Diff from National Median Source EUI	38%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	475

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: _____ Date: _____

Licensed Professional

___ _____
.
(___)___-_____
_____

Professional Engineer Stamp (if applicable)